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Daytona Beach

For previous catalogs, see Catalog Archive (http://catalog.erau.edu/daytona-beach/archive)
About the University

Leading the World in Aviation and Aerospace Education
http://www.erau.edu

Daytona Beach, Florida, Campus
Embry-Riddle Aeronautical University
1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
(386) 226-6000
Admissions: (386) 226-6100 or (800) 862-2416
Financial Aid: (800) 943-6279
E-mail (Admissions): dbadmit@erau.edu

Prescott, Arizona, Campus
Embry-Riddle Aeronautical University
3700 Willow Creek Road
Prescott, AZ 86301-3720
(928) 777-3728
Admissions: (928) 777-6600 or (800) 888-3728
Financial Aid: (928) 777-3765
E-mail (Admissions): pradmit@erau.edu

Worldwide Campuses and Online
Embry-Riddle Aeronautical University
1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
(800) 522-6787 or (800) 359-3728
Admissions: (800) 522-6787
Financial Aid: (866) 567-7202
E-mail (Admissions): wwadmissions@erau.edu

This catalog becomes effective May 1, 2019.
The 2019-2020 academic calendar applies to the Daytona Beach campus. Worldwide Campus students should contact the local Embry-Riddle center director for the academic calendar applicable to their specific location. This calendar is subject to change.

Orientation programs for all new Daytona Beach students are planned, scheduled, and conducted before registration each semester. A special orientation program for new international students is held prior to the general orientation required for all new students. New students will receive special information regarding the date, time, and place of orientation activities from Admissions approximately 30 calendar days in advance of the activities.

In compliance with federal laws and regulations, Embry-Riddle Aeronautical University does not discriminate on the basis of race, color, national origin, sex, gender identity, gender expression, sexual orientation, disability, veteran status, predisposing genetic characteristic, age, religion, or pregnancy status. An Equal Opportunity institution, the University does not discriminate in the recruitment and admission of students, in the recruitment and employment of faculty and staff, or in the operations of any program and activity. The Office of Title IX Compliance is available to answer any questions you may have. The office located in the Henderson Welcome Center, may be reached at (386) 226-7971 or dbtitle9@erau.edu.

Designed for use during the period stated on the cover, this catalog gives a general description of Embry-Riddle Aeronautical University and provides detailed information regarding the departments in the institution and curricula offered by the University. The online edition of this catalog will be considered to be the official version reflecting any addendums or corrections to the publication. The provisions of the catalog do not constitute a contract between the student and the University. The faculty and trustees of Embry-Riddle Aeronautical University reserve the right to change, without prior notice, any provision, offering, or requirement in the catalog. This includes the right to adjust tuition and fees, as necessary. The University further reserves the right at all times to require a student to withdraw for cause.

Official University Photography
Embry-Riddle Aeronautical University reserves the right to photograph members of the University community, including, but not limited to, its students and faculty, in situations appropriate to the image of the academic institution, and to publish likenesses in Embry-Riddle Aeronautical University publications, videos, or other recruitment or promotional materials. However, the University will, to the extent feasible, honor requests of constituents who do not wish their images to be photographed or published.

Message from the President
Welcome,
Congratulations on joining the Embry-Riddle community, which extends to more than 135,000 alumni who have helped to build our reputation as the premier university focused on aviation and aerospace.

Embry-Riddle will be the world’s source for innovation and excellence in aerospace education and applied research. Your work here will help turn that vision into reality.

We are an inclusive institution that welcomes students and faculty from more than 100 countries and diverse cultures. The perspective and talent you contribute will help us advance innovation, which is a core value.

Our 100+ degree programs will ground you in the fundamentals and prepare you for emerging career opportunities. To meet the needs of the industries we serve, we will continue to add new programs – many the first of their kind. Embry-Riddle was first to open a College of Security & Intelligence; the first to offer a Ph.D. program in aviation; and the first to launch undergraduate degree programs in space physics, spaceflight operations and aerospace physiology. In spring of 2019, we launched the first graduate engineering course in hybrid propulsion and urban air mobility aircraft.

Whatever your field of study, you will benefit from discovery-driven education that challenges you to apply the skills you are building, in classrooms, labs and perhaps on the flight line.

You will not have to wait until after graduation to make meaningful contributions. Nearly 90 percent of our students work with faculty-mentors or industry partners on research, Capstone Projects and internships. The university will continue to expand our research enterprise and host competitions to encourage creative problem solving and entrepreneurship.

Faculty and staff are here to support your success. So am I. During my open office hours on campus (or virtually), you will receive invitations to chat with me, one-on-one, throughout the year.

As an Embry-Riddle Eagle —now and forever— we expect great things from you. May you make lifelong friends, turn your talents into mastery and advance technology to the benefit of all.

P. Barry Butler, Ph.D.
Embry-Riddle’s History

Aviation and Embry-Riddle: The Lifelong Partnership

In 1903 Orville and Wilbur Wright made history with their sustained, controlled flight of a powered aircraft. Only a few short years later, the advent of regular passenger service and the start of World War I combined to produce a dynamic new industry to meet the demands of commercial and military aviation.

Unlike many other developments at the end of the Industrial Revolution, aviation required a special education — learning how to fly, learning about safety and weather, and learning about engines — from skilled maintenance to the outer limits of performance.

The need for trained pilots and mechanics quickly led to the establishment of a new type of school, one focused totally on aviation. In the beginning, these organizations were often a combination of airplane dealership, airmail service, flight training center, and mechanic school. The original Embry-Riddle operations fit that mold precisely.

On Dec. 17, 1925, exactly 22 years after the historic flight of the Wright Flyer, barnstormer John Paul Riddle and entrepreneur T. Higbee Embry founded the Embry-Riddle Company at Lunken Airport in Cincinnati, Ohio. The following spring the company opened the Embry-Riddle School of Aviation, coinciding with the implementation of the Air Commerce Act of 1926, which required, for the first time, the certification and medical examination of pilots.

Within three years the school had become a subsidiary of AVCO, the parent of American Airlines. Embry-Riddle remained dormant during most of the 1930s, mirroring the casualties of the Great Depression, and the Lunken Airport operation was phased out. By the end of the decade, however, World War II erupted in Europe and the demand for skilled aviators and mechanics grew significantly. Embry-Riddle’s second life was about to begin.

In South Florida, Embry-Riddle opened several flight-training centers and quickly became the world’s largest aviation school. Allied nations sent thousands of fledgling airmen to the Embry-Riddle centers at Carlstrom, Dorr, and Chapman airfields to become pilots, mechanics, and aviation technicians. Some 25,000 men were trained by Embry-Riddle during the war years.

After the war, under the leadership of John and Isabel McKay, Embry-Riddle expanded its international outreach while strengthening its academic programs.

With Jack R. Hunt as president, in 1965 Embry-Riddle consolidated its flight, ground school, and technical training programs in one location by moving northward to Daytona Beach, Florida. This move, which proved to be a moment of singular importance, was made possible by Daytona Beach civic leaders who donated time, money, and the use of personal vehicles. The relocation signaled the rebirth of Embry-Riddle and the start of its odyssey to world-class status in aviation higher education.

In 1968, Embry-Riddle was accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award degrees at the associate, bachelor, and master levels, and in 1970 changed its name from “Institute” to “University.” Also in 1970, centers were established at U.S. military aviation bases to serve the educational needs of active-duty military personnel.

In 1978, under President Hunt’s leadership, Embry-Riddle opened a western campus in Prescott, Arizona, on the 511-acre site of a former college. With superb flying weather and expansive grounds, the Prescott Campus has been an outstanding companion to the University’s eastern campus in Daytona Beach.

Continuing Hunt’s legacy was Lt. Gen. Kenneth L. Tallman, president of Embry-Riddle for five years. He came to the University after a distinguished 35-year military career that included service as superintendent of the U.S. Air Force Academy. Under Tallman’s leadership, a school of graduate studies and the electrical engineering degree program were introduced. He led the University into research with the addition of the engineering physics degree program. He also developed stronger ties between Embry-Riddle and the aviation/aerospace industry.

Dr. Steven M. Sliwa led the University from 1991 through 1998. Sliwa, the University’s third president, is best known for creating an entrepreneurial environment and for developing strategic
partnerships with industry. These partnerships included a joint venture with FlightSafety International; a partnership with Cessna Aircraft Company; a technology alliance with IBM; and an exclusive educational partnership with the Aircraft Owners and Pilots Association. He also spearheaded a $100+ million capital expansion program, which included an $11.5 million congressional line-item appropriation. In addition, new academic and research programs were created at his direction to respond to structural changes in the industry while increasing market share in the University’s core programs.

Embry-Riddle’s fourth president, Dr. George H. Ebbs, led the University from 1998 through 2005. During and following his tenure, the annual college guide produced by U.S. News & World Report has consistently ranked Embry-Riddle’s undergraduate Aerospace Engineering program No. 1 in the nation. Embry-Riddle’s Aerospace Engineering program is the largest in the nation, as is its Aeronautical Science (professional pilot) program.

Under the leadership of Dr. Ebbs, a new graduate degree program in Safety Science was introduced, as well as new undergraduate degree programs in Computer Science, Global Security and Intelligence Studies, Mechanical Engineering, Software Engineering, and Space Physics. In addition, major construction was initiated at the Daytona Beach and Prescott residential campuses.

Dr. Ebbs presided over three military contracts worth a total of more than $57 million. Under those contracts Embry-Riddle provides aviation-related degree programs to the U.S. military in Europe; trained Air Force, Air National Guard, and international flight safety officers at Kirtland Air Force Base in Albuquerque, N.M.; and trained Air Force pilots at the U.S. Air Force Academy in Colorado Springs.

Dr. John P. Johnson served the University as the fifth President. He previously served as Embry-Riddle’s Interim President and as Provost and Chief Academic Officer. Before joining Embry-Riddle, he was the Provost and Vice President for Academic Affairs at Texas A&M University, Texarkana, and served as Dean at the Medical University of South Carolina and at Northern Kentucky University.

Under Dr. Johnson’s leadership, Embry-Riddle expanded its research activity; developed a global strategy to take its aviation and aerospace expertise overseas; and launched Ph.D. degree programs in Aerospace Engineering, Aviation, Aviation Business Administration, Electrical Engineering and Computer Science, Engineering Physics, Human Factors, and Mechanical Engineering. Working with the FAA and industry leaders, Dr. Johnson positioned the University as one of the nation’s leaders in the development of next-generation air traffic management technology.

Dr. P. Barry Butler became the sixth president of Embry-Riddle in March 2017. His primary areas of focus are student success, research and innovation, corporate engagement, economic development, and continued global expansion. Before joining Embry-Riddle he was Executive Vice President and Provost at the University of Iowa. He joined the University of Iowa faculty in 1984 as an assistant professor in the Department of Mechanical Engineering and subsequently progressed to the rank of professor. Before entering administration in 1998, Dr. Butler was a member of the Engineering Faculty Council, as well as the University of Iowa’s Faculty Senate and Faculty Council. Other positions held by Dr. Butler at the University of Iowa include Department Executive Officer of the Department of Mechanical Engineering, Associate Dean for Academic Programs, and Interim Dean and Dean of Engineering, where he held the rank of full professor in the Department of Mechanical and Industrial Engineering. At the University of Iowa he was the coordinator of the Iowa Space Grant Consortium, a statewide organization funded by NASA for the past 21 years whose mission is to coordinate and improve the state’s future in aerospace science and technology and to stimulate aerospace research, education, and outreach activities throughout the state.

Accreditations and Affiliations

Institution-wide Accreditation

Embry-Riddle Aeronautical University — including the Daytona Beach Campus, the Prescott Campus, and the Worldwide Campus — is accredited by the Southern Association of Colleges and Schools Commission on Colleges to award degrees at the associate, baccalaureate, master and doctorate levels. Contact the Commission at 1866 Southern Lane, Decatur, GA, 30033, or call 404-679-4500
for questions about the accreditation of the University, or if there is evidence that the institution is non-compliant with a requirement, standard or substantive change.

SACSCOC Reaffirmation Letter 1
SACSCOC Reaffirmation Letter 2
SACSCOC Approval of ERAU at Level VI

Campus-Academic Program Accreditations, Recognitions, Approvals

Daytona Beach Campus

Aviation
The Ph.D. degree program in Aviation, the master’s degree program in Aeronautics, the bachelor degree programs in Aeronautical Science (Professional Pilot), Air Traffic Management, Unmanned Aircraft Systems Science, Aerospace and Occupational Safety, Aviation Business Administration, and the bachelor and associate degree programs in Aviation Maintenance Science are accredited by the Aviation Accreditation Board International (AABI), 115 S. 8th Street, Suite 102 Opelika, AL 36801 Telephone: 334-748-9359; https://www.aabi.aero/accreditation/accredited-programs/.

Aviation - Maintenance
The certificate programs in Aviation Maintenance Technology (airframe, power plant, and airframe and power plant) are certified by the Federal Aviation Administration (FAA).

Aviation - Flight
Certificate programs in Flight (private, commercial, instrument, multi-engine, flight instructor and instrument flight instructor ratings) and Flight Dispatch are approved by the Federal Aviation Administration (FAA).

Business
The Master of Business Administration program, the Master of Business Administration in Aviation Management, and the bachelor degree program in Business Administration, majors in Management, Marketing, and Accounting and Finance, the bachelor degree program in Aviation Business Administration, major in Air Transportation, are accredited by the Accreditation Council for Business Schools and Programs (ACBSP), 11520 West 119th Street, Overland Park, KS, 66213; Telephone: 913-339-9356; https://www.acbsp.org/.

Engineering

English Language Institute
The Certificate program, Embry-Riddle English Language Institute (ERLI), is accredited by the Commission for English Language Program Accreditation (CEA), 1001 North Fairfax Street, Suite 630 Alexandria, VA 22314 USA; Telephone 703-665-3400; https://ceaccredit.org/.

Prescott Campus

Aviation
The bachelor degree programs in Aeronautical Science/Fixed Wing; select areas of concentration in Aviation Business Administration including Flight Operations/Fixed Wing, Management, Airport Management; and the master’s degree in Safety Science are accredited by the Aviation Accreditation Board International (AABI), 115 S. 8th Street, Suite 102 Opelika, AL 36801 Telephone: 334-748-9359; https://www.aabi.aero/accreditation/accredited-programs/.

Aviation - Flight
Certificate programs in Flight (private, commercial, instrument, multi-engine, flight instructor and instrument flight instructor ratings) and Flight Dispatch are approved by the Federal Aviation Administration (FAA).

Business
The bachelor degree programs in Global Business and Supply Chain Management, Forensic Accounting and Fraud Examination, Aviation Business Administration with concentrations in Airport Management, Management, Financial Management, and Flight Operations, and Business Administration with a concentration in Management are accredited by the Accreditation Council for Business Schools
and Programs (ACBSP), 11520 West 119th Street, Overland Park, KS, 66213; Telephone: 913-339-9356; https://www.acbsp.org/.

**Engineering**

**Worldwide Campus**

**Aeronautics**
The bachelor degree program in Aeronautics is accredited by the Aviation Accreditation Board International (AABI), 115 S. 8th Street, Suite 102 Opelika, AL 36801 Telephone: 334-748-9359; https://www.aabi.aero/accreditation/accredited-programs/.

**Business**
The bachelor degree programs in Aviation Business Administration and in Technical Management, and the master’s degree programs in Business Administration in Aviation and in Management, and the Logistics and Supply Chain Management are accredited by the Accreditation Council for Business Schools and Programs (ACBSP), 11520 West 119th Street, Overland Park, KS, 66213; Telephone: 913-339-9356; http://www.acbsp.org/.

**Business - Project Management**
The master’s degree program in Project Management is accredited by the Project Management Institute Global Accreditation Center for Project Management Education Programs (GAC), 14 Campus Boulevard, Newtown Square, PA, 19073; Telephone: 610-355-1601; http://www.pmi.org/gac/global-accreditation-center.aspx.

**Emergency Services**
The bachelor degree program in Emergency Services is accredited by the International Fire Service Accreditation Congress (IFSAC), 1812 West Tyler Avenue, Stillwater, OK, 74078; Telephone: 405-744-8303; E-mail: admin@ifsac.org, Web: https://ifsac.org/about.

It is also recognized by the National Fire Academy in accordance with the standards established by the Fire and Emergency Services Higher Education model core curriculum under the U.S. Fire Administration, 16825 S. Seton Ave., Emmitsburg, MD, 21727; Telephone: 800-238-3358, 301-447-1000; www.usfa.fema.gov.

**State Authorizations**
For information on specific authorizations or licensures for any state, or for contact information for a particular state or licensing entity, please contact the Office of State Authorizations at 386-226-9096 or wwstatea@erau.edu.

**Complaints/Inquiries**
Constituent complaints related to possible accreditation violations can be addressed to the listed accreditors using the contact information included above.

Please note: Normal inquiries, or complaints about the institution or any campus (such as admission requirements, financial aid, educational programs, etc.) should be addressed directly to the campus’s offices and not to an accreditor’s office.

- Daytona Beach 386-226-6000 http://daytonabeach.erau.edu/
- Prescott 928-777-3728 http://prescott.erau.edu/
- Worldwide 386-226-6910 http://worldwide.erau.edu/face
- Online 800-522-6787 http://online.erau.edu

**Embry-Riddle at a Glance**
Embry-Riddle Aeronautical University is the world’s largest, fully accredited university specializing in aviation and aerospace. A truly international institution, the University educates undergraduate and graduate students at its residential campuses in Daytona Beach, Florida, and Prescott, Arizona; at its more than 125 Worldwide Campus locations around the globe; and through online learning.

The University offers a wide array of more than 80 undergraduate and graduate degree programs in aviation, aerospace, business, engineering, safety, security and intelligence, transportation, and related high-tech fields.

Always moving forward in step with the aviation and aerospace industry, Embry-Riddle offers Ph.D. degree programs in Aerospace Engineering, Aviation, Aviation Business Administration,
Electrical Engineering & Computer Science, Engineering Physics, Human Factors Psychology, and Mechanical Engineering.

These Ph.D. programs expand the applied research opportunities in which Embry-Riddle faculty and students collaborate with the industry, government agencies, and other universities in meeting real-world challenges. Frequent research partners include the FAA, NASA, the National Science Foundation, and the U.S. Air Force.

*U.S. News & World Report, USA Today, Wall Street Journal* and others rank Embry-Riddle highly in the categories of best undergraduate aerospace engineering programs, best undergraduate engineering programs, best bachelor’s degrees in engineering, best colleges in Arizona and Florida, best regional university (South), best college astronomy observatories, top colleges for aerospace careers, and top colleges for internship and co-op programs.

*Military Times, Military Advanced Education & Transition, U.S. Veterans, Victory Media, and U.S. News & World Report* also name Embry-Riddle best for veterans, top military-friendly school, top veteran-friendly school, best online bachelor’s programs for veterans, best regional university (South) for military and veterans, best online MBA programs for veterans, and best online non-MBA graduate business programs for veterans.

*U.S. News & World Report* gives Embry-Riddle’s Worldwide Campus superior marks in the categories of best online bachelor’s programs, best online graduate MBA program, best online graduate non-MBA program, and best online engineering degree programs.

Embry-Riddle is ranked highly among private colleges for best value, best starting salary, and best return on investment by Affordable Colleges Online, College Choice, PayScale, Smart Asset, Value Colleges, and the U.S. Department of Education.

**Daytona Beach**

The University’s 185-acre eastern campus in Daytona Beach, Florida, is located next to Daytona Beach International Airport and Daytona International Speedway, only minutes from the Atlantic Ocean, and only an hour’s drive from Kennedy Space Center and Orlando.

The new College of Arts & Sciences building includes an observatory with the largest university-owned research telescope in the Southeast. A new Student Center nearing completion will be the largest building on campus, consolidating most student services in one location.


The new John Mica Engineering & Aerospace Innovation Complex, located in Embry-Riddle’s Daytona Beach Research Park, is a hybrid research center and business incubator attracting scientists, entrepreneurs, and venture capitalists.

Student teams from the Daytona Beach Campus regularly take top honors in competitions hosted by the Society of Automotive Engineers and the Association for Unmanned Vehicle Systems International. Aeronautical Science students excel in annual flight competitions such as the women’s Air Race Classic and the National Intercollegiate Flying Association’s SAFECON regional and national events.

**Prescott Campus**

The University’s mile-high, 539-acre western campus is located in Prescott, Arizona. Extensive recreational facilities and opportunities in and near the campus include hiking, mountain biking, kayaking, skiing, and snowboarding.

The new STEM (Science, Technology, Engineering, and Math) Education Center houses 20 state-of-the-art labs dedicated to robotic systems, satellites, unmanned aerial systems, commercial aircraft, military aircraft, physics, chemistry, biology, and more. The building also contains classrooms, a multimedia center, a supercomputer system, and the Jim and Linda Lee Planetarium. Elsewhere on campus is the nation’s largest university-based Aircraft Accident Investigation Lab.

The campus is home to the nation’s first College of Security & Intelligence. It offers bachelor’s degrees in Cyber Intelligence & Security and in Global Security & Intelligence Studies as well as master’s degrees.
in Cyber Intelligence & Security and in Security & Intelligence Studies.

Noteworthy degree programs at the Prescott Campus include Forensic Biology, Forensic Psychology, Forensic Accounting & Fraud Examination, Industrial/Organizational Psychology, Wildlife Science, and Simulation Science, Games, & Animation.

The College of Aviation offers degrees for professional pilots with fixed-wing and rotary-wing options. Student flight teams have won numerous national championships in NIFA SAFECON competitions and rank highly in the women’s Air Race Classic.

Worldwide Campus

The Worldwide Campus provides educational opportunities for working professionals. Its academic programs are offered online and at more than 125 civilian and military learning centers in Germany, Italy, Japan, South Korea, Spain, Turkey, the United Kingdom, and the United States. With flexible course delivery systems, students can learn in the classroom, online, or a blend of the two, switching between instruction modes as needed -- of particular importance for deployed military students. In addition, via Worldwide’s EagleVision technology, students at different geographical locations can receive instruction at the same time.

As the industries we serve continue to evolve, so does Embry-Riddle, accelerating into the future as an aerospace, business, science, engineering, and research powerhouse, producing graduates who are well-prepared to become leaders in their fields. Guiding the process of evolution are dedicated teachers, administrators, alumni, trustees, and advisory board members who share our students’ love of aviation and who strive to ensure Embry-Riddle’s continued position as the world’s premier aviation and aerospace university.

Our Student Philosophy

Adopted by Jack R. Hunt in 1975
Updated and reaffirmed by President P. Barry Butler, Ph.D., in 2017

A Student...
Is the most important person in this university.

A Student...
Is not an interruption of your work, but the purpose of it.

A Student...
Is not a cold statistic, but a human being with feelings and emotions like your own.

A Student...
Is not someone to argue or match wits with.

A Student...
Is a person who brings us needs—It is our job to fill those needs.

A Student...
Is deserving of the most courteous and attentive treatment we can provide.

A Student...
Is the person who makes it possible to pay your salary whether you are faculty or staff.

A Student...
Is the lifeblood of this and every university.

A Student...
Is something you once were, REMEMBER?
## Calendar

### Summer Semester (Term A) 2019
*(May 14 – June 24)*

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<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 13-14</td>
<td>Orientation and Registration</td>
</tr>
<tr>
<td>May 14</td>
<td>Classes Begin</td>
</tr>
<tr>
<td>May 27</td>
<td>HOLIDAY - Memorial Day</td>
</tr>
<tr>
<td>June 20</td>
<td>Last Day of Classes</td>
</tr>
<tr>
<td>June 21</td>
<td>Study Day</td>
</tr>
<tr>
<td>June 22 &amp; 24</td>
<td>Final Examinations</td>
</tr>
<tr>
<td>August 17</td>
<td>Summer Degrees Conferred, no Ceremony</td>
</tr>
</tbody>
</table>

### Summer Semester (Term B) 2019
*(July 2 – August 12)*

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 1-2</td>
<td>Orientation and Registration</td>
</tr>
<tr>
<td>July 2</td>
<td>Classes Begin</td>
</tr>
<tr>
<td>July 4</td>
<td>HOLIDAY – Independence Day</td>
</tr>
<tr>
<td>July 15</td>
<td>Application for Graduation Deadline</td>
</tr>
<tr>
<td>July 16</td>
<td>Thesis/Dissertation Defense Deadline</td>
</tr>
<tr>
<td>August 8</td>
<td>Last Day of Classes</td>
</tr>
<tr>
<td>August 8</td>
<td>Thesis/Dissertation submission to library</td>
</tr>
<tr>
<td>August 9</td>
<td>Study Day</td>
</tr>
<tr>
<td>August 10 &amp; 12</td>
<td>Final Examinations</td>
</tr>
<tr>
<td>August 17</td>
<td>Summer Degrees Conferred, no Ceremony</td>
</tr>
</tbody>
</table>

### Fall Semester 2019
*(August 26 – December 11)*

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 19-21</td>
<td>Check-in &amp; New Student Move-in</td>
</tr>
<tr>
<td>August 21-25</td>
<td>Orientation</td>
</tr>
<tr>
<td>August 22-23</td>
<td>New Student Registration</td>
</tr>
<tr>
<td>August 26</td>
<td>Classes Begin</td>
</tr>
<tr>
<td>September 2</td>
<td>HOLIDAY – Labor Day</td>
</tr>
</tbody>
</table>

### Spring Semester 2020
*(January 8 – April 29)*

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>January 6-7</td>
<td>Orientation and Registration</td>
</tr>
<tr>
<td>January 8</td>
<td>Classes Begin</td>
</tr>
<tr>
<td>January 20</td>
<td>HOLIDAY - Martin Luther King Jr. Day</td>
</tr>
<tr>
<td>February 17</td>
<td>HOLIDAY - Presidents Day</td>
</tr>
<tr>
<td>March 9-13</td>
<td>Spring Break</td>
</tr>
<tr>
<td>March 15</td>
<td>Application for Graduation Deadline</td>
</tr>
<tr>
<td>March 31</td>
<td>Thesis/Dissertation Defense Deadline</td>
</tr>
<tr>
<td>April 23</td>
<td>Last Day of Classes</td>
</tr>
<tr>
<td>April 23</td>
<td>Thesis/Dissertation submission to library</td>
</tr>
<tr>
<td>April 24</td>
<td>Study Day</td>
</tr>
<tr>
<td>April 25, 27-29</td>
<td>Final Examinations</td>
</tr>
<tr>
<td>May 4</td>
<td>Commencement*</td>
</tr>
</tbody>
</table>

* Commencement dates are subject to change. See the Graduation Web Page (http://daytonabeach.erau.edu/campus-life/graduation) for the latest information.
Admissions

General Procedures
New students are eligible for admission at the beginning of the fall, spring, and summer terms. High school students may apply at the beginning of their senior year. Applications received after the priority filing dates will be processed on a space-available basis.

<table>
<thead>
<tr>
<th>Term</th>
<th>Filing Priority</th>
<th>Notification</th>
<th>Deposit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>January 15</td>
<td>Rolling</td>
<td>May 1</td>
</tr>
<tr>
<td>Spring</td>
<td>November 1</td>
<td>Rolling</td>
<td>November 1</td>
</tr>
<tr>
<td>Summer Term A</td>
<td>April 1</td>
<td>Rolling</td>
<td>As requested</td>
</tr>
<tr>
<td>Summer Term B</td>
<td>June 1</td>
<td>Rolling</td>
<td>As requested</td>
</tr>
</tbody>
</table>

For more information and to apply, contact the Admissions Office or visit our website at: http://daytonabeach.erau.edu/admissions/

Embry-Riddle Aeronautical University
Director of Admissions
1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
(386) 226-6100 or (800) 862-2416
email address: dbadmit@erau.edu
http://www.embryriddle.edu

Immunizations
Entering students born after Dec. 31, 1956, must submit certified proof of immunization with two doses of MMR (measles/mumps/rubella) vaccine. These immunizations must have been administered after the student’s first birthday with live virus vaccines. Students living on campus must also show proof of meningitis and hepatitis B vaccinations or sign and submit a waiver to decline them. For more information, refer to the University’s Medical Report Form.

FAA Medical Certificate
Each student who is accepted as a flight student must submit a copy of the FAA Medical Certificate, Class I or II.

Undergraduate Admissions

First-Year Applicant
The University defines a first-year applicant as one who is applying for degree status directly from high school. The University offers admission to all applicants who present an academic record that demonstrates their ability to graduate. To reach an admissions decision, the following information is considered: overall academic performance and course load, rank in class (if available), selected major, letters of recommendation and standardized test scores. The University’s Admissions Office implements established academic policies and requirements that define the necessary qualifications for admission.

Entrance requirements to the University include 4 years of English; 3 years minimum, 4 years preferred college preparatory mathematics; 3 years of social science; and 2 years of science including a laboratory science, 3 years preferred. Additional courses may be required depending on the major selected. Admitted students usually present more than the minimum requirements. The University reserves the right to change entrance requirements without prior notice.

Standardized Testing
SAT I reasoning test or ACT is strongly recommended for admission for U.S. citizens and permanent residents. International students, please see the International Applicants section of this chapter for further admission requirements.

Admitted Student Information
Students accepted for admission must submit a $200 non-refundable tuition deposit by the stated date. This deposit confirms attendance to the University and is credited toward the first semester’s tuition.

If you decide to accept our offer of admission for the fall term, you must submit the tuition deposit by the Candidates Common Reply date of May 1. Spring term deposit date is Nov. 1. Summer term deposit dates are April 1 for summer A and May 1 for summer B.

The deposit will be held in the student’s account for one year in case the student enrolls during that year. After one year the deposit is forfeited.
A student who cancels the application at any point in the admissions process may reactivate the application without a fee for one year at any time up to the admissions deadline for the same semester of the following academic year. After one year, a new application, fee, and supporting documents must be submitted.

**English Language Proficiency**

Admissions encourages all of our applicants for whom English is not the primary language spoken at home to take the TOEFL or IELTS exam to supplement their verbal SAT I score. This information will aid the University in accurately assessing verbal skills. For more information about testing dates and locations, contact:

**TOEFL Services**

Educational Testing Service  
P.O. Box 6151  
Princeton, NJ 08541-6151  
1-609-771-7100 (worldwide)  
1-877-863-3546  
http://www.toefl.org

-OR-

**IELTS International Services**

825 Colorado Boulevard, Suite 201  
Los Angeles, CA 90041  
USA  
Telephone: 323 255 2771  
Email: ielts@ieltsintl.org  
http://www.ielts.org/default.aspx

-OR-

The College Board  
5 Columbus Ave.  
New York, NY 10023  
(212) 713-8000

-OR-

The College Board  
Box 1025  
Berkeley, CA 94701  
http://www.collegeboard.com

You can also meet the language proficiency requirement by completing Embry-Riddle’s intensive language program (Embry-Riddle Language Institute or ERLI). For more information about ERLI contact:

Daytona Beach Campus  
Phone (386) 226-6192  
Email: erli@erau.edu  
Website: http://db.erau.edu/erli

**Transcripts**

The Admissions Office accepts either an official secondary school transcript or the General Education Development Certificate (GED). An official transcript or GED score report must be sent directly from the issuing institution to Embry-Riddle.

**Advanced Standing**

Advanced standing may be awarded for prior learning achieved through postsecondary education, testing, work and/or training experience, or programs completed before enrollment at Embry-Riddle. Students who feel their background warrants consideration for advanced standing not already granted for specific courses may request course equivalency examinations. Flight experience will be evaluated in accordance with procedures outlined later in this section.

It is the student’s responsibility to ensure that all documentation is submitted to the University. This information can either be sent with the application for admission or mailed under separate cover. Formal application for advanced standing for flight training must be made before the end of the student’s first semester of attendance at the appropriate campus.

All academic evaluations for advanced standing will be completed before the end of the student’s first semester of attendance at, or readmission to, the University. The student will be given a copy of the completed official evaluation and have 30 calendar days to question the credit awarded. Advanced standing and transfer credit granted in accordance with these procedures will be authenticated by the Admissions Office and maintained by the campus Records Office. Documentation that may be submitted for consideration toward advanced standing includes military training, FAA certificates, credit for examination scores, and professional experience. Credit may be awarded as follows:

1. The University offers advanced placement credit toward a college degree to those students who present official College Entrance Examination Board (CEEB) Advanced Placement Test scores of 3 or better on any examination. Up to 30 hours of International Baccalaureate (IB) credit may be earned for official test scores of 4 or higher.
2. Embry-Riddle follows the standards recommended by the American Council on Education for awarding credit for the College Level Examination Program (CLEP) general examinations. To be officially evaluated for credit, the test scores must be submitted before the student’s initial enrollment as a degree candidate. The number of credit hours recognized by Embry-Riddle for these examinations in various disciplines are as follows:

- Communications: 6 credit hours
- Humanities: 6 credit hours
- Social Sciences: 6 credit hours
- Natural Sciences: 6 credit hours
- Mathematics: 6 credit hours

3. The University has approved certain CLEP subject examinations, Defense Activity for Non-Traditional Educational Support (DANTES) examinations, and Excelsior College Examination (ECE) for award of credit as applicable to the student’s program. Scores from these examinations must be submitted before initial enrollment as a degree candidate to be officially evaluated for credit. Credit for these examinations may not be applied toward the last 30 credit hours required for a bachelor degree or the last 15 credit hours required for an associate degree.

4. Training in military service schools will be considered for credit by each curriculum division, based on the recommendation of the American Council on Education.

5. Students who hold a pilot certificate may be eligible for advanced standing. Advanced standing based on a pilot certificate may be awarded for the appropriate flight course. A student who received college credit for their flight training may be eligible for advanced standing for certain academic courses. Contact the Aeronautical Science Department for a determination of the exact amount of credit to be awarded. In any case, advanced standing credit must be applied for during the first semester. To obtain credit, the applicable FAA certificate must be presented at the time that the advance standing request is made. All advanced standing credit for flight courses will be recorded on academic transcripts at Embry-Riddle.

6. Students holding a Commercial Pilot Certificate or Airline Transport Pilot Certificate, with significant recent experience beyond the basic certification level, may petition for additional credit. Students may be required to complete a flight evaluation or successfully complete a flight course on campus before becoming eligible to enroll in any off-campus Embry-Riddle affiliated airline training program. All certificate levels refer to U.S. FAA certificates. Foreign certificate holders must convert their licenses to FAA-issued certificates prior to any credit being awarded.

7. Students who hold the FAA Airframe and Powerplant Certificate may receive advanced standing.

8. The Aeronautics degree awards college credit based on an individual’s past training and job experience in an aviation-related field. A description of advanced standing applicable to the Aeronautics degree may be found in the Academic Programs section of the catalog.

9. A student who possesses qualifications not listed above and who believes that their background warrants consideration for advanced standing may submit appropriate evidence of credentials for evaluation.

Transfer Applicants

The University welcomes applicants who have demonstrated success at other institutions of higher education. For purposes of admission, a transfer student is defined as any student who has earned college credit or military credit after graduating from high school.

In making transfer admission decisions, the Admissions Office reviews official transcripts of all college-level work attempted and completed. Transfer candidates who have earned fewer than 30 college-level credit hours are also required to submit an official final high school transcript. Applicants who graduated from a Florida high school should submit official high school transcript in order to be eligible for the Florida tuition discount.

The minimum grade point average required for admission to Embry-Riddle is a 2.00 from the last institution attended and a combined GPA of 2.00 from all Universities attended. The minimum GPA for transfer students applying to technical majors is 2.5. Most successful transfer applicants present at least a 2.50 (C+) average on a four-point scale. Applicants
with grade point averages between a 2.00 and a 2.40 will be reviewed on a case-by-case basis.

The University reserves the right to refuse admission to students who are on probationary status or who were academically dismissed from other colleges or universities. If the University admits such students, they will be admitted with conditional status.

Transfer Credit
For information on transfer credit (http://daytonabeach.erau.edu/admissions/undergraduate/credit).

For specific information on transfer credit course equivalencies (http://daytonabeach.erau.edu/admissions/undergraduate/transfer-credit).

1. Transfer credit may be granted under the following conditions:
   a. Appropriate coursework completed at an accredited degree granting institution listed in the Accredited Institutions of Postsecondary Education (AIPE) published by the American Council of Education (ACE) with a grade of A, B, C, P, or equivalent will be accepted.
   b. Grades are not transferable.
   c. Previous flight experience may be accepted in accordance with the Embry-Riddle policy as stated in the Advanced Standing section of this chapter. Credit hours are transferable if earned at institutions accredited by the appropriate regional agency. Non-duplicate transfer credit will be accepted for courses completed within the past ten years. Transfer of credits older than ten years will be considered on a case-by-case basis. It is left to the discretion of the student, in consultation with the student’s academic advisor, to determine whether to retake the courses when placement testing indicates a deficiency. Embry-Riddle has sole discretion in determining which and how many transfer credit hours will be accepted toward degree requirements.
   d. Embry-Riddle evaluates previous academic credit on a course-by-course basis. Acceptable transfer work will be indicated on the Embry-Riddle transcript. If classes are not applicable to the student’s degree program at Embry-Riddle, they will be considered as electives in excess of minimum degree requirements. The level of credit (upper or lower division) is determined by evaluation of the course at Embry-Riddle.

2. Embry-Riddle may, at its discretion, require an evaluation examination for any course submitted for transfer credit if there is doubt concerning the equivalency of the transfer course with a similar course offered at Embry-Riddle. Embry-Riddle cannot guarantee that courses are transferable. Courses are accepted at the discretion of the University.

3. The transfer student’s records (transcripts, etc.) will be evaluated according to the rules and regulations as described in this catalog, and in accordance with University policies in effect at the time of the student’s admission to a degree program. After evaluation, the student will be sent a course-by-course outline of all transfer credit accepted by the University.

Nontraditional Student Applicants
Embry-Riddle acknowledges that full-time employment experiences often provide the motivation and discipline to be a successful student in college. If a student’s academic career has been interrupted for a minimum of three years due to personal or financial reasons, the care of dependents, or serving time in the U.S. military, Embry-Riddle considers the student a nontraditional applicant and recognizes that his/her high school academic record may not accurately reflect the student’s ability. If a GED (General Education Development Certificate) has been earned, an official copy of the results must be sent to Embry-Riddle from the issuing agency. The following items must be provided by those wishing to be considered for admission:

1. Completed application form and $50 application fee (nonrefundable).

2. Official copy of high school transcript or completion of the General Education Development Test (GED scores must be sent to Embry-Riddle directly by the testing agency).

3. Documentation of activities or full-time employment experience (civilian, military, or any combination equaling three years).

Returning Student Applicants
An Embry-Riddle student whose attendance at the University is interrupted may be required to apply for readmission. In such cases, a new application
for admission must be filed with the Director of Admissions. For more information, refer to the Continued Enrollment section of the catalog.

Non-Degree Seeking Applicants

Embry-Riddle recognizes the needs of working adults who are interested in furthering their education for retraining or for enhancing professional skills. Students who meet University admission requirements are permitted to enroll in courses as special students in a non-degree seeking status. These students are permitted to continue their enrollment as long as they maintain satisfactory academic status or until they file a formal application for admission as a degree-seeking student. Students in this status will be allowed to complete up to 24 credit hours (12 for graduate), after which they must apply through the Admissions Office for matriculation into a degree program. Persons interested in applying as non-degree seeking students can get more information from the Admissions Office.

Degree Completion Program/Active Duty Military Personnel

All branches of the armed services offer various “Bootstrap” and degree completion programs. Embry-Riddle welcomes applications from qualified military personnel seeking to participate in such programs. Applications must be submitted by established deadlines. Upon receipt of the student’s application and supporting documents, the University will evaluate previous college coursework, military education, and work experience to determine eligibility for advanced standing. Each applicant receives a copy of the University evaluation form stating specifically the courses for which credit has been given.

Masters Admissions

Introduction

Embry-Riddle seeks master’s students of good character who have demonstrated scholastic achievement and capacity for future growth. Our admission process is aimed at identifying the best students who show the potential to succeed in one of our master’s programs. We use the guidelines in the next section to determine which applicants are to be granted full admission to a master’s program. Students who fail to meet these guidelines but have the potential for success in a master’s program may be granted a conditional admission. Students admitted under conditional status will have to prove their ability to pursue a master’s program by meeting specific performance criteria set by the program coordinator.

Admission decisions are often rendered in the anticipation of the applicant successfully completing the baccalaureate degree or some other admission requirement. Admission granted by such actions is provisional and is automatically rescinded if the applicant fails to meet the requirement before the specified date for the start of masters-level study.

Specific programs may require that potential degree candidates display a mastery of a number of topical areas critical to the initiation of master-level study in their fields. Candidates are informed of these requirements along with their notification of acceptance.

Any questions relating to the criteria or any other aspect of the admissions process should be addressed to the Graduate Admissions Office on the Daytona Beach Campus.

General Criteria

All masters applicants must have earned baccalaureate degree or equivalent. If earned in the United States, this degree must be from an appropriately accredited institution. If earned outside the United States, the degree must be from an institution that offers a degree program that is equivalent to one in an accredited degree granting institution listed in the Accredited Institutions of Postsecondary Education (AIPE) published by the American Council of Education (ACE). Applicants educated at foreign schools may be required to submit an evaluation by submitting official certified documentation of their educational achievements to a foreign credential evaluation organization specified by Embry-Riddle.

A well-defined process will be used to determine whether a student is fully qualified for admission to a specific master program. Criteria for making this judgment will include academic record, work experience, professional activities, publications, recommendations, written statements, and interviews, as appropriate.
Articulation of applicable courses to meet program requirements, or course prerequisites, may be required as a condition of admission.

Procedures for Admission

Applicants must follow these steps to be considered for admission into our master's programs prior to the application deadline:

1. **Complete an Online Application** (https://embry-riddle.force.com/TX_SiteLogin?startURL=%2FTargetX_Portal__PB): Answer each question carefully, select the desired major and term, and pay the $50 non-refundable application fee.

2. **Submit Official Transcripts**: Official transcripts from each college and university attended. The transcripts should also include degree conferred and conferral date if applicable.
   - If applicant attended a college or university outside the United States, a foreign credential evaluation (https://daytonabeach.erau.edu/international-programs/international-graduate-admissions) is required
   - Course descriptions for all graduate coursework to be considered for transfer credit. For more information, please refer to the master's transfer credit section

3. **Submit GMAT/GRE Test Scores**: Official test scores are required for admission consideration into specific programs. To review which programs require test scores, please refer to the program specific requirements section.
   - For information on GMAT administration, please visit this site (http://www.mba.com)
   - For information on the GRE administration. Please visit this site (http://www.ets.org/gre)

4. **Submit Supporting Documents**: In addition to transcripts and test scores, applicants must send the subsequent documents to the Office of Graduate Admissions:
   - **Statement of objectives**: required essay to demonstrate strong capacity for written communication. The statement should be at least three to four paragraphs long and include:
     - A description of the applicant’s long-term professional goals, defining how Embry-Riddle’s program supports those interests and goals
     - A description of the applicant’s interests and background
     - A description of the applicants’ reasons for desiring to do graduate work in the selected field
   - **Three letters of recommendation**: two academic and one professional are preferred.
   - **Resume**: outlining education, work experience, special activities, and awards.

Admission decisions will be rendered once all documents have been received. If you have any questions about your application, please contact the Office of Graduate Admissions (http://daytonabeach.erau.edu/admissions/graduate) using the information below.

Daytona Beach Graduate Admissions
Embry-Riddle Aeronautical University
1 Aerospace Boulevard
Daytona Beach, FL 32114
Phone: (800) 388-3728 - or - (386) 226-6176
E-mail: graduate.admissions@erau.edu
Website (http://daytonabeach.erau.edu/admissions/graduate)

Non-degree Seeking Applicants

Non-degree graduate applications are accepted in extenuating circumstances and must be first approved by the Vice Provost of Academic Support. If application is approved, applicant must submit a statement of purpose and all post-secondary official transcripts. Applicants can only take up to 12 credit hours. After that, they must apply for a degree program by completing an online application (https://embry-riddle.force.com/TX_SiteLogin?startURL=%2FTargetX_Portal__PB).

Admission Time Limit

Applicants who have been accepted for admission into Embry-Riddle master's programs must enroll in Embry-Riddle master's level courses within one year from the date of the semester for which they were accepted. Those who do not enroll within the specified time period must reapply for admission and provide a new set of supporting documents.
Transfer Credit

Students seeking to transfer prior academic work from an accredited institution toward their Embry-Riddle master's program must submit appropriate supporting documentations as part of the admission process. The request must be made in writing and must be accompanied by official transcripts, syllabi (course by course description) or equivalent evidence of such work. Requests must be approved by the academic department chair or their designee. A maximum of four classes (twelve credits) can be transferred toward the Embry-Riddle master’s degree program.

Prior academic work and courses taken at other institutions by veteran students and/or other eligible students receiving Veterans Education Benefits will be evaluated and credit granted as appropriate and will be reported to the DVA as required by law.

Escrow credit may be received for certain master's level courses taken by Embry-Riddle undergraduates.

Credit may be received for certain master's level courses taken as non-degree master's level work or as part of another Embry-Riddle master's degree program. When transferring from one Embry-Riddle master's program to another this credit may include prior work on a GRP or thesis.

In order to satisfy a master's degree program requirement, the academic work for which such credit is sought must be determined to be specifically relevant to the applicant's master's degree program at Embry-Riddle. The content of the applicable course or other program should be used to determine the nature of the credit to be applied to the student’s degree requirement. The appropriate academic department chair or designee shall make these determinations.

Credit will be granted only if the student demonstrated performance expected of a master's student at Embry-Riddle; in the case of master's level courses, this normally means that the course was completed with a B or better (3.00 CGPA on a 4.00 grading scale).

Credit for academic work used to satisfy the requirements of an undergraduate degree will not be accepted toward the requirements for a master's degree.

Credit will generally be accepted only for courses that were completed in the seven-year period immediately preceding the date that the student begins classes.

Permission to obtain master's level credit for courses to be taken outside the University after matriculation must be granted by the academic department chair or designee.

The last nine hours of master's level credit on a degree program must be earned at Embry-Riddle.

A student may not be enrolled in more than one degree program. Upon completion of an Embry-Riddle master's degree program, a student may elect to apply to another master's degree program at this university.

Intra-University Transfer

Current master’s students at either the Prescott or Worldwide Campus may transfer to the Daytona Beach campus if they meet the following requirements:

- Must be in an active student status
- Must meet requirements for the Daytona Beach master's program
- Must not have any financial obligations at their prior campus

Students should contact their respective advisor to initiate the process of transferring to the Daytona Beach campus.

Note: An admission application is not required for these students.

Conditional Admission

Students who fail to satisfy the guidelines for full admission, but have the potential for success in a master's program, may be granted a conditional admission. These students must prove their ability to pursue a graduate program by meeting specific performance criteria after matriculation at the University. The conditions of admission will be communicated to applicants in the letter of admission. While in a conditional status, these students are not eligible for assistantship opportunities.

These students will remain in a conditional status until they have completed 9 hours of masters-level work. During this period, students may receive no
grade lower than a B and will not be permitted to repeat courses. Upon successful completion of the appropriate undergraduate prerequisite courses, these students will transition into full graduate student status.

**Note:** Conditional Admission is only applicable to US citizens or US permanent resident students.

**Accelerated Bachelor's to Master's Programs**

These programs are designed to allow qualified students to begin a master’s degree while still completing the bachelor degree, thus finishing both degrees in a shorter time. In some cases, these degrees allow for the crossing of disciplines — earning a B.S. in one field and an M.S. in another, which gives graduates a versatility and breadth of knowledge sought by employers in today’s job market. Students must have a 3.2 CGPA and receive approval from the bachelor’s program coordinator, master’s program coordinator, Graduate Admissions, and, if applicable, Financial Aid and International Student & Scholar Services.

**Admission Deposit**

Admitted students must submit a non-refundable $200 tuition deposit at least 30 days prior to matriculation. The deposit will be held in the student’s account for one year and will be credited toward tuition during the first semester of attendance.

**Program Specific Criteria**

In addition to the general criteria for admission, some of our master’s programs have additional program-specific admission requirements.

**Master of Business Administration (MBA)**

Applicants to the MBA program are required to take the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) or other equivalent assessment prior to matriculation. MBA applicants are encouraged to score above the 50th percentile in all areas of either the GMAT or GRE. Coordinators may waive the requirement if another master’s degree or equivalent industry work have been completed. The student should possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher.

Once admitted, students are required to complete an MBA preparatory system of learning units prior to the beginning of class. The system used is not for Embry-Riddle credit, but is an assessment-based system that must be completed to demonstrate the student possesses the required prerequisite knowledge necessary to begin the MBA program.

**Master of Business Administration in Aviation Management (MBAAM)**

Applicants to the MBAAM program are required to take the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) or other equivalent assessment prior to matriculation. MBAAM applicants are encouraged to score above the 50th percentile in all areas of either the GMAT or GRE. Coordinators may waive the requirement if another master’s degree or equivalent industry work have been completed. The student should possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher.

Once admitted, students are required to complete an MBAAM preparatory system of learning units prior to the beginning of class. The system used is not for Embry-Riddle credit, but is an assessment-based system that must be completed to demonstrate the student possesses the required prerequisite knowledge necessary to begin the MBAAM program.

**Master of Science in Aeronautics (MSA)**

Applicants to the MSA program must have prerequisite knowledge in the areas of:

- Behavioral Science
- Economics
- Computer Applications
- Mathematics (including Statistics)

Applicants who not possess such knowledge, may be required to register for undergraduate prerequisite courses in these areas. Applicants should possess strong academic records as evidenced by a CGPA of 3.00 or higher. The GMAT or GRE are not required for admission into this program.

**Master of Science in Aerospace Engineering (MSAE)**

Applicants to the MSAE program should have an undergraduate degree in aeronautical engineering, aerospace engineering, or other engineering related degrees. The bachelor’s degree earned must be from an ABET-accredited engineering institution or its international equivalent. Applicants should also possess a strong academic record, generally
evidenced by a CGPA of 3.00 or higher. The Graduate Records Examination (GRE) is required for acceptance into this program and applicants are encouraged to score above the 50th percentile in all subject areas.

Applicants with a bachelor’s or an equivalent degree in any engineering discipline, mathematics, or physical science, who otherwise meet the requirements for full admission, may also be admitted into the MSAE program. Within the MSAE program, applicants may opt for the thesis option or the non-thesis option.

Note: Entry into the MSAE program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Master of Science in Aviation Finance (MSAF)
Applicants to the MSAF program are required to take the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE). MSAF applicants are encouraged to score above the 50th percentile in all areas of either the GMAT or GRE. Coordinators may waive the requirement if another master’s degree or equivalent industry work have been completed. The student should possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher.

Applicants possessing an undergraduate degree in business, accounting, finance or economics, or related transportation fields of study should meet the prerequisites for the MSAF. Applicants from other majors are accepted into the MSAF program but need to demonstrate undergraduate classes in economics, accounting, finance and statistics. Applicants who do not have a background in these areas, would need to take the appropriate ERAU undergraduate courses as a condition for admission. These pre-requisite courses would need to be completed prior to taking graduate level course work in the subject area.

Master of Science in Civil Engineering (MSCIV)
Applicants to the MSCIV program should have an undergraduate degree in any engineering related field. The bachelor’s degree earned must be from an ABET-accredited engineering institution or its international equivalent. Applicants should also possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. The Graduate Records Examination (GRE) is required for acceptance into this program and applicants are encouraged to score above the 50th percentile in all subject areas.

Note: Entry into the MSCIV program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Master of Science in Cybersecurity Engineering (MSCYBE)
Applicants to the MSCYBE program should have an undergraduate degree in computer science, engineering, or related discipline. Applicants should also possess strong academic records, generally evidenced by a CGPA of 3.00 or higher. The GMAT or GRE are not required for admission into this program.

Note: Entry into the MSCYBE program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Master of Science in Data Science (MSDS)
Applicants to the MSDS program should have an undergraduate degree in any technical related field (a degree with at least 4 semesters of college-level Math). Applicants with a non-technical undergraduate degree will be required to complete additional modules. Applicants should also possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. The Graduate Records Examination (GRE) is required for acceptance into this program and applicants are encouraged to score above the 50th percentile in all subject areas.

Note: Entry into the MSDS program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Master of Science in Electrical and Computer Engineering (MSECE)
Applicants to the MSECE program should have an undergraduate degree in electrical engineering, computer engineering, computer science, physical sciences, or any another engineering related discipline. The bachelor’s degree earned must be from an ABET-accredited engineering institution or its international equivalent. Applicants should also possess a strong academic record, generally
Master of Science in Engineering Physics (MSEP)
Applicants to the MSEP program should have an undergraduate degree in engineering, physics, chemistry, or mathematics. Applicants should also possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. The Graduate Records Examination (GRE) is required for acceptance into this program and applicants are encouraged to score above the 50th percentile in all subject areas.

Master of Science in Human Factors (MSHF)
Applicants to the MSHF program must have prerequisite knowledge in the areas of psychology and statistics. If applicants do not possess such knowledge, they may be required to register for undergraduate prerequisite courses in these areas. Applicants should also possess strong academic records, generally evidenced by a CGPA of 3.00 or higher. The GMAT or GRE are not required for admission into this program.

Master of Science in Mechanical Engineering (MSME)
Applicants to the MSME program should have an undergraduate degree in any engineering related field. The bachelor’s degree earned must be from an ABET-accredited engineering institution or its international equivalent. Applicants should also possess strong academic records, generally evidenced by a CGPA of 3.00 or higher. The Graduate Records Examination (GRE) is required for acceptance into this program and applicants are encouraged to score above the 50th percentile in all subject areas.

Master of Science in Occupational Safety Management (MSOSM)
The MSOSM program welcomes graduates with an undergraduate degree as well as working professionals with experience. Applicants to this program must have prerequisite knowledge in the area of Quantitative Methods. Applicants who do not possess such knowledge may be required to register for prerequisite courses. Applicants should also possess strong academic records, generally evidenced by a CGPA of 3.00 or higher. The GMAT or GRE are not required for admission into this program.

Master of Science in Software Engineering (MSSE)
Applicants to the MSSE program must have prerequisite knowledge in the areas of:

- Discrete Mathematics
- Data Structures and Algorithms
- Computing Systems (operating systems, computer architecture)
- Programming involving high-level language (for example, C/C++, JAVA, Ada, Visual Basic)

Applicants who do not possess such knowledge may be required to register for undergraduate prerequisite courses in these areas. Applicants should also possess strong academic records, generally evidenced by a CGPA of 3.00 or higher, along with a creditable background in computing.

The GRE exam, although not mandatory, is strongly encouraged for this degree program and for consideration of fellowship and assistantship award programs offered by the Department of Computing.

Master of Science in Systems Engineering (MSSYSE)
Applicants to the MSSYSE program should have an undergraduate degree in computer engineering, physical sciences, or any engineering discipline. The bachelor’s degree earned must be from an ABET-accredited engineering institution or its international equivalent. Applicants should also possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. The GMAT or GRE are not required for admission into this program.
Applicants who do not possess the required background maybe admitted conditionally with the provision that they complete specific undergraduate courses prior to enrolling in graduate courses.

Master of Science in Unmanned and Autonomous Systems Engineering (MSUASE)

Applicants to the MSUASE program should have an undergraduate degree in computer engineering, physical sciences, or any engineering discipline. The bachelor’s degree earned must be from an ABET-accredited engineering institution or its international equivalent. Applicants should also possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. The Graduate Records Examination (GRE) is required for acceptance into this program and applicants are encouraged to score above the 50th percentile in all subject areas. These scores inform admissions decisions and help to determine the level of support for graduate assistantships or scholarships.

Applicants with closely related non-engineering undergraduate degrees and/or a technical will be considered for the systems engineering track. A conditional admission may be required contingent upon passing prerequisite courses.

Embry-Riddle students who graduated from the Bachelor of Science in Unmanned Aircraft Systems Science may be admitted to the MSUASE program. However, it can only be in the Systems Engineering area of concentration once they complete a Systems Engineering minor and its math prerequisites (MA 241 and MA 242).

Note: Entry into the MSUASE program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Ph.D. Admissions

Introduction

Status quo is virtually an unknown concept in the aerospace industry. The technology with which aerospace works and the national and international regulations by which it must abide are subject to rapid, frequent, and sweeping change. Aerospace touches every sphere of modern personal and business life and, therefore, must be sensitive to and respond to stimuli from a variety of unrelated sources. A healthy aviation industry is critical to the nation’s economic well-being and security.

Embry-Riddle graduate degree programs are designed to stress pragmatic solutions to the managerial, technological, and organizational challenges in the aviation and aerospace industry today. The problems currently confronting industry are brought into the classroom for analysis, making use of the latest theories, tools, and techniques available to engineers, operations personnel, and managers. Case studies, simulations, computer-aided analysis, and computer-assisted design, as well as experiential exercises are interspersed throughout the curricula to achieve a balance between theory and the realities of the aviation/aerospace industrial world of the 21st century.

In most programs, opportunities are provided in each degree program to tailor the curriculum to meet specific, individual career objectives. Classes are scheduled to accommodate both full-time and part-time study. Many of the masters-level courses are nonsequential, allowing study to begin in any term. Electives needed to complete the requirements of any masters degree are selected from among the 500/600 numbered courses (except BA 503 and the AED course series) listed in this catalog with approval of the degree program coordinator.

General Criteria

All doctoral applicants must have earned baccalaureate or master’s degree. If earned in the United States, this degree must be from an appropriately accredited institution. If earned outside the United States, the degree must be from an institution that offers a degree program that is equivalent to one in an accredited degree granting institution listed in the Accredited Institutions of Postsecondary Education (AIPE) published by the American Council of Education (ACE). Applicants educated at foreign schools may be required to submit an evaluation by submitting official certified documentation of their educational achievements to a foreign credential evaluation organization specified by Embry-Riddle.

A well-defined process will be used to determine whether a student is fully qualified for admission to a specific Ph.D. program. Criteria for making this judgment will include academic records, work experience, professional activities, publications,
recommendations, written statements, and interviews, as appropriate.

Articulation of applicable courses to meet program requirements or course prerequisites may be required as a condition of admission.

Procedures for Admission

Applicants must follow these steps to be considered for admission into our doctoral programs prior to the application deadline:

1. **Complete an Online Application**: Answer each question carefully, select the desired major and term, and pay the $50 non-refundable application fee.

2. **Submit Official Transcripts**: Official transcripts from each college and university attended. The transcripts should also include degree conferred and conferral date if applicable.
   - If applicant attended a college or university outside the United States, a foreign credential evaluation (https://daytonabeach.erau.edu/international-programs/international-graduate-admissions) is required.
   - Course descriptions for all graduate coursework to be considered for transfer credit. For more information, please refer to the doctoral transfer credit section.

3. **Submit GMAT/GRE Test Scores**: Official test scores are required for admission consideration into specific programs. To review which programs require test scores, please refer to the program specific requirements section.
   - For information on GMAT administration, please visit this site (http://www.mba.com).
   - For information on the GRE administration. Please visit this site (http://www.ets.org/gre).

4. **Submit Supporting Documents**: In addition to transcripts and test scores, applicants must send the subsequent documents to the Office of Graduate Admissions:
   a. **Statement of objectives**: required essay to demonstrate strong capacity for written communication. The statement should be at least three to four paragraphs long and include:
      - A description of the applicant’s long-term professional goals, defining how Embry-Riddle’s program supports those interests and goals.
      - A description of the applicant’s interests and background.
      - A description of the applicants’ reasons for desiring to do graduate work in the selected field.
      - A research topic proposal.
   b. **Three letters of recommendation**: two academic and one professional are preferred.
   c. **Resume**: outlining education, work experience, special activities, and awards.

Admission decisions will be rendered once all documents have been received. If you have any questions about your application, please contact the Office of Graduate Admissions (http://daytonabeach.erau.edu/admissions/graduate) using the information below:

Daytona Beach Graduate Admissions
Embry-Riddle Aeronautical University
1 Aerospace Boulevard
Daytona Beach, FL 32114
Phone: (800) 388-3728 - or - (386) 226-6176
E-mail: graduate.admissions@erau.edu
Website (http://daytonabeach.erau.edu/admissions/graduate)

The University reserves the right to refuse admission to students who are on probationary status or who were academically dismissed from other colleges or universities. If the University admits such students, they will be admitted with conditional status.

**Admission Time Limit**

Applicants who have been accepted for admission into Embry-Riddle Ph.D. programs must enroll in Embry-Riddle courses within one year from the date of the semester for which they were accepted. Those who do not enroll within the specified time period must reapply for admission and provide a new set of supporting documents.

**Transfer Credit**

Students seeking to transfer prior academic work from an accredited institution toward their Embry-Riddle Ph.D. program must submit appropriate
supporting documentations as part of the admission process. The request must be made in writing and must be accompanied by official transcripts, syllabi (course by course description) or equivalent evidence of such work. Requests must be approved by the academic department chair or their designee. The combined total credit applied to an Embry-Riddle Ph.D. degree may not exceed 12 credit hours.

Prior academic work and courses taken at other institutions by veteran students and/or other eligible students receiving Veterans Education Benefits will be evaluated and credit granted as appropriate and will be reported to the DVA as required by law.

In order to satisfy a Ph.D. degree program requirement, the academic work for which such credit is sought must be determined to be specifically relevant to the applicant’s Ph.D. degree program at Embry-Riddle. The content of the applicable course or other program should be used to determine the nature of the credit to be applied to the student’s degree requirement. The appropriate Daytona Beach or Prescott academic department chair or designee shall make these determinations.

Credit will be granted only if the student demonstrated performance expected of a Ph.D. student at Embry-Riddle (in the case of masters courses, this normally means that a B or better (3.00 CGPA on a 4.00 system).

Credit for academic work used to satisfy the requirements of an undergraduate degree will not be accepted toward the requirements for a Ph.D. degree.

Credit will generally be accepted only for courses that were completed in the seven-year period immediately preceding the date that the student begins classes.

Permission to obtain Ph.D. credit for courses to be taken outside the University after matriculation must be granted by the academic department chair or designee.

The last nine hours of Ph.D. credit on a degree program must be earned at Embry-Riddle.

A student may not be enrolled in more than one degree program. Upon completion of an Embry-Riddle master’s degree program, a student may elect to apply to another master’s degree program at this university.

Graduate Internships

Graduate internships are temporary professional opportunities in industry available to graduate students. There are two types of internships: resident and nonresident. Resident internships are professional work activities supported by a partnership between industry and the University and conducted on campus under the supervision of a faculty/staff sponsor in conjunction with the employer. Nonresident internships are professional work activities conducted off-campus at the supporting organization’s facility. Full-time employees of the offering organization are not eligible for an internship appointment and cannot receive academic credit for their professional position.

Masters students who have full graduate status, are degree seeking, in good standing with a minimum of six graduate credit hours completed, and who have earned a cumulative GPA of 3.00 on a 4.00 basis are eligible to apply for graduate internships. Students must demonstrate adequate communication and technical skills.

Students selected for an internship may register for the approved number of credit hours in the appropriate departmental internship course and will be charged tuition for one credit hour. Masters-level academic credit is awarded at a rate of one credit hour for every 200 clock hours of work completed, up to a maximum of three credit hours in one semester. Three internship credit hours may be applied toward degree requirements in many degree programs. Students are advised to consult with their Graduate Program Coordinator for approval to use internship credits in their degree program curriculum.

International students must verify their eligibility to work in the U.S. with International Student Services BEFORE accepting a co-op or internship and may not register for a co-op or internship after having completed their educational requirements, according to the regulations of the United States Citizenship and Immigration Services.

Thesis, Research Project and Capstone Project Requirements

Students who elect a thesis, graduate research project or graduate capstone project must obtain
approval of the research topic. The University encourages master’s students to select thesis, graduate research/capstone project topics that permit them to participate in faculty research. Once approved, a research advisor and one or more additional committee members are selected and approved by the department coordinator or designee. Normally, if a student is working with a faculty research team as part of his/her thesis or graduate/capstone research project, the faculty member who is directing the student’s research should generally be the student’s research advisor. The graduate research/capstone project option may not be available for all programs.

Program Specific Criteria
In addition to the general criteria for admission, some of our masters programs have additional program-specific admission requirements.

Ph.D. in Aerospace Engineering (PHDAE)
The objective of this Ph.D. program is to provide an opportunity for highly qualified students to complete a rigorous program of advanced study and engage in research centered on developing new knowledge for a field related to aerospace engineering.

The program is open to students who have already earned a bachelor's or master's degree in a closely related engineering discipline, have an exemplary academic record and have demonstrated the ability and keen interest in independent scientific inquiry. For these students the program provides exceptional research opportunities in key areas of aerospace engineering to work on applied and interdisciplinary research projects that matter to industry.

The general areas of research are aerodynamics, dynamics and control, propulsion, and aerospace structures. The College of Engineering offers a number of mature master's degree programs including Master of Science in Aerospace Engineering (thesis), Master of Aerospace Engineering (non-thesis), Civil, Cybersecurity, Mechanical, Software, Electrical and Computer Engineering, and Unmanned and Autonomous Systems which all have an aerospace focus consistent with the university niche and provide a rich menu of advanced graduate courses from which to select.

Graduates of the Ph.D. in Aerospace Engineering program are expected to identify, formulate, and solve complex aerospace engineering problems through their great depth of understanding of fundamental principles of engineering sciences, the knowledge of advanced mathematical methods, a mastery of scientific and engineering research techniques, and expertise in today’s enabling numerical and computer-aided engineering tools. They are expected in their practice in industry, academia, or government to push boundaries of knowledge in aerospace engineering by conceiving, planning, producing, and disseminating original research.

Applicants to the Ph.D. program in Aerospace Engineering must have a minimum cumulative grade point average (CGPA) of 3.5 have taken the Graduate Record Examination (GRE) and have an acceptable score on both quantitative and verbal sections and submit a complete application package before the deadline specified in the University catalog. The application package should include statements of goals (two to five pages) and reasons for wishing to pursue doctoral studies, incorporating interests and background as well as three letters of recommendation.

International applicants whose primary language is not English must also achieve the minimum score requirement of TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Test System) as required by the University.

A minimum of 18 credit hours of coursework beyond a master's degree is required for the Ph.D. in Aerospace Engineering. The goal of the coursework is primarily to support the student’s research endeavors; therefore, courses outside the concentration area or outside the AE department are allowed as deemed appropriate by the advisor. At least one 3-credit-hour advanced mathematics course is required. All courses must be graduate level courses (i.e., 500 or 600), and must be approved by the student’s advisor. A Ph.D. student must maintain a minimum of a 3.0 GPA for each semester enrolled in the program and a 3.0 CGPA throughout his/her doctoral studies.

A minimum of 24 credit hours of dissertation research must be completed. Ph.D. students may register for no more than 6 credit hours of dissertation each semester after they pass the
qualifying exam. The Ph.D. requires a minimum of 42 units beyond the master’s degree, including both coursework and dissertation units.

Candidates for the Ph.D. are required to take and pass written qualifying examinations directly related to the area of concentrated study, plus an additional exam in mathematics.

While the program requires a rigorous course work beyond the master’s degree, any coursework prescribed for candidates is intended to prepare him/her for the work on the thesis. The award of the Ph.D. is based on the submission of a satisfactory thesis.

Specific information about the program, including admission and course requirements, can be found in the Embry-Riddle Aeronautical University Doctoral Programs Catalog and at the program website (http://erau.edu/degrees/phd/aerospace-engineering).

Note: Entry into the PHDAE program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Ph.D. in Aviation (PHDAVIA)
The demand for aviation professionals with the skills to conduct research and solve problems continues to grow in response to the increasing complexity and evolution of the aviation field. The Ph.D. in Aviation program is designed to address that need by allowing students to pursue doctoral studies in aviation in a diverse, intellectually versatile and multi-disciplinary environment. It is the first Ph.D. in aviation in the U.S.

Courses are offered online for greater accessibility to the working professional. Participation in three six-day on-campus residency seminars is required during the program. This program format provides doctoral degree students an innovative way to achieve their personal, educational, and professional goals.

The Ph.D. in Aviation program is designed to enable students to achieve the following learning objectives: develop mastery of the central theories and concepts in the field of aviation, including foundations, safety management, economics, and regulatory procedures; pose and solve theory-based and research-based problems designed to advance applications in the field of aviation; extend the aviation body of knowledge by conceiving, planning, producing, and communicating original research; develop and demonstrate expertise in instructional processes; and demonstrate leadership, collaboration, and communication necessary for scholarly work in aviation.

Courses are offered during three 15-week terms per year. The program requires completion of four aviation core courses, a four-course sequence in statistics and research methodology, and four specialization or cognate courses. A qualifying exam tests student’s mastery of core and cognate subject matter and is conducted at the end of the course work. Completion and defense of a dissertation is the final phase of the program. The dissertation is a formal academic paper that constitutes the culmination of the doctoral program. The purpose of the dissertation is to prepare students to be professionals in a discipline, to develop the skills necessary to engage in independent research, and to advance the body of knowledge in aviation. The program requires completion of 90 credit hours of coursework, residency seminars, and dissertation courses, including 30 credit hours from the student’s master’s degree.

Specific information about the program, including admission and course requirements, can be found in the Embry-Riddle Aeronautical University Doctoral Programs Catalog and at the program website (http://aviationphd.erau.edu).

Note: Entry into the PHDAVIA program is only available for the Fall semester of each academic year.

Ph.D. in Aviation Business Administration (PHDABA)
The objective of this unique Ph.D. program is to provide an opportunity for highly qualified students to complete a rigorous program of advanced study and engage in research centered on developing new knowledge for a field related to aviation business administration.

The program is open to students who have already earned a Master’s degree in a closely related business discipline, have an exemplary academic record and have demonstrated the ability and keen interest in real world aviation business challenges. For these students the program provides exceptional research opportunities in key areas of business to work on applied and interdisciplinary research.
projects that matter to the business of aviation and aerospace industries. The program has been designed to accommodate working professionals who seek to advance their knowledge and conduct high-quality research in aviation business while being employed.

The general areas of research are management, economics, finance, operations, marketing, strategy, and management information systems focused towards aviation. The Daytona Beach College of Business has been the first to offer master’s degree programs in business administration. Currently it offers MBA, MBA in Aviation Management, Master’s in Aviation Finance and supporting similar degrees offered by the Worldwide campus in terms of course design and delivery. The Daytona Beach College of Business currently offers a diverse range of courses to the students with different specializations from which to choose.

The Ph.D. graduates are expected to lead the aviation industry, formulate, and solve complex business oriented challenges through their great depth of understanding of fundamental principles of business administration. These graduates will be the leaders in industry, academia, or government conceiving, planning, producing, and disseminating original research.

Applicants to the Ph.D. program in Aviation Business Administration must have a solid background in terms of their GPA, have taken the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) and have an acceptable score on both quantitative and verbal sections, and submit a complete application package before the deadline specified by the University catalog. International applicants whose primary language is not English must also achieve the minimum score requirement specified by the University.

The Ph.D. requires completion of 60 credits, including both coursework and dissertation units. The Ph.D. students are expected to complete 36 credit hours of coursework for the Ph.D. in Aviation Business Administration. These courses are divided into 3 groups. The first group consisting of 15 credit hours provides the necessary foundation of aviation business disciplines. The second group consisting of 9 credit hours is designed to support the student’s quantitative skills in business and prepare them for analytical research. The third group consisting of 12 credit hours is designed to help students get a deeper understanding of their proposed area of research by being exposed to the latest developments in the field. These courses will help students to pursue research endeavors and therefore courses outside the concentration area or outside the Daytona Beach College of Business are allowed as deemed appropriate by the advisor. Students may be exempted from some of the coursework if they have taken them before or show substantial industry experience in the field as recommended by the Doctoral Degree Program Committee.

A Ph.D. student must maintain a minimum of a 3.0 GPA for each semester enrolled in the program and a 3.0 CGPA throughout his/her doctoral studies.

A minimum of 24 credit hours of dissertation research must be completed. Ph.D. students may register for no more than 6 credit hours of dissertation each semester after they pass the qualifying and preliminary exams.

Candidates for the Ph.D. are required to take and pass written qualifying and preliminary examinations directly related to the area of proposed research. While the program requires a rigorous course work beyond the Master’s degree, any coursework prescribed for candidates is intended to prepare them for the work on the dissertation. The award of the Ph.D. is based on the submission of a satisfactory dissertation.

Specific information about the program, including admission and course requirements, can be found in the Embry-Riddle Aeronautical University Doctoral Programs Catalog and at the program website (https://erau.edu/degrees/phd/aviation-business-administration).

**Note:** Entry into the PHDABA program is only available for the Fall semester of each academic year.

**Ph.D. in Electrical Engineering and Computer Science (PHDEECS)**

Electrical Engineering and Computer Science (EE&CS) are the endpoints for a range of related intellectual domains that includes Computer Engineering, Software Engineering, and Systems Engineering as well. With inclusion of computational elements that communicate wirelessly in more and more engineered systems, particularly those in
aerospace and aviation, there is increasing demand in industry, government, and the academy for researchers capable of exploring the frontiers of knowledge within each of Electrical Engineering and Computer Science and across the related domains. The Ph.D. in EE&CS gives qualified students the opportunity to develop and display their ability to execute original research and engage in knowledge discovery in any and all of these domains.

The focus of the program is research: students in the program must perform original research culminating in a publishable dissertation. The program supports the Electrical, Computer, Software, and Systems Engineering (ECSSE) department’s strategic research thrusts of see and avoid for unmanned and autonomous systems, of assured systems engineering including cybersecurity engineering, and of modeling and simulation as applied in the worlds of aerospace and aviation. Other research interests developed by program participants in conjunction with their research advisor are anticipated, as is appropriate for the range of intellectual areas encompassed by EE&CS.

In addition to the dissertation credits of 24 hours, students must complete coursework appropriate to the intended dissertation research. Students entering from the master degree must complete 18 credits of coursework (total 42 credits after the master’s); those entering from the bachelor degree, 48 credits of coursework (total 72 credits after the bachelor’s). Coursework must include at least 3 credits of mathematics at the 500-, 600-, or 700- level. All program students must complete a qualifying exam early in their program of study and later a preliminary dissertation exam based on their proposed research. Upon completion of the research program, the student must successfully defend their dissertation before a committee comprised of their research advisor and four others, including at least two other members of the ECSSE faculty and one member from outside the department. Committee members external to ERAU, such as individuals from industry or other academic institutions, may be included as allowed by ERAU doctoral policies.

Qualified applicants will have a 3.2/4.0 GPA with a bachelor’s degree from an ABET accredited undergraduate institution or international equivalent; those applying with a master’s degree will also have a 3.2/4.0 GPA in their graduate studies. The Graduate Record Exam must have been taken within five years prior to application, with scores having been reported to ERAU. Those for whom English is not their native language must demonstrate competence in spoken and written English as per ERAU policies.

Specific information about the program, including admission and course requirements, can be found in the Embry-Riddle Aeronautical University Doctoral Programs Catalog (https://catalog.erau.edu/daytona-beach/engineering/phd/electrical-engineering-and-computer-science).

Note: Entry into the PHDEECS program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Ph.D. in Engineering Physics (PHDEP)

The Ph.D. in Engineering Physics provides advanced education and research opportunities to exceptional students by providing a research environment that fosters collaboration, creative thinking, and publishing of findings in peer-reviewed archival journals and proceedings. The general areas of research are Spacecraft Engineering, Space Physics, and Upper Atmospheric Physics. The program is a natural outgrowth of the M.S. program in Engineering Physics, and of the B.S. program in Engineering Physics, which is one of the largest ABET-accredited B.S. in Engineering Physics programs in the nation.

Graduates of the Ph.D. in Engineering Physics program are expected to identify, formulate, and solve space science and spacecraft engineering problems; develop and apply expertise in advanced space physics, upper atmospheric physics, and spacecraft engineering; develop a mastery of scientific and engineering research techniques; and extend the knowledge base in space science and spacecraft engineering by conceiving, planning, producing, and communicating original research.

The minimum entry requirement to the program is a master’s degree in engineering or physics or closely related discipline. A minimum CGPA of 3.2/4.0 is required for both the bachelor’s and Master’s degrees completed. The program also requires a minimum GRE (verbal plus quantitative) score of 1200 obtained within the previous two years of the application. Moreover, applicants are required to submit statements of goals (two to five pages), to include reasons for wishing to pursue doctoral
studies, incorporating interests and background, and three letters of recommendation.

The Ph.D. in Engineering Physics curriculum is modeled after traditional programs in engineering and physics at other institutions. The program requires 45 hours beyond a master’s degree, to include 12 hours in core, a minimum of 6 hours of electives and 27 hours of dissertation, the successful completion of a two-day written comprehensive examination prior to beginning the dissertation, the successful presentation of a dissertation research proposal, the successful completion of a written dissertation, and the successful oral defense of the dissertation before the dissertation committee and an audience of peers and other interested scholars.

Specific information about the program, including admission and course requirements, can be found in the Embry-Riddle Aeronautical University Doctoral Programs Catalog (https://catalog.erau.edu/daytona-beach/arts-sciences/phd/engineering-physics).

Note: Entry into the PHDEP program is only available for the fall and spring semester of each academic year. Summer start is not offered.

Ph.D. in Human Factors (PHDHF)

The Ph.D. program in Human Factors (HF Ph.D.) provides an opportunity for highly qualified students, from a variety of backgrounds, which may include Psychology, Physiology, Life Sciences, and Engineering, to pursue a rigorous program of advanced study, engage in high-quality research, and develop new knowledge within specialized areas of Human Factors. Although a relatively new discipline, Human Factors has grown tremendously for the past several decades, both as a discipline and a profession. Highly educated and experienced Human Factors professionals are in great demand in academia, government agencies and as researchers in private companies.

The Ph.D. in Human Factors is an 84 credit, five-year program for students entering with a BS degree or 48 credits (3 years) for students entering with a MS degree. The program focuses on core educational elements of the discipline including sensation, perception, cognition and statistics, with specializations offered in three key research areas: aviation/aerospace human factors, medical human factors, and technology-enhanced and game-based learning and testing.

Students enrolling should have an interest in one of the three research areas mentioned above with a goal of entering a career in academia or as a researcher in a government agency or private corporation. The program will be offered as a traditional doctoral program, with classes being offered face to face and not through remote delivery. Students will be expected to be full-time and in residence at the Daytona Beach Campus in order to complete coursework and embark on a research specialization.

Note: Entry into the PHDHF program is only available for the Fall semester of each academic year.

Ph.D. in Mechanical Engineering (PHDME)

The Ph.D. program in Mechanical Engineering offers highly-qualified students an opportunity to demonstrate their ability to conduct original applied and/or interdisciplinary research and to develop new knowledge in the field. Mechanical Engineering is a broad, dynamic, and in-demand field and graduates will be well prepared for research careers in industry, government, or academia.

The program is open to students who have earned a bachelor’s or master’s degree in a closely related engineering discipline, have an exemplary academic record, and have demonstrated ability to and interest in conducting independent scientific inquiry. The Mechanical Engineering department’s key focal areas of high performance vehicle systems, robotics and autonomous systems, clean energy systems, and biomechanical systems will serve as foci for research, but the program is designed to be customizable to individual research topics commensurate with the broad nature of the field.

Applicants to the Ph.D. program in Mechanical Engineering are required to have a minimum CGPA of 3.5/4.0 and have achieved an acceptable score on the GRE. Applicants must also demonstrate an aptitude for high-level research through submission of resumes, publications, portfolios, or interviews and must submit a written statement outlining the student’s research interests and personal goals. The package must also include three letters of recommendation and be submitted before the deadlines specified in the catalog. International applicants whose primary language is not English must also achieve the minimum score requirement
on the TOEFL or IELTS exams as required by the University.

The requirements for the Ph.D. in Mechanical Engineering are focused heavily towards enabling and requiring the student to establish, complete, and defend a program of original research. Students will be required to define and complete a plan of study containing a minimum of 18 credit hours of graduate-level coursework beyond the master’s degree and 24 credit hours of dissertation research. Students entering the program with only a bachelor’s degree will also be required to complete either the thesis or non-thesis options of the MSME program.

In addition to coursework, students in the program must pass a qualifying exam to demonstrate aptitude in and mastery of the fundamentals of engineering and mathematics. Students will then be required to prepare and defend a dissertation proposal that outlines the student’s proposed research in a preliminary examination to be admitted to degree candidacy. Candidates will complete the degree by completing a program of original research and preparing and defending a dissertation.

Specific information about the program, including admission and course requirements, can be found in the Embry-Riddle Aeronautical University Doctoral Programs Catalog (https://catalog.erau.edu/daytona-beach/engineering/phd/mechanical-engineering).

**Note**: Entry into the PHDME program is only available for the fall and spring semester of each academic year. Summer start is not offered.

### International Applicants

**International Undergraduate Applicants**

Embry-Riddle is authorized under federal laws to enroll non-immigrant alien students. An international applicant is defined as a nonresident, non-immigrant applicant entering the United States on a non-tourist visa (typically an F-1 or a J-1 visa).

The following items must be provided:

1. **Application Form and Deposit**
   - Completed application form and $50 application fee (nonrefundable).

2. **Transcripts**
   - For students who attend school within the United States, an official copy of upper secondary school academic records (must be sent directly from the school to Embry-Riddle). These records must arrive in the Admissions Office in the original envelope with an unbroken seal to be considered official. We also can accept emailed transcripts directly from an official school representative with an official school email address and email signature.

3. **Standardized Test Scores**
   - The SAT I: Reasoning Test or the ACT is strongly recommended for admission. Standardized test results are required if a student would like to be considered for a potential merit scholarship and are always reviewed in conjunction with a student’s academic record. They are never the sole factor used to determine eligibility. For information about the SAT/ACT test dates and locations please contact

4. **Language Proficiency**
   - To be admitted into a degree program, students must meet the minimum language proficiency criteria. International students who have graduated from an English educational system within the last two years, or for whom English is the primary language, are usually not required to take a language proficiency exam. Students whose language of instruction was **not** in English must submit official TOEFL or IELTS, or Cambridge scores. The preferred TOEFL score for admissions is 79 (IBT-Internet based). The preferred IELTS score for admission is 6.0, or a Cambridge English score of 170 or higher. Students scoring below the preferred score can consider enrolling in our Embry-Riddle Language Institute (ERLI). Admission to ERLI does not guarantee admission to an Embry-Riddle degree program. Admissions also encourages all applicants for whom English is not the primary language spoken at home to consider taking the SAT I to supplement their TOEFL score.
     - TOEFL Services, http://www.toefl.org, 1-(609) 771-7100 (worldwide), 1-(877) 863-3546
     - ERLI Embry-Riddle Language Institute, http://db.erau.edu/erli, (386)226-7614, info below

5. **Foreign Credential Evaluation**
All undergraduate and graduate applicants who have educational experience outside the United States are required to provide an official course-by-course evaluation in English, which includes the cumulative grade-point average, unless specifically exempted through a qualifying ERAU program. A copy of the foreign transcript must accompany the official credit evaluation. The evaluation must be certified by one of the Foreign Credential Evaluation Services (FCE) approved by Embry-Riddle. A fee is charged for the translation service and must be paid by the applicant directly to the FCE.

If a student has graduate-level work (either transfer or advanced standing) that is indicated on the foreign credential evaluation as meeting the requirements for an undergraduate degree, it will not be reviewed for applicability toward an ERAU graduate degree.

Educational systems differ country by country. The following services are versed in providing a comparison of a country’s education system to the system in the United States. This comparison includes education levels, credits, and grades. The report is considered official only if mailed from the agency directly to ERAU. We prefer all applicants use the foreign credential evaluation services provided by World Education Services. We will also accept evaluations from the following agencies: ECE, IEE (https://www.foreigntranscripts.com), IERF, Josef Silny & Associates and SpanTran (https://www.spantran.com/institutional_applications/SpanTran%20Application%20for%20Embry-Riddle%20Aeronautical%20University.pdf).

**World Education Services, Inc.**
Bowling Green Station
P.O. Box 5087
New York, NY 10274-5087
Phone: (212) 966-6311
Fax: (212) 739-6100
www.wes.org (http://www.wes.org)

Foreign credential evaluations are NOT needed for: Students who have attended an IB Program, a high school with U.S. Regional Accreditation, or an American International School.

6. **I-20 Requirements for International Students.**

Before an I-20 can be issued, international students must submit the following:

a. Affidavit of Financial Support for International Students (available on our website: http://daytonabeach.erau.edu/admissions/international/index.html)

b. The Affidavit of Financial Support must be dated within 6 months of the start term, and is required for immigration purposes but is not required for an admission decision

c. Supporting bank letter verifying appropriate funds on deposit.* This amount will reflect the amount needed to cover tuition, fees, books, health insurance, and living expenses for one year, plus $4,000 for each accompanying dependent. In the case of sponsored students, an official notification of public or private sponsorship will take the place of a bank letter. A University assistantship contract does not relieve a student from the requirement to provide both a financial affidavit and a supporting bank letter, unless waived by the appropriate University official. International students must be fully prepared upon arrival on campus to meet all normal living expenses and manage their finances for the period of time required to complete the degree.*

d. At least 30 days prior to matriculation, students accepted for admission must submit a $200 tuition deposit. The deposit will be held in the student’s account for one year and will be credited toward tuition during the first semester of attendance. After one year, if the student has not matriculated, the deposit is forfeited.

e. The I-20 will be issued to the student upon acceptance to the University, once a student follows all of the required steps.

f. The I-20 Form must be in the student’s possession before departure and presented to the nearest U.S. embassy or consulate to obtain the necessary entry visa before departure to the United States. These rules and procedures apply equally to international students already studying in the United States who wish to transfer to ERAU or wish to pursue a master's degree or doctoral degree at Embry-Riddle. The only exception is that they must follow the procedures required by the U.S. Immigration and Customs Enforcement to obtain approval for the transfer. Students...
should seek the assistance of the international student advisor at their current university to assist them with the transfer procedures. Transfer students should follow the steps outlined on the ERAU website (https://internationalservices.erau.edu) to have their I-20 transferred to Embry-Riddle. This will allow our admissions office to issue a new I-20.

7. Immunization Record
Provide documentation of immunity to vaccine-preventable diseases as described in material sent from the University. At enrollment, all students from areas determined to be endemic or at high risk for tuberculosis will be required to have a tuberculosis skin test (Mantoux test) and additional medical follow-up as needed and directed by the campus Health Services Office.

8. FAA Medical Certificate
All flight students must provide an FAA Medical Certificate, Class I or II, at least 60 calendar days before the desired enrollment date. Students who do not have access to an FAA-approved physician may take this exam after arriving in the United States. International students desiring flight programs will be required to complete federal screening procedures where applicable.

All materials submitted become the property of Embry-Riddle Aeronautical University and cannot be reproduced, returned, or forwarded.

* See application for specific dollar amount requirement.
** Specifics will be provided during application process.

International Graduate Applicants
Embry-Riddle is authorized under federal laws to enroll non-immigrant alien students. An international applicant is defined as a nonresident, non-immigrant applicant entering the United States on a non-tourist visa (typically a F-1 or a J-1 visa).

The following items must be provided:

1. Application Form and Deposit
Completed application and $50 application fee (nonrefundable).

2. Transcripts
For schooling within the United States, an official transcript from each college or university attended (must be sent directly from the school to Embry-Riddle). These records must arrive in the Admissions Office in the original envelope with an unbroken seal to be considered official.

3. GRE/GMAT Test Scores
Official test scores may be required for consideration into specific programs. Request that Educational Testing Service (ETS) send your GMAT or GRE scores, if applicable. Embry-Riddle's school code is 5190.

4. Language Proficiency
To be admitted into a degree program, students must meet the minimum language proficiency criteria. International students who have graduated from an English educational system within the last two years, or for whom English is the primary language, are usually not required to take a language proficiency exam. Students whose language of instruction was not in English must submit official TOEFL or IELTS, or Cambridge scores. The preferred TOEFL score for admissions is 213 (computer based), 550 (paper based), or 79 (IBT-Internet based). The preferred IELTS score for admission is 6.0, or a Cambridge English score of 170 or higher. Students scoring below the preferred score may be deferred for enrollment to our Embry-Riddle Language Institute (ERLI). Admission to ERLI does not guarantee admission to an Embry-Riddle degree program.

TOEFL Services, http://www.toefl.org, 1-(609) 771-7100 (worldwide), 1-(877) 863-3546
ERLI Embry-Riddle Language Institute, http://db.erau.edu/erli, (386)226-7614, info below

5. Foreign Credential Evaluation
All international undergraduate and graduate applicants who have any educational experience outside the United States may be required to provide an official course-by-course foreign credential evaluation in English that includes the cumulative grade point average. The evaluation must be certified by the Foreign Credential Evaluation Services (FCE) and sent directly to Embry-Riddle. A fee is charged for the evaluation service and must be paid by the applicant directly to the FCE. Please note that all materials
submitted become the property of the FCE/Embry-Riddle Aeronautical University and cannot be reproduced, returned, or forwarded. We prefer all applicants use the foreign credential services provided by World Education Services. We also will accept evaluations from the following services: ECE, IERF, and Josef Silny & Associates.

World Education Services (WES), http://www.wes.org/educators/icap.asp
(800) 937-3898 -or- (212) 966-6311, email: info@wes.org

6. I-20 Requirements for International Students.
Upon application, international students must submit the following:

a. affidavit of Financial Support for International Students (available on our website: http://daytonabeach.erau.edu/admissions/international/index.html
b. Supporting bank letter verifying appropriate funds on deposit.* This amount will reflect the amount needed to cover tuition, fees, books, health insurance, and living expenses for one year, plus $4,000 for each accompanying dependent. In the case of sponsored students, an official notification of public or private sponsorship will take the place of a bank letter. A University assistantship contract does not relieve a student from the requirement to provide both a financial affidavit and a supporting bank letter, unless waived by the appropriate University official. International students must be fully prepared upon arrival on campus to meet all normal living expenses and manage their finances for the period of time required to complete the degree.*

c. At least 30 days prior to matriculation, students accepted for admission must submit a $200 tuition deposit. The deposit will be held in the student’s account for one year and will be credited toward tuition during the first semester of attendance. After one year, if the student has not matriculated, the deposit is forfeited.

d. The I-20 will be issued to the student upon acceptance to the University once all required documentation has been received.

e. The I-20 Form must be in the student’s possession before departure and presented to the nearest U.S. embassy or consulate to obtain the necessary entry visa before departure to the United States. These rules and procedures apply equally to international students already studying in the United States who wish to transfer to ERAU or wish to pursue a master’s degree or doctoral degree at Embry-Riddle. The only exception is that they must follow the procedures required by the U.S. Immigration and Customs Enforcement to obtain approval for the transfer. Students should seek the assistance of the international student advisor at their current university to assist them with the transfer procedures. Transfer students should contact their current school’s International Student Service Office and request that their SEVIS record be released to Embry-Riddle at the end of their last semester at their current school. This will allow our admissions office to issue a new I-20.

7. Immunization Record
Provide documentation of immunity to vaccine-preventable diseases as described in material sent from the University. At enrollment, all students from areas determined to be endemic or at high risk for tuberculosis will be required to have a tuberculosis skin test (Mantoux test) and additional medical follow-up as needed and directed by the campus Health Services Office.

8. FAA Medical Certificate
All flight students must provide an FAA Medical Certificate, Class I or II, at least 60 calendar days before the desired enrollment date. Students who do not have access to an FAA-approved physician may take this exam after arriving in the United States. International students desiring flight programs will be required to complete federal screening procedures where applicable.**

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* See application for specific dollar amount requirement.

** Specifics will be provided during application process.

SEVIS
SEVIS is the Student and Exchange Visitor Information System consisting of a governmental
computerized system to maintain and manage data related to foreign students and exchange visitors during their stay in the United States. This system allows for real-time access to this information and assists colleges and universities in ensuring that students comply with the terms of the visas. For more information about SEVIS and visa requirements, please refer to the U.S. Immigration and Customs Enforcement (ICE) Web site at http://www.ice.gov/sevis/.

Embry-Riddle Language Institute (ERLI)
The Embry-Riddle Language Institute is an intensive English program providing English language instruction and cultural orientation to non-native speakers of English with 6 starting points per year (2 in spring; 2 in summer; and 2 in fall). ERLI also offers special short-term programs for students who need English for specific purposes. If you desire to become more proficient in listening, speaking, reading, and writing the English language for personal or professional reasons, or need to meet Embry-Riddle Aeronautical University’s language proficiency requirement, this intensive English program is for you. Students can be granted full admission to the University pending completion of the program and/or a passing TOEFL or IELTS score, assuming they meet all other University admission requirements. ERLI students enjoy the benefits of full ERAU student status. Other benefits of our program include field trips and social events, full access to Embry-Riddle Aeronautical University facilities, and special topics courses such as Aviation Topics and Academic Topics. Concurrent enrollment in ERLI and the University is also available for eligible students.

For more information, please contact:

Embry-Riddle Language Institute
1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
Phone: (386) 226-7614
Email: erli@erau.edu
Website: http://db.erau.edu/erli
Academic Regulations and Procedures

Regulations, Procedures and Student Responsibilities

All Embry-Riddle students are responsible for knowing all academic regulations and procedures required for continued attendance at the University. Academic regulations and procedures are presented in University publications such as this Catalog, the Student Honor Code (http://daytonabeach.erau.edu/campus-life/dean-of-students/honor), the Flight Operations Manual, and the Housing & Residence Life Community Standards (http://daytonabeach.erau.edu/campus-life/housing/policy-guide). These documents are available for reference online and at campus records offices, student government offices, and academic departments throughout the University. A student who requires clarification of any policy or regulation should seek help from their academic advisor, program coordinator, or the Office of the Registrar. University regulations will not be waived because a student pleads ignorance of established policies and procedures.

The University reserves the right to change curricula and academic regulations and procedures without notice or obligation. Such changes are published in the next catalog and through periodic University announcements.

Students should consult the graduate section of this catalog for academic policies and regulations for graduate programs.

Academic Advising

Each new student is assigned an academic advisor. Academic advisors help students choose and schedule academic programs that meet their educational goals.

Academic advisors post their scheduled office hours and students should call on them frequently and whenever assistance is needed.

Schedule of Classes and Registration

A schedule of classes is prepared for each term at all locations served by the University. The University reserves the right to make necessary and appropriate adjustments to the published schedule to include cancellation or rescheduling of any class.

Students are required to register for each term of enrollment. Students will be allowed to register via online registration, however, most students should, and first-year students and students in academic difficulty must, consult with their academic advisor for approval of course selection prior to registration. Once the student’s schedule is approved the advisor will release their hold allowing them to register online. Registration for continuing students, for flight blocks is conducted one week ahead of regular registration and must be accomplished in person at flight operations. Registration must be completed and payment of all tuition deposits and fees must be made by the designated payment date. Students are not officially enrolled until they complete all phases of registration, including financial requirements.

Late registration will be allowed during the first five days of the fall and spring semesters and the first three days of the summer terms, if unusual circumstances prevent the student from registering during the scheduled period. Except for flight courses, registration will not be allowed after the last day of late registration. Due to the scheduling requirements associated with flight training, flight course registration continues throughout the term.

Waitlist

A registration waitlist is an electronic process that auto-enrolls students in closed classes if a seats becomes available. This enables students to get into the class they want without having to continuously check for possible openings. Waitlist operates on a first-come, first-served basis. This process ensures that a student who adds his or her name to the waitlist first has a better chance of getting into a closed course if a seat opens up.

Adding your name to a course waitlist does not guarantee enrollment.

Exclusion from Courses

A student making no real progress in a course or whose behavior is detracting from the course may be excluded from the course by the appropriate dean with a grade of W or F. Students have five calendar days following written notification of this exclusion in which to appeal. Until the final disposition of the
appeal, the student is considered enrolled in the course.

**Academic Integrity/Conduct**

**Undergraduate**

Embry-Riddle is committed to maintaining and upholding intellectual integrity. The faculty, colleges, divisions, or campuses of the University may impose sanctions on students who commit the following academic integrity violations; and these sanctions may include a failing grade on the assignment, a failing grade for the course, suspension, or dismissal from the University.

1. **Plagiarism**: Presenting as one's own the ideas, words, or products of another. Plagiarism includes use of any source to complete academic assignments without proper acknowledgment of the source.

2. **Cheating** is a broad term that includes the following:
   a. Giving or receiving help from unauthorized persons or materials during examinations.
   b. The unauthorized communication of examination questions prior to, during, or following administration of the examination.
   c. Collaboration on examinations or assignments expected to be individual work.
   d. Fraud and deceit, which include knowingly furnishing false or misleading information or failing to furnish appropriate information when requested, such as when applying for admission to the University.

Students exhibiting the following undesirable acts of conduct may be suspended or dismissed from the University. Criminal acts must be reported to the appropriate law enforcement and University authorities.

1. Unauthorized alteration or misuse of one's own or another's academic records or transcripts.
2. Forging, altering, falsifying, destroying, or unauthorized use of a University document, record, or identification. This includes using the logo, stationery, or business cards of the University or otherwise identifying oneself as an agent of the University for personal, non-University business.
3. Misuse of computing facilities and/or security violations.

4. Conduct that disrupts the educational process of the University.

**Graduate**

Embry-Riddle is committed to maintaining and upholding intellectual integrity. The faculty, colleges, divisions, or campuses of the University may impose sanctions on students who commit the following academic integrity violations.

1. **Cheating**: The use of inappropriate sources of information on a test or being a party to obtaining or possessing an examination before the time the examination is scheduled.
2. **Plagiarism**: Presenting as one's own the ideas, words, or products of another.
3. **Forgery and unauthorized alteration or misuse** of one’s own or another’s academic records or transcripts.
4. Knowingly furnishing fake or misleading information to the University when seeking admission to the University or campus.
5. Forging, altering, falsifying, destroying, or unauthorized use of a University document, record, or identification. This includes using the logo, stationery, or business cards of the University or otherwise identifying oneself as an agent of the University for personal, non-University business.
6. **Misuse of computing facilities and/or security violations.**
7. Sanctions may include a failing grade on the assignment, a failing grade for the course, or dismissal from the University.

**Unit of Credit**

Semester credits are used throughout the University system. Transferred quarter hours will be converted to semester credit hours on the following basis: A quarter hour equals two-thirds of a semester hour.

**Grade Reports**

Grades are issued each term; see the Office of the Registrar (https://ernie.erau.edu/Departments/registrar/Pages/Default.aspx) website for dates. Students can access their grades immediately after they are posted, via the "Student Service Center" in ERNIE.
The University is prohibited from releasing grade information without the express written authorization of the student.

**Grade Point Averages: GPA, CGPA**

A term grade point average (GPA) and cumulative grade point average (CGPA) are computed for each student after every term. The GPA is calculated by dividing the number of grade points earned during the term by the number of GPA units in that period. The CGPA is determined by dividing the total number of grade points by the total number of GPA units at the University. Grade points and hours attempted are accrued in courses graded A, B, C, D, F, and WF only.

**Dropping a Course with no transcript notation**

Students may drop a course, with no notation of course enrollment on their transcripts. The drop period extends through the third week of spring and fall terms and the second week of summer terms.

**Auditing a Course (AU)**

Because students audit a course solely to enhance their knowledge, academic credit is not granted toward degree requirements for audited courses. Students may change their registration from audit to credit during the add period only. They may change from credit to audit until the last day of the withdrawal period. When a student auditing a course fails to maintain satisfactory attendance, as determined by the instructor, a grade of W will be assigned.

**Withdrawing from a Course (W)**

Students receive the grade of W if they withdraw from a course by the end of the published withdrawal period. If students stop attending their classes and fail to withdraw from the University, an F is assigned for each course in which they were enrolled.

Students are not permitted to drop or withdraw from a course while a charge of academic dishonesty is pending. Students who withdraw from a flight course before their initial attempt at the final phase check receive a W.

**Withdrawal from the University**

Students who leave the University for any reason must conduct an exit interview, and officially process a withdrawal clearance through the Office of Registrar. When a student withdraws from the University after the end of the scheduled withdrawal period and before the end of term, a WF grade will be assigned for all courses in which the student is enrolled unless an exception is granted for medical reasons or other extenuating circumstances.

**Incomplete Grades (I)**

In exceptional cases, faculty may assign the temporary grade of incomplete (I) if a student is unable to complete the required work in a course because of medical emergency, death in the family, military duty, or other extenuating circumstances. If a student does not complete the course within the specified period of the following term, the grade I will automatically convert to an F.

Coursework must be completed in a time period to be determined by the instructor, but no later than the end of the fourth week of the subsequent semester. The Chief Academic Officer or designee may waive/extend the period.

**Incomplete Flight Courses (IP)**

Because the length of time required to complete a flight course varies, flight course terms do not coincide with the normal academic semester. Due to this disparity, the temporary grade IP is assigned for flight courses in which students are still active at the end of the academic semester. The grade of IP will be maintained until such time as the student completes the course and receives a letter grade.

**Transcript Requests**

To request a transcript, see the Office of the Registrar (http://daytonabeach.erau.edu/about/records) website for specific details.

**Privacy of Student Records**

The University respects the rights and privacy of students in accordance with the Family Educational Rights and Privacy Act (FERPA). At its discretion, the University may disclose certain items of directory information without the consent of the student, unless the student submits a written nondisclosure request. Students are required to login to ERNIE (Embry-Riddle Network for Information Exchange) portal, go to “Student Service Center,” find “Personal Information” section, and complete “Auxiliary Access” to designate up to three individuals to make payments and access student records. Directory information consists of student name, ERAU e-mail address, ERAU Box address, campus or college
attended, course of study and areas of specialization, dates admitted, attended, and graduated, enrollment and class status, degrees sought or earned and dates received or anticipated, awards, honors, and special programs or recognitions, and – for student athletes and scholarship recipients – the ERAU ID photograph. Additionally, the following may be included as directory information, but is only released for compelling reasons and only with advance approval of the Registrar, Dean of Students or their designee: address, telephone number, non-ERAU e-mail address, date of birth, factual disciplinary history, and information from public sources.

The University will obtain written consent from students before disclosing any personally identifiable information from their education records with the exception of the directory information. The receipt of a written request to release an education record via fax satisfies this requirement. Such written consent must specify:

1. The records to be released.
2. The purpose of the disclosure.
3. Identify the party or class of parties to whom disclosure may be made and their address.
4. When transcripts are to be sent by fax, the written request must contain the telephone fax number where the transcript is to be sent. Generally, transcripts should be faxed only if an urgency exists. A faxed transcript may or may not be considered official by the recipient, subject to their policies, security measures, and validation procedures.
5. Must be signed and dated by the student or former student.

The law gives students and former students the right to inspect and review information contained in their education records. The student must submit a written request to the Office of the Registrar. The Office of the Registrar must make the records available for inspection and review within 45 days of the request.

FERPA allows disclosure of educational records or their components under certain conditions. Students desiring additional information on FERPA may contact the Office of The Registrar.

Tobacco and Drug Policy

Student Education and Assistance

University Alcohol and Other Drug (AOD) Prevention Information (https://ernie.erau.edu/Departments/dean-of-students-daytona/Pages/Alcohol-and-Drug-Assistance-Program.aspx)

Embry-Riddle promotes substance abuse awareness by sponsoring educational programs and distributing literature. The University is additionally committed to assisting students in the resolution of problems associated with substance abuse and encourages students to seek additional help through referrals from the University Health Services and Counseling Offices.

Tobacco Policy

Embry-Riddle Aeronautical University recognizes the need to ensure an educational and work environment that is reasonably free from various health hazards. It is well established that the use of tobacco products is attributable to certain forms of health problems. In keeping with our core value of making our environment safer for everyone, the university has implemented a comprehensive tobacco-free policy for all of our campus locations.

Students are prohibited from using any tobacco product whether in the form of cigarettes, cigars, pipes, dipping/snuff, smokeless cigarettes, electronic cigarettes/vaping, hookahs, or chewing tobacco.

It is the policy of the University that tobacco products will not be allowed anywhere on University owned or leased property (including buildings, parking lots, personal vehicles, etc.). Additionally, tobacco products are prohibited in all University vehicles including vans, trucks, buses, and all University aircraft.

Any University employee or student who violates this policy shall be reminded that the use of tobacco products is not permitted anywhere on campus. Any employee or student who continues to violate or disregard this policy is subject to appropriate disciplinary actions.

Any individual conducting business with the University, or engaged in contracted services, or any visitor to the University who violates this policy, shall be reminded that use of tobacco products is prohibited on campus. Continued violations or
disregard for this policy shall result in the individual being required to leave University property.

Drug Policy
“Embry-Riddle has a responsibility to educate and promote healthy, low-risk choices within our student population and to support similar policies found within the aviation, aerospace, and related industries. The University intends to be clear on its position regarding the use, possession, and/or sale of illegal drugs and toward those who have knowledge of violations of any federal, state, and local laws. Additionally, the University will take serious action regarding the abuse of legal substances or the illegal sale of legal substances. The University intends to comply with the Drug Free Workplace Act of 1988, the Drug Free Schools and Communities Act Amendments of 1989, Department of Transportation regulations, and Federal Aviation Administration regulations regarding drug and alcohol abuse.

Students in specialized programs may be subject to drug testing under FAA, NCAA, and other regulations. Each program will have policies and procedures regarding drug testing, and applicable students are required to understand each rule and consequence of that program. In addition, each program may have additional regulations that must be enforced and could affect a person’s ability to participate in the program.

Additional Drug Testing Policies:
• Flight Students: refer to the Flight Operations Manual (FOM) for all policies and procedures. The drug testing program applies to all students who engage in flight training at the University.
• Athletes: student athletes participating in intercollegiate sports and representing Embry-Riddle are subject to drug testing as outlined by the Athletic Department; for information, see the University Director of Sports Medicine in the Athletic Department
• ROTC Cadets: ROTC programs follow Department of Defense regulations
• Aviation Maintenance Science Students: reference the Aviation Maintenance Science Random Drug Testing Program provided by the AMS Department

Drug Testing
The University tests for marijuana, cocaine, opiates, amphetamines, and phencyclidine (PCP) and other synthetic drugs as follows:

1. Random testing of students engaged in flight training.
2. Required post-accident testing for students involved in an aircraft accident. Students are tested for drugs within 24 hours after an accident. An accident is defined as any occurrence associated with the operation of an aircraft that results in any person suffering death or serious injury, or where the aircraft receives substantial damage as determined by the National Transportation Safety Board. The accident can occur at any point between the time a person boards the aircraft with the intention of flight and the time all have disembarked.
3. Pre-employment testing will be required for any student who applies to work in a safety-sensitive student assistant position at the University.
4. The University, in conjunction with judicial proceedings, may also require drug testing. Students will follow the guidelines outlined in the Honor Code (http://daytonabeach.erau.edu/campus-life/dean-of-students/honor).
5. In the event that drug testing is required, students who fail to comply with testing procedures refuse to be tested, or test positive for illegal drugs are subject to the following actions:
   a. Students who fail to comply with all University directives concerning the place of testing, the manner in which they are to arrive at the test site, and any other related matters are subject to disciplinary action up to and including dismissal from the University.
   b. Students who refuse to be tested after being requested to do so by the University will be dismissed from the flight program and possibly the University.
   c. Students whose test results show positive for the use of an illegal or non-prescribed drug, as verified by a medical review officer, will result in dismissal from the Flight program and up to and including dismissal from the University.

The cost of drug testing is the responsibility of the University. Embry-Riddle has contracted with a professional testing service as the certified laboratory
for the collection and analysis of test specimens. This testing service will adhere to all requirements for chain of custody, test reporting, and specimen retention in accordance with proposed DOT and FAA regulations.

**Notification**

Students applying to attend the residential campuses are notified of the drug testing requirement through various University publications. The drug testing policy is also explained on appropriate flight course registration forms.

**Flight**

**Flight Course Related Information**

All flight training at Embry-Riddle occurs in late-model, fully equipped aircraft. In addition, procedures trainers and flight-training devices give the student a safe, flexible, and cost-effective training environment. The flight-training program operates under all applicable FAA rules, regulations, and requirements. The student is responsible for adhering to those rules, regulations, and requirements, which are contained in the Embry-Riddle Flight Operations Manual and local campus bulletins.

While flight training is an integral part of the Aeronautical Science program, it is also contained in other degree programs, either as an area of concentration, minor course of study, or as elective credit on a space-available basis. Students should investigate the applicability of certain courses to their program along with the necessary prerequisite/corequisite course requirements prior to making any commitment and investment.

ERAU has determined the required flight hours for each unit subject and they are published at [http://daytonabeach.erau.edu/college-aviation/flight/flight-course-costs/index.html](http://daytonabeach.erau.edu/college-aviation/flight/flight-course-costs/index.html)

**Flight Course Scheduling**

Students begin their initial flight course during their first year in attendance. The exact start date depends on the academic preparation of the student, student desire, weather conditions, and aircraft and instructor availability. The length of time required to complete a course will also vary based on these same factors. All flight-training courses may begin and end at any time during the academic year and may not coincide with the beginning and ending dates of the published semester schedule. Therefore, students who begin a flight course late in the semester should be prepared for training in that course to continue into the next semester.

Flight courses require a minimum block of time and may include flying on weekends. Study, preparation, and some flight lessons may require time outside this block. Students, particularly beginning students, are cautioned not to overload their course schedules when taking a flight course.

Students in degree programs that require flight training to be conducted on campus may be given priority in their initial flight block registration.

**Academic Credit for Flight Training After Matriculation**

All students desiring to complete off-campus flight training for academic credit after matriculation must be pre-approved in writing in advance by the Flight Department. The credit that will be awarded is Advanced Standing (see Awarding Advanced Standing section below). The procedures for requesting this credit when the preapproved off-campus flight training is satisfactorily completed will be specified in the written approval form "Off Campus Flight Authorization Request". Address any questions to the Flight Department. Credit for any AS courses will not be awarded for flight certificates or ratings attained after matriculation (only FA credit). See the following sections for specific requirements.

**Aviation Accreditation Board International (AABI) Accredited Programs**

Students in AABI accredited programs will be awarded credit for FAA certificates held prior to matriculation. Students will be approved in writing in advance by the Flight Department to complete one certificate or rating off campus for Advanced Standing credit if significant flight training from an appropriately rated instructor was logged prior to matriculation. If FAA certificates are held, this training must have occurred after the attainment of the most recent certificate for which credit is granted. After a student matriculates into an AABI accredited program, all flight training for credit must be completed at Embry-Riddle or approved in writing in advance by the Flight Department at another AABI accredited program. In all cases, students must satisfactorily complete at least one FA course on-campus after Advanced Standing credit is awarded or after an AABI accredited program course is
transferred for an FA course. In either case, this flight course must include an FAA practical exam that results in the issuance of an FAA certificate or rating. Advanced Standing credit may not be awarded for any AS course for flight ratings attained off campus after matriculation. These requirements also pertain to credit for flight certificates or ratings applied to Flight Minors within an AABI accredited program. Students should refer to their catalog to verify if their degree program is AABI accredited.

Restricted Airline Transport Pilot Certificate
Upon graduation, the Daytona Beach Aeronautical Science degree can qualify a graduate for the Restricted Airline Transport (R-ATP) certificate under FAR Part 61.160. Note that satisfying the AS degree requirements alone may not qualify the graduate for the R-ATP. This Federal Aviation Administration (FAA) regulation is subject to change. For detailed information, please contact the Aeronautical Science Program Coordinator.

Fill out the online application https://webforms.erau.edu/public/coa/reduced-atp-minimums/

Flight Minors, Majors, or Areas of Concentration
Students not in an AABI accredited program may be authorized to complete their Private Pilot Single Engine FAA Certification off campus if approved in writing, in advance, by the Flight Department. Students in non-AABI accredited programs will be awarded credit for FAA certificates, held prior to matriculation. Students will be approved in writing in advance by the Flight Department to complete one certificate or rating off campus for Advanced Standing credit if flight training from an appropriately rated instructor was logged prior to matriculation. If FAA certificates are held, this training must have occurred after the attainment of the most recent certificate for which credit is granted. After a student matriculates into a non-AABI accredited program pursuing Flight Minors, Majors, Areas of Concentration, Specialization or Tracks that require an FA course(s) he or she must complete their flight training at Embry-Riddle (unless approved as described previously in this section). Students must satisfactorily complete at least one FA course on-campus after Advanced Standing credit is awarded for an FA course. This flight course must include an FAA practical exam that results in an issuance of an FAA certificate or rating. Advanced Standing credit may not be awarded for any AS course for flight ratings attained off-campus after matriculation. If students declare a change of program to an AABI accredited program the Advanced Standing credit for flight training after matriculation may not be applicable.

Open Elective Credit
Students who are not in AABI accredited programs and are not pursuing Flight Minors, Majors, or Areas of Concentration will be awarded credit for FAA certificates held prior to matriculation. After these students matriculate, off-campus flight training for academic credit may be approved in writing in advance by the Flight Department for Advanced Standing credit. Advanced Standing credit is awarded for an FA course. Advanced Standing credit may not be applied towards an AS course for flight ratings attained off-campus after matriculation. Students who declare a change of program to an AABI accredited program are advised the Advanced Standing credit for flight training after matriculation may not transfer. Students declaring a Flight Minor, Major, or Area of Concentration must successfully complete at least one FA course on-campus after, the Advanced Standing credit is awarded for an FA course.

Awarding Advanced Standing
Students who obtain off-Campus flight training that was approved in writing in advance by the Flight Department may obtain Advance Standing credit. Upon satisfactory completion of the pre-approved flight training, all students must show their copy of the approved "Off Campus Flight Training Authorization Request" form in addition to the appropriate documents of their training to the Flight Department. Approved Advanced Standing credit for an FA course will be applied to the student’s transcript. Advanced Standing credit will not be awarded for any AS course for flight ratings attained off-campus after matriculation.

Aviation and Transportation Security Act
The Aviation and Transportation Security Act (ATSA) requires students registered for Flight (FA) courses to show acceptable documentation of U.S. citizenship OR to complete background check requirements.
Students enrolled in an FA course must present ONE of the following to the Flight Data and Certification Department, Flight Operations building room 207:

1. A valid, unexpired U.S. passport (if the passport expires during training, a current proof of valid citizenship is required)
2. An original birth certificate with raised seal documenting birth in the United States or one of its territories
3. An original U.S. naturalization certificate with raised seal, Form N-550 or Form N-570
4. An original certification of birth abroad, Form FS-545 or Form DS-1350
   -OR-
   An original certificate of U.S. citizenship, Form N-560 or Form N-561

If using other than a valid passport, a valid driver license with a photo or a government-issued photo ID will also be required. Photocopies of the above are not acceptable, even certified copies. This process needs to be completed only one time for the entire curriculum at Embry-Riddle for U.S. Citizens.

Those unable to complete the above requirements, including international and permanent resident alien students, will be able to register for FA courses but must comply with U.S. Department of Homeland Security (DHS) notification requirements for each course taken. Before receiving any flight training, they must provide DHS through the Transportation Security Administration (TSA) a set of fingerprints, a photo, a processing fee, and must register online. Upon receipt of authorization received directly from the TSA, the student can register and begin training. Once the student is registered and has received authorization from the TSA, the student may begin training. Some advanced flight courses may require a waiting period of up to 30 days. If Embry-Riddle receives any directive from the DHS or TSA, the student may be administratively withdrawn as appropriate to the DHS or TSA directive. This information and fee, but not the fingerprints, must be sent periodically during flight training and will be coordinated through Embry-Riddle’s Flight Department. Please contact the Aeronautical Science Department for more information.

**Undergraduate Regulations and Procedures**

**Course Load Status**

Twelve credit hours constitute the minimum load for full-time student status during the fall and spring terms. The minimum load for full-time student status during each summer session is six credit hours. Students enrolled in fewer credits than the minimum full-time load are classified as part-time. All courses taken for credit are counted in determining the student’s load for a term.

The normal maximum load is 16 hours during spring and fall semesters or 9 hours during each summer session. A student whose cumulative grade point average (CGPA) is 3.00 or higher may register for an overload with prior, written approval of the appropriate department chair or designee.

With advisor's written approval, a student with more than 27 completed credit hours and a cumulative ERAU GPA of 3.00 or higher may register for up to 18 credit hours, in a fall or spring semester, with no increase in tuition for hours over the block. Completed credit hours and a cumulative GPA at the end of the previous terms will be used for eligibility. If you are pre-registered for a future term, your eligibility for block rate will be recalculated at the end of the current term.

**Class Attendance**

Because regular attendance and punctuality are expected in all courses, attendance may be included in the grading criteria of an individual class. Absences are counted from the first scheduled meeting of the class. Because minimum contact hour requirements have been imposed by the FAA for certain classes leading to FAA certificates, attendance requirements in those courses are rigorously enforced. Explanations for all absences should be given to the instructor in advance whenever possible.

A final examination is normally given in each course at the end of the term. A student who misses a final examination without advance permission from the instructor may be assigned a failing grade (F) for the course. A grade of incomplete (I) may be given if the student has obtained advance permission from the
instructor or can provide satisfactory evidence that the absence could not be prevented.

Flight block attendance is mandatory, and missed flight activities (orals, simulators, and flights) will result in loss of letter grades for the flight course. The Embry-Riddle Flight Operations manual explains detailed policies for flight cancellations.

Grading System

The following indicators, used on grade reports and transcripts, signify the quality of a student’s academic performance.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Student Performance</th>
<th>Grade Points Per Credit Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Superior</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Above average</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>Below average</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
<td>0</td>
</tr>
<tr>
<td>WF</td>
<td>Withdrawal from the University-Failing</td>
<td>0</td>
</tr>
<tr>
<td>W</td>
<td>Withdrawal from a course</td>
<td>N/A</td>
</tr>
<tr>
<td>AU</td>
<td>Audit</td>
<td>N/A</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete (or no grade submitted)</td>
<td>N/A</td>
</tr>
<tr>
<td>P</td>
<td>Passing grade (credit)</td>
<td>N/A</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory (noncredit)</td>
<td>N/A</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
<td>N/A</td>
</tr>
<tr>
<td>T</td>
<td>Transfer credit</td>
<td>N/A</td>
</tr>
<tr>
<td>N</td>
<td>No grade submitted by Instructor</td>
<td>N/A</td>
</tr>
<tr>
<td>X</td>
<td>Advanced Standing (other than course equivalency examinations)</td>
<td>N/A</td>
</tr>
<tr>
<td>XP</td>
<td>Credit by course equivalency examination</td>
<td>N/A</td>
</tr>
<tr>
<td>IP</td>
<td>In progress</td>
<td>N/A</td>
</tr>
<tr>
<td>NC</td>
<td>No credit awarded</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Classification of Students

Students are classified at the end of each semester based on the total number of credit hours earned in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-Year</td>
<td>fewer than 28 hours</td>
</tr>
<tr>
<td>Sophomore</td>
<td>28-57 hours</td>
</tr>
<tr>
<td>Junior</td>
<td>58-87 hours</td>
</tr>
<tr>
<td>Senior</td>
<td>88 hours or more</td>
</tr>
</tbody>
</table>

Grade Appeal Process

Consistent with the Grievance Process, students are encouraged first to address their issues of concern regarding grades directly with the course instructor to attempt a resolution. If a resolution cannot be reached, students must follow the following procedure:

- Contact the course instructor to discuss the grade dispute and attempt a resolution.
- If a resolution cannot be reached with the course instructor, the student must contact the Department Chair responsible for the course in question by providing a written petition outlining the dispute in detail.
- The Department Chair will notify the student in writing of the outcome.
- If a resolution cannot be decided at the Department Chair level, the student should then submit the original petition, the written decision from the Department Chair and a request for review to the Dean of the College (or designee) responsible for the course. He/she will render the final decision.
- The Dean of the College (or designee) will notify the student in writing of the final outcome.
- The deadline to submit a grade dispute petition to the Dean of the College is six weeks from the date the initial grade was issued.

Repeating a Course

With the exception of flight courses, which may be repeated only once, a student may attempt any University course only three times, including the initial grade, repeat grades, and any withdrawals and audits. In the case of extraordinary, extenuating circumstances, a fourth attempt may be granted by the Chief Academic Officer or designee. The grade for each attempt will appear on the student’s permanent academic record. In determining the student’s CGPA, the grade for subsequent attempts of a course replaces the previous grade a maximum of two times.

Grades from courses taken off campus do not replace on-campus grades in the computation of the cumulative GPA.
Grade Forgiveness

Grade forgiveness aids students to move from one degree program to a different program. The following guidelines and requirements must be met:

Grade forgiveness can occur only once in a student’s undergraduate career at ERAU. If a student changes degree program another time, grade forgiveness cannot be used.

1. Students must officially change their degree programs to apply for grade forgiveness and must submit the Grade Forgiveness Petition to the Registrar through ERNIE Central simultaneously with the Request for Program Change form.

2. A maximum of four (4) courses can be forgiven.
   a. Courses that could be forgiven must not be required for the student’s new degree program nor used as open electives in the new degree program.
   b. All forgiven courses continue to appear on the transcript including the original grade earned in that course (see APU-07).
   c. Credit hours of forgiven courses are not calculated into the total hours attempted/earned, nor are the honor points calculated into the CGPA.
   d. If a student changes degree programs again and courses previously forgiven are required for the new degree program, they will be reinstated and again be calculated in the student’s CGPA.

3. Students on academic warning or probation who use grade forgiveness will remain on current academic status and be subject to stipulations set forth in APU-27.

4. Forgiveness is not applicable to students on academic suspension; students on suspension must follow procedures in APU-27 for reversal before initiating a Grade Forgiveness Petition.

A nonrefundable fee is charged for administering each equivalency exam. Because students may take a course equivalency exam only once for each course, those failing a course equivalency examination must enroll in and complete the course to receive credit. Students submit their applications to the chair of the academic department offering the course.

Change of Degree Program

Students may apply to change their degree programs if they meet academic qualifications and if the degree program is not at capacity. The student should contact the program coordinator of the new program to initiate the application. Once the student is accepted into the new degree program they should contact the program coordinator of their current program to complete the process.

When a student elects to change degree programs, the requirements of the catalog in effect at the time the request was approved apply, with certain exceptions. Students considering such changes should contact their academic advisor or department chair to determine how they will be affected.

Two Undergraduate Degrees

To earn a second baccalaureate degree, students must complete a minimum of 25% of coursework over and above that required for the declared primary degree. At least 60 credit hours must be completed in residence at the University and at least two-thirds additional credit hours must be 300-400 level courses.

Double Majors

Double majors are defined as two programs. That is, the student completes one baccalaureate degree with two different programs; the student receives one diploma. The transcript will reflect one baccalaureate degree with a second major. To earn two undergraduate degrees, the student must complete all requirements for both programs. Requirements for both programs must be completed before degree conferral can occur. Some pairings of programs may not be open to students seeking the
B.S. degree in two programs. Students must obtain permission of the appropriate program coordinator to enter a second program. The student becomes subject to the requirements of the second program as stated in the catalog in effect at the time of matriculation or of the catalog in effect at the time the second major is declared.

Continuous Enrollment
Students are considered to be continuously enrolled, regardless of the number of hours for which they register, unless:

1. A student enrolls at another institution without advance written approval.
2. A student fails to enroll in at least one course at Embry-Riddle within a two year period from the last term of attendance.
3. A student has been suspended or dismissed from the University.
4. A student has completed a bachelor’s, master’s, or Ph.D. degree.

A student who falls into one of the exceptions noted above must apply for readmission to the University under the catalog in effect the semester in which they re-enroll.

Catalog Applicability
The catalog in effect at the time of a student’s initial matriculation remains applicable as long as the student remains in the original degree program.

If a student does not maintain continuous enrollment at the University, the student must apply for readmission. The provisions of the catalog in effect at the time of readmission then become applicable to the student.

Curricular requirements stated in the applicable catalog will not be affected by later catalogs unless the student elects to graduate under the provisions of a later catalog. Students who change from one undergraduate degree program to another come under the provisions of the catalog in effect on the date the change of program petition was approved. Students electing to graduate under the provisions of a later catalog must meet all requirements (admission, transfer, graduation, and so on) contained in that catalog.

Attendance at Other Institutions
Once admitted to the University as degree candidates, students are expected to complete all work to be applied toward their degrees with the University unless advance written authorization is granted.

Students in good academic standing must petition in advance to receive credit for courses or training, including flight instruction, outside the University while maintaining enrollment at Embry-Riddle. To initiate this procedure, students must process a Petition to Take Courses at Another Institution. If the Office of the Registrar has no formal documentation of course equivalency, students must provide adequate evidence to the course-specific department chair that the petitioned courses are equivalent to Embry-Riddle courses or are acceptable as elective credit in their degree program.

When not enrolled at Embry-Riddle, students must follow normal petition procedures to enroll in courses at another institution. Students may not co-enroll at another institution. After initial matriculation, students may not earn more than a total of 18 semester hours or the equivalent at another institution.

Link to Off Campus Petition form (https://webforms.erau.edu/private/records/off-campus-petition/daytona)

Academic Standing
Dean’s List and Honor Roll
To be eligible for term honors, students must have maintained at least a 2.0 CGPA and must not have received a D or F during the term. In addition, students must have achieved a term GPA of 3.5-4.0 for inclusion on the Dean’s List or 3.20-3.49 for inclusion on the Honor Roll. Students must be enrolled full-time to be eligible for these honors.

Academic Warning, Probation, Suspension, and Dismissal
Warning
A student whose cumulative grade point average (CGPA) is less than 2.0 for one term is placed on academic warning. They are restricted to registering for 15 credit hours and they must repeat every course in which they received a grade of F, and it is recommended to repeat grades of D. However,
students considering a program change should consult with the new Program Coordinator prior to scheduling any repeated courses. The academic program of a student on warning may be further restricted by the College Dean or designee.

Probation
A student whose cumulative GPA is less than 2.0 for two consecutive terms is placed on academic probation.

A student who has a single term GPA of less than 1.0 will be placed on academic probation.

Students on probation are classified as students not in good standing and may not serve as elected members of the Student Government Association, may not participate in intercollegiate athletics as members of a University team, may not serve on the editorial staff of a campus publication, and will lose eligibility for financial aid programs. They are restricted to registering for 12 credit hours and they must repeat every course in which they received a grade of D or F. However, students considering a program change should consult with the new Program Coordinator prior to scheduling any repeated courses. The academic program of a student on probation may be further restricted by the College Dean or designee.

Students who are placed on academic probation will be allowed to complete any flight course in which they are currently enrolled. However, they will not be allowed to enroll in subsequent flight courses until they return to good academic standing. A first-semester student who has a term GPA of less than 1.0 will be required to develop a plan of study with their program coordinator prior to registering.

Suspension
A student whose term GPA is below 2.0 while on academic probation will be suspended from the university. If the student maintains a term GPA greater than 2.0 and the student’s cumulative GPA remains below 2.0, he or she will remain on academic probation.

A student on academic warning who has a subsequent term GPA of less than 1.0 will be suspended from the University.

Dismissal
A student who has been suspended and readmitted is on probationary status until the CGPA has been raised to 2.0. If the term GPA falls below 2.0 during the probationary period, the student is dismissed. Any previously suspended student who has been restored to good standing but whose academic performance subsequently deteriorates to a level that would qualify for initial suspension is dismissed. Academic dismissal is final and the student will not be readmitted to the University. Residential campus students desiring to appeal an academic dismissal must submit a petition within 30 days of notification to the campus Registrar through ERNIE Central. The Registrar will forward the petition to the Academic Standards and Readmission Committee. Students will provide documentation to the committee and may appeal in person. The student will also have the option of arranging for representation by a faculty advocate to assist with the pleading of his or her case.

When a change of grade or the conversion of the grade I changes a student’s academic status, the previous academic status of warning, probation, or suspension is removed and does not become part of the student’s permanent record.

Suspension and Dismissal for Cause
The University reserves the right to suspend or dismiss a student at any time and without further reason, if the student exhibits the following undesirable conduct:

1. Actions that pose a risk to the health, safety, or property of members of the University community, including, but not limited to, other students, faculty, staff, administrative officers, or the student himself/herself.

2. Conduct that disrupts the educational process of the University.

3. Any other just cause.

Readmission
A student who has been suspended from the University for any reason may apply for readmission to the Office of the Registrar through ERNIE Central.

A student who has been academically suspended may apply for readmission after 12 calendar months following the suspension and after completing a minimum of 15 pre-approved hours of academic credit with a CGPA of 2.5 or higher from an accredited institution. If the University readmits such
students, they will be admitted with probationary status.

A student who is on academic probation after re-admission from suspension will be dismissed from the university if their semester/term GPA falls below a 2.00.

**Student Grievance Procedure**

It is the policy of Embry-Riddle Aeronautical University to administer its educational programs in a fair, equitable, academically sound manner and in accordance with the appropriate regulations and criteria of its governing board, accrediting associations, and federal and state laws and regulations. Students are provided an opportunity to express any complaint, grievance, or dispute that upon investigation may be remedied.

The Dean of Students Office will provide advice and guidance to students who present grievances or complaints, whether personal or academically-related. Appeals concerning previously assigned grades are specifically processed through the academic administrative chain, beginning with the course instructor. The Dean of Students Office will provide general guidance on the grade appeal process and other academically-related issues.

Students are first encouraged to address their grievance, whether personal or academic, directly with the faculty/staff concerning the issue. This is considered an informal process and is meant to empower the student to confront the source of their concern, as well as minimize the length of time involved in achieving a resolution. If no agreement is reached, students may choose to put their grievance in writing directly to the next appropriate department head or director with responsibility for the area of concern or may seek assistance from the Dean of Students Office to file and process a formal written grievance. Any student, at any time, may choose to file a formal written grievance with the Dean of Students Office and can start by selecting the online Grievance Form (https://cm.maxient.com/reportingform.php?EmbryRiddleDaytona&layout_id=5), if possible. Students are encouraged to include details, specific information, and a complete description of the issue of contention for review by appropriate staff, department, and/or individuals.

- The written complaint will be stored in the student conduct data management system for record-keeping purposes. A copy of the report will be forwarded to the appropriate Department Chair, Director, or College Dean as appropriate, along with a request for review and follow-up.
- The Dean of Students Office will keep record of correspondence regarding student grievance cases as provided by the student to the office.

In the event that a student wishes to file a grievance or complaint against another student, the Embry-Riddle student Honor Code and applicable hearing procedures may be applied.

When it is appropriate, the Dean of Students Office offers formal mediation services for dispute resolution. Mediation may take place in lieu of Honor Code proceedings but requires commitment on the part of both parties that the process and the outcome are formal and result in a binding contract.

**Graduation Requirements and Honors**

**Graduation Requirements**

Students must complete the general graduation requirements as prescribed by the University, as well as all degree requirements specified in the degree being pursued. The following summary of graduation requirements is provided for all students:

1. Students must initiate an application for graduation. The application must be received by the Office of the Registrar through ERNIE Central within the time limit established by that office.
2. Students must successfully complete all required courses for a particular degree listed in the applicable catalog.
3. Students must successfully complete the minimum number of credit hours required for the degree as listed in the applicable catalog.
4. Students pursuing a bachelor’s degree must complete the last 30 credit hours at the University, or the last 15 hours if pursuing an associate’s degree.

5. Students pursuing a bachelor’s degree must complete a minimum of 40 credit hours in upper-division (300 and 400 level) courses. Credit transferred from other institutions will be accepted at the discretion of Embry-Riddle.

6. For degree completion, at least 25 percent of semester credit hours must be earned through Embry-Riddle instruction.

7. Students pursuing any undergraduate degree must earn a minimum cumulative grade point average (CGPA) of 2.00 for all work completed at the University.

8. Candidates for the B.S. in Aerospace Engineering, B.S. in Civil Engineering, B.S. in Computer Engineering, B.S. in Electrical Engineering, B.S. in Mechanical Engineering, B.S. in Software Engineering, B.S. in Computer Science, B.S. in Space Physics and the B.S. in Engineering Physics must also earn a minimum CGPA of 2.00 in all required core courses. Details are specified under the degree requirement headings of the Academic Programs section in this catalog.

9. Students will not be issued a diploma or transcript of their records until all debts or obligations owed to the University have been satisfied.

10. Students will not be issued a diploma unless their behavior is in good standing, according to University policies and regulations. This includes, but is not limited to, not being on disciplinary probation.

11. Students will not be permitted to participate in formal graduation ceremonies conducted at the residential campuses until all the degree requirements listed above have been satisfied. Students anticipating degree completion during the summer terms may be eligible to participate in the spring commencement ceremony if they meet established guidelines.

12. Following the graduation exercise, the diploma will be mailed to the address provided by the student.

**Graduation Honors**

Graduation honors recognize students who have demonstrated excellent performance throughout their Embry-Riddle academic career. They are only awarded to students who complete baccalaureate degree programs. To be eligible, the student must have completed at least 45 credit hours in residence. The level of graduation honors will be based on the cumulative grade point average for all courses taken at Embry-Riddle. The honors level will appear on the student’s academic transcript with the degree information.

Graduation honors (baccalaureate only) will be awarded in accordance with the following criteria, no rounding is applied:

<table>
<thead>
<tr>
<th>Honors Level</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summa Cum Laude</td>
<td>At least 3.90</td>
</tr>
<tr>
<td>Magna Cum Laude</td>
<td>At least 3.70 and less than 3.90</td>
</tr>
<tr>
<td>Cum Laude</td>
<td>At least 3.50 and less than 3.70</td>
</tr>
</tbody>
</table>

To be recognized for honors at the formal commencement ceremonies, all degree requirements must have been met.

**Masters Regulations and Procedures**

**Academic Advising**

The graduate program coordinator or their designee is the student’s academic advisor. Academic advisors help students choose and schedule courses that meet their educational goals. The advisor’s approval is required prior to registration.

Academic advisors post a schedule of office hours, and students should feel free to call on their advisors when assistance or discussion is needed.

**Course Load**

Full-time masters students normally take nine semester credit hours. Additional courses above this load require permission from the appropriate college dean or designee. The minimum course load for full-time status is six credit hours in fall and spring, or three credit hours in a summer session. If a student demonstrates exceptional academic performance, the department chair or designee may approve a maximum one-course overload.
A student’s enrollment may be restricted when deemed in the best interest of the student. Students in accelerated or 3+1+1 programs are considered full-time if their combined course load equals full-time based on graduate and undergraduate policy (i.e., 6 credits undergraduate + 3 credits graduate = full-time status).

Grading System
The following indicators are used on grade reports and transcripts.

• Incomplete Grade (I)
  In exceptional cases, faculty may assign the temporary grade of incomplete (I) if a student is unable to complete the required work in a course because of medical emergency, death in the family, military duty, or other extenuating circumstances. If a student does not complete the course in the specified period, the grade of I automatically converts to an F.

• Thesis Grading
  A student enrolled for a thesis will receive a grade each term, as determined by the student’s thesis committee. If the student is making progress toward completion of the thesis, the adviser will record a grade of S. If the student has not made progress, the adviser will record a grade of U. No more than one U grade is allowed or the student will be dismissed. Students must continually register for one credit hour of thesis until complete.

• Internship Grading
  A final grade of P or F is awarded upon completion of a graduate internship.

• Graduate Research Project Grading
  If the student is making progress, a grade of IP is awarded at the end of each term. Upon completion of the graduate research project, a final grade of P or F will be awarded. That grade will replace the IP for 690. All grades of IP will change to N for 690C. A student enrolled in a graduate research project must continually register for one credit hour of 690C until the graduate research project is complete.

• Graduate Capstone Project Grading
  A final letter grade is awarded upon completion of the graduate capstone project. GCP courses carry three credit hours and students are expected to complete them in one semester. Students who don’t complete a capstone project in a timely manner must take the course again. Students who do not finish the GCP by the end of the semester may receive a grade of I (Incomplete) at the instructor’s discretion. If the I grade is not redeemed by the deadline for changing Incomplete grades, the grade will revert to an F.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Student Performance</th>
<th>Grade Points Per Credit Hour</th>
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<tbody>
<tr>
<td>A</td>
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<tr>
<td>B</td>
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<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Passing</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
<td>0</td>
</tr>
<tr>
<td>WF</td>
<td>Withdrawal from the University-Failing</td>
<td>0</td>
</tr>
<tr>
<td>W</td>
<td>Withdrawal from a course</td>
<td>N/A</td>
</tr>
<tr>
<td>AU</td>
<td>Audit</td>
<td>N/A</td>
</tr>
<tr>
<td>I</td>
<td>Passing but incomplete</td>
<td>N/A</td>
</tr>
<tr>
<td>IP</td>
<td>In progress</td>
<td>N/A</td>
</tr>
<tr>
<td>N</td>
<td>No grade submitted by instructor</td>
<td>N/A</td>
</tr>
<tr>
<td>P</td>
<td>Passing grade (credit)</td>
<td>N/A</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory</td>
<td>N/A</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
<td>N/A</td>
</tr>
<tr>
<td>T</td>
<td>Transfer credit</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Repeating a Course
Students with masters status may be permitted one opportunity to repeat one course in which a grade of less than a B was earned for the purpose of improving their cumulative grade point average. The student must submit a written request and receive approval of the department chair or designee. Both grades earned appear on the transcript, but only the replacement grade is included in the calculation of the cumulative grade point average. This applies to thesis credit and graduate research/capstone project credit as well.
Dual Master's Degrees
Master's students who have completed their degrees and who wish to enroll in an additional master's degree must apply for admission to that degree through the Graduate Admissions office. A master's student is allowed to apply up to 12 applicable credit hours from one master's degree program to meet the requirements of another master's degree program. In order to be awarded a second graduate degree, the student must satisfy all the requirements of the degree sought.

Transfer Between Master Degree Programs
A masters student who wishes to transfer from one program to another must apply through Graduate Admissions. The department responsible for the new program has the prerogative to accept or reject the student's request and to determine the courses applicable to the new program. Requests for transfer of credits from Embry-Riddle or other institutions and/or advanced standing credits should be included in the application.

When a student elects to transfer from one degree program to another, the catalog in effect when the transfer is approved is applicable.

Graduate Internships
Graduate internships are temporary professional opportunities in industry available to graduate students. There are two types of internships: resident and nonresident. Resident internships are professional work activities supported by a partnership between industry and the University and conducted on campus under the supervision of a faculty/staff sponsor in conjunction with the employer. Nonresident internships are professional work activities conducted off-campus at the supporting organization’s facility. Full-time employees of the offering organization are not eligible for an internship appointment and cannot receive academic credit for their professional position.

Masters students who have full graduate status, are degree seeking, in good standing with a minimum of nine graduate credit hours completed, and who have earned a cumulative GPA of 3.00 on a 4.00 basis are eligible to register for graduate internship credit. Students must demonstrate adequate communication and technical skills.

Students selected for an internship may register for the approved number of credit hours in the appropriate departmental internship course and will be charged tuition for one credit hour. Masters-level academic credit is awarded at a rate of one credit hour for every 200 clock hours of work completed, up to a maximum of three credit hours in one semester. Three internship credit hours may be applied toward degree requirements in many degree programs. Students are advised to consult with their Graduate Program Coordinator for approval to use internship credits in their degree program curriculum.

International students must verify their eligibility to work in the U.S. with International Student Services BEFORE accepting an internship, and may not register for an internship after having completed their educational requirements, according to the regulations of the United States Citizenship and Immigration Services. An internship must be required in the curriculum or fulfill a required elective.

Thesis, Graduate Research Project and Graduate Capstone Project Options
Students who elect a thesis, graduate research project or graduate capstone project must obtain approval of the research topic. The University encourages masters students to select thesis, graduate research/capstone project topics that permit them to participate in faculty research. Once approved, a research advisor and one or more additional committee members are selected and approved by the department coordinator or designee. Normally, if a student is working with a faculty research team as part of their thesis or graduate/capstone research project, the faculty member who is directing the student’s research should generally be the student’s research advisor. The graduate research/capstone project option may not be available for all programs.

Assistantships
Master assistantships are academic appointments that are normally reserved for qualified graduate students at the Daytona Beach Campus. A graduate teaching assistant helps in teaching undergraduate students in specified courses or laboratories under the general supervision of a faculty member. A teaching assistant must have completed 18 graduate credit-hours in the discipline. A graduate research assistant is involved in research activities under the direction of a faculty member or a research assistant.
associate. A graduate administrative assistant assists departments or faculty with curriculum development, special projects, and other duties as assigned. To be eligible for a master assistantship, a student must have full graduate status in a degree program, must have maintained a CGPA of 3.00 out of a possible 4.00 or above through the end of the semester (graduate or undergraduate) preceding the appointment, must maintain a 3.0 GPA during the semester, and must demonstrate adequate communication and technical skills.

Each department has the responsibility to post the availability of its graduate assistantships. Students interested in applying should submit a resume directly to the department. Incoming students should contact departments directly about the availability of assistantships.

Full graduate assistantships carry a stipend set by the University and a tuition waiver for up to nine graduate credits per semester. Graduate assistants with such appointments are expected to devote 20 hours each week to carry out their assignments effectively. Under some circumstances, partial assistantships providing either tuition or a stipend may be granted. In such cases, expected time to be devoted is set by the assigning department. Graduate assistants are permitted to accept other University employment; however, University policies limit students to a total of 25 hours and international students to 20 hours of work per week, including the graduate assistantship. Graduate teaching, research, and administrative assistantships, both full and partial, require that the recipient be registered for at least six graduate credits at Embry-Riddle for any semester of their appointment. Summer registration is not required, but encouraged.

**Undergraduate Enrollment in Graduate Courses**

During their senior year, Embry-Riddle undergraduate students may take selected Embry-Riddle master's courses, normally 500-level, for credit toward their undergraduate or master's degree. Students must have earned at least 88 semester hours applicable to their undergraduate degree, have the approval of the program coordinator of the appropriate master's program, and have at least a 2.50 CGPA to qualify for enrollment in master's courses while an undergraduate. Credits earned at the 500 level normally can be applied either to undergraduate or master's degree requirements as designated by the student. Once approved, the designation by the student becomes permanent and may not be changed at a later date. An undergraduate student may not enroll in more than 12 credit hours of graduate courses prior to completion of the bachelor's degree and admission to a graduate degree program.

**Catalog Applicability**

1. A petition to come under the provisions of a later catalog requires approval from the department chair or designee.
2. Former master students who reapply for admission to the University will, if readmission is granted, come under the provisions of the catalog in effect at the time of readmission.
3. Students who change from one master's degree program to another come under the provisions of the catalog in effect on the date the change of program petition was approved.

**Time Limitation for Degree Completion**

The student has seven years from the date of admission to the master's degree program to complete the degree. No Embry-Riddle course older than seven years at the time of graduation may be used in the program of study for a master's degree. (Prerequisite courses are exempt from this requirement.) Transfer courses older than seven years, earned at other universities, may be accepted at the discretion of the appropriate program coordinator. Students who do not maintain continuous enrollment (missing enrollment at the University for a period of two years) must file for readmission to the University. The seven year limit is measured from when the student was first admitted to the Embry-Riddle program.

**Student Grievance**

It is the policy of Embry-Riddle to administer its educational programs in a fair, equitable, academically sound manner and in accordance with the appropriate regulations and criteria of its governing board, accrediting associations, and federal and state laws and regulations. To this end, master's students are given an opportunity to express any complaint, grievance, or dispute that upon investigation may be redressed.
Academic Standing

Warning
Full-time students whose cumulative grade point average (CGPA) falls below 3.00 are placed on Academic Warning. Students on Academic Warning must raise their cumulative grade point average to 3.00 in the next 12 hours of graduate work.

Dismissal
Students will be dismissed from their master’s program whenever any of the following conditions occur:

- Students on conditional status fail to satisfy the conditions of their admission.
- A final grade of less than B is received in any three master’s courses.
- A final grade of F has been received for any two master’s courses.
- A final grade of F is received in any course worth 6 credit hours or more.
- The cumulative grade point average has not been raised to at least 3.00 within the first twelve master’s hours attempted after the semester/term in which the student is placed on academic warning.
- Two grades of U occur during the course of the thesis research.
- A final grade less than B is received in any prerequisite undergraduate course.

Master’s students may appeal their academic dismissal from the University by submitting a petition in writing detailing the existence of any exceptional mitigating circumstances to the Vice Chancellor of Academic Support or designee within 30 days of the receipt of the dismissal notice. The Vice Chancellor of Academic Support or designee will refer the student petition to the appropriate appeals committee for recommendation. Upon recommendation of the appeals committee, the Vice Chancellor or designee reviews the case and makes the final determination of the action to be taken. Such action will be taken in a timely manner not to exceed 30 days of the receipt of the petition. If confirmed, academic dismissal is final.

STUDENTS MAY ONLY APPEAL A DISMISSAL ONE TIME.

Dismissal for Cause
The University reserves the right to dismiss a student at any time and without further reason, if the student exhibits the following undesirable conduct:

1. Actions that pose a risk to the health, safety, or property of members of the University community, including, but not limited to, other students, faculty, staff, administrative officers, or the student himself/herself.
2. Conduct that disrupts the educational process of the University.
3. Any other just cause.

Loss of Master’s Status and Readmission
Under certain circumstances (other than graduation), a masters student may lose graduate status and will no longer be considered a student at Embry-Riddle. This can occur when:

1. A student voluntarily withdraws from the University.
2. A student is dismissed from the University and the dismissal becomes final.
3. A student fails to meet the requirement for continuous enrollment. This occurs when a student does not enroll in at least one term in a two-year period.
4. A student does not complete the degree requirements of a master’s program within seven years of starting the graduate program.
5. A student completes a master’s program.

Students who fail to maintain continuous enrollment for any reason are required to apply for readmission under the catalog in effect at that time.

Graduation Requirements and Honors

Graduation Requirements
The following summary of graduation requirements is provided for all students. An Embry-Riddle master’s degree will be conferred upon the successful completion of the general requirements of the University and the specific requirements of the degree sought.

1. All course, thesis, GRP, GCP and other academic requirements, as appropriate, must be met.
2. The student is not on negative academic standing.
3. All debts and obligations to the University are satisfied.
4. The student is not under University investigation for misconduct or other disciplinary matters.
5. A student must be enrolled in the term in which he/she graduates.
6. An application for graduation must be initiated by the student and received in the time limit specified by the appropriate campus records office.
7. Participation in graduation exercises will not be permitted, a diploma will not be awarded, nor a transcript annotated as complete, until all of the degree requirements have been satisfied.

Graduation Honors
Students who have completed a master's degree program and who have excelled academically throughout their graduate careers are recognized through the publication of graduation honors on the transcript and in the commencement program. To be eligible, graduate students must have completed their degree program with a cumulative grade point average of 4.00 based on grades received in all courses at the graduate level.

Ph.D. Regulations and Procedures
Regulations and Procedures
All University graduate/doctoral academic and non-academic procedures and regulations are subject to change. Therefore, all procedures and regulations in effect at a given time may not be reflected in the current catalog. When such changes do occur, notice of the change may be in the form of an addendum or in the next catalog. Catalog addenda are effective on the date published unless otherwise stated.

Student Responsibilities
Students are responsible for being fully informed about all procedures and regulations governing their participation in Embry-Riddle’s graduate programs. The necessary information may be found in the current catalog, Student Handbook, orientation and information packets published and distributed by the campuses, and periodic announcements published by the University. A student who requires clarification of any policy or regulation should seek help from their academic advisor or ERNIE Central. University regulations will not be waived because a student is unaware of established standards and procedures.

Schedule of Classes and Registration
Ph.D. course schedules are published by the appropriate university registrar offices and by the specific department offering the course(s).

An academic credit hour requires a minimum of 700 minutes of classroom or comparable instruction time during which the registered Ph.D. student and the course instructor are directly engaged. In the event of the cancellation of a scheduled classroom meeting, either as a result of factors beyond the University’s control or for a special academic activity or due to instructor illness, the instructor will make every effort to reschedule the class.

Students are required to register for each term of enrollment. Tuition deposits, registration, and fee payments must be completed according to instructions published by the Office of the Registrar. Students are not officially enrolled until they complete all phases of registration, including financial requirements.

Late registration will be allowed during the first five days of classes if unusual circumstances prevent the student from registering during the normal registration period. Registration will not be allowed after the last day for late registration, as designated in the academic calendar of this catalog.

A schedule of classes is prepared for each term. The University reserves the right to make necessary and appropriate adjustments to the published schedule to include cancellation or rescheduling of any class.

Academic Integrity/Conduct
Embry-Riddle is committed to maintaining and upholding intellectual integrity. The faculty, colleges, divisions, or campuses of the University may impose sanctions on students who commit the following academic integrity violations.

Cheating: The use of inappropriate sources of information on a test or being a party to obtaining or possessing an examination before the time the examination is scheduled.

Plagiarism: Presenting as one’s own the ideas, words, or -products of another.
Forgery and unauthorized alteration or misuse of one’s own or another’s academic records or transcripts.

Knowingly furnishing fake or misleading information to the University when seeking admission to the University or campus.

Forging, altering, falsifying, destroying, or unauthorized use of a University document, record, or identification. This includes using the logo, stationery, or business cards of the University or otherwise identifying oneself as an agent of the University for personal, non-University business.

Misuse of computing facilities and/or security violations, including attempted violations of computing facilities.

Sanctions may include a failing grade on the assignment, a failing grade for the course, or dismissal from the University.

Class Attendance
Because regular attendance and punctuality are expected in all courses, attendance may be included in the grading criteria of an individual class. Absences are counted from the first scheduled meeting of the class.

A final examination is normally given in each course at the end of the term. A student who misses a final examination without advance permission from the instructor may be assigned a failing grade (F) for the course. A grade of incomplete (I) may be given if the student has obtained advance permission from the instructor or can provide satisfactory evidence that the absence could not be prevented.

Unit of Credit
Semester credits are used throughout the University system. Transferred quarter hours will be converted to semester credit hours on the following basis: A quarter hour equals two-thirds of a semester hour.

Course Load Status
Full-time doctoral students normally take nine semester credit hours. The minimum course load for full-time status is six credit hours. Additional courses above this load require permission from the appropriate department chair. If a student demonstrates exceptional academic performance, the department chair or designee may approve a maximum one-course overload. A student’s enrollment may be restricted when deemed in the best interest of the student.

Grading System

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<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Satisfactory</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Conditional/Passing</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
<td>0</td>
</tr>
<tr>
<td>WF</td>
<td>Withdrawal from the University-Failing</td>
<td>0</td>
</tr>
<tr>
<td>W</td>
<td>Withdrawal from a course</td>
<td>N/A</td>
</tr>
<tr>
<td>AU</td>
<td>Audit</td>
<td>N/A</td>
</tr>
<tr>
<td>I</td>
<td>Passing but incomplete</td>
<td>N/A</td>
</tr>
<tr>
<td>IP</td>
<td>In progress</td>
<td>N/A</td>
</tr>
<tr>
<td>N</td>
<td>No grade submitted by instructor</td>
<td>N/A</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory</td>
<td>N/A</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
<td>N/A</td>
</tr>
<tr>
<td>T</td>
<td>Transfer credit</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Grade Reports
Final grades are issued at the end of each term. Students can access their grades immediately after they are posted, via Student Online Services.

The University is prohibited from releasing grade information without the express written authorization of the student. Such authorization must be granted each term because blanket authorizations are prohibited by law.

Grade Point Averages:
GPA, CGPA
A term grade point average (GPA) and cumulative grade point average (CGPA) are computed for each student after every term. The GPA is calculated by dividing the number of grade points earned during the term by the number of hours attempted in that period. The CGPA is determined by dividing the total number of grade points by the total number of hours attempted at the University. Grade points and hours attempted are accrued in -courses graded A, B, C, F, and WF only. The courses and credits from another graduate program at Embry-Riddle, accepted by the appropriate department chairman as applicable
toward the Ph.D. program, will be included in the CGPA.

**Adding, Dropping, or Withdrawing from Courses**

Students may add or drop a course during the add-drop as designated by the campus and the program. If a course is dropped, the course will not be entered into the academic transcript. Refunds will be in accordance with the applicable schedules published by the University.

A student may withdraw from a course without academic penalty until the published course withdrawal date. The student must complete the proper university forms to accomplish the withdrawal. An official withdrawal cannot be accomplished simply by ceasing regular class attendance. When a course has not been completed and the official withdrawal procedure has not been properly followed, a grade of F will be assigned.

**Auditing a Course (AU)**

Because students audit a course solely to enhance their knowledge, academic credit is not granted toward degree requirements for audited courses. Students may change their registration from audit to credit during the “add” period only, with the approval of the chair (or designee) of the Ph.D. department in which the student is enrolled. They may change from credit to audit until the last day of the withdrawal period. When a student auditing a course fails to maintain satisfactory attendance, as determined by the instructor, a grade of W will be assigned.

**Incomplete Grade (I)**

An instructor may assign an “I” grade to a student who is passing, but is unable to complete the course requirements before the scheduled end of the term because of severe hardship beyond the control of the student, as determined by the instructor.

An “I” grade must be redeemed within thirty days following the end of the term in which the “I” grade was assigned. The campus Associate Vice President of Academics and the office of the University Dean of Research and Graduate Studies may waive/extend the period.

Incomplete grades which are not redeemed are automatically converted to course grades of “F” upon expiration of the redemption period.

**Repeating a Course**

Students may petition to repeat one course in which a grade of C was earned for the purpose of improving their grade point average, a student must submit a written request and receive approval of the department chair or designee. Both grades earned appear on the transcript, but only the replacement grade is included in the calculation of the grade point average.

**Withdrawal from the University**

Students who leave the University for any reason must officially process a withdrawal clearance through through ERNIE Central to be processed by the Office of the Registrar. When a student withdraws from the University after the end of the scheduled withdrawal period, a WF grade will be assigned for all courses in which the student is enrolled unless an exception is granted for medical reasons or other extenuating circumstances by the Associate Vice President or designee.

**Academic Probation and Dismissal**

**Probation**

Full-time students whose cumulative grade point average (CGPA) falls below 3.20 are placed on Academic Probation. Students on Academic Probation must raise their cumulative grade point average to 3.20 in the next 12 hours of graduate work.

Students will be dismissed from their Ph.D. program whenever any of the following conditions occur:

- Students on conditional status who fail to satisfy the conditions of their admission.
- Earn less than a B in two graduate courses.
- Earn an F in any graduate courses.
- Two grades of U occur during the course of the dissertation research.
- A student does not complete the degree requirements of a Ph.D degree within seven years of starting the Ph.D. program and an extension to the time to degree has not been granted.

Students may appeal their academic dismissal from the University only once.

Students may appeal their academic dismissal from the University by submitting a petition in writing detailing the existence of any exceptional, mitigating
circumstances to the office of the University Dean of Research and Graduate Studies (CAO) or designee within 30 days of the receipt of the dismissal notice. The campus CAO or designee will refer the student petition to the appropriate appeals committee for recommendation. Upon recommendation of the appeals committee, the Dean of Research and Graduate Studies or designee reviews the case and makes the final determination of the action to be taken. Such action will be taken in a timely manner not to exceed 30 days following the Dean of Research and Graduate Studies or designee’s receipt of the petition. If confirmed, academic dismissal is final.

Dismissal for Cause
The University reserves the right to dismiss a student at any time and without further reason, if the student exhibits the following undesirable conduct:

Academic performance issues, academic misconduct, non-academic misconduct.

Actions that pose a risk to the health, safety, or property of members of the University community, including, but not limited to, other students, faculty, staff, administrative officers, or the student himself/herself.

Conduct that disrupts the educational process of the University.

Any other just cause.

Loss of Doctoral Status and Readmission
Under certain circumstances (other than graduation), a Ph.D student may lose postgraduate status and will no longer be considered a student at Embry-Riddle. This can occur when:

A student voluntarily withdraws from the University.

A student is dismissed from the University and the dismissal becomes final.

A student fails to meet the requirement for continuous enrollment. This occurs when a student does not complete at least one course in a two-year period.

A student does not complete the degree requirements of a Ph.D program within seven years of starting the post Ph.D. program.

Students who fail to maintain continuous enrollment for any reason are required to apply for readmission under the catalog in effect at that time.

Time Limitation for Degree Completion
The student has seven years from the date of admission to the doctoral degree program to complete the degree. No Embry-Riddle course older than seven years at the time of graduation may be used in the program of study for a doctorate degree. (Prerequisite courses are exempt from this requirement.) Transfer courses older than seven years, earned at other universities, may be accepted at the discretion of the appropriate program coordinator. Students who do not maintain continuous enrollment (missing enrollment at the University for a period of two years) must file for readmission to the University, although seven years is measured from when the student was first admitted to the program.

Graduation Requirements
The following summary of graduation requirements is provided for all students. An Embry-Riddle Ph.D. degree will be conferred upon the successful completion of the general requirements of the University and the specific requirements of the degree sought.

• All course, dissertations, and other academic requirements, as appropriate, must be met.

• The student will have registered, presented and successfully defended a Ph.D. dissertation as determined by the Ph.D. department.

• All debts and obligations to the University are satisfied.

• The student is not under University investigation for misconduct or other disciplinary matters.

• A student must be enrolled in the term in which he/she graduates.

• The student is expected to complete the degree within seven years of matriculating into a Ph.D. program unless a specific extension has been granted by the department chair and approved by the University Dean of Research and Graduate Studies.

• An application for graduation and the request to participate in Commencement exercises must be initiated by the student and received within the time limit specified by the Office of the Registrar.
• Participation in graduation exercises will not be permitted, a diploma will not be awarded, and a transcript will not be complete, until all the degree requirements have been satisfied.

Ph.D. students earning Master’s degree

• Ph.D. students admitted straight from a Bachelor’s degree will earn the Master’s degree and the Ph.D. upon completion of all requirements for the Ph.D. The Master’s graduation application fee will be waived.

• The Master’s degree will be conferred once all Master’s requirements are fulfilled if utilizing Master’s degree for teaching credentials in the department. The Master’s graduation application fee will be waived.

• Courses utilized toward the Master’s degree will be designated by the department on a Plan of Study. These courses will be moved to the Master’s transcript prior to degree conferral.

Transcript Requests

Transcript can be ordered online through ERNIE. Under the Office of the Registrar page there is a link for an official transcript to be ordered.

Student Grievances

It is the policy of Embry-Riddle to administer its educational programs in a fair, equitable, academically sound manner and in accordance with the appropriate regulations and criteria of its governing board, accrediting associations, and federal and state laws and regulations. To this end, graduate students are given an opportunity to express any complaint, grievance, or dispute that upon investigation may be redressed.

Student Education and Assistance

Embry-Riddle promotes substance abuse awareness by sponsoring educational programs and distributing literature. The University is additionally committed to assisting students in the resolution of problems associated with substance abuse and encourages students to seek additional help through referrals from the University Health Services and Counseling Offices.

Ph.D. Teaching and Research Assistantships

The University may provide Ph.D. assistantships (tuition waivers and/or financial stipends) to selected, qualified students in certain Ph.D. programs. They are designed to assist graduate students early in their Ph.D. studies with the cost of maintaining enrollment in the Ph.D. program and to provide teaching and/or research experiences that contribute to an enrichment of the academic experience. It is expected that following the assignment of the Ph.D. student to a research advisor, grant and/or contract support (when available) will be used to fund financial stipends supporting the student and to help defray course tuition and research credit costs.

To be eligible for a University-funded assistantship (Graduate Teaching Assistantship), a student must be enrolled in a Ph.D. degree program and be performing satisfactorily. Satisfactory performance includes maintaining a CGPA of 3.20 or higher out of a possible 4.00 through the end of the semester preceding the appointment.

Ph.D. teaching assistants who act as the teacher of record (i.e., having primary responsibility for teaching a course for credit and/or assigning final grades for such a course) must be credentialed for teaching according to university policy.

Ph.D. students receiving University-funded assistantships must be registered as full-time students as determined by individual department guidelines.

University-funded assistantships providing financial support are generally awarded on a 12 month basis and require the recipients to devote twenty hours each week to carry out their assigned duties. In the case of partial levels of assistance, the number of hours per week worked is determined by the department but will not fall below ten hours per week.

While holding a university-funded assistantship, a student’s total University employment (including the assistantship) may not exceed twenty-five hours per week. Students holding an assistantship may have other university employment, but it must be approved by the sponsor of the assistantship.

University-funded assistantships providing course credit tuition waivers and financial support to Ph.D. students are generally available until the end of the semester the student sits for the Qualifying Examination.

Oversight of a Ph.D. student’s performance while supported by a University-funded assistantship (tuition waiver or financial support) is the
responsibility of the immediate supervisor and the department chair.

Non university-funded Ph.D. research assistantships (Graduate Research Assistantships) funding Ph.D. candidates doing research for their dissertation (usually following admission to candidacy) are the responsibility of, and are expected to be provided by, research advisors with funding from grants or contracts supporting the faculty research. The level of financial support and the duration of such support will be decided by the research advisor in consultation with the department chair but is expected to be reasonably consistent with University guidelines as advised by the office of the University Dean of Research and Graduate Studies.

Qualifying Examination & Admission to Candidacy
The student must pass a written qualifying examination in the field of study. At the discretion of the department the qualifying examination may also include an oral examination. Upon successfully passing the qualifying examination, the student is considered for admission to candidacy for a Ph.D. degree.

Usually, students will sit for the qualifying exam during or immediately following their last semester of coursework. If the performance on the examination is unsatisfactory, the Ph.D. program chair will determine whether the student is allowed to retake the examination or any part of the examination according to the individual program requirements.

Admission to a Ph.D. program does not automatically include admission to candidacy for the Ph.D. degree. The faculty of the department must evaluate the progress of the student and determine that the student has completed all course and other requirements, has passed the qualifying examination, and is otherwise qualified to fulfill the research requirements leading to completing the Ph.D. dissertation.

Departments may follow different procedures for formal admission to candidacy. The student should consult with the department chair or dean for information on these procedures.

Dissertation
The dissertation is required of every candidate for the Ph.D. degree. The dissertation is an original, critical treatment of a topic chosen by the candidate and approved by the Dissertation Advisory Committee, composed of individuals delegated by the appropriate department as detailed in the specific department guidelines. It is written in English.

If the Ph.D. candidate has collaborated with others in carrying out the research upon which the dissertation is based, the candidate’s own contribution to the research must be specified and clearly stated in a separate section immediately preceding the text.

The dissertation, when completed, must be of publishable quality and able to be published, although publication is not required. It must not be restricted by any entity outside the University from being published. It is expected to make a significant contribution to the body of knowledge of the discipline. If all or part of the dissertation is published, a statement that the publication is based upon the dissertation must be included in the publication. Other criteria may be imposed by the appropriate department.

When preparing the dissertation document, the Ph.D. candidate will follow the procedures detailed in the University’s guidelines for preparation of dissertations and theses, which are available through the office of the University Dean of Research and Graduate Studies, the Ph.D. department offices, or the University web site.

Dissertation Advisory Committee
Each student will have a Dissertation Advisory Committee to assist in advising and guiding the student through the dissertation in all of its phases. This Advisory Committee will be formed either upon candidacy (or as soon thereafter as appropriate) or when the dissertation proposal is accepted, depending upon the particular Ph.D. program guidelines.

The composition of the Dissertation Advisory Committee should be of individuals of assistant professor rank or higher and will follow the guidelines of the particular Ph.D. program.

Dissertation Oral Committee
The role of the Oral Committee is to provide explicit final judgment of the quality of the work of scholarship submitted and defended by the Ph.D. candidate.
The voting members of the Oral Committee are appointed by the Department Chair in consultation with the office of the University Dean of Research and Graduate Studies. The Committee will consist of the members of the Dissertation Advisory Committee and one full-time faculty member with the rank of assistant professor or above who is a member of a department other than that of the candidate. Other department specific criteria may apply to the membership of the Committee and are described in the Guidelines for the formation of the Dissertation Advisory Committee.

Additional guest members with or without vote may be appointed to the Oral Committee by the Department Chair in consultation with the office of the University Dean of Research and Graduate Studies. Such guest members are expected to be recognized experts in the field of the candidate’s dissertation.

The Oral Committee will also have a member representing and appointed by the office of the University Dean of Research and Graduate Studies. This person will serve as an ex officio representative of the University in a parliamentary capacity to assure that each final oral examination follows procedures consistent with University expectations and rules of order and to assure that all appropriate necessary documentation is in order and complete.

**Dissertation Oral Examination**

The purpose of the oral examination is to determine whether the candidate has satisfactorily presented a significant, original thesis in the dissertation and whether the candidate has adequately defended the dissertation.

The presentation and defense of a significant, original dissertation is the culmination of the work for the Ph.D. degree. Everything else is considered preliminary for this presentation. Prior coursework prepares the student for research work on the dissertation and the Qualifying Examination is used to determine whether that preparation is adequate. In effect, the oral examination provides an explicit final judgment of the quality of the work of scholarship but, also, implicitly judges the quality of the entire graduate education of the candidate leading up to and culminating with the presentation and the defense of the dissertation.

The candidate is eligible to take the oral examination only after completing all other requirements for the degree. The oral examination will focus on the subject matter covered by the dissertation and in the specific field in which the dissertation is written.

At least six months must have elapsed since the candidate's admission to candidacy for the degree. The oral examination will be administered at locations specified in the Guidelines for each program.

The dissertation must have been registered with the office of the University Dean for Research and Graduate Studies at least two weeks prior to the oral examination. Oral examinations will be scheduled by the department chair but not less than five weeks prior to the Commencement ceremony elected for degree conferral.

The vote of the Oral Committee will be taken by the chair. More than one dissenting vote by the committee will signify that the candidate fails this exam. The candidate will be allowed one repeat examination if there is a failure of the examination unless a majority of the voting members of the Oral Committee vote against a repeat examination.

The copyright for the dissertation belongs to the candidate.

The candidate is required to supply a digital version of the dissertation to the library which will be published through the University’s subscription to UMI’s ProQuest online dissertation services.
Financial Information

Student Accounts
At the time of acceptance for admission, a University account is created for every student. This account remains open until graduation. The primary use of this account is for University charges and payments.

If an account has a credit balance, the student may request a refund, transfer to EAGLE Dollars, or flight account if applicable. All students are encouraged to enroll in eRefunds. This allows funds to be deposited directly into a checking or savings account.

We advise all students to open and maintain an account at a local bank for personal matters.

Electronic Communication Policy: Students registering for classes or obtaining other goods and services provided through Embry-Riddle Aeronautical University are advised that the Student Financial Services office provides all financial account information using the Student Center in ERNIE. We also send you important notices via your ERAU email account. It is your responsibility to review your ERAU student account status and email account weekly and make payment by the published due date.

You will need to contact the Student Financial Services office in writing if you choose not to have your accounts receivable charges paid with your financial aid disbursement. However, this may delay your disbursement. If you are receiving an institutional loan, you are obligated to repay the amount of your loan in accordance with the terms outlined in your Promissory Note.

It is your responsibility to either pay or make arrangements to satisfy all University debts, which may exceed your financial aid on or before the tuition payment deadline.

Payment Procedures
Students may view and pay all account activity, including balance due online in ERNIE > Student Homepage > Finances > My Student Account. At the Daytona Beach Campus accepted pay-methods include debit (in-person only), personal check, money order, cashier’s check, electronic check, wire transfer (fees apply), credit card (online only and fees apply) including VISA, MC, Discover and American Express. Payments made by mail should be addressed to the Student Financial Services office and timed to arrive prior to the published payment deadline. Charges incurred after the payment deadline are due immediately through the end of add/drop. Charges incurred after add/drop are due 30 days from the date of the charge, or the last day of class, whichever occurs first.

Payment Plans and Deferments
Payment plans are available each semester for all charges, excluding flight costs, books and course materials. You may enroll in a payment plan for each semester that you are registered. Plans are available online, 30 days prior to the start of each semester and must be on file by the payment due date. An enrollment fee of $50.00 is added to your first payment.

Anticipated Financial Aid will place a deferment on your account for the amount awarded.

Any student whose tuition and fees are paid by a third party, (Foreign Embassy, U.S. Government, etc.) is considered a sponsored student. Formal arrangements for sponsor payments should be made with the Student Financial Services office. Veteran’s Education benefits are obtained by contacting Veteran Student Services. Student Financial Services will invoice a third-party sponsor on behalf of a student, however, if the sponsor does not pay by the terms stated on the invoice, the student will be held responsible for the balance due. The student will be subject to all collection proceedings which include registration, diplomas and transcripts holds.

Books and Supplies
Purchases are made directly from the University Bookstore. Cash, checks, Eagle Dollars, Visa, MasterCard, and American Express are accepted. Students whose anticipated financial aid is higher than the total amount for tuition and fees may request a book voucher at ERNIE Central up to $500.00.

Payment Deadlines
2019-20 Payment deadlines are:

- 2019 Summer A & C – May 6, 2019
- 2019 Summer B - June 24, 2019
- 2019 Fall – August 16, 2019
- 2020 Spring – January 3, 2020
Payments must be received by these dates, so please plan accordingly:

- For mail delivery – allow 10 business days

By ERNIE>Campus Solutions>Finances>My Student Account – immediate!

**Delinquent Accounts**

Embry-Riddle Aeronautical University is a not-for-profit institution of higher learning. As such, student receivable accounts are considered to be educational loans offered for the sole purpose of financing an education and are not dischargeable in bankruptcy proceedings.

When a student’s account is delinquent the student is notified via email to their ERAU email address. A delinquent student account will result in suspension of all academic processing and information on class performance. Grades, diplomas and transcripts will be withheld, as well as future enrollments. Sums remaining unpaid will be charged interest at the maximum rate allowed by law. The student is also subject to the costs of collection, which may be based on a percentage at a maximum of 33% of the debt will be added to your student account balance. In addition, all costs and expenses, including reasonable attorney’s fees we incur will be passed on to the student.

**Tuition and Fees**

**Residential and Fees**

**Residential Campus Tuition and Fees**

**Fall/Spring Tuition**

Students registering for coursework during the spring or fall term totaling 12-16 credit hours are billed according to a “block tuition” rate. Registration for coursework equaling 1-11 credit hours is charged on a per-credit-hour basis. Students whose undergraduate course loads during fall or spring semesters are greater than 16 hours are charged the semester rate plus a per-credit-hour charge for those credit hours over 16.

A student with more than 27 CUM credit hours and a cumulative GPA of 3.00 or higher may register (with advisor written approval) for up to 18 credit hours, in a fall or spring semester, with no increase in tuition for hours over the block.

Courses taken in the Aviation Maintenance Science Department (AMS courses) are billed separately from other academic courses, and have a lower per-credit-hour tuition rate.

Summer tuition rates are determined solely by the number of credit hours per term. Each summer term is billed separately.

Detailed tuition rates are described in the current academic year financial insert (http://daytonabeach.erau.edu/admissions/estimated-costs).

**Hourly Flight Rates**

Rates vary by type of aircraft or simulator. Please see the financial insert applicable to Daytona Beach campus for specific rates.

**Payment for Flight Instruction**

The University uses a cash-basis payment method for all flight instruction. Payment is required at the completion of each training session.

Unpaid flight training sessions will be charged to your student account on the 1st and 15th of each month. A Financial Hold may be placed on your student account and you may be suspended from future flight trainings until the activities are paid.

Flight pay-methods include Flight Dollars, Credit Card (fees apply), electronic check and guaranteed anticipated Financial Aid.

**Room and Board**

Room and Board fees may be incurred each semester by students attending the Daytona Beach Campus and should be used when estimating the cost of attendance. Freshman and sophomore students may be required to live in University-managed housing and participate in the Embry-Riddle Dining Services meal program. A variety of meal plans are offered that may be supplemented with the Eagle Card to suit individual needs. Please refer to the campus financial brochure and/or Housing and Dining Services brochures for the appropriate campus for current options, requirements, and costs.

**Mandatory Fees**

The following fees are mandatory where applicable. Please see the financial insert (http://daytonabeach.erau.edu/admissions/estimated-costs).
• Graduation fee
• Student Government Association fee
• Health service fee
• International student service fee
• Health Insurance
• Orientation fee
• Technology fee
• Student facility fee

User Fees
Other fees apply for services that are not considered mandatory. Please see the financial insert (http://daytonabeach.erau.edu/admissions/estimated-costs).

Graduate internship tuition is based on the cost of one credit and charged for the semester of internship.

Refund Policy
Students who officially withdraw from all classes may be eligible for partial refund of tuition. Dropped courses or partial withdrawals after add/drop are not eligible for tuition refunds. Summer term refunds are calculated on a per-course basis. During all terms the effective date of the withdrawal, as determined by the Office of the Registrar, governs refund computations (see the Academic Calendar). Students who are suspended for disciplinary reasons will not be eligible for a full or percentage refund. Please reference the Withdrawal/Refund Schedule applicable to the Daytona Beach Campus.

The following are refundable according to the Withdrawal/Refund Schedules:

- Tuition
- Student Government Association fees
- Housing fees (less housing processing fee)
- International student service fee
- Health service fee
- Technology fee
- Student facility fee
- Meal plans (Until 10 days after orientation)

### University Withdrawal/Refund Schedule

#### Fall/Spring Semesters

<table>
<thead>
<tr>
<th>Period</th>
<th>Class days</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1-5</td>
<td>100%</td>
</tr>
<tr>
<td>II</td>
<td>6-10</td>
<td>80%</td>
</tr>
<tr>
<td>III</td>
<td>11-15</td>
<td>60%</td>
</tr>
<tr>
<td>IV</td>
<td>16-20</td>
<td>40%</td>
</tr>
<tr>
<td>V</td>
<td>21-25</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>26 and after</td>
<td>0%</td>
</tr>
</tbody>
</table>

#### Summer A/B terms

<table>
<thead>
<tr>
<th>Period</th>
<th>Class days</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1-3</td>
<td>100%</td>
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<tr>
<td>II</td>
<td>4-6</td>
<td>80%</td>
</tr>
<tr>
<td>III</td>
<td>7-9</td>
<td>60%</td>
</tr>
<tr>
<td>IV</td>
<td>10-12</td>
<td>40%</td>
</tr>
<tr>
<td>V</td>
<td>13-15</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>16 and after</td>
<td>0%</td>
</tr>
</tbody>
</table>

A Petition for Refund due to circumstances clearly beyond the student’s control, such as illness or required military service, must be in writing and must be accompanied by appropriate documentation, such as a physician’s statement or military orders.

Housing Contracts
Students who have housing contracts must contact the Housing and Residence Life Office to release their obligation. Any refunds will be determined at that time. All housing deposits will remain on account until the housing contract expires. The Housing and Residence Life Office will authorize release of the deposit to the student account.

### Financial Assistance

Embry-Riddle participates in a number of federal, state, and University-administered programs that
help students and their families meet educational
costs.
Embry-Riddle believes the primary responsibility
for financing education lies with the student and the
student’s family. Therefore, the student should apply
for financial aid early, save money, look for ways to
reduce costs, and become aware of specific program
requirements by reading all financial aid publications.
Financial aid awards are meant to supplement
what the student and family can contribute toward
costs and rarely cover all educational expenses. All
financial assistance will be limited to the student’s
individual remaining need or Embry-Riddle’s
established cost of attendance.
A complete description of financial assistance
programs and optional financing programs
available to students and their parents is
available on the Web under the Financial Aid
(http://daytonabeach.erau.edu/financial-aid)
section. Students who expect to need help in
meeting their financial obligations are encouraged
to seek such assistance through one or more of the
programs available for this purpose.

Programs Available
The major categories of financial assistance
programs include scholarships, grants, loans, and
student employment. Loans from state and federal
government sources or from private lenders must
be repaid; the interest rate, however, is usually low,
and the repayment period is extended. Grants and
scholarships do not have to be repaid, nor does the
income earned through student employment. Most of
these programs are based on the student’s financial
need.

Scholarships
Embry-Riddle
A limited number of academic scholarships are
awarded to entering freshmen and college transfers
who possess outstanding academic credentials.
An incoming student’s completed application for
admission to the University is the only application
required for scholarship awarding consideration.
For more information about scholarships, students
should contact the Financial Aid Office of the
Daytona Beach Campus.

Grants

Federal (Undergraduate Only)
- Federal Pell Grant
- Federal Supplemental Educational Opportunity
  Grant

State and Institutional (Undergraduate Only)
- Sibling Grant
- Florida Student Assistance Grant
- Florida Effective Access to Student Education
  Program
- Florida Bright Futures Scholarship Program
- Grants from other states

Loans

Federal
- Federal Direct Subsidized Loan
- Federal Direct Unsubsidized Loan
- Federal Parent Loan for Undergraduate Students
  - PLUS (Undergraduate Only)
- Federal PLUS Loan for Graduate Students
  (Graduate)
- Other private-sector educational loans

Employment
The Student Employment Office provides assistance
to students seeking part-time employment on or off-
campus.
On-campus employment is available to students
regardless of financial need. Working on or off
campus not only gives students more financial
support, but also helps them develop self-confidence,
gain valuable employment and credit references,
establish a work record, acquire useful skills in time-
management, financial planning and communication.

Eligibility Requirements
To be considered eligible to apply for most financial
aid programs, students must:
1. Be U.S. citizens or eligible non-citizens
2. Be enrolled or accepted for enrollment as at least
   a half-time student in a degree program
3. Be making satisfactory progress toward a degree
4. Be registered with Selective Service if required to
do so
5. Establish financial need
6. Not be in default on a loan or owe a repayment on a previous financial aid award received at any institution

The Application Process
After applying for admission to the University, students may complete the Free Application for Federal Student Aid (http://www.fafsa.ed.gov) (FAFSA). Each year, students are required to reapply for financial aid.

Some funds are limited. Students are encouraged to complete the FAFSA as early as possible beginning October 1.

Satisfactory Academic Progress for Financial Aid Recipients
Federal regulations require ERAU to define minimum standards of satisfactory academic progress (SAP) to determine your eligibility for financial aid. ERAU must set certain standards to ensure you are progressing toward degree completion. If you do not meet the standards, you will not be able to receive financial aid.

How is SAP measured?
The following measurements will be reviewed to determine good standing for continued financial aid eligibility:

Qualitative: College level grade point (Cumulative GPA)

Quantitative (Pace): College credits completed and time frame needed to complete the degree

What are the standard requirements?

Qualitative:
• Undergraduate students: Minimum cumulative GPA of 2.0
• Graduate students: Minimum cumulative GPA of 3.0

Quantitative/Pace:
• College credits hours completed: required to complete 67% of total credit hours attempted.

How to calculate PACE
Cumulative number of credit hours student successfully completed
Cumulative number of credit hours student attempted

Application of Grades and Credit Hours:
1. Credit hours attempted are all course credit hours for which you are enrolled as of the end of add/drop period.
2. For calculating credit hours, grades of "F" (failure), "I" (incomplete), "IP" (in progress), "W" (withdrawn), "WP" (withdrawn passing), "WF" (withdrawn failing), "U" (unsatisfactory), AU (audited), FX (ceased attendance) and repeated courses, are counted as hours attempted but not as credit hours completed.
3. For example, a sophomore that has attempted 60 credit hours and has satisfactorily completed 48 of those credit hours would have completed 80% of attempted credits hours.

Time frame needed to complete the degree: You are not allowed to attempt more than 1.5 times, or 150%, of the number of hours in your degree program of study.

Repeat Courses
For courses repeated during your program of study, both the original and repeated credit hour will be counted as attempted hours in rate of progress calculations.

Transfer Credit Hours/Change of Degree Program
Transfer credits that are accepted toward your educational program count as both attempted and completed credits.

Withdrawing from courses
Withdrawing from courses may impact your financial aid awards. Before withdrawing from class, you should contact the Financial Aid Office to determine the consequences.

Withdrawing from the university or dropping all courses in a term
Students who totally withdraw or drop all courses in a term, and receive aid may owe the university money. Before withdrawing from the university, you should contact the Financial Aid Office to determine the consequences.

When are these standards reviewed?
The standards are reviewed once each academic year at the end of the spring semester. Email
notifications will be sent to your ERAU email account, if you fail to meet the SAP standards.

What happens if I’m not meeting the standards?

Financial Aid Suspension

Students who fail to meet satisfactory academic progress are placed on financial aid suspension. You will not receive federal or institutional aid during this suspension.

Can I appeal my suspension?

You have the option to appeal the suspension. An appeal must be based on extenuating circumstances that seriously affected academic performance such as student or parent injury or illness, death of a relative or other special circumstances.

The Appeal Process

Contact the Financial Aid Office to begin processing an appeal. We will supply you with the appeal form and required steps. You will need to explain what type of circumstances contributed to the academic problem and what plans you have to eliminate those problems in the future. We realize that sharing personal information can be difficult. Be assured that your statement will remain confidential. An academic plan approved by an academic advisor may be required.

Financial Aid Probation

For students who are successful in their appeal, aid will be reinstated; however, placed on probation for one payment period/term. At the conclusion of the probation term, you must be meeting the school’s SAP standard in order to qualify for further Federal Title IV Funding. If you are academically suspended, dismissed, or not permitted to continue your enrollment, you will not be eligible to receive financial aid.

Reinstatement

You may reestablish your eligibility for financial assistance by achieving the satisfactory academic progress standards. Keep in mind this will be at your own expense as you are ineligible for aid. Once you have earned the required grade point average or completed the required credit hours, you must contact Financial Aid to request the reinstatement of your financial aid eligibility.

Do these standards apply to every financial aid program?

These standards are related directly to the Federal Financial Aid programs. However, state, institutional and private sources of aid have other standards that must be considered. Refer to your state web sites to review the specific criteria for each program. Contact the Financial Aid staff to determine the specific requirements of each type of aid that you receive.

Return of Federal Financial Aid for Withdrawal

Students who officially withdraw from all of their classes are subject to the Return of Title IV Federal Financial Aid Programs Policy. Students who stop attending or participating in all of their classes will be considered an unofficial withdrawal and will also be subject to the Return of Title IV Federal Financial Aid Programs Policy. The Embry-Riddle Return of Title IV Funds Policy, in accordance with federal regulations, will determine the amount of financial aid funds to be returned.

How does ERAU determine the Return of Title IV Funds amount?

Students earn a percentage of their federal financial aid each day they are enrolled and active in their classes. When a student withdraws from the university, or ceases attendance or has non-participation in all courses in a semester/term, this percentage is calculated by the number of days attended divided by the number of days in the term. The amount of federal aid you received and your institutional charges will also be used to determine the amount of federal funds to be returned. Students withdrawing beyond 60% of the semester will have 100% of Title IV programs funds earned.

Who is responsible for the Return of Funds?

Both the university and/or the student could be responsible for the return of funds. The financial responsibility is determined as part of the return of Title IV funds calculations. If the university is responsible, the funds are returned to the appropriate program. If any portion of the return of funds is due to a grant program, the university will return the funds, on behalf of the student. If the student is responsible for repayment of direct loans, the repayment will be administered according to the
terms of the promissory note. In some cases, the
student may have a balance owed to the university.

**How will the money be returned?**

The money will first be returned to the loan and/
or grant programs that you received during the
semester. ERAU must follow a specific order in
returning the money. The order is:

1. Federal Unsubsidized Stafford Loan
2. Federal Subsidized Stafford Loan
3. Federal Parent Loan for Undergraduate Students
4. Federal Pell Grant
5. Federal Supplemental Educational Opportunity
   Grant
6. Other Federal Programs

**Is there anything else I should know if I withdraw from the university?**

Yes, if you must withdraw from ERAU, you should
complete a Withdrawal Clearance form through the
Office of the Registrar. This form will be used to
determine your withdrawal date, and the amount of
funds to be returned, if applicable.

**What constitutes an unofficial withdrawal for Federal (Title IV) Financial Aid?**

If students stop attending or cease to participate
in all of their classes and fail to withdraw from the
University, an FX grade is assigned for each course
in which they were enrolled and stopped attending.
If the student receives FX grades in all classes, the
student will be considered an unofficial withdrawal.
The Return of Title IV funds will be calculated based
on the last recorded activity date, or if that cannot be
determined, the mid-point of the term.

**Payment Deferrals**

Students who use financial assistance to pay their
University charges may have the payment date
extended for the amount of their award if their funds
are not ready to be disbursed by the date payment
is due. This is called a payment extension. Any
difference between the total charges and the amount
of the extension granted must be paid according to
the University’s payment procedure. To qualify for
a payment extension, students must have applied
for financial assistance and must have received final
approval of their award.
Student Life and Services

The Dean of Students Office seeks to empowER our students through enhanced experiences and access to opportunities.

We serve as advocates, connecting students to resources, and support the academic mission to promote student success. To prepare students for life as Embry-Riddle Eagles, the Dean of Students Office provides services in the following areas.

- Work with individual students who are referred to our office or who need referral to resources
- Respond to students and situations of concern
- Mediate grievances and provide a sounding-board for daily challenges
- Oversee the University conduct process
- Administer the academic integrity process in conjunction with faculty
- Open lines of communication for students to share their input

Also the Office verifies information for security clearance background investigations and employment references while adhering to the Family Educational Rights and Privacy Act of 1974 (FERPA) to protect educational records based on the student's preferences.

Students have access to many resources throughout the Student Affairs division, many of which the Dean of Students oversees.

- Career Services
- Counseling Center
- Center for Faith and Spirituality
- Health Services
- Housing & Residence Life
- Student Engagement & Student Union

Diversity and Inclusion Office

Mission

Embry-Riddle’s Office of Diversity & Inclusion at Daytona Beach strives to advance the campus community’s understanding, commitment, and respect for diversity. Through education, programming, advocacy and outreach the office will foster an environment that is both nurturing and supportive for all students, faculty, and staff.

Vision

The vision of the Office of Diversity and Inclusion at Embry-Riddle, Daytona Beach, is to be a world leader of diversity and inclusion education and experiential learning.

Value Statement

Embry-Riddle Aeronautical University administrators recognize that our students, staff, and faculty are our greatest strength. Embry-Riddle fosters a culture where students, staff, faculty, and guests are valued for their contributions and are motivated to participate to the fullness of their potential. The following value statement from the Office of Diversity and Inclusion summarizes how we embrace cultivating a campus environment where everyone is respected and significant to campus life:

*Our campus culture nurtures and celebrates different and unique perspectives while valuing the ideas and efforts of individual contributors in a safe and non-judgmental environment. We are committed to attracting and retaining a diverse group of students, faculty, staff, and guest so that we are enriched by the variety of people this world has to offer. We purposely promote civility and respect so that our stakeholders will enjoy meaningful experiences. We consider one of our most important missions to be the stewardship of our students, who are our primary focus. Their well-being and feeling of belonging is paramount to this office. It is our goal to ensure that students feel welcomed and included into the Embry-Riddle “family”.*

Student Union

The Student Union serves the students of ERAU by providing unique co-curricular opportunities, resources, and services to maximize their educational experiences to allow for holistic growth and development. The department strives to create an environment in which students are encouraged and aided in the exploration of co-curricular involvement, leadership development,
student programming, self-governance, and civic engagement.

Through these services, the Student Union staff support and enhance holistic development by building community, complementing the academic experience, and advancing life skills.

There are over 160 student organizations on the Daytona Beach Campus. The department encourages participation in sports clubs, special interest groups, Greek life (sororities and fraternities), honor societies, aviation clubs, military organizations, and religious organizations. The Department of Student Union provides support for all these organizations in addition to assisting students in starting new student organizations. Involvement on campus develops skills in social responsibility, strong group dynamics, leadership, communication, management, budgeting, and decision making. Students have the opportunity to learn about all the student organizations at the fall and spring Activities Fair.

The Student Union is also the point of contact for the Student Government Association and its divisions – the student programming board (Touch-N-Go Productions), the WIKD 102.5 FM radio station, and the Avion newspaper – as well as New Student Orientation, Family Relations, Leadership Development Programs, the International Student Programming Council and Blue & Gold Week. Additional information can be found online via ERAU Connection.

For specific information, contact the Student Union at (386) 226-6039 or dbstuact@erau.edu.

Student Government Association

The Student Government Association (SGA) is responsible for providing a link between the students and the faculty, staff, and administration. While being the voice of the students, the SGA provides many services, represents the student body, and is actively involved with student programs. SGA services to the students include a free beverage service, Safe Ride, which provides a free taxi ride to students when they are in unsafe situations; legal consultation service; lockers; banners; color printing; and free faxing. SGA members also participate on almost every committee on campus, and the president of the SGA is a member of Embry-Riddle’s Board of Trustees. Direct questions, comments, or concerns to sgapres@erau.edu or call (386) 226-6045.

Student Government Association Leadership Program

The Student Government Association (SGA) at each residential campus offers partial tuition waivers for elected officials of the organization. The amount of the waiver varies depending on the position held. The goal is to stimulate interest in holding elected office and to recognize the commitment student leaders make in such positions.

For information about the criteria students must meet to run in an SGA election, or for other information about the program, contact the Student Government Association office.

Students Under Age 18

A student under the age of 18 is required to have a signature from a parent or guardian to participate in certain campus events such as field trips, recreational activities, and sporting events. Attempting to obtain a signature for each would be burdensome for both the student and the parent or guardian, possibly causing the student to miss activities normally associated with college life.

A waiver form may be signed one time by the parent or guardian and the student giving consent for the student to sign in place of the parent or guardian for all activities and events that require written consent. Waiver forms are available in the Dean of Students Office. The waiver expires the day the student reaches the age of 18.

Athletics

Intramural and Recreational Sports

Intramural and Recreational Sports at the Daytona Beach Campus strives to create an atmosphere of competition and fun by offering a wide variety of activities ranging from team sports such as flag football, volleyball, basketball, dodgeball, and softball to individual competition in such sports as table tennis, racquetball, and tennis. Other sports are also available on request. Visit www.erau-imsports.com (http://www.erau-imsports.com) for additional information.

The director assists chartered clubs and organizations with the use of sports facilities and equipment. An equipment-loan program offers many
items for free checkout on an overnight basis with a valid University I.D. card. Students are encouraged to use all on-campus sports-related facilities (outdoor swimming pool, tennis and basketball courts, playing fields, indoor racquetball, gymnasium, and fitness center). Hours vary for each facility and are posted. Visit www.erau-fitness.com (http://www.eraufitness.com) for additional information.

In addition to on-campus recreational activities, a virtually unlimited variety of outdoor recreational opportunities are possible. Hiking, camping, fishing, and sailing are a few of the activities available in the neighboring surroundings.

Whether students seek a highly competitive league to demonstrate their athletic skills or select a competition that encourages group participation for fun and to stay in shape and reduce the stress in their lives, they are sure to find what they are looking for in intramural and recreational sports. The department of Intramural & Recreational Sports is also a source for on-campus employment. Students are able to work as lifeguards, fitness supervisors, and officials at special events.

Discounts to major theme parks and attractions in the area are offered frequently throughout the year though arrangements by the Intramural & Recreational Sports Department.

**Intercollegiate Athletics**

Embry-Riddle provides a highly competitive varsity sports program on the Daytona Beach Campus. The University is a member of NCAA Division II and competes as part of the Sunshine State Conference.

Since the inception of intercollegiate athletics in 1989, Embry-Riddle has captured 108 conference championships and two national championships (men’s basketball, 2000 and men’s tennis, 2013).

In addition to their prowess on the fields and courts, student-athletes at Embry-Riddle have posted a grade point average higher than the campus average for 18 consecutive years.

The University sponsors 19 intercollegiate sport programs at the Daytona Beach Campus, including men’s baseball, basketball, cross country, golf, lacrosse, rowing, soccer, softball, tennis, track & field and volleyball. The Daytona Beach campus also sponsors a co-ed Cheerleading team. Any student who meets both University and NCAA eligibility requirements is able to compete for a position on a varsity team. Athletic grants-in-aid, in varying amounts, are generally awarded to recruited varsity student-athletes, with walk-on players earning the right to compete for scholarship assistance, when available.

For more information on the Eagles, including game schedules, rosters, results, and statistics, go to http://www.erauathletics.com. Embry-Riddle students are admitted to all regular-season home games free of charge.

**EAGLEcard**

The EAGLEcard, which you will receive at orientation, is the official Embry-Riddle University identification card for all students. It should be readily available at all times to present to University officials who may request verification. The EAGLEcard is the property of Embry-Riddle University, which reserves the right to revoke use of the EAGLEcard on any of its accounts at any time. Only the individual to whom it is issued may use the EAGLEcard. Other uses include:

- Activity Card: Your EAGLEcard allows you access to student activities, events, games, voting, and other services provided by Embry-Riddle.

- Access Card: If you reside in on-campus University housing, your EAGLEcard will give you access to your residence hall and Tallman Commons. Also, certain labs and buildings require the use of an EAGLEcard for entry.

- Library: You must present your EAGLEcard each time you check out library materials.

- Prepaid Debit Card: Your EAGLEcard offers a debit account that is managed by the University. There are no cash withdraws from this account. The EAGLE Dollar account can be used at any University point of sale, including vending, copy, laundry machines, dining locations, and the University bookstore. The EAGLE Dollar account is also accepted as payment by some of the local merchants in the Daytona Beach area; see our website for a complete listing:
Meal Plans: These are accessed via your EAGLEcard. (See the Dining Services section for more information regarding meal plans.)

Deposits
The EAGLE Dollars minimum deposit is $1.00. Deposits to this account can be made at the Cashier’s Office, at one of the on-campus Value Transfer Stations, or via the Web on your ERNIE homepage. The University reserves the right to suspend any account if a negative balance goes unpaid for more than 30 days, or if a student account is delinquent.

Transactions
The cardholder must present their EAGLEcard at the time of purchase. All sales transactions charged to an account through the use of the EAGLEcard are final at the point and time of sale. The cardholder is responsible for observing the amount charged during the transaction and monitoring balances. A cardholder can check their account balances online via the cardholder’s University Blackboard account. Up to 90 days’ history is available. A cardholder is responsible for all transactions.

Statements
The cardholder can obtain a detailed statement of their debit transactions through their ERNIEaccount. Up to 180 days’ of history is available. A cardholder is responsible for all transactions.

Account Closing and Refund
Your funds in an EAGLEcard account are not transferable and there are no cash withdrawals permitted from the account(s). The funds will stay there semester-to-semester, year-to-year, and will not be refunded unless the cardholder withdraws, graduates, or is dismissed from the University, with proof required. A request for a refund must be submitted to the EAGLEcard Office in writing. A $10.00 processing fee will be applied to any remaining funds in your EAGLEDollars account. A one-time fee of $25.00 will be applied to any remaining funds on an inactive account, (an EAGLEcard is inactive after two years of non-use). The remaining balance will be processed in accordance with the Florida statute(s) regarding abandoned property.

Lost or Stolen Card
The cardholder is required to immediately contact the EAGLEcard Office during normal business hours (8 a.m. to 5 p.m.), the Safety Communication Office after business hours, or via the Web through the cardholders ERNIE account, if an EAGLEcard is lost or stolen. This action will suspend the card until it is reactivated at the EAGLEcard Office. The cardholder is responsible for all transactions charged to their accounts prior to proper notification to the EAGLEcard Office, the Safety Office, or via the Web. Once the card has been reported as lost or stolen, all accounts and privileges accessed with use of the EAGLEcard will be suspended.

Replacement of Lost/Stolen or Replacement Cards
A replacement fee of $15.00 will be charged for lost cards. The fee will be waived if a card was reported as stolen and a report number was issued by a government agency. A replacement fee of $5.00 will be charged for damaged cards if the cardholder turns in the non-functioning card to the EAGLEcard Office.

Error Resolution
If you feel there has been an error on your account, please notify the EAGLEcard Office within 60 days from the date of the transaction in question. In order to resolve the problem we will require the following:

- Name, student ID number
- Description of the error or transaction in question
- Dollar amount of the transaction in question
- A clear explanation of why you believe there is an error

Disclosure of Accounting Information to Third Parties
The University will disclose information to third parties about the account holder’s account(s) or the transfer made only:

1. in order to comply with court orders or other applicable laws, or
2. if the account holder gives written or verbal permission, or
3. if the student’s account receivables is in the third party’s name.

All policies and procedures are subject to change.
Health and Wellbeing

Center for Faith and Spirituality
The purpose of the Center for Faith and Spirituality is to encourage and support students in nurturing their spirit, that part of the self that seeks meaning, purpose and connection. The Chaplains are available for individual conversations and counseling, small group discussions, and student group presentations and collaborations. The Center for Faith and Spirituality also offers assistance to students looking to connect with a faith-based student organization on campus and/or a faith community off campus. The Chaplains work to promote mutual respect, understanding, and cooperation between students of different spiritual and ethical beliefs.

Counseling Services
The mission of the Counseling Center is to foster student development, growth, and learning. The department provides a calm, safe, supportive environment for students to discuss and explore issues affecting their mental health, wellness, interpersonal relationships, and their academic performance, persistence, and success. Counseling services are short-term in nature; eight-session limit per semester, and four-session limit per summer term. Information shared in counseling, including the fact that a student received services, is confidential. Counseling records are separate from academic and administrative records. For students needing more extensive and specialized treatments, referrals to community counselors, psychologists, and psychiatrists are available. The Counseling Center also promotes mental health awareness and wellness through campus-wide activities, programs and presentations. Daily wellness posts are available on the department’s Facebook, and a variety of mental health assessments and resources are also available on the department’s website, via ERNIE.

Disability Support Services
The University is committed to ensuring access and providing reasonable accommodation for students with documented disabilities who request assistance. The Director serves as the advocate of Disability Support Services (DSS) at the Daytona Beach residential campus, Worldwide Campuses, and online.

Students’ needs are addressed on an individual basis with regard to their specific disabilities, academic and career goals, learning styles, and objectives for personal development. Campus-specific services include academic advisement or assistance with planning academic schedules, registration assistance and advance registration, academic intervention programs, time management training, study skills assistance, arrangements for peer tutoring, testing modifications, advocacy, and facilitation of physical access. In addition, DSS supports returning veterans in need of service.

Because certain academic programs are FAA-certified, those programs are subject to regulation by that agency. Therefore, regulatory limitations may delay or preclude participation or licensure in those programs by persons with certain disabilities.

Prospective students considering a program of study are encouraged to contact the Disability Support Services staff for information on policies and procedures, eligibility concerns, or campus-specific services. All information is confidential and not for inclusion in the students’ University records.

Health Services
Maintaining optimum health promotes a productive university experience. Health Services promotes student wellness through direct care, education, and assistance with lifestyle modification.

Services include medical diagnostic assessment, prescriptive and nursing care, referrals, wellness education and counseling, women’s health care, medical grounding of flight students, and assistance with aerospace medical concerns.

Students must satisfy the mandatory immunization requirement prior to arriving on campus. The Medical Report form supplied by University Admissions indicates the immunizations that students must document in order to reside in University-managed housing.

Prospective flight students should note that certain sensory impairments, medical, neurobiological, and psychological conditions, and the use of mitigating prescriptive medications may delay or preclude medical certification by the FAA. These issues should be discussed with an aviation medical examiner (AME) to ensure participation in flight instruction. Students may also contact the Health...
Services clinical staff for information on eligibility for medical certification by calling (386) 226-7917.

Health Insurance Requirement for Students

All students must have health insurance and provide proof of coverage on an annual basis; coverage must be continuous throughout enrollment at Embry-Riddle. The University recommends that students who are currently insured contact their plan administrator to ascertain benefits and limitations while enrolled. Some plans cover only emergency room care or require extended waits to become established with a local provider; many plans reimburse services received out-of-network at a lower rate or not at all.

All students are automatically enrolled in the University’s student health insurance plan. Students with comparable private insurance may waive out of this plan to have the premium removed from their account. Prior to completing the waiver request, we encourage students and/or their parents to review the University’s basic student plan and major medical options at www.uhcsr.com (http://www.uhcsr.com). The waiver request must be received and approved by the semester deadline. Failure to waive the insurance by the semester deadline will result in the nonrefundable insurance fee remaining on the student’s account. Embry-Riddle is not responsible for insurance waivers that are submitted after the deadline. The waiver can be found in WebAdvisor by logging onto ERNIE (domestic students only).

International students (with and F-1 or a J-1 visa) must present their policy in person or via e-mail at the Immigration Services office (the HUB, building 273, dbiss@erau.edu). Please be sure to have the following items on your policy for the waiver:

- Provide the toll-free telephone number in the United States of your insurance company.
- The policy must have coverage for sicknesses, injuries, medical evacuation and repatriation of remains.
- The amount of health insurance coverage requirements is a minimum of $100,000 up to $200,000 the amount has to be in dollar, no other currency accepted.
- Please provide the website address information for your insurance company.

Housing and Dining

Living On-Campus

Embry-Riddle believes that the on-campus living experience is an integral and positive part of a well-rounded university education. Interaction with other students in the residential community is a major contributor to student success. National research shows that students who live on campus earn better grades, tend to be more involved in campus activities, and are more likely to graduate than students who live off campus. The Department of Housing & Residence Life offers programs and services that support the academic mission of the University and promote student success. All residence halls are staffed by specially trained personnel who are committed to helping students and promoting a positive community environment.

Residential Facilities

Residence halls are furnished and air-conditioned. All residence halls have laundry facilities, vending facilities and easy access to campus dining areas. Housing fees include all utilities, internet, and cable TV access. Although computer labs are conveniently located in certain residence halls and academic buildings, students should provide their own personal computers for use in their rooms. Each residence hall is designated for new or returning students. Housing accommodations are available for students with varying physical abilities. Requests for these spaces should be made to Disability Support Services.

Residency and Board Requirements

Residency Policy: All first-year and transfer students are required to live in ERAU-managed housing for their first two academic years (fall and spring semesters). Exemptions to the residency requirement are below. All first-year students are required to purchase a 14-meal-per-week plan for each of their first consecutive fall and spring semesters. First-year students may upgrade to larger meal plans if desired.

Please Note: First-year students who start during the Summer B term will be required to live in ERAU-managed housing and purchase at least a 14 meal-per-week meal plan for the Summer B term as well.

Exemptions to the residency requirements are as follows:
• Transfer students who have earned more than 56 college credit hours after graduating high school or who are 21 years of age or older on or before September 1 of their year of entry to the University.
• Students who are legally married or in a verified domestic partnership, and
• Students who are full-time, year-round residents within 50 miles of ERAU’s Daytona Beach Campus, for a minimum of one year prior to entering Embry-Riddle.

All requests for a residency exemption must be submitted in writing to the Department of Housing & Residence Life with supporting documentation of circumstances. Students who meet one of the exemptions above are not required to live in ERAU-managed housing, but may apply to live on-campus and assigned if space is available.

Housing Application Process
New students accepted to Embry-Riddle will receive instructions on how to submit the housing application online. A completed application, along with the housing deposit, must be submitted online to the Department of Housing & Residence Life in order to receive an assignment. The housing application is available at dbhousing.erau.edu.

Dining Services
A variety of nutritious and satisfying dining services and meal plan options are offered. Dining facilities are conveniently located throughout the campus. They offer a wide range of food selections, from full hot meals to fast food and snacks. Dining service hours are designed to meet the needs of students, with meals available throughout the day and late into the night. For the health conscious individuals, daily vegetarian and vegan options are offered at the dining locations. Accommodations can be made for students with special dietary needs or medical conditions. Dining service personnel are available to consult with students on an individual basis. Requests for special services should be made to the General Manager of Dining Services.

Please note the following information regarding meal plan requirements.
All first-year students are required to purchase a minimum 14-meal-per-week plan for each of their first consecutive fall and spring semesters. First-year students may upgrade to larger meal plans if desired. This minimum required plan provides 14 full meals per week and flexible Riddle Bucks that can be used to purchase individual food items at any campus dining location. First-year students may upgrade to three premium meal plans including an unlimited meal plan. For more information about Dining Services please visit http://daytonabeach.erau.edu/campus-life/dining/index.html.

Student Services
Career Services Office
Career Services provides career resources and career development assistance to all Embry-Riddle degree seeking students. Visit the Career Services website, which offers students tools and resources for identifying cooperative education/internship and full-time employment opportunities, including resources for international students, veterans and other specialized student populations. To get started, activate your account on Handshake, a web-based career management system and job search database, and upload a resume. Handshake is accessed via single sign on through ERNIE.

Aviation, aerospace, manufacturing, government and companies in a wide array of industries recruit Embry-Riddle students and alumni for cooperative education/internship, research and full-time positions. Career Services hosts many of these employers throughout the year as they participate in events such as information sessions, on-campus interviews, and the fall and spring Industry/Career Expos.

Career Services employs a staff of program managers to provide career advisement, professional career workshops, mock interviews, and resume reviews.. Career Services encourages students to contact us early in their education to explore career options, map out their path to career readiness, and to develop successful job search strategies.

For more information, contact:
Career Services, Mori Hosseini Student Union, Suite 313
(386) 226-6054
http://careerservices.erau.edu

First Year Programs
Dedicated to helping students achieve their academic goals, the First Year Programs (FYP)
team consists of highly qualified academic advisors, student ambassadors, peer mentors, and tutors who work together with faculty and staff campus-wide to assist students in their transition to university life.

First Year Programs, conveniently located on campus in the College of Business, Suite 115, focuses on the academic success of first-year students through developmental and intentional academic advisement. First Year Programs coordinates and provides academic counseling, grade monitoring, academic intervention strategies, and tutoring, and acts as a liaison for students seeking appropriate sources of information and specialized services on campus. First Year Programs oversees the college success course UNIV 101 for the campus and coordinates with the Living-Learning Program in the residence halls.

FYP oversees the First Generation Student Program and the First Class Program. The First Generation Student Program is designed to help students who are among the first generation in their families (to attend a university) to succeed. The First Class Program is designed to give selected first year students a head start in their university experience during the Summer B semester.

For more information, contact:
First Year Programs
College of Business, Suite 115
1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
Email: dbfyprog@erau.edu
https://ernie.erau.edu/Departments/first-year-programs-daytona
(386) 226-7073
(386) 226-6165 (fax)

Hunt Library
The Hunt Library provides information resources, services, and facilities to Daytona Beach and Worldwide students, faculty, and staff in support of the University’s commitment to excellence in teaching, learning, and research.

Visitors to the library will find resources in a variety of formats: books, documents, journals, and aircraft manuals. An extensive collection of research databases, online journals, conference proceedings, ebooks, streaming videos, and more are available to Embry-Riddle students, faculty, and staff through the library’s website: http://huntlibrary.erau.edu/.

Most can be accessed from off-campus and provide full-text access to books, articles, documents, and other research materials. The library also houses thousands of print books to support the curriculum.

Research Librarians are available at the ASK desk, as well as by telephone, email, text and chat, to assist with research and course-related information needs. Contact Ask a Librarian at http://huntlibrary.erau.edu/help/ask-a-librarian for assistance.

Other library services include Interlibrary Loan for obtaining materials from other libraries, Course Reserves containing many assigned readings, and online Research Guides designed to help students get started on a specific research topic or type of assignment.

There are multiple computer terminals, on-site technical assistance, printing, photocopying/scanning, WiFi, and charging areas. With a variety of seating options, the Hunt Library is a comfortable, popular venue to research, browse, study, and gather for group projects.

Information Technology Services
Information Technology strives to provide students with stable, secure, highly available, always-on systems via the Web that offer a leading-edge in technology. The University’s Web portal, known as ERNIE (Embry-Riddle Network for Information Exchange), can be found at http://ernie.erau.edu. ERNIE gives students one-stop-shopping for class and University information as well as details on campus events. This is where you will find the Campus Solutions’ Student Services Center for access to various services, such as enrollment, unofficial transcripts, class grades, class schedules, account balances, and flight schedules.

Information Technology also provides the following services:
- Online learning system for access to classes and online course materials
- Computerized labs and classrooms
- Various academic software titles (access via the labs and some available through ERNIE)
- Email account
- Microsoft One Drive - 1 TB of storage
- Personal SharePoint site
• Assistance in connecting to the Residential Network (ResNet) for on-campus housing
• Free software downloads, including popular Microsoft titles and anti-virus software
• Wireless Internet access available in all buildings and residence halls

The ERAU mobile application is available for iPhone, Android and Blackberry devices. Enjoy convenient access to classes and coursework, news and events, campus maps and directories, sports, and videos.

International Programs Office
The International Programs Office serves as the central point of contact for issues concerning international students at Embry-Riddle. The office is comprised of the following departments: International Admissions, Immigration Services, Language Institute (ERLI), Global Engagement, and the Office of Diversity and Inclusion. All of these offices work together to enhance the international student experience, contribute to the students experience and academic success.

For more information, contact:
386-226-7663
International.admissions@erau.edu

International Student Programming
The Department of Student Activities & Campus Events runs an International Student Orientation which is held each semester to familiarize students with University policies and procedures as well as the American education system in general. In addition, international students are encouraged to join the International Student Programming Council which plans and implements educational, cultural and social programs for all international students.

For more information, contact:
International Student Programming Council
JP Riddle Student Center
1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
https://connection.erau.edu/organization/ispc
(386) 226-6039
(386) 226-6014 (fax)

Mail
Prior to a student’s arrival and during the time they live in campus Housing, all personal mail and packages delivered by the USPS, UPS, Federal Express and DHL should be addressed as follows:

If box number is known:
Student’s Full Name (include middle initial)
ERAU Box # XXXX
1 Aerospace Boulevard
Daytona Beach, FL 32114-3977

If box number is unknown:
Student’s Full Name (include middle initial)
“New ERAU Student”
1 Aerospace Boulevard
Daytona Beach, FL 32114-3977

All mail & package/s are sorted, processed and delivered by box number, so please be sure to include your mailbox number when giving out your address and when ordering items online. Items received without a box number delays the delivery of your mail/packages until the end of day.

Requirement for having an on Campus Mailbox is as follows:

Only Students living in Campus Housing are eligible to be assigned or have a campus mailbox and are asked to check it at least once a week to avoid the mailbox from becoming over full with mail/magazines. Mail/packages left in the mailbox for
more than 30 days will be returned to the sender as unclaimed. A visit to the Mail Center is mandatory once an on campus student moves off campus or leaves the University and will be asked to turn in your mailbox key and provide a forward address. Only USPS domestic mail & packages will be forwarded for a 4 month period. The forward service does not include UPS, Fed-Ex, DHL, Amazon or international mail items.

Safety and Security
Safety and security is provided by the Campus Safety & Security Department 24 hours per day, seven days per week. The department consists of full-time officers and part-time student assistants. The Safety & Security Department provides patrol and escort services, crime prevention programs, communications/dispatch services, and monitors life safety systems. The department provides coverage to the campus and its satellite locations. Safety officers respond to routine requests for service as well as to emergency situations. They conduct field investigations, parking and traffic enforcement, support for special events, and specialized security service to the campus flight line. The Crime Prevention section engages in safety education, victim assistance and crime prevention programs for students, faculty and staff. The department maintains a close liaison with local law enforcement agencies to provide the safest possible learning environment.

For further information, please see our website http://daytonabeach.erau.edu/about/safety/index.html.

Student Employment
The Student Employment Office provides assistance to students seeking part-time employment on or off campus. On-campus employment is available to students regardless of financial need. Working on or off campus not only gives students more financial support, but also helps them develop self-confidence, gain valuable employment and credit references, establish a work record, and acquire useful skills in time management, financial planning, and communication. Once students are registered at the Daytona Beach Campus they may seek employment by visiting our office or by viewing all available positions via our online system. Once students are offered employment on campus, they must provide ORIGINAL documentation for proof of identity and employment eligibility.

Because students work and serve each other at Embry-Riddle, a sense of community is created. Students are participants in the life and work of the University as well as consumers of the educational program. Embry-Riddle depends on student workers for much of the work essential to sustain day-to-day operations.

Embry-Riddle adheres to the principle of equal employment opportunities for all students.

Current students desiring further information may visit our internal website on ERNIE.

Veteran Student Services
Embry-Riddle degree programs are approved by the appropriate State Department of Veterans Affairs (State Approving Agency) for enrollment of persons eligible to receive education benefits from the Department of Veterans Affairs (VA).

Students must be pursuing a degree in a specific program to be eligible to receive benefits. Admission procedures for veterans and other eligible persons are the same as those for other students. Students who do not satisfy all requirements for full admission may be certified for two terms; however, they may be required to repay the VA for some or all benefits received if they do not achieve full admission status during that time.

Title 38, United States Code, sections 3474 and 3524, requires that education assistance to veterans and other eligible persons be discontinued when the student ceases to make satisfactory progress toward completion of the training objective. Accordingly, benefits will be interrupted for undergraduate students whose CGPA is less than 2.00 for three consecutive terms or who are otherwise subject to suspension and for graduate students who are subject to dismissal. The VA will be appropriately notified of the unsatisfactory progress. The student must submit a written request to reinstate education benefits. The request must include proof of academic counseling and the conditions for continued enrollment or re-entrance. The VA will determine eligibility for reinstatement of benefits, based in part on the school's recommendation.

Veterans’ progress will be measured according to University standards as published in this catalog, and
the rules and regulations of the VA apply. The criteria used to evaluate progress are subject to change. Application and interpretation of the criteria are solely at the discretion of Embry-Riddle.

Students are responsible for notifying the School Certifying Official of any change in their enrollment or change in personal information affecting their eligibility. Students also must remain in compliance with University and Department of Veterans Affairs requirements.

Students may receive education benefits only for courses that are required for their designated degree program. Students who receive VA benefits are subject to strict academic regulations and should be aware of how auditing courses, repeating a course, changing degree programs or enrollment status, and other actions may affect their eligibility to receive benefits.

For further information concerning approved programs and the application process, eligible persons should contact Veteran Student Services, 386-226-6350, or email dbva@erau.edu, https://daytonabeach.erau.edu/military/index.html.

For additional information concerning Veterans Education Benefits administered by the Department of Veterans Affairs, go to www.gibill.va.gov (http://www.gibill.va.gov).

Military Tuition Assistance
Military tuition assistance may be available to graduate students on active military duty. For further information, students should contact the educational services officer at their assigned installation.
Special Opportunities

Cooperative Education/Internship
The Cooperative Education/Internship Program offers qualified undergraduate students an opportunity to gain valuable practical work experience, explore career options, develop contacts in the industry, and earn college credit. Requirements and benefits vary by degree program and by employer. Students should discuss their co-op/internship plans with their academic advisor, Career Services program manager, when applicable, the co-op/internship faculty advisor in their degree program. One upper-level open elective credit hour is awarded for every 100 clock hours of work completed, up to a maximum of six credit hours in one semester. Additional information, including eligibility requirements and current openings, is available from Career Services and on the Career Services website, DB Career Services Team Site in ERNIE, and in Handshake. Students who register for an official University co-op/internship to earn academic credit will be charged tuition for one credit hour.

Those students planning to participate in the Cooperative Education/Internship Program during the summer have the opportunity to apply for some financial help through the Co-op Assistance Award Program. Information will be emailed to students during the spring semester regarding deadlines, eligibility and application requirements.

Guidelines for co-op/internship:
• Complete a mandatory advising session with a Career Services Program Manager and sign a Student Agreement.
• Complete 30 college or university credit hours prior to registering for the experience through Career Services. Transfer students must have completed a total of 30 college or university credits, including 12 credit hours at ERAU.
• Earn and maintain a cumulative grade point average of at least 2.50 for all ERAU course work, be degree-seeking, and be in good academic standing to register for academic credit.
• Enrollment in ERAU courses within the past year.
• 12 co-op/intern credit hours may be applied toward the degree program. Department Chair or designee approval needed to apply co-op/internship hours toward specified or technical elective degree requirements.
• On-campus experiences, virtual positions, independent research activity and special projects are not considered for co-op/intern credits.
• International students must verify their eligibility to work in the U.S. with International Student Services BEFORE accepting a co-op or internship, and may not register for a co-op or internship after having completed their educational requirements, according to the regulations of the United States Citizenship and Immigration Services. A co-op or internship must be required in the curriculum or fulfill a required elective.

Embry-Riddle Language Institute (ERLI)
The Embry-Riddle Language Institute is an intensive English program providing English language instruction and cultural orientation to non-native speakers of English with 6 starting points per year (2 in spring; 2 in summer; and 2 in fall). ERLI also offers special short-term programs for students who need English for specific purposes. If you desire to become more proficient in listening, speaking, reading, and writing the English language for personal or professional reasons, or need to meet Embry-Riddle Aeronautical University’s language proficiency requirement, this intensive English program is for you. Students can be granted full admission to the University pending completion of the program and/or a passing TOEFL or IELTS score, assuming they meet all other University admission requirements. ERLI students enjoy the benefits of full ERAU student status. Other benefits of our program include field trips and social events, full access to Embry-Riddle Aeronautical University facilities, and special topics courses such as Aviation Topics and Academic Topics. Concurrent enrollment in ERLI and the University is also available for eligible students.

For more information, please contact:
Embry-Riddle Language Institute
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
Phone: (386) 226-7614
Email: erli@erau.edu
Website: http://db.erau.edu/erli
Office of Global Engagement Programs
The Office of Global Engagement (OGE) is proud to offer all our students unique and award winning academic programs, as well as, research and volunteer programs abroad. OGE recognizes the unquestionable benefits of international exposure in today’s increasing globalization. Embry-Riddle offers its students a wealth of opportunities to study abroad in over 50 destinations spanning five continents. Whether it’s as short as a week or a one-month summer adventure or a semester/year-long program, these programs provide students with experiences that will greatly enhance not only their academic and professional lives but also their personal lives.

Students in good academic standing from ALL degree programs, both undergraduate and graduate, from any of our campuses have the opportunity to take courses through our partner universities that will be directly applicable to and count toward their degree programs at Embry-Riddle. These exchanges may be semester or year-long and most exchange programs are available in English. Additionally, there are programs taught in the language of the host country. Qualified exchange program participants may also have the opportunity to be placed in internships with companies or research labs abroad.

Our innovative and, in many cases, one-of-a-kind summer programs are taught in English by ERAU professors and host professors throughout the world. Our summer programs are designed to enhance student learning in unique and dynamic ways through academics and opportunities to visit businesses and organizations only open to our students because of ERAU collaborations and partnerships. Embry-Riddle offers a variety of two to six week summer programs at half-price tuition. This reduced tuition serves as an additional incentive for students to explore other countries, cultures, languages, foods, and experiences while advancing their education and enhancing future career competitiveness. Living expenses in many of our destinations can be substantially lower than in the United States, allowing students to save even more.

Spring brings even more opportunities to globalize. The Office of Global Engagement, in collaboration with various colleges and offices on campus, also offers Volunteer Abroad Programs, Spring Abroad (which is tied to a formal course) and IGNITE Abroad Research Programs. These are held over Spring Break.

Our newest initiative, Domestic Away, offers specific opportunities to students through college departments who have identified a domestic program, organization or location that will provide long term benefits for their students. The Domestic Away programs will focus on a specific aspect to help enhance student learning by taking them to a learning location stateside.

For information on financial aid for our global programs, please contact the Financial Aid office.

SEE IT IN PERSON, be an ERAU Eagle Abroad! Take the road less traveled and let your journey begin! #GoGlobal

Ronald E. McNair Scholars Program
This program is named in honor of the African-American mission specialist, Dr. Ronald E. McNair, who died in the 1986 Challenger Space Shuttle disaster, and is funded by a U.S. Department of Education TRiO grant. This prestigious program offers academic enrichment opportunities and other support services to eligible underrepresented and low income/first generation undergraduate students who are interested in exploring graduate degree opportunities, which may lead to a Ph.D. Among its many attributes, the program provides mentoring, academic and career counseling, Graduate Record Examination (GRE) preparation, a research methodology and statistics workshop, funded research opportunities, and cultural/social activities. Acceptance into the program is selective and is based on a special application process. Eligible transfer students are also welcome to apply. For more information, contact:

McNair Scholars Program
(386) 226-6149
dbmcnair@erau.edu

Strategic Languages: Russian and Arabic
Students on the Daytona Beach campus can enroll in up to four semesters of two strategic languages, Russian and Arabic. As a result of a consortium partnership with Stetson University, Stetson faculty deliver Russian language classes to ERAU and Stetson students. Stetson students receive face-to-face instruction, and ERAU students simultaneously participate via a telepresence classroom on the DB
To enhance the learning environment, a native Russian speaker serves as a teaching assistant in the telepresence classroom, and the Stetson instructor travels to the ERAU campus once a week to conduct a face-to-face laboratory tutorials. An ERAU faculty member delivers Arabic language classes using the same strategies, except in reverse. ERAU students receive face-to-face instruction, and Stetson students simultaneously participate via a telepresence classroom on the Stetson campus. The same enhancements of a native Arabic speaker and weekly laboratory hours are in place at Stetson. ERAU students can elect a minor in Arabic Studies, comprising a minimum of three language classes and two upper-level courses in Arabic culture and/or history.

ERAU students who are interested in enrolling in strategic languages can gather more information about the courses by contacting:

Humanities and Communication Department
Dr. Donna Barbie or Dr. Emad Hamdeh
(386) 226-6668

Aviation Maintenance Science
Airframe and Powerplant Technician Certification

The maintenance technical track courses, which are part of the Baccalaureate and Associate of Science in Aviation Maintenance Science (AMS) degree programs, as well as a minor course of study, provides the student the necessary training to successfully attain the Federal Aviation Administration’s (FAA) Airframe and Powerplant (A&P) mechanic’s certification. This technical track consist of a carefully selected blend of theory and practical applications that can be completed in 16 months and is only offered at the Daytona Beach Campus.

Students perform airframe repairs and the overhaul of engines and their accessories, including those used in Embry-Riddle’s pilot training fleet. The facilities, equipment, curriculum, and instructional faculty are fully credentialed and approved under Title 14 of the Code of Federal Regulations, part 147. Embry-Riddle holds an Air Agency Certificate No. NX4T404M and an FAA Repair Station Certificate No. NX42404M.

Avionics Line Maintenance Specialization

The Avionics Line Maintenance minor provides the student the necessary training to successfully obtain the Federal Communication Commission’s General Radiotelephone Operator’s License as well as advanced avionics training using current industry standards and procedures. Students learn basic wiring and electronic concepts, system installations, and advanced avionics line maintenance troubleshooting techniques. This minor course of study is available to students in a Baccalaureate degree that have met the pre-requisite requirements. The pre-requisite requirements are met by completing the AMS Airframe technical track or by possessing an A&P certificate.

Sources of Information

For general academic and admissions information regarding the Aviation Maintenance Science programs:

Aviation Maintenance Science Dept.
Embry-Riddle Aeronautical University
1 Aerospace Boulevard
Daytona Beach, FL 32114
(386) 226-7617 - or - (877) 904-3746
(386) 226-6778 (fax)
http://erau.edu/ams

Honors Program

Embry-Riddle Honors Program

The Honors Program at Embry-Riddle is highly selective, offering students an enriched educational experience while also giving them opportunities to enhance campus and community life for others. Honors Program students enroll in several general education seminars focused on relevant, stimulating, interdisciplinary topics that encourage critical and creative thinking. Honors classes are small, the faculty are carefully selected, and the courses are student-centered and discussion-oriented. The Honors experience in the major emphasizes close involvement with selected faculty, research opportunities, and individually tailored projects. The program also adds to campus life through its guest speaker series and through activities sponsored by its student organization. Graduates of the Honors Program are models of academic excellence and student leadership.
Some features of the Honors Program:

- 12 credit hours of Honors in general education; in addition, at least 12 credit hours of Honors in the major. The Honors Program does not automatically add credit hours to any major.
- Honors seminars no larger than 24 students.
- Honors faculty.
- Guest speakers and artists of national/international notoriety who spend time with students in specially scheduled sessions.
- Honors Living Learning Community housing for first-year Honors Program students.
- Priority registration for classes.
- Research opportunities.
- Co-op and internship opportunities.
- Summer study-abroad opportunities.

**ROTC**

Reserve Officer Training programs are subject to the control of the service branch that sponsors them and are operated according to the rules and regulations established by the service branch. These may be changed from time to time without notice or obligation.

Not all Reserve Officer Training programs are available at all University campuses or locations. Students should contact the Admissions Office to determine program availability.

**Reserve Officer Training Corps**

The following campus-based organizations provide tuition scholarships to students who meet specific academic, medical, and physical requirements. In addition, Embry-Riddle may offer special financial assurances to ROTC Scholarship winners.

For more information on all requirements and benefits, refer to the Special Academic Programs and Opportunities section of the catalog.

- Air Force Reserve Officer Training Corps (ROTC)
- Army Reserve Officer Training Corps (ROTC)
- Naval Reserve Officer Training Corps (ROTC)
- U.S. Marine Corps Platoon Leaders Class Program

**Air Force**

The Air Force Reserve Officer Training Corps (Air Force ROTC) is an educational program designed to give men and women the opportunity to become Air Force officers. It prepares young men and women to become leaders in today’s high-tech Air Force while completing their college degrees. Air Force ROTC enrollment is not restricted to individuals who wish to become commissioned officers in the U.S. Air Force. Students may elect to take Air Force ROTC courses for academic credit only, earning elective credits for all University degrees.

Any qualified student may enroll in Air Force ROTC; check with your local Air Force ROTC detachment for more information.

**Four Year and Three Year Program**

The first half of the four-year program is called the General Military Course, which is offered during a student’s freshman and sophomore years. This program allows students to try out Air Force ROTC for up to two years without incurring any obligation (unless they are on an Air Force ROTC scholarship). The freshman and sophomore level classes cover fundamental information about the Air Force and the historical development of airpower. If students join as a sophomore and only have three years of college remaining, may combine their freshman and sophomore classes in order to complete their degree plan and AFROTC requirements in 3 years. The last two years are called the Professional Officer Course. These junior and senior level classes cover leadership skills, national security affairs, and preparation for active duty. Textbooks and reference materials are provided electronically and free of charge for all Air Force ROTC courses.

**Field Training**

All Air Force ROTC cadets must attend field training also known as “basic training”. Cadets usually attend field training during the summer between their second and third years of college. The purpose of field training is to evaluate military discipline and Air Force leadership potential, and to determine readiness for entry into the Professional Officer Course (POC) via leadership, followership, and team-building opportunities.

**Air Force ROTC Scholarships**
Air Force ROTC offers scholarships covering a student’s college education for two, three, or four years. Each scholarship pays up to full tuition, laboratory fees, incidental fees, an annual book allowance of $600, and a tax-free stipend during the academic year of $300-$600 per month, depending on their academic year. In addition to the Air Force’s scholarship aid, Embry-Riddle also offers financial incentives to new high school Air Force ROTC scholarship winners.

All high school three-year Air Force ROTC scholarship recipients will receive a minimum University assurance of $15,000 during the first year of attendance, and $8,500 in each subsequent year. All high school four-year Air Force ROTC scholarship recipients will receive a minimum university assurance of $5,000 for each year of attendance. University funding includes any university scholarships, need-based grants, and awards. University funding, in combination with funding from Air Force ROTC, cannot exceed the cost of education. This university assurance is offered at the discretion of the university Financial Aid Department, not Air Force ROTC.

High school students interested in a scholarship should apply as soon as possible in the six-month application period (June 1 to December 1 of their senior year). The online application for the High School Scholarship Program can be found at www.afrotc.com.

In-college scholarship opportunities may be available for students already enrolled in the Air Force ROTC program. Check with your local Air Force ROTC detachment for more information.

All scholarship applicants must meet the following requirements:

• Be a U.S. citizen
• Be less than 31 years old as of December 31 of the year you will commission
• Meet minimum military and physical standards
• Meet minimum term and cumulative GPA
• The higher the student’s GPA and SAT/ACT scores, the better their chance of being selected as a scholarship recipient.

For more information, contact:
AFROTC Detachment 157
Embry-Riddle Aeronautical University

1 Aerospace Boulevard
Daytona Beach, FL 32114-3900
(386) 226-6880
afrotcdb@erau.edu
http://daytonabeach.erau.edu/rotc/air-force/index.html

Army

Army Reserve Officer Training Corps (ROTC) is open to men and women, freshmen through seniors, as well as graduate students. Army ROTC may lead to a commission as an officer in the U.S. Army. Army ROTC enhances a student’s education by providing unique leadership and management training, along with practical experiences. The curriculum is designed to be challenging, educational, and flexible enough to allow students to meet scholastic and personal goals. Classes and training include leadership development, problem-solving, decision making, tactics, physical training, map reading, land navigation, rappelling, rifle marksmanship, patrolling, drill and ceremony, military history, ethics, and military law. Students may earn 18 hours of academic credit for completing four years of Army ROTC. The ROTC courses may also be applied towards open elective requirements in many of our degree programs. All uniforms, military textbooks, and equipment are issued to all ROTC Cadets at no charge.

Army Reserve Officer Training

The Army Reserve Officer Training Corps program gives students an opportunity to acquire the skills and knowledge necessary for commissioning as a second lieutenant in the U.S. Army. The program offers a two, three, and four-year option. The two-year option allows students with at least two academic years remaining in college to meet all requirements for commissioning by attending Cadet Initial Entry Training (CIET) or using past military experience for credit. Graduate students are also eligible to participate in the two year program.

Basic Military Science

The Basic Military Science courses are offered during the freshman and sophomore years. These courses cover time management, ethics, military organization, equipment, weapons, map reading, land navigation, use of compass, rank structure, threat, communications, leadership, and physical training. Each course consists of classroom
instruction and a mandatory lab. Students are required to have a doctor’s statement allowing participation in college-level physical education classes. Freshman and sophomore students may enroll in Basic Military Science classes with no obligation to the Army. Graduation from Cadet Initial Entry Training (CIET) at Fort Knox, KY is required prior to advancing to Advanced Military Science.

Advanced Military Science
The Advanced Military Science courses are normally taken during the junior and senior years (or during your two years as a graduate student). These courses specialize in small unit tactics, preparation and conduct of military training, military justice system, staff procedures, decision making and leadership, managerial concepts, problem analysis, military writing, the ethics of the professional soldier, and physical training. The courses consist of classroom instruction and a mandatory lab. This phase requires attendance at the five-week Cadet Leadership Course (CLC) held at Fort Knox, KY during the summer following your junior year.

Cadet Initial Entry Training (CIET)
A summer training program is offered for students without previous ROTC or military training who will be academic juniors. CIET is a five-week course at Fort Knox, Ky., during the summer after their sophomore year, and qualifies a student for entry into the Advanced Course, thus allowing completion of all requirements for commissioning in two years. Students attending the summer camp at Fort Knox receive approximately $800. Students receive six hours of credit for the basic military science course upon completion of CIET.

Benefits
All contracted military science students receive a monthly stipend of $300-$500 per month.

Two-year, three-year, and Four-year, scholarships are available to those who qualify. The higher the student’s GPA, SAT/ACT scores, and their performance as a Cadet, the better the chance of being selected as a scholarship recipient.

In addition, entering freshmen who receive three-year advance designee and four-year Army ROTC scholarships are eligible to receive additional financial incentives from Embry-Riddle. On-Campus and Army Green to Gold Scholarship winners may also be eligible for these incentives as well.

All applicants must meet the following requirements:
• Be under 31 years of age prior to commissioning,
• Meet required medical and physical standards,
• Have a minimum cumulative academic GPA of 3.0,
• Have a minimum SAT score of 1030 or an ACT composite score of 22+.

Scholarship Benefits Include:
• Full tuition and fees each year,
• A subsistence allowance of $300-$500 per month,
• A $600 book allowance per semester.

Admission to the Basic Course:
• Enrollment in a baccalaureate or master degree program,
• Must be at least 17 years of age at time of entry,
• U.S. citizen,
• Must maintain full-time student status each term.

Admission to the Advanced Course:
• Be a U.S. citizen
• Successful completion of the Basic Course, Cadet Initial Entry Training (CIET), or its equivalent,
• Successful completion of the Army physical examination,
• Selection by the professor of Military Science,
• Agreement to complete the Advanced Course requirements and serve on active duty, reserve, or National Guard duty as a commissioned officer,
• Maintain a 2.00 overall academic GPA and a 3.00 ROTC GPA,
• Must maintain full-time student status each term.

Army Green to Gold
If you are currently on active duty and will have two years of active duty before school starts and are accepted by Embry-Riddle as either a freshman, sophomore, or junior, you can compete for an Active Duty Green to Gold four, three, or two-year scholarship.

Scholarship Requirement
You must have a GT score of 110 or higher and a cumulative grade point average of 3.0+ on a 4.00 grading system to be eligible for the three or two-
year scholarship. A GT score is not required for individuals applying for a four-year scholarship. Four-year applicants must have a cumulative grade point average of 3.0 on a 4.00 grading scale. All applicants must meet other eligibility requirements. An SAT score totaling 1030 or an ACT composite score of 22+ is required for three and four-year Green to Gold scholarships.

For further information contact:
Embry-Riddle Army ROTC
1 Aerospace Boulevard.
ROTC Building, Second Floor
Daytona Beach, FL 32114-3900
(386) 226-6470/7376
(386) 226-7615 (fax)
email: armyrotc@erau.edu

Physical Training
All non-scholarship cadets are required to attend physical training a minimum of three days per week as part of the course grade. All scholarship and Advanced Course cadets are required to attend physical training four days per week as part of the course grade. Physical training is normally conducted Monday, through Friday from 5:45 a.m. to 7 a.m.

Naval
Marine Corps Platoon Leaders Course Program
For freshmen, sophomores, and juniors, the Marine Corps offers the Platoon Leaders Course (PLC) program. Freshmen and sophomores attend two six-week training sessions and juniors attend one 10-week session at Quantico, Va. During the training sessions candidates can earn from $2,100 to $3,200, depending on which training session is attended. In addition, eligible candidates may apply for two financial assistance programs, the Financial Assistance Program (FAP) and the College Tuition Assistance Program (CTAP). Call or visit the Web site to receive more information.

To be eligible for the program, the student must be a U.S. citizen (either native-born or naturalized), with full-time enrollment in a minimum of 12 academic credits per semester, and must be working toward an accredited/recognized baccalaureate degree.

The PLC Program offers two entry-level paths that lead to commissioning as a second lieutenant in the U.S. Marine Corps. The first is the Guaranteed Aviation Program. Applicants must have a qualifying ACT, SAT, or ASVAB score and must take the Aviation Selection Test Battery (ASTB). Those who have at least the minimum score of 4/6 on the ASTB; pass a Class 1 aviation medical examination performed at a Navy medical facility; pass a Marine Corps Physical Fitness Test (PFT); and are accepted into the program by Headquarters Marine Corps, will be eligible to receive a contract guarantee. The second program is the Ground Officer Program. This program encompasses all military occupational specialties not directly related to piloting aircraft, or guaranteed law.

To be eligible for the U.S. Marine Corps Platoon Leaders Class Program, a student must be enrolled full-time. Openings are available for men and women with any major who are under the age of 28.

Contact the Officer Selection Office at (866) 290-2680 (toll free) or (407) 249-5873.

Naval Aviation Club
A dynamic Naval Aviation Club informs and assists students who are eager to learn about naval aviation careers. Membership dues are nominal and no academic credit is conferred. The club features guest speakers and aircraft from fleet squadrons, in addition to field trips to naval air stations, aircraft carriers, and the cradle of naval aviation at Pensacola. Current Navy policy information is made available through close liaison with Navy Recruit Command representatives.

For more information, contact the president of the Embry-Riddle Naval Aviation Club.

Naval Reserve Officers Training Corps
The Naval Reserve Officers Training Corps (NROTC) unit administers the Naval Science Program at Embry-Riddle. All students enrolled in the University who are physically and mentally qualified are eligible to apply for entry into the NROTC Program. This program affords men and women the opportunity to receive instruction in Navy-specified courses that in conjunction with the baccalaureate degree and U.S. citizenship will qualify them for a commission in the U.S. Navy or Marine Corps. Students are selected on their own merit to become officers in the U.S. Navy and Marine Corps. As naval officers, Embry-Riddle NROTC graduates become eligible for varied careers, serving in aviation squadrons, on surface
ships, on submarines, and in special operations, or in numerous sub-specialties as an officer of the Marine Corps.

Students interested in the Embry-Riddle NROTC Program may compete for four-year NROTC national scholarships prior to matriculation. Students who join the unit through the NROTC College Program are eligible to compete for other types of scholarships throughout their college career. With the consent of the Professor of Naval Science, any student, although not enrolled in the NROTC Program, is eligible for enrollment in naval science courses.

Contact the NROTC department at (386) 323-8990 or nrotc@erau.edu for more information.

Naval ROTC Four Year National Scholarship Programs

Scholarship students are appointed Midshipmen, U.S. Navy Reserve. The Navy pays for tuition, fees, uniforms, a stipend for textbooks each semester, and a per month subsistence allowance starting at $250 per month for first-year candidates and up to $400 for senior students during the academic year. Four-year scholarship students are normally selected through national competition during their senior year in high school. However, students who are already enrolled in college and have less than 30 college credits but not in the NROTC Program may compete nationally for four-year scholarships during their freshmen year of college.

Although it is not a requirement, students in the NROTC Scholarship Program are encouraged to pursue a major in engineering, mathematics, chemistry, or physics to meet the technological requirements of the Navy. Other fields of study for a major leading to a baccalaureate degree are permitted with the approval of the Professor of Naval Science. Regardless of the major, every Navy scholarship student must complete one year of calculus and calculus-based physics.

Students must include certain Navy-specified courses in their program and complete a program of courses as prescribed by the Professor of Naval Science. Upon graduation and successful completion of the Naval Science curriculum, the Midshipman will receive a commission as an Ensign in the U.S. Navy or Second Lieutenant in the U.S. Marine Corps and will serve on active duty for a minimum of five years.

Contact the NROTC department at (386) 323-8990 or nrotc@erau.edu for more information.

Naval ROTC College Program

Students enrolled in the NROTC College Program can compete for full scholarships of various lengths. Once selected for a scholarship, students fall under the Scholarship Program described above. Students who are not selected for a scholarship may be eligible for selection to Advanced Standing status and will be appointed as a Midshipman prior to the commencement of the Advanced Course starting their junior year.

The Navy pays for uniforms and naval science textbooks during the four-year period and, during the junior and senior years, pays the Midshipman a monthly subsistence allowance. Each student is selected for enrollment in the program through application to the NROTC and will be selected on the basis of past academic performance, potential, personal interviews, and a physical examination. A College Program Midshipman acquires a military service obligation only after entering the Advanced Course at the beginning of the junior year.

Although there are no restrictions on the major college program students may pursue, it is highly recommended that they pursue a course of study similar to that of scholarship students. Students must also include in their program certain Navy-specified courses and a program of courses in naval science. Students, upon graduation and successful completion of the Naval Science curriculum, receive a commission as an Ensign in the U.S. Navy or as a Second Lieutenant in the U.S. Marine Corps and will serve on active duty for a minimum of five years.

Contact the NROTC department at (386) 323-8990 or nrotc@erau.edu for more information.

Naval ROTC Two-Year Scholarship

NROTC offers a two-year scholarship program that is designed specifically for students commencing their third year of college who were not enrolled in the NROTC program during their freshman and sophomore years. Applications must be submitted during the sophomore year by March 1 to permit processing, personal interviews, and a physical examination. Qualifications for acceptance into this program include demonstrated ability to complete college-level physics and calculus courses.
Upon acceptance into this program, the student will attend a six-week intensive course at the Naval Science Institute in Newport, R.I., in the summer prior to beginning the junior year of study. Students in a five-year engineering curriculum may attend the institution between their third and fourth years. The six-week summer course qualifies the student for enrollment in the NROTC Program at the junior level. During the student’s attendance at the Naval Science Institute, the Navy provides room and board, books, uniforms, transportation from home and return, and also pays the student a monthly stipend. Upon successful completion of the course, the student will return to the University and participate as a scholarship student in the NROTC program. Students, upon graduation and successful completion of the Naval Science curriculum, receive a commission as an Ensign in the U.S. Navy or as a Second Lieutenant in the U.S. Marine Corps and will serve on active duty for a minimum of five years.

Contact the NROTC department at (386) 323-8990 or nrotc@erau.edu for more information.

**Naval ROTC Summer Training**

The NROTC Scholarship Program and College Program Advanced Standing students are required to complete training of approximately four to six weeks during summer recesses. During the first summer period, each scholarship student receives instruction in aviation training, marine combat training, surface warfare indoctrination, and submarine indoctrination either in Norfolk, Va., or San Diego, Calif. The second summer training is performed aboard operational ships of the U.S. fleet from an enlisted service member’s perspective. During the third summer, candidates for U.S. Navy commissions will perform training aboard operational ships from a junior officer’s perspective. The students who qualify for nuclear propulsion training may elect to cruise on nuclear-powered ships or submarines. Some midshipmen cruise with allied navies through the Midshipman Foreign Exchange Program. Transportation costs to and from the training sites, subsistence, quarters, and monthly pay will be paid to every participating student.

The candidates for U.S. Marine Corps commissions will perform training at the U.S. Marine Corps Base, Quantico, Va. The Marine Option NROTC Summer Training Program is designed to prepare midshipmen for appointment to commissioned grade by providing basic military instruction and physical training. An evaluation of midshipmen is made to ensure that they possess the leadership, academic, and physical qualifications required for appointment to commissioned grade in the Marine Corps.

Contact the NROTC department at (386) 323-8990 or nrotc@erau.edu for more information.

**Nuclear Propulsion Officer Candidate Program**

Two and a half years prior to college graduation, future nuclear power officers can enter the Nuclear Propulsion Officer Candidate Program (NUPOC). This program offers you a monthly stipend from $2,990 to $5,000 per month for up to 30 months depending on location, a $15,000 selection bonus, and an additional $2,000 bonus upon completing nuclear propulsion training. After completion of the 12-week course at Officer Candidate School, nuclear power officers then begin training at the Naval Nuclear Power Training Command (NNPTC) in Charleston, S.C. This 24-week course helps students understand the complex nature of nuclear propulsion through a broad background on theory and operations mechanics. Once you’ve successfully completed NNPTC, you’ll begin training at a Nuclear Power Training Unit for real-life work on an actual operating reactor. You’ll work at all junior watch stations and eventually assume the role of engineering officer of the watch in charge of the entire plant. Submarine nuclear-trained officers attend Submarine Basic Course, a 12-week course that will familiarize you with submarine safety and operations and all of the necessary aspects of submarine life as an officer. Surface ship nuclear power officers will first attend officer candidate school, complete a sea tour, and attend Surface Warfare Officer School prior to receiving nuclear power training. The NROTC department can offer more information and contact information for the Navy Officer Recruiter.

Contact the Nuclear Officer Programs Recruiter, at (407) 240-5939 Ext 1407 for more information.

**Civil Engineering Corps Collegiate Program (CEC)**

Provides money for students to focus on completing their degree without having to take on a part time
job. They will graduate with a guaranteed job as a commissioned officer in the U.S. Navy.

Eligibility:
• Must be a U.S. citizen
• Must be physically qualified
• 19-35 years old on date of commissioning
• Minimum 3.0 GPA on a 4.0 scale (engineering or architecture degree)
• 24 months or less from graduation (in an accredited ABET or NAAB program)

Benefits:
• Earn up to $101,000 while in college
• Medical/dental coverage and life insurance
• Possible advancement while in college
• College years enrolled in program counts toward retirement
• Full-time student; military duties begin after degree obtained

Please contact General Officer Programs, at (407) 240-5939 Ext 1405 for more information.

Industry Programs
Certificate of Study in Airworthiness Engineering
The Certificate of Study in Airworthiness Engineering (CSAE) is a unique graduate-level program focused on the science and regulatory causalities of airworthiness engineering for air-system lifecycle certification. The program concentrates on different technical and regulatory aspects of achieving and sustaining airworthiness for an air-system. The curriculum is structured to address the aerospace professional and students alike on the educational needs regarding the principles of airworthiness engineering, especially those who are engaged in the design, development, certification, production, operation, and maintenance of air-systems - either manned and unmanned.

The CSAE program consists of 4 courses, all of which must be taken in cohort form, in sequence, and may not be separately taken. New cohorts begin each Spring term. The program is offered in blended delivery format using both synchronous Face–To–Face (FTF) and web-based instruction modalities. Upon successful completion of each course, earned graduate credit is recorded on an official transcript. Certificate credit, which serves as the core requirement for the MSAWE degree program may additionally be applied toward other master’s degrees, if the recipients so choose. The CSAE requires the successful completion of all 4 courses, 12 credits, extending over a 15-month-long period.

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<td>UAS 501</td>
<td>Introduction to Unmanned Aircraft Design</td>
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<td><strong>Total Credits</strong></td>
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</table>
General Education

Basic Skills Requirement
Embry-Riddle recognizes the importance of communication and quantitative skills in all areas of aerospace. Successful pilots, engineers, airport managers, aviation maintenance technicians, and other aviation professionals must possess these skills to perform their jobs effectively. Embry-Riddle, therefore, requires all students, including transfer students, to demonstrate proficiency in writing, reading, and mathematics before they are permitted to complete registration during their first term at the University. Proficiency may be demonstrated by earning qualifying scores on SAT/ACT tests, or by transferring credit for college-level English and mathematics courses.

If they cannot demonstrate proficiency in these basic skills, students must enroll in COM 20, a reading, writing, and critical thinking skills course. Quantitative skills courses (MA 4, MA 6) help students prepare for introductory mathematics courses required in the various degree programs.

Students whose primary language is not English are required to demonstrate advanced English proficiency by achieving a satisfactory score on a placement test. Students unable to demonstrate such proficiency must enroll in appropriate basic skills courses in their first term at the University. These courses are COM 8 and COM 18.

Although basic skills courses are computed into the student’s term grade point average (GPA) and cumulative grade point average (CGPA), credits earned in basic skills courses do not apply to minimum degree requirements in any degree program.

General Education Program
Recognizing its general and special missions in education, Embry-Riddle embraces a General Education Program. Comprising nearly one-third of every degree program, this course of study ensures that students possess the attributes expected of all university graduates. Encouraging intellectual self-reliance and ability, the General Education Program enables students, regardless of their degree program, to acquire a broad range of knowledge.

By completing the General Education Program, students gain and enhance competence in written and oral communication. They practice reasoning and critical thinking skills and demonstrate computer proficiency. As students engage in this course of study, they familiarize themselves with and investigate ideas and methodologies from several disciplines. These include the arts and humanities, the social sciences, the natural sciences, and mathematics. The program also helps students recognize interrelationships among the disciplines. All students participate in a laboratory experience.

Promoting the appreciation of varied perspectives, the General Education Program provides intellectual stimulation, ensuring that students are broadly educated. This course of study empowers students to make informed value judgments, to expand their knowledge and understanding of themselves, and to lead meaningful, responsible, and satisfying lives as individuals, professionals, and concerned members of their society and the world.

University General Education Competencies
While taking General Education required courses, students develop a basic set of General Education skills based on course learning outcomes. These skills are instrumental to student success in upper-level courses within their degree program; in these courses, students practice these skills, eventually demonstrating mastery before graduation. As a result, students graduate with a set of General Education competencies that will provide the basis for success in life and on the job. The following skills are the competencies that all University students will develop, practice, and master in preparation for graduate school or the workplace.

Collaborative Learning
Students will be able to work effectively with others on diverse teams to produce quality written documents, oral presentations and/or meaningful projects. Students will assist in organizing other to accomplish a shared task, contribute actively to a group, and work to resolve any conflicts that occur.

Communication
Students will communicate concepts in written, digital and oral forms for technical and/or non-technical audiences.
Critical Thinking
Students will synthesis and apply knowledge in order to define and solve problems within professional and personal environments.

Cultural Literacy
Students will analyze historical events, cultures, cultural artifacts, social issues, and/or philosophical concepts.

Information Literacy
Students will conduct meaningful research, including gathering information from primary and secondary sources as well as incorporating and documenting source material in their writing.

Quantitative Reasoning
Students will, through mathematical proficiency and analysis, demonstrate the use of digitally enabled technology in order to interpret data for the purpose of drawing valid conclusions and solving associated mathematical and/or economic problems.

Scientific Literacy
Students will analyze scientific evidence as it relates to the physical world and its Inhabitants.

General Education Program Requirements (a minimum of 36 credit hours)
Embry-Riddle Aeronautical University’s General Education Program encourages effective learning and provides a coherent base for students to pursue their academic specializations. In specific support of the goals of general education, candidates for bachelor degrees must complete a minimum of 36 credit hours of course work in the following areas. If a general education requirement is fulfilled through placement rather than credit, students will make up the credit in the following areas in order to meet the minimum of 36 credit hours.

Communication Theory and Skills
9 hours
In order to lead meaningful and responsible lives in complex societies, students produce, evaluate, articulate, and interpret information and meanings in oral and written communications.

Mathematics
6 hours
In order to develop quantitative reasoning skills and to use and understand the language of science and technology, students must demonstrate mathematical proficiency. Three hours may be satisfied by placement, examination, or course completion. The other three hours must be completed by taking a course that has MA 140 (College Algebra) or MA 111 (College Math for Aviation I) as a prerequisite or co-requisite.

Computer Science/Information Technology
3 hours
In order to use computers and to understand and evaluate their significance in the solution of problems, students study the concepts, techniques, and tools of computing.

Physical and Life Sciences
6 hours
In order to appreciate current understandings of the natural world, students study the concepts and methods of the physical and life sciences, applying the techniques of scientific inquiry to problem solving. One course must include a laboratory.

Humanities and Social Sciences
In these two areas, students are required to complete 12 hours:
3 hours of lower-level Humanities
3 hours of lower-level Social Sciences
3 hours of lower-level or upper-level Humanities or Social Sciences
3 hours of upper-level Humanities or Social Sciences (300-400, not including HU 475)

Humanities
In order to participate in the complexity of human experiences that arise in a framework of historical and social contexts, students are exposed to the Humanities. Areas of study may include cultural, esthetic, philosophical, and spiritual dimensions of the human condition.

Social Sciences
In order to understand interrelationships between the individual and society and connections between historical memory and the future, students examine the social sciences, including history, government, economics, psychology, or sociology.
General Education Program Courses

General Education courses may be chosen from the list below, assuming prerequisites are met. See degree programs for recommended courses in Mathematics, Computer Science, and Physical/Life Sciences.

<table>
<thead>
<tr>
<th>Communication Theory and Skills (9)</th>
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<tbody>
<tr>
<td>COM 122 English Composition</td>
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<tr>
<td>COM 219 Speech</td>
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<tr>
<td>COM 221 Technical Report Writing</td>
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<tr>
<td>or COM 222 Business Communication</td>
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<table>
<thead>
<tr>
<th>Mathematics (6)</th>
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<tbody>
<tr>
<td>MA 111 College Mathematics for Aviation I</td>
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<tr>
<td>MA 112 College Mathematics for Aviation II</td>
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<tr>
<td>MA 120 Quantitative Methods I</td>
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<tr>
<td>MA 140 College Algebra</td>
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<tr>
<td>MA 143 Precalculus Essentials</td>
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<tr>
<td>MA 220 Quantitative Methods II</td>
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<tr>
<td>MA 222 Business Statistics</td>
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<tr>
<td>MA 241 Calculus and Analytical Geometry I</td>
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<tr>
<td>MA 242 Calculus and Analytical Geometry II</td>
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<tr>
<td>MA 243 Calculus and Analytical Geometry III</td>
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<thead>
<tr>
<th>Computer Science/Information Technology (3)</th>
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<tr>
<td>BA 120 Introduction to Computer Based Systems</td>
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</tr>
<tr>
<td>CS 118 Fundamentals of Computer Programming</td>
<td>3</td>
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<tr>
<td>CS 120 Introduction to Computing in Aviation</td>
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<tr>
<td>CS 223 Scientific Programming in C</td>
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<tr>
<td>CS 225 Computer Science II</td>
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<tr>
<td>CYB 235 Computer and Network Technologies</td>
<td>3</td>
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<tr>
<td>EGR 115 Introduction to Computing for Engineers</td>
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<tr>
<td>EGR 120 Graphical Communications</td>
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<table>
<thead>
<tr>
<th>Physical and Life Sciences (6)</th>
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<tbody>
<tr>
<td>BIO 120 Foundations of Biology I</td>
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<tr>
<td>BIO 121 Foundations of Biology II</td>
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<tr>
<td>BIO 121L Foundations of Biology II Lab</td>
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<tr>
<td>BIO 142 Introduction to Environmental Science</td>
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<tr>
<td>BIO 215 Genetics</td>
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<td>BIO 215L Genetics Laboratory</td>
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<tr>
<td>BIO 216 Microbiology</td>
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<td>BIO 216L Microbiology Laboratory</td>
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<td>BIO 305 Human Anatomy and Physiology I</td>
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<td>BIO 305L Human Anatomy &amp; Physiology Laboratory</td>
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<td>BIO 306 Human Anatomy and Physiology II</td>
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<td>BIO 306L Human Anatomy and Physiology II Laboratory</td>
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<td>BIO 321 Behavioral Neuroscience I</td>
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<td>BIO 322 Behavioral Neuroscience II</td>
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<td>BIO 405 Molecular and Cell Biology</td>
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<td>BIO 406 Forensic DNA Analysis</td>
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<td>BIO 406L Forensic DNA Analysis Laboratory</td>
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<td>CHM 101 Basic Chemistry</td>
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<td>CHM 110 General Chemistry I</td>
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<td>CHM 110L General Chemistry I Laboratory</td>
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<td>CHM 111 General Chemistry II</td>
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<td>CHM 111L General Chemistry II Laboratory</td>
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<tr>
<td>CHM 140 Chemistry for Engineers</td>
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<td>CHM 140L Chemistry for Engineers Laboratory</td>
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<tr>
<td>CHM 210 Organic Chemistry I</td>
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<td>CHM 210L Organic Chemistry I Laboratory</td>
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<td>CHM 211 Organic Chemistry II</td>
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<tr>
<td>CHM 310 Biochemistry</td>
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<td>GEO 215 Introduction to Geoscience</td>
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<td>PS 103 Technical Physics I (Laboratory Option: PS 115L)</td>
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<td>PS 104 Technical Physics II (Laboratory Option: PS 115L)</td>
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<td>Introductory Physics I Laboratory</td>
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<td>PS 116</td>
<td>Foundations in the Sciences</td>
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<tr>
<td>PS 117</td>
<td>Introductory Physics II</td>
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<td>PS 117L</td>
<td>Introductory Physics II Lab</td>
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<td>PS 160</td>
<td>Physics for Engineers II</td>
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<td>PS 224</td>
<td>Astronomy (Laboratory Option: PS 224L)</td>
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<td>PS 226</td>
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<td>PS 227</td>
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<td>PS 228</td>
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<td>PS 250</td>
<td>Physics for Engineers III (Laboratory Option: PS 253)</td>
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<td>PS 302</td>
<td>Evolution of Scientific Thought</td>
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<td>PS 303</td>
<td>Modern Physics (Laboratory Option: PS 305)</td>
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<td>PS 320</td>
<td>Classical Mechanics</td>
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<td>WX 201</td>
<td>Survey of Meteorology</td>
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**Humanities and Social Sciences (12)**

**Humanities**

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<tr>
<th>Course Code</th>
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<tr>
<td>HU 140</td>
<td>Western Humanities I: Antiquity and the Middle Ages</td>
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<td>HU 141</td>
<td>Western Humanities II: Renaissance to Postmodern</td>
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<tr>
<td>HU 142</td>
<td>Studies in Literature</td>
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<tr>
<td>HU 143</td>
<td>Introduction to Rhetoric</td>
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<tr>
<td>HU 144</td>
<td>Studies in Art</td>
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<tr>
<td>HU 145</td>
<td>Themes in the Humanities</td>
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<tr>
<td>HU 146</td>
<td>Music Appreciation and Criticism</td>
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<tr>
<td>HU 300</td>
<td>World Literature</td>
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<tr>
<td>HU 302</td>
<td>Contemporary Issues in Science</td>
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<td>HU 305</td>
<td>Modern Literature</td>
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<tr>
<td>HU 310</td>
<td>American Literature</td>
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<tr>
<td>HU 315</td>
<td>Studies in Dramatic Literature and Theater Arts</td>
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<td>HU 316</td>
<td>Studies in Music</td>
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<td>HU 321</td>
<td>Mythology</td>
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<tr>
<td>HU 325</td>
<td>Exploring Film</td>
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<tr>
<td>HU 330</td>
<td>Values and Ethics</td>
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<tr>
<td>HU 335</td>
<td>Technology and Modern Civilization</td>
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<td>HU 336</td>
<td>Travel Communication</td>
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<td>HU 338</td>
<td>Traversing the Borders: Interdisciplinary Explorations</td>
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<td>HU 341</td>
<td>World Philosophy</td>
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**Social Sciences**

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<td>Comparative Religions</td>
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<tr>
<td>HU 363</td>
<td>Communication and Society</td>
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<tr>
<td>HU 375</td>
<td>The Nature of Language</td>
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<tr>
<td>HU 415</td>
<td>Nonverbal Communication</td>
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<tr>
<td>HU 420</td>
<td>Applied Cross-Cultural Communication</td>
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<tr>
<td>HU 399/499</td>
<td>Special Topics in Humanities</td>
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<tr>
<td>HON 150</td>
<td>Honors Seminar I</td>
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<tr>
<td>HON 250</td>
<td>Honors Seminar II</td>
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<tr>
<td>HON 350</td>
<td>Honors Seminar III</td>
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</table>

**EC 200**  An Economic Survey * 3

**EC 210**  Microeconomics 3

**EC 211**  Macroeconomics 3

**GCS 201**  Introduction to Global Conflict Studies 3

**GCS 300**  International Conflict Resolution 3

**GCS 302**  Gender Security 3

**GCS 304**  Political Violence 3

**GCS 306**  Theories of Nations and Nationalism 3

**GCS 308**  Transnational Crime 3

**PSY 101**  Introduction to Psychology 3

**PSY 310**  Sensation and Perception 3

**PSY 315**  Cognitive Psychology 3

**PSY 340**  Industrial-Organizational Psychology 3

**PSY 350**  Social Psychology 3

**PSY 352**  Personality: A Systems Approach 3

**PSY 365**  Abnormal Psychology 3

**SS 110**  World History 3

**SS 115**  Introduction to International Relations 3

**SS 120**  U.S. History 3

**SS 130**  History of Aviation in America 3

**SS 140**  Introduction to Middle East Mediterranean World 3

**SS 210**  Introduction to Sociology 3

**SS 302**  Evolution of Scientific Thought 3

**SS 311**  U.S Military History 1775-1900 3

**SS 320**  Government of the U.S. 3

**SS 321**  U.S. Military History 1900-Present 3

**SS 322**  Modern Russian History 3

**SS 325**  International Studies 3

**SS 326**  Russian-U.S. Relations 3
<table>
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<tr>
<td>SS 328</td>
<td>History of U.S. Intelligence</td>
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<tr>
<td>SS 331</td>
<td>Current Issues in America</td>
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<tr>
<td>SS 333</td>
<td>U.S. - Asian Relations</td>
<td>3</td>
</tr>
<tr>
<td>SS 334</td>
<td>Contemporary Africa and the World</td>
<td>3</td>
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<tr>
<td>SS 336</td>
<td>The Modern Middle East in World Affairs</td>
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<tr>
<td>SS 337</td>
<td>Globalization and World Politics</td>
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<tr>
<td>SS 340</td>
<td>Modern U.S. Foreign Policy</td>
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<tr>
<td>SS 353</td>
<td>Early U.S. Foreign Policy</td>
<td>3</td>
</tr>
<tr>
<td>SS 363</td>
<td>Inter-American Relations</td>
<td>3</td>
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<tr>
<td>SS 399/499</td>
<td>Special Topics in Social Science</td>
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</table>
Degrees and Programs

Embry-Riddle reserves the right to terminate or modify program requirements and content, as well as the sequence of program offerings from term to term, for educational, financial, or other reasons that it determines are sufficient to warrant such action.

Embry-Riddle offers students opportunities to pursue academic programs in a wide variety of aviation and aerospace fields. Each degree program includes both General Education and academic specialization, the two components complementing each other. The University currently offers the following programs at the Daytona Beach Campus.

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Ph.D. in Mechanical Engineering (p. 288)
Minor Courses of Study

Minor courses of study are academic programs designed to satisfy students’ personal interests and to meet their professional needs. Students explore, in some depth, the offerings in a field of study. A minor course of study provides the student with significant experience in a discipline organized around skills, methodology, and subject matter. Minor courses of study are posted on the academic transcript at the time of completion of the baccalaureate degree.

To gain the greatest value from their academic experiences, students are encouraged to select minors that complement their degree program and/or other minors they are pursuing. Designed to include a minimum number of required courses, minors provide students, whenever possible, with flexibility in fulfilling program requirements.

A minor program does not provide the depth of knowledge and experience that a major does. All minors consist of 15-24 hours of coherent academic coursework under the following guidelines:

- At least six hours must be fulfilled at the upper level
- Six hours of coursework applied to a minor must be completed at Embry-Riddle
- At least three of those hours completed in residence must be at the upper level
- No more than two substitutions (6 credits) are permitted in any minor. The Program Coordinator of the minor must approve the substitutions. For students with multiple minors, two substitutions in one minor or one substitution in two minors is allowed.
- A minor may not be applied toward more than one baccalaureate degree
- Students must earn a 2.0 GPA or higher in the minor to complete that program of study successfully
- Students become subject to the requirements of the minor as stated in catalog in effect at the time the minor is declared

Some minor restrictions (p. 100) apply when pursuing particular degree programs or areas of concentration
- A minor must be in a discipline outside of the student’s major field of study
- Students are encouraged to declare a minor by the beginning of their senior year
- Students in the Aerospace Engineering department must complete at least six credit hours of coursework applied to the minor that are not specifically required in the student’s degree program

The following minors are offered at the Daytona Beach Campus.

- Aeronautical Studies (p. 100)
- Aerospace Life Sciences (p. 101)
- Airline Operations (p. 101)
- Air Traffic Control (p. 101)
- Air Transportation (p. 102)
- Applied Mathematics (p. 102)
- Applied Meteorology (p. 102)
- Arabic Studies (p. 102)
- Asian Studies (p. 103)
- Astronomy (p. 103)
- Astrophysics (p. 103)
- Aviation Law (p. 104)
- Aviation Maintenance Science Airframe (p. 104)
- Aviation Maintenance Science Powerplant (p. 104)
- Aviation Safety (p. 105)
- Avionics Line Maintenance (p. 105)
- Biomedical Engineering (p. 105)
- Biomedical Sciences (p. 106)
- Business Administration (p. 106)
- Chemistry (p. 106)
- Communication and Broadcast Media (p. 107)
- Computational Mathematics (p. 107)
- Computer Aided Design/Computer Aided Manufacturing (p. 108)
- Computer Science (p. 108)
- Cybersecurity Application and Management (p. 108)
• Cybersecurity Engineering (p. 108)
• Electrical and Computer Engineering (p. 109)
• Emergency Management (p. 109)
• Energy Systems (p. 110)
• Entrepreneurship (p. 110)
• Finance (p. 110)
• Flight (p. 110)
• Forensic Accounting (p. 111)
• Geographic Information Systems (p. 111)
• Global Conflict Studies (p. 111)
• High Performance Vehicles (p. 112)
• Homeland Security (p. 112)
• Human Factors (p. 112)
• Humanities (p. 113)
• International History (p. 113)
• Marketing (p. 114)
• Military Science (p. 114)
• Occupational Safety (p. 115)
• Physics (p. 115)
• Psychology (p. 115)
• Robotic Systems (p. 116)
• R (p. 116)ussian Studies (p. 116)
• Space Studies (p. 116)
• Supply Chain Management in Aviation and Aerospace (p. 116)
• Systems Engineering (p. 117)
• Terrorism Studies (p. 117)
• Unmanned Aircraft Systems Applications (p. 118)
• Unmanned Aircraft Systems (UAS) in Public Safety (p. 118)

Minor Restrictions

<table>
<thead>
<tr>
<th>Major</th>
<th>Minor Courses of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aeronautical Science</td>
<td>Aeronautical Studies, Flight, Flight Test and Simulation</td>
</tr>
<tr>
<td>Aeronautics</td>
<td>Flight Test &amp; Simulation</td>
</tr>
<tr>
<td>Aerospace &amp; Occupational Safety</td>
<td>Aviation Safety, Occupational Safety</td>
</tr>
<tr>
<td>Aerospace Engineering</td>
<td>No Restrictions</td>
</tr>
<tr>
<td>Aerospace Physiology</td>
<td>Aerospace Life Science, Biomedical Sciences</td>
</tr>
<tr>
<td>Air Traffic Management</td>
<td>Air Traffic Control</td>
</tr>
</tbody>
</table>

Astronomy & Astrophysics Astronomy, Astrophysics, Physics
Aviation Business Administration Air Transportation, Business Administration, Finance, Marketing
Aviation Business Administration - Supply Chain subplan Air Transportation, Business Administration, Finance, Marketing, Supply Chain
Aviation Maintenance Science Airframe, Powerplant
Business Administration Air Transportation, Business Administration, Finance, Marketing
Civil Engineering No Restrictions
Communication Communication & Broadcast Media
Computational Mathematics Applied Mathematics, Computational Mathematics
Computer Engineering Computer Science, Electrical and Computer Engineering
Computer Science Computer Science
Computer Science - Cybersecurity Engineering AOC Cybersecurity Engineering
Computer Science - Human Factors AOC Human Factors
Electrical Engineering Electrical and Computer Engineering
Engineering Physics Physics
Global Conflict Studies Global Conflict Studies or International History
Human Factors Psychology Human Factors, Psychology
Homeland Security Homeland Security
Interdisciplinary Studies No Restrictions
Mechanical Engineering - High Performance Vehicle track High Performance Vehicle
Mechanical Engineering - Robotic Systems track Robotic Systems
Mechanical Engineering - Energy Systems track Energy Systems
Mechanical Engineering - Biomedical Systems track Biomedical Engineering
Meteorology Applied Meteorology
Software Engineering Computer Science
Spaceflight Operations Space Studies
Space Physics Physics
Unmanned Aircraft Systems Science Unmanned Aircraft Systems Applications

Aeronautical Studies

This minor will allow students in non-Aeronautical Science degree programs an increased exposure to advanced aviation knowledge by taking a sequence of 18 hours of mostly upper-level Aeronautical Science courses and acquire credit for a minor. No more than nine of the 18 hours required for
A minor in Aeronautical Studies can be earned by successfully completing six of the following:

Select six of the following: 18

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 254</td>
<td>Aviation Legislation</td>
</tr>
<tr>
<td>AS 309</td>
<td>Aerodynamics</td>
</tr>
<tr>
<td>AS 310</td>
<td>Aircraft Performance</td>
</tr>
<tr>
<td>AS 311</td>
<td>Aircraft Engines - Turbine</td>
</tr>
<tr>
<td>AS 350</td>
<td>Domestic and International Navigation</td>
</tr>
<tr>
<td>AS 356</td>
<td>Aircraft Systems and Components</td>
</tr>
<tr>
<td>AS 357</td>
<td>Flight Physiology</td>
</tr>
<tr>
<td>AS 402</td>
<td>Airline Operations</td>
</tr>
<tr>
<td>AS 405</td>
<td>Aviation Law</td>
</tr>
<tr>
<td>AS 408</td>
<td>Flight Safety</td>
</tr>
<tr>
<td>AS 410</td>
<td>Airline Dispatch Operations</td>
</tr>
<tr>
<td>AS 411</td>
<td>Jet Transport Systems</td>
</tr>
<tr>
<td>AS 420</td>
<td>Flight Technique Analysis</td>
</tr>
</tbody>
</table>

Total Credits 18

### Aerospace Life Sciences

This interdisciplinary program of study provides fundamental knowledge of general biology, and a more advanced knowledge of life sciences in aviation and aerospace applications. Of the 16 credit hours required for this minor, seven must be earned with BIO 120 and BIO 120L and HF 440. The remaining 9 credits can be earned with any combination of other courses from the listing below:

Select three of the following: 9

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF 440</td>
<td>Aerospace Physiology</td>
</tr>
<tr>
<td>BIO 120</td>
<td>Foundations of Biology I</td>
</tr>
<tr>
<td>BIO 120L</td>
<td>Foundations of Biology I Laboratory</td>
</tr>
<tr>
<td>AS 357</td>
<td>Flight Physiology</td>
</tr>
<tr>
<td>BIO 142</td>
<td>Introduction to Environmental Science</td>
</tr>
<tr>
<td>HF 321</td>
<td>Psychopharmacology</td>
</tr>
<tr>
<td>HF 326</td>
<td>Human Performance in Extreme Environments</td>
</tr>
<tr>
<td>PSY 310</td>
<td>Sensation and Perception</td>
</tr>
<tr>
<td>PSY 335</td>
<td>Physiological Psychology</td>
</tr>
<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
</tr>
</tbody>
</table>

Total Credits 16

### Airline Operations

This minor focuses on the multi-faceted and dynamic nature of airline operational control. Courses include instrument and commercial pilot procedures, advanced navigation, aircraft performance, air traffic control, and meteorology with practical exercise scenarios in the Airline Operations Center lab. The minor includes the courses required for the Aircraft Dispatch Certification program. Note: AS 434, Airline Operations Command and Control course is not required for FAA Dispatch certification. AS 434 is the capstone course for the minor and normally is taken last. A grade of “C” or higher is required for AS 221 and AS 321.

Select three of the following: 9

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 221</td>
<td>Instrument Pilot Operations</td>
</tr>
<tr>
<td>AS 321</td>
<td>Commercial Pilot Operations</td>
</tr>
<tr>
<td>AS 332</td>
<td>Dispatch Aircraft Performance</td>
</tr>
<tr>
<td>AS 402</td>
<td>Airline Operations</td>
</tr>
<tr>
<td>AS 410</td>
<td>Airline Dispatch Operations</td>
</tr>
<tr>
<td>AS 434</td>
<td>Airline Operations Command and Control</td>
</tr>
</tbody>
</table>

Total Credits 24

### Air Traffic Control

The Air Traffic Control (ATC) minor provides the fundamental traffic control knowledge and technical competency through a mix of classroom instruction, computer-based instruction, and realistic ATC laboratory simulations.

Select three of the following: 9

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 202</td>
<td>Introduction to Air Traffic Management</td>
</tr>
<tr>
<td>AS 410</td>
<td>Airline Dispatch Operations</td>
</tr>
<tr>
<td>WX 410</td>
<td>Weather for Commercial Air Transport</td>
</tr>
</tbody>
</table>

Total Credits 24
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 305</td>
<td>Introduction to Terminal Radar Operations</td>
<td>3</td>
</tr>
<tr>
<td>AT 315</td>
<td>Introduction to Air Traffic Control Tower</td>
<td>3</td>
</tr>
<tr>
<td>AT 401</td>
<td>Advanced Terminal Radar Operations</td>
<td>3</td>
</tr>
<tr>
<td>AT 405</td>
<td>En route Radar Operations</td>
<td>3</td>
</tr>
<tr>
<td>AT 406</td>
<td>En route Non-Radar Operations</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Air Transportation**

Minor in Air Transportation for non-business students.

**Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 215</td>
<td>Transportation Principles</td>
<td>3</td>
</tr>
<tr>
<td>BA 310</td>
<td>Airport Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 315</td>
<td>Airline Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 327</td>
<td>Airline-Airport Operations</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one of the following: 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 322</td>
<td>Aviation Insurance</td>
<td></td>
</tr>
<tr>
<td>BA 324</td>
<td>Aviation Labor Relations</td>
<td></td>
</tr>
<tr>
<td>BA 405</td>
<td>General Aviation Marketing</td>
<td></td>
</tr>
<tr>
<td>BA 410</td>
<td>Management of Air Cargo</td>
<td></td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td></td>
</tr>
<tr>
<td>BA 412</td>
<td>Airport Planning and Design</td>
<td></td>
</tr>
<tr>
<td>BA 418</td>
<td>Airport Administration and Finance</td>
<td></td>
</tr>
<tr>
<td>BA 419</td>
<td>Aviation Maintenance Management</td>
<td></td>
</tr>
<tr>
<td>BA 424</td>
<td>Project Management in Aviation Operations</td>
<td></td>
</tr>
<tr>
<td>BA 426</td>
<td>International Aviation Management</td>
<td></td>
</tr>
<tr>
<td>BA 450</td>
<td>Airline/Airport Marketing</td>
<td></td>
</tr>
<tr>
<td>EC 420</td>
<td>Economics of Air Transportation</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits** 18

**Applied Mathematics**

Students may earn a minor in Applied Mathematics by completing the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 241</td>
<td>Calculus and Analytical Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MA 242</td>
<td>Calculus and Analytical Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>MA 243</td>
<td>Calculus and Analytical Geometry III</td>
<td>4</td>
</tr>
<tr>
<td>MA 245</td>
<td>Applied Differential Equations</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>or MA 345 Differential Equations and Matrix Methods</td>
<td></td>
</tr>
<tr>
<td>MA Electives (approved by department chair)</td>
<td>5-6</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits** 20-22

**Applied Meteorology**

The minor in Applied Meteorology introduces the student with an interest in weather to the intriguing world of meteorology. The minor requires nine hours of WX courses beyond the two required courses, and WX 301, a total of 15 hours of WX courses. Six hours of these classes must be higher numbered classes than WX 301. Always check the catalog course descriptions for prerequisites.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>WX 201</td>
<td>Survey of Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>WX 301</td>
<td>Aviation Weather</td>
<td>3</td>
</tr>
<tr>
<td>WX 363</td>
<td>Thunderstorms</td>
<td></td>
</tr>
<tr>
<td>WX 365</td>
<td>Satellite and Radar Weather Interpretation</td>
<td></td>
</tr>
<tr>
<td>WX 410</td>
<td>Weather for Commercial Air Transport</td>
<td></td>
</tr>
<tr>
<td>WX Electives for flight students:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>WX 363</td>
<td>Thunderstorms</td>
<td></td>
</tr>
<tr>
<td>WX 365</td>
<td>Satellite and Radar Weather Interpretation</td>
<td></td>
</tr>
<tr>
<td>WX 410</td>
<td>Weather for Commercial Air Transport</td>
<td></td>
</tr>
</tbody>
</table>

Or any combination of WX courses.

**Total Credits** 15

**Arabic Studies**

The Arabic Studies minor introduces students to the cultures, histories, and languages of the Arab countries, and to cross-cultural comparisons between the United States and the Arab world. Students can earn the minor by successfully completing at least 15 related credit hours.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAR 101</td>
<td>Arabic I</td>
<td>3</td>
</tr>
<tr>
<td>LAR 102</td>
<td>Arabic II</td>
<td>3</td>
</tr>
<tr>
<td>LAR 201</td>
<td>Arabic III</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Upper-level HU/SS *</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total Credits** 15
Asian Studies

The Asian Studies minor introduces students to the cultures, histories, and languages of Asian countries, and to cross-cultural comparisons between the United States and Asia. Students can earn the minor by successfully completing at least 18 related credit hours. At least nine of those 18 credit hours must be earned in residence at Embry-Riddle. These 18 credits can be earned from the following options:

Option 1
Complete all 18 credit hours from the list of Asian Studies courses below.

Option 2
Transfer up to nine credits in an Asian language or from Asian Studies courses, and earn nine Asian Studies credits from Embry-Riddle.

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 110</td>
<td>World History</td>
<td>3</td>
</tr>
<tr>
<td>HU 145</td>
<td>Themes in the Humanities</td>
<td>3</td>
</tr>
<tr>
<td>LCH 101</td>
<td>Mandarin Chinese I</td>
<td>3</td>
</tr>
<tr>
<td>LCH 102</td>
<td>Mandarin Chinese II</td>
<td>3</td>
</tr>
<tr>
<td>LCH 201</td>
<td>Mandarin Chinese III</td>
<td>3</td>
</tr>
<tr>
<td>or HU 199</td>
<td>Special Topics in Humanities</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 325</td>
<td>International Studies</td>
<td>3</td>
</tr>
<tr>
<td>SS 333</td>
<td>U.S. - Asian Relations</td>
<td>3</td>
</tr>
<tr>
<td>HU 399</td>
<td>Special Topics in Humanities</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 18

Credit-hour requirements for minors in various disciplines have a minimum of 15 hours and are outlined in the catalog. At least 6 hours must be fulfilled at the upper level. In addition, at least 6 hours of course work applied to a minor must be completed at Embry-Riddle Aeronautical University, of which at least 3 hours completed in residence must be at the upper level. No more than two substitutions (6 hours) are permitted in any minor.

Astronomy

Students may earn a minor in Astronomy by successfully completing the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP 425</td>
<td>Observational Astronomy</td>
<td>3</td>
</tr>
<tr>
<td>PS 150</td>
<td>Physics for Engineers I</td>
<td>3</td>
</tr>
<tr>
<td>or PS 226</td>
<td>Physics I</td>
<td></td>
</tr>
<tr>
<td>PS 160</td>
<td>Physics for Engineers II</td>
<td>3</td>
</tr>
<tr>
<td>or PS 227</td>
<td>Physics II</td>
<td></td>
</tr>
<tr>
<td>PS 224</td>
<td>Astronomy</td>
<td>3</td>
</tr>
<tr>
<td>PS 224L</td>
<td>Introductory General Astronomy Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>PS 250</td>
<td>Physics for Engineers III</td>
<td>3</td>
</tr>
<tr>
<td>or PS 228</td>
<td>Physics III</td>
<td></td>
</tr>
<tr>
<td>PS 253</td>
<td>Physics Laboratory for Engineers</td>
<td>1</td>
</tr>
<tr>
<td>or PS 226L</td>
<td>Physics I Laboratory</td>
<td></td>
</tr>
<tr>
<td>PS 303</td>
<td>Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PS 305</td>
<td>Modern Physics Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Credits: 21

Astrophysics

Students may earn a minor in Astrophysics by successfully completing the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS 250</td>
<td>Physics for Engineers III</td>
<td>3</td>
</tr>
<tr>
<td>or PS 228</td>
<td>Physics III</td>
<td></td>
</tr>
<tr>
<td>PS 253</td>
<td>Physics Laboratory for Engineers</td>
<td>1</td>
</tr>
<tr>
<td>or PS 226L</td>
<td>Physics I Laboratory</td>
<td></td>
</tr>
<tr>
<td>PS 303</td>
<td>Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PS 305</td>
<td>Modern Physics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>PS 316</td>
<td>Introductory Astronomy and Astrophysics I</td>
<td>3</td>
</tr>
<tr>
<td>PS 317</td>
<td>Introductory Astronomy and Astrophysics II</td>
<td>3</td>
</tr>
<tr>
<td>PS 318</td>
<td>Introductory Astrophysics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>PS 401</td>
<td>Astrophysics</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 18
Aviation Law
The minor in Aviation Law lets students explore various aviation-related legal disciplines. The minor requires the student to take AS 405 and AS 414 and then an additional nine hours for a total of 15 credit hours. The remaining nine hours can be earned with any combination of other courses as listed below.

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 405</td>
<td>Aviation Law</td>
<td>3</td>
</tr>
<tr>
<td>AS 414</td>
<td>Aviation and the Administrative Law Process</td>
<td>3</td>
</tr>
</tbody>
</table>

Select three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 254</td>
<td>Aviation Legislation</td>
<td>3</td>
</tr>
<tr>
<td>AS 312</td>
<td>Ethics in Aviation Environment</td>
<td>3</td>
</tr>
<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BA 322</td>
<td>Aviation Insurance</td>
<td>3</td>
</tr>
<tr>
<td>SF 462</td>
<td>Health, Safety, and Aviation Law</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits** 15

Aviation Maintenance Science

Airframe
The minor in Aviation Maintenance Science Airframe will lead to a student being qualified for FAA testing, and upon passing the required exams, becoming an FAA-certified mechanic with the airframe rating. The minor requires 12 credit hours of general AMS coursework plus 18 credit hours of airframe-specific AMS coursework. In order to receive this minor, a minimum GPA of 2.0 must be achieved in the AMS general courses and also a minimum of 2.0 in the AMS airframe courses. For a transfer student, at least 50% of the courses required for this minor must be taken at Embry-Riddle. For a student who has completed the Aviation Maintenance Science Airframe minor, or has the FAA Mechanic’s Certificate with airframe rating, only the 18 credits of airframe-specific courses will be needed to complete this minor.

Students may earn a minor in Aviation Maintenance Science Powerplant by successfully completing the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS 115</td>
<td>Aviation Mathematics and Physics</td>
<td>2</td>
</tr>
<tr>
<td>AMS 116</td>
<td>Fundamentals of Electricity</td>
<td>4</td>
</tr>
<tr>
<td>AMS 117</td>
<td>Tools, Materials and Processes</td>
<td>4</td>
</tr>
<tr>
<td>AMS 118</td>
<td>Aircraft Familiarization and Regulations</td>
<td>2</td>
</tr>
<tr>
<td>AMS 271</td>
<td>Aircraft Reciprocating Powerplant and Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 272</td>
<td>Powerplant Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
<td>2</td>
</tr>
<tr>
<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
</tr>
<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits** 30

Aviation Maintenance Science

Powerplant
The minor in Aviation Maintenance Science Powerplant will lead to a student being qualified for FAA testing, and upon passing the required exams, becoming an FAA-certified mechanic with the powerplant rating. The minor requires 12 credit hours of general AMS coursework plus 18 credit hours of powerplant-specific AMS coursework. In order to receive this minor, a minimum GPA of 2.0 must be achieved in the AMS general courses and also a minimum of 2.0 in the AMS powerplant courses. For a transfer student, at least 50% of the courses required for this minor must be taken at Embry-Riddle. For a student who has completed the Aviation Maintenance Science Airframe minor, or has the FAA Mechanic’s Certificate with powerplant rating, only the 18 credits of powerplant-specific courses will be needed to complete this minor.
### Aviation Safety

This minor has a strong aviation focus. Through relevant course selection, students may either concentrate on aircraft accident investigation or aviation safety management.

- **SF 210** Introduction to Aerospace Safety * 3
- **SF 320** Human Factors in Aviation Safety 3
- **SF 345** Safety Program Management 3

Select three of the following: 9

- **SF 309** Aerodynamics and Performance for Air Safety Investigators
- **SF 330** Aircraft Accident Investigation
- **SF 335** Mechanical and Structural Factors in Aviation Safety
- **SF 341** Safety and Security of Airport Ground Operations
- **SF 342** Investigation of Aircraft Systems and Components
- **SF 350** Aircraft Crash and Emergency Management
- **SF 357** Language as a Factor in Aviation Safety
- **SF 375** Propulsion Plant Investigation
- **SF 410** Design of Engineering Hazard Controls
- **SF 435** Aircraft Crash Survival Analysis and Design
- **SF 445** System Safety in Aviation
- **SF 462** Health, Safety, and Aviation Law
- **SF 399/499** Special Topics in Safety

**Total Credits** 18

* AS 408 may be substituted for SF 210 in this minor.

**NOTE:** SF 320, SF 330, SF 341, SF 345 and SF 462 can be used for either the Aviation Safety Minor or the Occupational Safety Minor, but NOT both.

**NOTE:** Students in the Aeronautical Science degree program pursuing the Aviation Safety minor who complete SF 210/SF 320 and one other upper-level SF course will not be required to take AS 408.

Students taking AS 408 will not be required to take SF 210. Students selecting this option must still meet the minimum number of hours required for degree completion in their declared area of concentration.

### Avionics Line Maintenance

For the student interested in working in an aircraft line maintenance environment, the Aviation Maintenance Science Department offers this minor in order to prepare the student for working with today’s complex electronic aircraft. The student will gain a working knowledge of the intricacies of avionics line maintenance from general aviation to air transport through classroom theory and lab projects. Avionics line maintenance is becoming a heavily demanded skill that aircraft technicians today must be capable of accomplishing. To bring about the high quality of maintenance required by the industry, avionics line technicians have to be knowledgeable in terrestrial and satellite navigation systems, airborne and onboard communication systems, surveillance systems, auto flight systems, glass flight deck installations, and the integration of all of these systems.

The Avionics Line Maintenance Minor is offered through the Aviation Maintenance Science Department. The courses that make up the minor are as follows:

- **AMS 116** Fundamentals of Electricity 4
- **AMS 264** General Aviation Aircraft Electrical and Instrument Systems 3
- **AMS 366** Transport Category Aircraft Electrical and Instrument Systems 3
- **AMS 380** Radio Communication Theory & Application 2
- **AMS 384** General Aviation Avionics Systems Integration 4
- **AMS 388** Air Transport Avionics Systems Line Maintenance 6

**Total Credits** 22

### Biomedical Engineering

The Biomedical Engineering Minor provides students with an understanding of the fundamental principles that lead to scientific discovery and technology innovation in the bioengineering and biomedical fields. This minor will prepare engineering students to pursue graduate academic and professional
careers serving a wide range of biomedical arena of research and development.

### Required Courses

- **ME 442** Biofluid Mechanics 3
- **ME 444** Biomechanics 3
- **ME 460** Biosolid Mechanics 3

Choose two (2) courses 6

- **BIO 305** Human Anatomy and Physiology I
- **BIO 305L** Human Anatomy & Physiology Laboratory
- **BIO 306** Human Anatomy and Physiology II
- **BIO 306L** Human Anatomy and Physiology II Laboratory
- **BIO 340** Survey of Clinical Instrumentation
- **BIO 405** Molecular and Cell Biology
- **BIO 405L** Molecular and Cell Biology Laboratory
- **BIO 440** Clinical Rotation
- **CHM 310** Biochemistry
- **CHM 310L** Biochemistry Laboratory
- **HF 312** Ergonomics and Bioengineering
- **HF 326** Human Performance in Extreme Environments
- **HF 440** Aerospace Physiology

**Total Credits** 15

### Biomedical Sciences

The Biomedical Sciences Minor is designed for students in majors other than Aerospace Physiology who are interested in the medical field. The minor will provide students with an Introduction to the fundamental concepts and principles inherent in all health care professions and related fields, thus allowing them to apply to allied health programs or to enter graduate programs in the biological sciences.

**Required Courses**

- **BIO 120** Foundations of Biology I 3
- **BIO 120L** Foundations of Biology I Laboratory 1
- **BIO 121** Foundations of Biology II 3
- **BIO 121L** Foundations of Biology II Lab 1

Specified Electives (Select 3 of the following courses) 10-12

- **BIO 215/215L** Genetics
- **BIO 216/216L** Microbiology
- **BIO 305/305L** Human Anatomy and Physiology I
- **BIO 306/306L** Human Anatomy and Physiology II
- **CHM 310/310L** Biochemistry
- **BIO 321** Behavioral Neuroscience I
- **BIO 322** Behavioral Neuroscience II
- **BIO 405/405L** Molecular and Cell Biology

**Total Credits** 18-20

### Business Administration

Students may earn a minor in Business Administration by successfully completing the following. This minor is not open to students pursuing degrees offered by the David B. O'Maley College of Business.

- **ACC 210** Financial Accounting 3
- **BA 201** Principles of Management 3
- **BA 220** Marketing 3
- **BA 332** Corporate Finance I 3
- **EC 200** An Economic Survey 3
  - or **EC 210** Microeconomics 3
  - or **EC 225** Engineering Economics 3

Specified Elective* 3

**Total Credits** 18

* Any additional ACC/BA/EC upper-level course.

### Chemistry

The Chemistry Minor provides a curriculum core in general chemistry, organic chemistry, and chemistry applied to the biomedical and environmental fields while enhancing critical thinking and analytical skills. Students interested in pursuing graduate programs (including allied health) focusing in medicine, pharmacy, industrial hygiene and engineering would benefit from this minor.
## Required Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM</td>
<td>General Chemistry I</td>
<td>3-4</td>
</tr>
<tr>
<td>110/110L</td>
<td>or CHM Chemistry for Engineers</td>
<td></td>
</tr>
<tr>
<td>CHM</td>
<td>General Chemistry II</td>
<td>3-4</td>
</tr>
<tr>
<td>111/111L</td>
<td>or CHM Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHM</td>
<td>Organic Chemistry II</td>
<td>3-4</td>
</tr>
<tr>
<td>210/210L</td>
<td>or CHM Biochemistry</td>
<td></td>
</tr>
<tr>
<td>CHM</td>
<td>Biochemistry</td>
<td>3-4</td>
</tr>
<tr>
<td>310/310L</td>
<td>or CHM Nanomaterials and Nanoscience</td>
<td></td>
</tr>
<tr>
<td>EP</td>
<td>Nanomaterials and Nanoscience</td>
<td>3-4</td>
</tr>
<tr>
<td>335</td>
<td>Environmental Chemistry</td>
<td>3-4</td>
</tr>
<tr>
<td>PS</td>
<td>Environmental Chemistry</td>
<td>3-4</td>
</tr>
<tr>
<td>314</td>
<td>Industrial Hygiene and Toxicology</td>
<td>3-4</td>
</tr>
<tr>
<td>SF</td>
<td>Physical Meteorology</td>
<td>3-4</td>
</tr>
<tr>
<td>WX</td>
<td>Physical Meteorology</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Total Credits: 12-13

## Specified Electives (Select 3 courses; at least 9-11 credits must be upper level)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>Aerospace Engineering Materials</td>
<td>3-4</td>
</tr>
<tr>
<td>COM</td>
<td>Introduction to News Writing</td>
<td>3-4</td>
</tr>
<tr>
<td>265</td>
<td>or COM Science and Technology</td>
<td>3-4</td>
</tr>
<tr>
<td>COM</td>
<td>Communication</td>
<td>3-4</td>
</tr>
<tr>
<td>225</td>
<td>or COM Digital Photography</td>
<td>3-4</td>
</tr>
<tr>
<td>COM</td>
<td>Media Relations I</td>
<td>3-4</td>
</tr>
<tr>
<td>340</td>
<td>or COM Environmental Communication</td>
<td>3-4</td>
</tr>
<tr>
<td>COM</td>
<td>Communication and Organizational</td>
<td>3-4</td>
</tr>
<tr>
<td>345</td>
<td>Culture</td>
<td>3-4</td>
</tr>
<tr>
<td>COM</td>
<td>Communication and Society</td>
<td>3-4</td>
</tr>
<tr>
<td>363</td>
<td>or COM Applied Cross-Cultural</td>
<td>3-4</td>
</tr>
<tr>
<td>COM</td>
<td>Communication</td>
<td>3-4</td>
</tr>
<tr>
<td>420</td>
<td>or WX Introduction to Broadcast</td>
<td>3-4</td>
</tr>
<tr>
<td>WX</td>
<td>Meteorology</td>
<td>3-4</td>
</tr>
<tr>
<td>280</td>
<td>or HU Communication and Society</td>
<td>3-4</td>
</tr>
<tr>
<td>HU</td>
<td>or HU Communication and Society</td>
<td>3-4</td>
</tr>
<tr>
<td>363</td>
<td>or HU Video Production</td>
<td>3-4</td>
</tr>
<tr>
<td>HU</td>
<td>or HU Video Production</td>
<td>3-4</td>
</tr>
<tr>
<td>475</td>
<td>or HU Environmental Communication</td>
<td>3-4</td>
</tr>
<tr>
<td>HU</td>
<td>or HU Environmental Communication</td>
<td>3-4</td>
</tr>
<tr>
<td>314</td>
<td>or HU Applied Cross-Cultural</td>
<td>3-4</td>
</tr>
<tr>
<td>HU</td>
<td>or HU Applied Cross-Cultural</td>
<td>3-4</td>
</tr>
<tr>
<td>350</td>
<td>or HU Communication and Society</td>
<td>3-4</td>
</tr>
<tr>
<td>HU</td>
<td>or HU Communication and Society</td>
<td>3-4</td>
</tr>
<tr>
<td>360</td>
<td>or WX Media Relations II</td>
<td>3-4</td>
</tr>
<tr>
<td>WX</td>
<td>or WX Media Relations II</td>
<td>3-4</td>
</tr>
<tr>
<td>280</td>
<td>or WX Introduction to Broadcast</td>
<td>3-4</td>
</tr>
<tr>
<td>WX</td>
<td>or WX Introduction to Broadcast</td>
<td>3-4</td>
</tr>
<tr>
<td>368</td>
<td>or WX Meteorology</td>
<td>3-4</td>
</tr>
<tr>
<td>WX</td>
<td>or WX Meteorology</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Total Credits: 21-24

## Computational Mathematics

The minor in Computational Mathematics is open to all students with strong interest in mathematics and computation. It is designed to provide students with a strong applied mathematics background and knowledge in the usage of computing tools to solve real-world problems. Students may earn a minor in Computational Mathematics by successfully completing the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA</td>
<td>Calculus and Analytical Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>241</td>
<td>or MA Calculus and Analytical Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>MA</td>
<td>Applied Differential Equations</td>
<td>3-4</td>
</tr>
<tr>
<td>245</td>
<td>or MA Differential Equations and Matrix Methods</td>
<td>3-4</td>
</tr>
<tr>
<td>MA</td>
<td>Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>348</td>
<td>or MA Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MA</td>
<td>Linear Optimization</td>
<td>3</td>
</tr>
<tr>
<td>410</td>
<td>or MA Data Mining</td>
<td>3</td>
</tr>
<tr>
<td>MA</td>
<td>Numerical Solution of Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>440</td>
<td>or MA Numerical Solution of Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MA</td>
<td>High Performance Scientific Computing</td>
<td>3</td>
</tr>
<tr>
<td>453</td>
<td>or MA High Performance Scientific Computing</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 20-21
Computer Aided Design/Computer Aided Manufacturing

Students may earn a minor in Computer Aided Design/Computer Aided Manufacturing by successfully completing the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 120</td>
<td>Graphical Communications</td>
<td>3</td>
</tr>
<tr>
<td>EGR 305</td>
<td>3D-CADD and Engineering Documentation</td>
<td>3</td>
</tr>
<tr>
<td>or CS 335</td>
<td>Introduction to Computer Graphics</td>
<td></td>
</tr>
<tr>
<td>ME 304</td>
<td>Introduction to Machine Design</td>
<td>3</td>
</tr>
<tr>
<td>or AE 318</td>
<td>Aerospace Structures I</td>
<td></td>
</tr>
<tr>
<td>ME 424</td>
<td>Automation and Rapid Prototyping</td>
<td>3</td>
</tr>
<tr>
<td>ME 428</td>
<td>Design for Manufacturing and Assembly</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 15

Computer Science

Students may earn a minor in Computer Science by successfully completing the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 223</td>
<td>Scientific Programming in C</td>
<td>3</td>
</tr>
<tr>
<td>or EGR 11</td>
<td>Introduction to Computing for Engineers</td>
<td></td>
</tr>
<tr>
<td>CS 225</td>
<td>Computer Science II</td>
<td>4</td>
</tr>
<tr>
<td>SE 300</td>
<td>Software Engineering Practices</td>
<td>4</td>
</tr>
<tr>
<td>XX 300-400</td>
<td>CS/CEC/SE Electives**</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Credits: 17

* SE 300 is a variable credit course. Students receive 4 credits (3 credit lecture, 1 credit laboratory).

** XX 300-400. In addition to any 300-400 level CS/CEC/SE electives, students may take any computer-related course approved by the CS minor program coordinator.

Cybersecurity Engineering

The minor in Cybersecurity Engineering is open to all majors. Students in this program will be learning the fundamentals of engineering cybersecurity to defend a range of computer systems. The acquired knowledge can be used for enhancing security of computer-based systems, including that of aviation and aerospace systems, as well as security of general purpose infrastructures and systems. The minor recognizes the need for introducing students to both defense and offense aspects of cybersecurity as such skills are needed in both the industry and government. Students may earn a minor in Cybersecurity Engineering by completing 16 credits as indicated in the following list:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 225</td>
<td>Computer Science II</td>
<td>4</td>
</tr>
<tr>
<td>CS 317</td>
<td>Files and Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>Choose three of the following Electives</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>CS 303</td>
<td>Network Security</td>
<td></td>
</tr>
<tr>
<td>CS 426</td>
<td>Digital Forensics</td>
<td></td>
</tr>
<tr>
<td>CS 427</td>
<td>System Exploitation and Penetration Testing</td>
<td></td>
</tr>
<tr>
<td>CS 428</td>
<td>Applied Cryptography</td>
<td></td>
</tr>
<tr>
<td>CS 432</td>
<td>Information and Computer Security</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 16

Cybersecurity Application and Management

The cybersecurity program (15 credits, 5 courses) is open to all majors and explores the many approaches and meanings of this field that is fast becoming central to our nation’s security. As we see every day in the press, cybersecurity can be used for offensive or defensive purposes. The approaches to defending critical infrastructures such as the energy grid, financial systems, the healthcare system, or agriculture, etc, can be either proactive (e.g., installing a firewall to detect and prevent attacks) or reactive (e.g., responding to an event). This program will introduce students to cybersecurity operations (e.g., day-to-day duties, actions, and responsibilities), governance (e.g., law, policy, and analysis), and education and training.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYB 235</td>
<td>Computer and Network Technologies</td>
<td>3</td>
</tr>
<tr>
<td>CYB 335</td>
<td>Information Security Tools and Techniques</td>
<td>3</td>
</tr>
<tr>
<td>CYB 365</td>
<td>Introduction to Digital Forensics</td>
<td>3</td>
</tr>
<tr>
<td>CYB 465</td>
<td>Cybercrime and Cyberlaw</td>
<td>3</td>
</tr>
<tr>
<td>CYB 485</td>
<td>War, Terrorism and Diplomacy in Cyberspace</td>
<td>3</td>
</tr>
<tr>
<td>or CYB 474</td>
<td>Issues in Aviation Cybersecurity</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 15
Electrical and Computer Engineering

The Minor in Electrical and Computer Engineering (ECE) can provide engineering undergraduate students with a fundamental knowledge of ECE in electricity, signals, circuits, and systems as well as a broader knowledge in a specific area of ECE. Engineering students may earn a minor in ECE by taking two required fundamental courses, one required depth course, and two elective courses, as listed below. Typical completion of the minor will require 15-19 credits, depending on the number of laboratory courses that are selected.

**Required Fundamental Courses** 6-7
- CEC 315 Signals and Systems
- EE 327 & EE 328 Electrical Engineering Fundamentals and Electrical Engineering Fundamentals Laboratory

**OR**
- EE 223 & EE 224 Linear Circuits Analysis I and Electrical Engineering Laboratory I

**Required Depth Course (Choose one of the following):** 3-4
- CEC 220 Digital Circuit Design & CEC 222 Digital Circuit Design Laboratory

**OR**
- EE 302 & EE 304 Electronic Devices and Circuits and Electronic Circuits Laboratory

**Elective Courses** 6-8
- **Any 300/400/500 level CEC or EE courses**

**Total Credits** 15-19

* For the purpose of this minor only, ES 405 will satisfy the CEC 220/CEC 222 or EE 302/EE 304 prerequisite requirement for ECE courses taken towards completion of the minor.

** Emergency Management**

This minor will provide knowledge in the field of emergency management, introducing the student to phases of emergency management: preparedness, mitigation, response, recovery, and will also explore the impact that meteorology plays in disaster response. Student will have the opportunity to learn the concepts of disaster communication and study other related courses such as management, psychology, and safety. The minor requires 15 credit hours of study (12 credit of required courses and 3 credit hours of specified electives) with different course listing for Homeland Security majors and non-Homeland Security majors. Pre-requisite requirements for certain courses maybe waived for students pursuing this minor on a case-by-case basis after advisement from the Homeland Security Program Coordinator.

**Required Courses for Non HS Majors**
- COM 460 Media Relations II 3
- HS 310 Fundamentals of Emergency Management 3

**OR**
- HS 315 Critical Infrastructure Security, Resilience, and Risk Analysis 3
- HS 370 Emergency Management Strategy and Policy 3
- WX 201 Survey of Meteorology 3

Select one of the following specified electives 3

- BA 201 Principles of Management
- COM 350 Environmental Communication
- GEO 210 Introduction to Geographic Information Systems
- SF 355 Industrial Hygiene and Toxicology

Or any applicable upper-level course with permission from the HS Program Coordinator

**Total Credits** 15

**Required Courses for HS Majors**
- COM 350 Environmental Communication 3
- COM 460 Media Relations II 3
- HS 370 Emergency Management Strategy and Policy 3
- WX 201 Survey of Meteorology 3

Select one of the following specified electives 3

- BA 201 Principles of Management
- BIO 142 Introduction to Environmental Science
GEO 210   Introduction to Geographic Information Systems
Or any applicable upper-level course with permission from the HS Program Coordinator

Total Credits  15

Classes from the core of the B.S. Homeland Security degree cannot be used as part of the Minor.

Energy Systems
This minor will provide knowledge in Energy Systems. It is open to all students in the College of Engineering except Mechanical Engineering students in the Energy Systems track. Students should be aware that they may be required to take additional prerequisite courses outside of the requirements for their degree program to be qualified to complete this minor.

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 316</td>
<td></td>
</tr>
<tr>
<td>ME 443</td>
<td></td>
</tr>
<tr>
<td>ME 445</td>
<td></td>
</tr>
<tr>
<td>ME 414</td>
<td></td>
</tr>
<tr>
<td>ME 434</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits  17

Entrepreneurship
The goal of this minor is to support those students interested in starting a business, including commercializing technology. This minor also supports those students that need a business plan or want to learn how to develop a plan. The minor is progressive from business foundations to foundations of entrepreneurship through a capstone class of Venture Creation.

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 205</td>
<td></td>
</tr>
<tr>
<td>or BA 201</td>
<td></td>
</tr>
<tr>
<td>BA 318</td>
<td></td>
</tr>
<tr>
<td>BA 330</td>
<td></td>
</tr>
<tr>
<td>BA 336</td>
<td></td>
</tr>
<tr>
<td>BA 438</td>
<td></td>
</tr>
<tr>
<td>Specified Electives</td>
<td></td>
</tr>
</tbody>
</table>

Select any BA/EC additional upper-level course.  3

Total Credits  18

Note: BA 205/BA 201 courses are for non-business students.

Finance
The Minor in Finance is for non-business students.

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td></td>
</tr>
<tr>
<td>ACC 332</td>
<td></td>
</tr>
<tr>
<td>ACC 434</td>
<td></td>
</tr>
<tr>
<td>EC 210</td>
<td></td>
</tr>
<tr>
<td>or EC 211</td>
<td></td>
</tr>
<tr>
<td>or EC 225</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the following:  3

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 312</td>
<td></td>
</tr>
<tr>
<td>ACC 340</td>
<td></td>
</tr>
<tr>
<td>BA 334</td>
<td></td>
</tr>
<tr>
<td>BA 336</td>
<td></td>
</tr>
<tr>
<td>BA 418</td>
<td></td>
</tr>
<tr>
<td>EC 315</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits  15

Flight
The Flight minor incorporates the courses required to obtain the FAA commercial pilot certificate with instrument and multi-engine ratings. In addition to the required flight courses, rigorous academic classes are included to provide professional pilot education in excess of the minimum FAA requirements for the associated FAA certificates. Included is instruction in CRM, team building, resource management, communication skills, and other topics associated with piloting multi-engine aircraft at the commercial level.

After matriculation to Embry-Riddle, all flight training and academic courses must be completed on-campus to earn the minor in Flight.

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 121</td>
<td></td>
</tr>
<tr>
<td>or AS 221</td>
<td></td>
</tr>
<tr>
<td>or AS 321</td>
<td></td>
</tr>
<tr>
<td>Upper-Level AS Course</td>
<td></td>
</tr>
</tbody>
</table>

Select any BA/EC additional upper-level course.  3
Flight courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA 121</td>
<td>Private Single Flight</td>
<td>1</td>
</tr>
<tr>
<td>FA 221</td>
<td>Instrument Single Flight</td>
<td>1</td>
</tr>
<tr>
<td>FA 321</td>
<td>Commercial Single Flight</td>
<td>1</td>
</tr>
<tr>
<td>FA 323</td>
<td>Commercial Multi Add On</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Credits 18

* See the Advanced Standing section in the University Academic Regulations and Procedures and the Aeronautical Science Notes under the Aeronautical Science degree sections of this catalog for information pertaining to these courses and the awarding of credit for previously earned FAA certificates.

** A grade of "C" or higher is required for AS 121, AS 221, and AS 321.

Forensic Accounting

The forensic accounting program (offered jointly between the College of Business and the Homeland Security program) teaches students how to understand money trails, conduct fraud investigations, and how illegal operations and organizations can hide their fiscal assets from the law in order to conduct illegal operations. Many federal agencies and organizations seek certified fraud examiners. As such, the forensic accounting program is designed around the required content areas of the certified fraud examiner (CFE) certification examination. Upon graduation with one’s undergraduate degree, and the forensic accounting minor, students will be prepared and eligible to sit for the CFE exam.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ACC 351</td>
<td>Auditing Principles and Procedures</td>
<td>3</td>
</tr>
<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BA 343</td>
<td>Fraud Detection</td>
<td>3</td>
</tr>
<tr>
<td>HS 321</td>
<td>Introduction to Fraud Investigation</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 15

Global Conflict Studies

The minor in Global Conflict Studies offers students a variety of courses that use a multi disciplinary approach to provide an understanding of the root causes of human conflict; the theory behind the management of conflict; the major global security challenges of the day; and a foundation in the methodology, technology, and political processes that attempt to prevent or resolve conflicts.

**Required courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS 201</td>
<td>Introduction to Global Conflict Studies</td>
<td>3</td>
</tr>
<tr>
<td>SS 115</td>
<td>Introduction to International Relations</td>
<td>3</td>
</tr>
</tbody>
</table>

**Select three of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYB 485</td>
<td>War, Terrorism and Diplomacy in Cyberspace</td>
<td>3</td>
</tr>
<tr>
<td>GCS 300</td>
<td>International Conflict Resolution</td>
<td></td>
</tr>
<tr>
<td>GCS 302</td>
<td>Gender Security</td>
<td></td>
</tr>
<tr>
<td>GCS 304</td>
<td>Political Violence</td>
<td></td>
</tr>
<tr>
<td>GCS 306</td>
<td>Theories of Nations and Nationalism</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>GCS 308</td>
<td>Transnational Crime</td>
<td></td>
</tr>
<tr>
<td>GCS 400</td>
<td>Topics in Global Conflict Studies</td>
<td></td>
</tr>
<tr>
<td>SS 325</td>
<td>International Studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

**High Performance Vehicles**

This minor introduces students to High Performance Vehicles. It is open to all students except Mechanical Engineering students in the High Performance Vehicle track. Students should be aware that they may be required to take additional prerequisite courses outside of the requirements for their degree program to be qualified to complete this minor.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 303</td>
<td>Vehicle Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 405</td>
<td>Vehicle Power Systems</td>
<td>3</td>
</tr>
<tr>
<td>ME 409</td>
<td>Vehicle Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 413</td>
<td>Preliminary Design for High Performance Vehicles with Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>ME 433</td>
<td>Senior Design for High Performance Vehicles with Laboratory</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

**Homeland Security**

This minor has a strong focus on protecting the nation’s transportation infrastructure and planning for, responding to, and emergency management of events dealing with acts of terrorism and natural and man-made disasters. This minor complements degrees in safety, aeronautical science, airport management, communication, human factors, aeronautics, business, or interdisciplinary studies. This minor requires 15 credit hours of the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYB 155</td>
<td>Foundations of Information Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 110</td>
<td>Introduction to Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 215</td>
<td>Introduction to Industrial Security</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Select two of the following:</strong></td>
<td></td>
</tr>
<tr>
<td>HS 310</td>
<td>Fundamentals of Emergency Management</td>
<td></td>
</tr>
<tr>
<td>HS 315</td>
<td>Critical Infrastructure Security, Resilience, and Risk Analysis</td>
<td></td>
</tr>
<tr>
<td>HS 320</td>
<td>Homeland Security Law and Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

**Human Factors**

Students may earn a minor in Human Factors by successfully completing the two specified courses and an additional three courses from the following list, totaling 15 credit hours. Three credits of HF 299, HF 399, or HF 499 and any HF experimental courses at or above the 300 level may be used to complete the electives portion of the minor with advance permission of the department chair.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
<tr>
<td>HF 300</td>
<td>Human Factors I: Principles and Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Select three of the following:</strong></td>
<td>9</td>
</tr>
<tr>
<td>HF 310</td>
<td>Human-Computer Interaction</td>
<td></td>
</tr>
<tr>
<td>HF 312</td>
<td>Ergonomics and Bioengineering</td>
<td></td>
</tr>
<tr>
<td>HF 315</td>
<td>Automation and Systems Issues in Aviation</td>
<td></td>
</tr>
<tr>
<td>HF 321</td>
<td>Psychopharmacology</td>
<td></td>
</tr>
<tr>
<td>HF 325</td>
<td>Human Factors and System Safety</td>
<td></td>
</tr>
<tr>
<td>HF 326</td>
<td>Human Performance in Extreme Environments</td>
<td></td>
</tr>
<tr>
<td>HF 330</td>
<td>Human Factors in Space</td>
<td></td>
</tr>
<tr>
<td>HF 335</td>
<td>Human Factors in Air Traffic Control</td>
<td></td>
</tr>
<tr>
<td>HF 352</td>
<td>Human Factors in Entertainment Systems</td>
<td></td>
</tr>
<tr>
<td>HF 410</td>
<td>Human Factors Engineering: Crew Station Design</td>
<td></td>
</tr>
<tr>
<td>HF 412</td>
<td>Simulating Humans in Complex Systems</td>
<td></td>
</tr>
<tr>
<td>HF 415</td>
<td>Human Factors in Simulation Systems</td>
<td></td>
</tr>
<tr>
<td>HF 422</td>
<td>Applied Ergonomic Design, Analysis, and Evaluation</td>
<td></td>
</tr>
<tr>
<td>HF 440</td>
<td>Aerospace Physiology</td>
<td></td>
</tr>
</tbody>
</table>

|            | **Total Credits**                                | **15**  |
Human Factors in Aviation Safety

Total Credits: 15

Humanities

Students may earn a minor in Humanities by successfully completing 18 hours. Within those 18 hours, students must select two courses from the HU 140-146 series for a subtotal of 6 credits.

Additionally, students must complete four courses selected from the list below for a subtotal of 12 credits. Note that at least one course from the following must be completed: HU 300, HU 305, and/or HU 310.

Select two of the following: 6
- HU 140 Western Humanities I: Antiquity and the Middle Ages
- HU 141 Western Humanities II: Renaissance to Postmodern
- HU 142 Studies in Literature
- HU 143 Introduction to Rhetoric
- HU 144 Studies in Art
- HU 145 Themes in the Humanities
- HU 146 Music Appreciation and Criticism

Select four of the following: 12
- HU 300 World Literature
- HU 302 Contemporary Issues in Science
- HU 305 Modern Literature
- HU 310 American Literature
- HU 325 Exploring Film
- HU 330 Values and Ethics
- HU 335 Technology and Modern Civilization
- HU 338 Traversing the Borders: Interdisciplinary Explorations
- HU 341 World Philosophy
- HU 345 Comparative Religions
- HU 355 Creative Writing

Total Credits: 18

HU 395/HU 495 and HU 399/HU 499 may be included in the minor with advance permission of the department chair.

International History

The minor in International History gives students exposure to foreign cultures and an understanding of the complex interactions between the United States and the world. The minor benefits students by preparing them to pursue careers in the global workplace or government, or to pursue graduate work in a variety of fields, including history and business.

Students may earn a minor in International History by successfully completing 15 credit hours composed of one course of lower-level Social Science and 12 credits chosen from specified electives, as seen below.

Courses used in the International Relations or the International History Minor cannot be used in the Terrorism Studies Minor.

Select one of the following: 3
- EC 200 An Economic Survey
- EC 210 Microeconomics
- EC 211 Macroeconomics
- SS 110 World History
- SS 120 U.S. History
- SS 130 History of Aviation in America
- SS 140 Introduction to Middle East Mediterranean World

Select four of the following: 12
- BA 335 International Business
- SS 311 U.S Military History 1775-1900
- SS 321 U.S. Military History 1900-Present
- SS 322 Modern Russian History
- SS 324 Topics in U.S. History
- SS 325 International Studies
- SS 326 Russian-U.S. Relations
- SS 328 History of U.S. Intelligence
- SS 331 Current Issues in America
- SS 333 U.S. - Asian Relations
- SS 334 Contemporary Africa and the World
- SS 336 The Modern Middle East in World Affairs
- SS 337 Globalization and World Politics
- SS 340 Modern U.S. Foreign Policy
- SS 353 Early U.S. Foreign Policy
**Marketing**

Minor in Marketing for non-business students.

**Core Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 330</td>
<td>Professional Selling</td>
<td>3</td>
</tr>
<tr>
<td>Select three of the following:</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>BA 318</td>
<td>Entrepreneurship I</td>
<td></td>
</tr>
<tr>
<td>BA 326</td>
<td>Marketing Management</td>
<td></td>
</tr>
<tr>
<td>BA 336</td>
<td>Electronic Commerce</td>
<td></td>
</tr>
<tr>
<td>BA 355</td>
<td>Marketing Research</td>
<td></td>
</tr>
<tr>
<td>BA 405</td>
<td>General Aviation Marketing</td>
<td></td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td></td>
</tr>
<tr>
<td>BA 450</td>
<td>Airline/Airport Marketing</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits** 15

**Military Science**

The Military Science program (19-24 credits, 9 courses) is open to all undergraduate majors, and ROTC and non-ROTC students, alike. This minor seeks to build awareness of government service, bolster leadership fundamentals, and gain an enhanced perspective of military operations and terminology.

To earn this minor, student will complete courses of the ROTC program in addition to one upper level course from Global Conflict Studies (GCS), Homeland Security (HS), or Social Sciences (SS). The minor is divided into four parts that mirrors ROTC training through a student's typical 4-year degree plan. Parts 1 and 2 may be completed concurrently.

**Part 1: Select two of the following: (2-5 credits, may be taken concurrently with Part 2)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF 101</td>
<td>U.S. Military Forces GMC</td>
<td>1</td>
</tr>
<tr>
<td>AF 102</td>
<td>U.S. Military Forces GMC</td>
<td>1</td>
</tr>
<tr>
<td>MSL 101</td>
<td>Basic Military Science I</td>
<td>1</td>
</tr>
<tr>
<td>MSL 102</td>
<td>Basic Military Science II</td>
<td>1</td>
</tr>
<tr>
<td>NSC 101</td>
<td>Introduction to Naval Science</td>
<td>2</td>
</tr>
<tr>
<td>NSC 102</td>
<td>Seapower and Maritime Affairs</td>
<td>3</td>
</tr>
</tbody>
</table>

**Part 2: Select two of the following: (2-6 credits, may be taken concurrently with Part 1)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF 201</td>
<td>The Evolution of USAF Air and Space Power (General Military Course)</td>
<td>1</td>
</tr>
<tr>
<td>AF 202</td>
<td>The Evolution of USAF Air and Space Power (General Military Course)</td>
<td>1</td>
</tr>
<tr>
<td>GCS 201</td>
<td>Introduction to Global Conflict Studies</td>
<td>3</td>
</tr>
<tr>
<td>MSL 201</td>
<td>Basic Military Leadership I</td>
<td>2</td>
</tr>
<tr>
<td>MSL 202</td>
<td>Basic Military Leadership II</td>
<td>2</td>
</tr>
<tr>
<td>NSC 201</td>
<td>Principles of Naval Leadership and Management</td>
<td>3</td>
</tr>
<tr>
<td>NSC 202</td>
<td>Navigation</td>
<td>3</td>
</tr>
<tr>
<td>SS 311</td>
<td>U.S Military History 1775-1900</td>
<td>3</td>
</tr>
<tr>
<td>SS 321</td>
<td>U.S. Military History 1900-Present</td>
<td>3</td>
</tr>
</tbody>
</table>

**Part 3: Once completed with Part 1 and 2, select two of the following: (6 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF 301</td>
<td>Air Force Leadership Studies (Professional Officer Course)</td>
<td>3</td>
</tr>
<tr>
<td>AF 302</td>
<td>Air Force Leadership Studies (Professional Officer Course)</td>
<td>3</td>
</tr>
<tr>
<td>MSL 301</td>
<td>Officership I</td>
<td>3</td>
</tr>
<tr>
<td>MSL 302</td>
<td>Officership II</td>
<td>3</td>
</tr>
<tr>
<td>NSC 301</td>
<td>Naval Engineering</td>
<td>3</td>
</tr>
<tr>
<td>NSC 302</td>
<td>Naval Weapons Systems</td>
<td>3</td>
</tr>
<tr>
<td>NSC 310</td>
<td>Evolution of Warfare</td>
<td>3</td>
</tr>
<tr>
<td>NSC 311</td>
<td>Fundamentals of Maneuver Warfare</td>
<td>3</td>
</tr>
</tbody>
</table>

**Part 4: Once completed with Parts 1-3, select three of the following: (9 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF 401</td>
<td>Preparation for Active Duty (Professional Officer Course)</td>
<td>3</td>
</tr>
<tr>
<td>AF 402</td>
<td>Preparation for Active Duty (Professional Officer Course)</td>
<td>3</td>
</tr>
<tr>
<td>GCS 300</td>
<td>International Conflict Resolution</td>
<td>3</td>
</tr>
<tr>
<td>GCS 400</td>
<td>Topics in Global Conflict Studies</td>
<td>3</td>
</tr>
<tr>
<td>HS 325</td>
<td>Terrorism: Origin, Ideologies, and Goals</td>
<td>3</td>
</tr>
<tr>
<td>HS 360</td>
<td>Strategic Planning and Decision Making in Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 411</td>
<td>Terrorism, Insurgency and Irregular Warfare</td>
<td>3</td>
</tr>
</tbody>
</table>
### Occupational Safety

This minor exposes students to the broader field of safety. While focusing on managing safety under OSHA, MSHA, and EPA regulations, which all business (aviation and non-aviation) in the United States must adhere to, this minor also covers safety programs required by the FAA.

#### Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 201</td>
<td>Introduction to Health, Occupational, and Transportation Safety</td>
<td>3</td>
</tr>
<tr>
<td>SF 355</td>
<td>Industrial Hygiene and Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>SF 410</td>
<td>Design of Engineering Hazard Controls</td>
<td>3</td>
</tr>
</tbody>
</table>

Select three of the following: 9

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 205</td>
<td>Principles of Accident Investigation</td>
<td></td>
</tr>
<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
<td></td>
</tr>
<tr>
<td>SF 320</td>
<td>Human Factors in Aviation Safety</td>
<td></td>
</tr>
<tr>
<td>SF 330</td>
<td>Aircraft Accident Investigation</td>
<td></td>
</tr>
<tr>
<td>SF 341</td>
<td>Safety and Security of Airport Ground Operations</td>
<td></td>
</tr>
<tr>
<td>SF 345</td>
<td>Safety Program Management</td>
<td></td>
</tr>
<tr>
<td>SF 365</td>
<td>Fire Protection</td>
<td></td>
</tr>
<tr>
<td>SF 405</td>
<td>Applications in Industrial Hygiene</td>
<td></td>
</tr>
<tr>
<td>SF 420</td>
<td>Analysis of Observational Data</td>
<td></td>
</tr>
<tr>
<td>SF 440</td>
<td>Design of Engineering Hazard Controls II</td>
<td></td>
</tr>
<tr>
<td>SF 462</td>
<td>Health, Safety, and Aviation Law</td>
<td></td>
</tr>
<tr>
<td>SF 399/499</td>
<td>Special Topics in Safety</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits:** 18

---

### Physics

Students may earn a minor in Physics by completing the list below. Engineering Physics or Space Physics students are not eligible.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS 150</td>
<td>Physics for Engineers I</td>
<td>3</td>
</tr>
<tr>
<td>or PS 226</td>
<td>Physics I</td>
<td></td>
</tr>
<tr>
<td>PS 160</td>
<td>Physics for Engineers II</td>
<td>3</td>
</tr>
<tr>
<td>or PS 227</td>
<td>Physics II</td>
<td></td>
</tr>
<tr>
<td>PS 250</td>
<td>Physics for Engineers III</td>
<td>3</td>
</tr>
<tr>
<td>or PS 228</td>
<td>Physics III</td>
<td></td>
</tr>
<tr>
<td>PS 253</td>
<td>Physics Laboratory for Engineers</td>
<td>1</td>
</tr>
<tr>
<td>or PS 228L</td>
<td>Physics III Laboratory</td>
<td></td>
</tr>
<tr>
<td>PS 303</td>
<td>Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PS 305</td>
<td>Modern Physics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Upper-Level Elective *</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 17

* Choose one elective from EP 320, EP 400, EP 440, PS 320, PS 400

### Psychology

Three credits of HF 299, HF 399, or HF 499 or PSY 299, PSY 399, or PSY 499 and any PSY experimental courses at or above the 300 level may be used to complete the electives portion of the minor with advance permission of the department chair.

#### Specified Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSY 350</td>
<td>Social Psychology</td>
<td>3</td>
</tr>
<tr>
<td>HF 300</td>
<td>Human Factors I: Principles and Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two of the following: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 317</td>
<td>Organizational Behavior</td>
<td></td>
</tr>
<tr>
<td>HU 363</td>
<td>Communication and Society</td>
<td></td>
</tr>
<tr>
<td>PSY 310</td>
<td>Sensation and Perception</td>
<td></td>
</tr>
<tr>
<td>PSY 315</td>
<td>Cognitive Psychology</td>
<td></td>
</tr>
<tr>
<td>PSY 320</td>
<td>Aviation Psychology</td>
<td></td>
</tr>
<tr>
<td>PSY 330</td>
<td>Learning and Motivation</td>
<td></td>
</tr>
</tbody>
</table>
### PSY 335 Physiological Psychology
### PSY 340 Industrial-Organizational Psychology
### PSY 345 Training and Development
### PSY 352 Personality: A Systems Approach
### PSY 365 Abnormal Psychology

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 335</td>
<td>Physiological Psychology</td>
<td></td>
</tr>
<tr>
<td>PSY 340</td>
<td>Industrial-Organizational</td>
<td></td>
</tr>
<tr>
<td>PSY 345</td>
<td>Psychology</td>
<td></td>
</tr>
<tr>
<td>PSY 352</td>
<td>Training and Development</td>
<td></td>
</tr>
<tr>
<td>PSY 365</td>
<td>Personality: A Systems Approach</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits:** 15

Three credits of HF 299, HF 399, or HF 499 or PSY 299, PSY 399, or PSY 499 may be substituted with advance permission of the department chair.

### Robotic Systems

This minor will provide knowledge in basic Robotics. It is open to all students except Mechanical Engineering students in the Robotic Systems track. Students should be aware that they may be required to take additional prerequisite courses outside of the requirements for their degree program to be qualified to complete this minor.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 311</td>
<td>Robotics Technologies for Unmanned Systems</td>
<td>3</td>
</tr>
<tr>
<td>ME 402</td>
<td>Robotic Arms</td>
<td>3</td>
</tr>
<tr>
<td>ME 404</td>
<td>Mechatronics</td>
<td>3</td>
</tr>
<tr>
<td>ME 407</td>
<td>Preliminary Design for Robotic Systems with Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>ME 437</td>
<td>Senior Design for Robotic Systems with Laboratory</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Credits:** 17

### Russian Studies

The Russian Studies minor introduces students to the cultures, histories, and language of the Russian-speaking world, and to cross-cultural comparisons between the United States and Russia. Students can earn the minor by successfully completing at least 15 related credit hours.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRU 101</td>
<td>Elementary Russian I</td>
<td>3</td>
</tr>
<tr>
<td>LRU 102</td>
<td>Elementary Russian II</td>
<td>3</td>
</tr>
<tr>
<td>LRU 201</td>
<td>Intermediate Russian I</td>
<td>3</td>
</tr>
<tr>
<td>SS 322</td>
<td>Modern Russian History</td>
<td>3</td>
</tr>
<tr>
<td>SS 326</td>
<td>Russian-U.S. Relations</td>
<td>3</td>
</tr>
<tr>
<td>SS 399</td>
<td>Special Topics in Social Science</td>
<td>1-6</td>
</tr>
</tbody>
</table>

### Space Studies

The Space Studies minor provides the student with a broad background in space flight operations, space technology, and space history covering past, present, and future programs. While focused on space exploration, the Space Studies courses also furnish insight into the major space projects that includes policy, planning, and outcomes. Students may earn a minor in Space Studies by completing 15 credits from the following list.

Select four of the following: 12

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 110</td>
<td>Introduction to Space Flight</td>
<td></td>
</tr>
<tr>
<td>SP 200</td>
<td>Planetary and Space Exploration</td>
<td></td>
</tr>
<tr>
<td>SP 210</td>
<td>Space Transportation System</td>
<td></td>
</tr>
<tr>
<td>SP 215</td>
<td>Space Station Systems and Operations</td>
<td></td>
</tr>
<tr>
<td>SP 220</td>
<td>Life Support Systems</td>
<td></td>
</tr>
<tr>
<td>SP 300</td>
<td>Satellite and Spacecraft Systems</td>
<td></td>
</tr>
<tr>
<td>SP 340</td>
<td>Russian Space Operations and Technology</td>
<td></td>
</tr>
<tr>
<td>SP 400</td>
<td>Introduction to Space Navigation</td>
<td></td>
</tr>
</tbody>
</table>

**In addition, all students must complete:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 425</td>
<td>Selected Topics in Space and Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 15

### Supply Chain Management in Aviation and Aerospace

Minor in Supply Chain Management in Aviation and Aerospace will consist of the following plan of study.

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 363</td>
<td>Supply Chain Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 410</td>
<td>Management of Air Cargo</td>
<td>3</td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two courses from the following: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 318</td>
<td>Entrepreneurship I</td>
<td></td>
</tr>
<tr>
<td>BA 321</td>
<td>Aviation/Aerospace Systems Analysis Methods</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits:** 15
### Systems Engineering

The minor in Systems Engineering provides the student with a foundation in the fundamentals of systems engineering. The minor recognizes and responds to the need within industry and government for graduating engineers to have a basic familiarity with principles and practices of systems engineering. Students may earn a minor in Systems Engineering by completing 15 credits as indicated from the following lists:

<table>
<thead>
<tr>
<th>Required Courses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 412 Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>SYS 301 Introduction to Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 304 Trade Studies, Risk and Decision Analysis</td>
<td>3</td>
</tr>
<tr>
<td>SYS 415 Systems Engineering Practices: Specialty Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective Courses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Select one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>AE 350 Project Engineering</td>
<td></td>
</tr>
<tr>
<td>BA 201 Principles of Management</td>
<td></td>
</tr>
<tr>
<td>CEC 300 Computing in Aerospace and Aviation</td>
<td></td>
</tr>
<tr>
<td>CIV 222 Introduction to Environmental Engineering</td>
<td></td>
</tr>
<tr>
<td>CIV 311 Introduction to Transportation Engineering</td>
<td></td>
</tr>
<tr>
<td>CIV 340 Construction Engineering</td>
<td></td>
</tr>
<tr>
<td>CS 350 Computer Modeling and Simulation</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 15

Additional electives may be considered upon consultation with and permission of the student’s advisor and the program coordinator.

### Terrorism Studies

The terrorism studies program (15 credits, 5 courses) combines several advanced topics in terrorism such as irregular warfare, concerns about transnational asymmetric insurgencies, counter-terrorism strategies and policy, and counter intelligence strategies with upper level courses in international relations. Of the five total courses, students choose two international relations courses from a large list of course in order to more deeply develop an appreciation of the issues and challenges that terrorists present in various nations and cultures and how those impact the U.S.

Courses used in the International Relations or the International History Minor cannot be used in the Terrorism Studies Minor.

<table>
<thead>
<tr>
<th>Select three of the following:</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 375 Studies in Transportation Sector Infrastructure and Protection</td>
<td></td>
</tr>
<tr>
<td>HS 411 Terrorism, Insurgency and Irregular Warfare</td>
<td></td>
</tr>
<tr>
<td>HS 435 International Crime and Criminal Justice Structure</td>
<td></td>
</tr>
<tr>
<td>HS 450 Advanced Topics in Terrorism</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select two of the following:</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS 300 International Conflict Resolution</td>
<td></td>
</tr>
<tr>
<td>GCS 304 Political Violence</td>
<td></td>
</tr>
</tbody>
</table>
**Unmanned Aircraft Systems Applications**

Students may earn a minor in Unmanned Aircraft Systems Applications by successfully completing the following. This minor is open to US citizens only.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 220</td>
<td>Unmanned Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>AS 235</td>
<td>Unmanned Aircraft Systems Operation and Cross-Country Data Entry</td>
<td>3</td>
</tr>
<tr>
<td>AS 323</td>
<td>Crew Resource Management for UAS</td>
<td>3</td>
</tr>
<tr>
<td>AS 368</td>
<td>UAS Sensing Systems</td>
<td>3</td>
</tr>
<tr>
<td>AS 390</td>
<td>Application of UAS Technology</td>
<td>3</td>
</tr>
<tr>
<td>UA 101</td>
<td>Remote Pilot Operations</td>
<td>1</td>
</tr>
<tr>
<td>UA 201</td>
<td>Mapping Applications and Data Collection with UAS</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Credits**: 17

---

**Unmanned Aircraft Systems (UAS) Public Safety**

The Unmanned Aircraft Systems in Public Safety minor provides students with an understanding of how UAS technologies can support local, state, and federal public safety related operations. Students will gain familiarity with operations, applications, and capabilities of UAS used to support this Industry.
The College of Arts and Sciences is home to several outstanding degree programs and, in addition, is the primary provider of the curricula that fulfill the University’s general education goals. Students may choose to pursue such majors as Communication, Computational Mathematics, Engineering Physics, Homeland Security, Human Factors Psychology, Interdisciplinary Studies, and Space Physics. At the graduate level, the College offers a Master of Science in Data Science, Engineering Physics, and Human Factors. Student may also choose from Ph.D. in Engineering Physics, and a Ph.D. in Human Factors. Minor programs of study are offered in Mathematics as well as many of the major fields.

The College of Arts and Sciences’ primary responsibility is to provide a high-quality educational opportunity to all adequately prepared students. It seeks to inculcate in its students a lifelong love of learning; an appreciation of the cultural, intellectual, and historical impact of the search for truth and knowledge; the opportunity for professional specialization; and emotional and social development through out-of-class experiences. All students are expected to master the skills that enable them to communicate clearly, to understand the logic of mathematics and the methods of scientific inquiry, and to understand their cultural heritage and that of others. The College seeks to develop in its students the ability to think independently, to accept responsibility, to interact with people different from themselves, to assess ideas, to challenge orthodoxies, and to criticize opinions in order to achieve the intellectual, ethical, and aesthetic maturity expected in educated citizens. The College affirms the right of all students to achieve an educational level limited only by their own commitment and ability.

The College endorses the use of non-traditional experiences to enhance learning, including cooperative education, industry internships, study abroad, and undergraduate research involvement. The College participates in the university Honors Program; thus students of exceptional academic promise can experience unique and challenging programs of study. Nationally and internationally renowned research programs provide excellent hands-on opportunities for graduate and undergraduate students.

The College of Arts and Sciences is home to Air Force, Army, and Naval Reserve Officers Training Corps (ROTC). The ROTC programs give students an opportunity to receive military training while pursuing a baccalaureate degree. Several significant scholarships are available for students interested in these excellent programs.

**Degrees**

**Bachelors**
- B.S. in Aerospace Physiology (p. 120)
- B.S. in Astronomy and Astrophysics (p. 123)
- B.S. in Communication (p. 124)
- B.S. in Computational Mathematics (p. 127)
- B.S. in Engineering Physics (p. 128)
- B.S. in Global Conflict Studies (p. 131)
- B.S. in Homeland Security (p. 133)
- B.S. in Human Factors Psychology (p. 135)
- B.S. in Interdisciplinary Studies (p. 138)
- B.S. in Space Physics (p. 142)

**Accelerated Masters Options**
- B.S./M.S. in Engineering Physics (p. 145)
- B.S. in Human Factors Psychology/M.S. in Human Factors (p. 143)

**Combined Masters Options**
- B.S. in Aerospace Engineering/MSHF (p. 146)
- B.S. in Communication/M.B.A. (p. 148)
- B.S. in Computational Math/M.B.A. (p. 149)
- B.S. in Computational Math/M.S.A.F (p. 149)
- B.S. in Global Conflict Studies/M.B.A. (p. 150)
- B.S. in Global Conflict Studies/M.S. in Human Security and Resilience (p. 151)
- B.S. in Homeland Security/M.B.A. (p. 151)
- B.S. in Homeland Security/M.S. in Cybersecurity Management and Policy (p. 152)
- B.S. in Homeland Security/M.S. in Human Security and Resilience (p. 152)
- B.S. in Human Factors Psychology/M.B.A. (p. 153)
- B.S. in Interdisciplinary Studies/M.B.A. (p. 153)

**Masters**
- M.S. in Data Science (p. 155)
- M.S. in Engineering Physics (p. 154)
- M.S. in Human Factors (p. 157)
Ph.D.
Ph.D. in Engineering Physics (p. 158)
Ph.D. in Human Factors (p. 160)

B.S. in Aerospace Physiology
The Bachelor of Science in Aerospace Physiology opens the door to careers in the aerospace life sciences by focusing on the scientific study of physiological processes in extreme environments. This STEM-based course covers anatomy and physiology, molecular and cellular biology, neurophysiology, genetics, microbiology, chemistry, physics, computer programming, and advanced mathematics and statistics.

Combined with clinical rotations and other first-hand experiences, students will be prepared to take advantage of internships during their studies. When they graduate, they'll be ready to advance on either a career or post-graduate track.

Admission Requirements
To enter this program, students must have completed four years of high school science and mathematics, demonstrating a high level of competency.

Degree Requirements
The Aerospace Physiology program comprises 121-122 credits as outlined below.

General Education Requirements
For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

General Education List
Communication Theory and Skills (COM 122, COM 219, COM 221) 9
Lower-Level Humanities 3
Lower-Level Social Sciences 3
Lower or Upper-Level Humanities or Social Sciences 3
Upper-Level Humanities or Social Sciences 3
Computer Science (CS 118 or CS 223 or EGR 115 or CYB 235) 3
Mathematics (MA 140, MA 222) 6

Physical and Life Sciences (BIO, CHM or PS from the core list) 6

Total Credits 36

Core List
BIO 110 Research Methods I 1
BIO 111 Research Symposium 1
BIO 120 Foundations of Biology I 3
BIO 120L Foundations of Biology I Laboratory 1
BIO 121 Foundations of Biology II 3
BIO 121L Foundations of Biology II Lab 1
BIO 210 Research 1
BIO 211 Research 1
BIO 215 Genetics 3
BIO 215L Genetics Laboratory 1
BIO 305 Human Anatomy and Physiology I 3
BIO 305L Human Anatomy & Physiology Laboratory 1
BIO 306 Human Anatomy and Physiology II 3
BIO 306L Human Anatomy and Physiology II Laboratory 1
BIO 310 Research 1
BIO 311 Research 1
BIO 340 Survey of Clinical Instrumentation 3
BIO 405 Molecular and Cell Biology 3
BIO 405L Molecular and Cell Biology Laboratory 1
BIO 410 Research 1
BIO 411 Research Symposium II 1
BIO 440 Clinical Rotation 3
CHM 110 General Chemistry I 3
CHM 110L General Chemistry I Laboratory 1
CHM 111 General Chemistry II 3
CHM 111L General Chemistry II Laboratory 1
HF 300 Human Factors I: Principles and Fundamentals 3
HF 440 Aerospace Physiology 3
PS 113 Introductory Physics I 3
PS 113L Introductory Physics I Laboratory 1
PS 117 Introductory Physics II 3
PS 117L Introductory Physics II Lab 1
UNIV 101  College Success  1
Total Credits  61

Students must select one Track

**Human Physiology Track**

**Specified Electives in Biology and Chemistry (with labs)**

Select one to three courses with lab(s)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 216</td>
<td>Microbiology</td>
<td></td>
</tr>
<tr>
<td>BIO 216L</td>
<td>Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHM 210</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHM 210L</td>
<td>Organic Chemistry I Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHM 310</td>
<td>Biochemistry</td>
<td></td>
</tr>
<tr>
<td>CHM 310L</td>
<td>Biochemistry Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

**Specified Electives in Psychology, Biology, Human Factors, and Other Subject areas**

*Select three to six courses*

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 321</td>
<td>Behavioral Neuroscience I</td>
<td></td>
</tr>
<tr>
<td>BIO 322</td>
<td>Behavioral Neuroscience II</td>
<td></td>
</tr>
<tr>
<td>CHM 211</td>
<td>Organic Chemistry II</td>
<td></td>
</tr>
<tr>
<td>CHM 211L</td>
<td>Organic Chemistry II Laboratory</td>
<td></td>
</tr>
<tr>
<td>ES 315</td>
<td>Space Environment and Effects</td>
<td></td>
</tr>
<tr>
<td>HF 312</td>
<td>Ergonomics and Bioengineering</td>
<td></td>
</tr>
<tr>
<td>HF 321</td>
<td>Psychopharmacology</td>
<td></td>
</tr>
<tr>
<td>HF 326</td>
<td>Human Performance in Extreme Environments</td>
<td></td>
</tr>
<tr>
<td>HF 399</td>
<td>Special Topics in Human Factors</td>
<td></td>
</tr>
<tr>
<td>HF 499</td>
<td>Special Topics in Human Factors</td>
<td></td>
</tr>
<tr>
<td>ME 442</td>
<td>Biofluid Mechanics</td>
<td></td>
</tr>
<tr>
<td>ME 444</td>
<td>Biomechanics</td>
<td></td>
</tr>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
<td></td>
</tr>
<tr>
<td>PSY 310</td>
<td>Sensation and Perception</td>
<td></td>
</tr>
<tr>
<td>PSY 320</td>
<td>Aviation Psychology</td>
<td></td>
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<tr>
<td>PSY 335</td>
<td>Physiological Psychology</td>
<td></td>
</tr>
<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
<td></td>
</tr>
<tr>
<td>SF 355</td>
<td>Industrial Hygiene and Toxicology</td>
<td></td>
</tr>
<tr>
<td>SP 220</td>
<td>Life Support Systems</td>
<td></td>
</tr>
</tbody>
</table>

Total  21

Open Electives - 300-400 Level  9

Total Credits  121-122

* PSY 101 must be taken as a Specified Elective if not completed as a lower level General Education Social Science requirement.

**Suggested Plan of Study**

**Year One**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 110</td>
<td>Research Methods I</td>
<td>1</td>
</tr>
<tr>
<td>BIO 111</td>
<td>Research Symposium</td>
<td>1</td>
</tr>
<tr>
<td>BIO 120</td>
<td>Foundations of Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BIO 120L</td>
<td>Foundations of Biology I Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIO 121</td>
<td>Foundations of Biology II</td>
<td>3</td>
</tr>
<tr>
<td>BIO 121L</td>
<td>Foundations of Biology II Lab</td>
<td>1</td>
</tr>
<tr>
<td>CHM 110</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 110L</td>
<td>General Chemistry I Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Total  21-22
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 111</td>
<td>General Chemistry II</td>
<td>3</td>
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**Suggested Plan of Study - Cellular Physiology and Biochemistry Track**

**Year Two**

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**Specified Electives: Cellular Physiology and Biochemistry Track**

PSY 101 (if not taken as LL SS Gen Ed), BIO 321, BIO 322, CHM 211 & 211L, PSY 310, PSY 320, PSY 335, HF 312, HF 321, HF 326, HF 399, HF 499, SF 315, SF 355, SP 220, ES 315, ME 442, ME 444

**Suggested Plan of Study - Human Physiology Track**

**Year Two**

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<td>or EGR 115</td>
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BIO 306 Human Anatomy and Physiology II 3
BIO 306L Human Anatomy and Physiology II Laboratory 1
COM 219 Speech 3
COM 221 Technical Report Writing 3
Specified Elective Biology & Chemistry (with lab) 4
Specified Elective Human Physiology Track or Biology & Chemistry (with lab) 3-4
Specified Elective Human Physiology Track 3
Credits Subtotal 30.0-31.0

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** Specified Electives in Biology & Chemistry (with labs): Human Physiology Track BIO 216 & BIO 216L; CHM 210 & CHM 210L; CHM 310 & CHM 310L**

** Specified Electives: Human Physiology Track PSY 101 (if not taken as LL SS Gen Ed), BIO 321, BIO 322, CHM 211 & 211L, PSY 310, PSY 320, PSY 335, HF 312, HF 321, HF 326, HF 399, HF 499, SF 315, SF 355, SP 220, ES 315, ME 442, ME 444

** B.S. in Astronomy and Astrophysics **

The Bachelor of Science in Astronomy & Astrophysics has a strong fundamental basis in mathematics and physics. Added to this basis are the General Education components and the specialized courses of the field of study. It takes advantage of our department's observatory facilities, including an instrumented 1 meter telescope (the largest University research telescope in the southeastern United States), and folds them into laboratory components of the program, combining mathematics, physics, optics, astronomy, astrophysics, and instrumentation. The program's strong emphasis on fundamental mathematics and applied sciences provides the flexibility to enter a broad variety of industrial and basic science applications, as well as graduate programs in related fields.

** Admission Requirements **

To enter this program, students must have completed four years of high school science and mathematics, demonstrating a high level of competency. Successful candidates for this program will be prepared to enter Calculus I and Chemistry for Engineers.
Degree Requirements
The Bachelor of Science in Astronomy & Astrophysics degree program requires 120 credit hours. The program can be completed in eight semesters. The courses necessary to earn this degree are listed below. A grade of C or better is required in MA 241/242/243 and PS 226/227/228 or PS 150/160/250 as a prerequisite for entry into all subsequent EP and PS courses.

General Education Requirements
For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

Suggested Plan of Study

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<td>Observational Astronomy</td>
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<td>EP 440</td>
<td>Engineering Electricity and Magnetism</td>
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<td>EP 455</td>
<td>Quantum Mechanics</td>
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<td>PS 405</td>
<td>Atomic Nuclear Physics</td>
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<td>Astrophysics II</td>
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<td>EP 492</td>
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<td>MA 441</td>
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**Credits Total:** 120.0

**B.S. in Communication**

The Bachelor of Science in Communication requires students to integrate knowledge of science and technology with practice in communication. In
this program, students learn how scientists think, how they frame research questions, and how they use various methodologies to pursue their goals. Communication students additionally practice gathering, analyzing, and disseminating scientific and technological information to a variety of audiences. A significant element of the program is the capstone experience, an internship in which students put theory into practice.

As modern society is increasingly influenced by developments in science and technology, the demand for skilled communicators in these fields continues to grow. Aviation, aerospace, and business industries, for example, require more internal communication specialists, as well as professionals in media and public relations, to relay information clearly and accurately. This program addresses that nationwide necessity.

News organizations rely on science communicators in various fields, including meteorology, medicine, technology, and the environment. Communication students have the opportunity to work in traditional media, such as newspapers, magazines, and broadcast media, as well as in digital formats on the web and social media. This program also offers a Broadcast Meteorology track for students who specifically want to become broadcast meteorologists.

The program’s focused, yet flexible, course of study requires students to hone specialized communication skills and positions them to enter career paths such as

1. Communicating science information to specific and general audiences through a variety of mass media,
2. Representing companies and organizations through media relations, using written, oral, and visual media,
3. Communicating news to general audiences through print and electronic media, and
4. Communicating weather-related information to general audiences as broadcast meteorologists.

**Degree Requirements**

The Bachelor of Science degree in Communication requires successful completion of a minimum of 120 credit hours, of which 40 credit hours must be upper-level courses (300-400 level). The Communication program requires coursework in General Education, the Communication Core, Communication Specified Electives, a Minor or a declared track in Broadcast Meteorology, and Open Electives:

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<th>Category</th>
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<td>Communication Core Requirements</td>
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<td>Specified Electives</td>
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<td>Minor or Broadcast Meteorology Track</td>
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<td>Open Electives</td>
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**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education (https://catalog.erau.edu/daytona-beach/general-education) section of this catalog. These minimum requirements are applicable to all degree programs.

*Note: Students in the Broadcast Meteorology Track are advised to take MA 222 as one of their General Education math requirements, as these students will use statistical analyses.*

**Communication Core Requirements**

The Communication core has three components: Required Communication Courses, Aviation and Aerospace Foundation Courses, and Science Foundation Courses.

**Required Courses**

This component of the Communication Core requires students to complete eleven courses, including the following:

<table>
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<td>Introduction to Media</td>
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<td>COM 265</td>
<td>Introduction to News Writing</td>
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<td>Mass Communication Law and Ethics</td>
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<td>Aviation and Aerospace Communication</td>
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<tr>
<td>or COM 410</td>
<td>Advanced Professional Writing</td>
<td>3</td>
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</table>

**College of Arts and Sciences**
COM 362 Communication and Organizational Culture 3

COM 399/499 Special Topics in Communication 3

or CE 396/397 Cooperative Education

COM 415 Nonverbal Communication 3

**Aviation/Aerospace Foundation Courses**

This component of the Communication Core requires students to complete two courses from among the following.

AS 120 Principles of Aeronautical Science
AS 220 Unmanned Aircraft Systems
SF 210 Introduction to Aerospace Safety
SP 110 Introduction to Space Flight
SP 200 Planetary and Space Exploration
SP 210 Space Transportation System
SS 130 History of Aviation in America
WX 301 Aviation Weather *

**Science Foundation Courses**

This component of the Communication Core requires students to complete two courses from among the following.

AS 357 Flight Physiology
BIO 142 Introduction to Environmental Science
HU 302 Contemporary Issues in Science
HU 335 Technology and Modern Civilization
PS 116 Foundations in the Sciences
PS 224 Astronomy
SS/PS 302 Evolution of Scientific Thought
WX 201 Survey of Meteorology *

Total Credits 45

**Specified Electives**

To supplement coursework from the Communication Core, students complete five classes selected from among the following specified electives in Communication, Humanities, and Broadcast.

Select five of the following: 15

COM 230 Digital Photography
COM 268 Sports Writing
COM 325 Mass Media and Current Events

COM 326 Social Media Communication (or COM 326HYB)
COM 364 Visual Design
COM 411 Web Design Workshop
COM 412 Advanced Technical Writing
COM 460 Media Relations II
HU 143 Introduction to Rhetoric
HU 363 Communication and Society
HU 375 The Nature of Language
HU 420 Applied Cross-Cultural Communication
WX 280 Introduction to Broadcast Meteorology

**COM 475** Video Production

Total Credits 15

* Course required for students in the Broadcast Meteorology Track.

**Minor**

Students who are not in the Broadcast Meteorology Track select, in consultation with their advisor, a minor that enhances their knowledge base and increases their job prospects. Total credits in the minor vary, depending on the minor chosen. Suggested minors include:

**Minors** | **Required Credits**
---|---
Aeronautical Studies | 18
Aviation Safety | 18
Business Administration | 18
Foreign Languages | 15
Human Factors | 15
Psychology | 15
International Relations | 15
Space Studies | 15
Marketing | 15

Total Credits 15-18

**Broadcast Meteorology Track**

Students in the Broadcast Meteorology Track must complete the following courses in lieu of a minor:

WX 261 Applied Climatology 3
WX 327 Operational Analysis and Forecasting 3
WX 363 Thunderstorms 3
WX 365  Satellite and Radar Weather Interpretation  3
WX 380  Advanced Broadcast Meteorology  3
WX 361  Global Climate Change  3
or WX 436 Advanced Operational Forecasting

Total Credits  18

Open Electives
Students complete open electives, experiencing the breadth of curriculum offerings of the University or selecting an additional minor.

Open Electives: Total Credits  6-9

Total Degree Credits  120

B.S. in Computational Mathematics
The Bachelor of Science in Computational Mathematics is designed to produce graduates who can operate at the intersection of applied mathematics, computer science and a science applications area. This degree program integrates mathematical modeling, computing and visualization to solve complex problems that arise in the physical, natural, and behavioral sciences as well as engineering. By the end of their second year, students should select an area of concentration that supplements the program core and aligns with their interests and career goals. In the capstone course this background is synthesized and applied to computational models that arise in such areas as atmospheric physics, structural dynamics, or computational fluid dynamics.

Because of the emphasis on applied mathematics, computing tools, and science applications, this program provides an excellent background for graduates to secure entry-level positions in various industries. Mathematics also serves as a respected degree leading to graduate study in many fields.

Program Requirements
UNIV 101  College Success  1
General Education  39
Core  35
Electives  15
Open Electives  30
Total Credits  120

General Education Requirements
For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

Communication Theory & Skills (COM 122, COM 219, COM 221)  9
Lower-Level Humanities  *  3
Lower-Level Social Sciences  *  3
Lower or Upper-Level Humanities or Social Sciences  3
Upper-Level Humanities or Social Sciences  *  3
Computer Science (CS 223 or CS 225 or EGR 115)  3
Mathematics  8
Physical and Life Sciences - one course must include a lab  7

Total Credits  39

Suggested Plan of Study

Year One

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MA 412 Probability and Statistics  3
Physical Science Elective  3
Physical Science Laboratory  1
Elective  3
Lower or Upper-Level Humanities or Social Science Elective  3
Open Elective  6
Credits Subtotal  30.0

Year Three

MA 305 Introduction to Scientific Computing  3
MA 348 Numerical Analysis I  3
MA 413 Statistics  3
MA 432 Linear Algebra  3
MA 441 Mathematical Methods for Engineering and Physics I  3
Elective  6
Upper Level Humanities or Social Science Elective  3
Open Electives  6
Credits Subtotal  30.0

Year Four

MA 490 Capstone Project  3
Elective  6
Open Electives  15
(MA 410 and MA 440) OR (MA 442 and MA 448)  6
Credits Subtotal  30.0
Credits Total:  120.0

* Elective requirement may be met with declaration and completion of any MINOR or TWO DEGREES OF THE SAME RANK or DOUBLE MAJOR. (ROTC courses also acceptable)

B.S. in Engineering Physics

The Bachelor of Science in Engineering Physics is designed to produce graduates with the knowledge and skills of both scientists and engineers. Combining the fields of space systems engineering and space physics, this program focuses on the scientific challenges and planning associated with mission design and research related to the exploration of the space environment, thereby providing an excellent stepping stone into the space program. Additionally, the Engineering Physics program’s strong emphasis on fundamental mathematics, engineering and applied sciences also provides the flexibility to enter a broad variety of engineering and physics applications and graduate programs.

The B.S. Engineering Physics program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. This program supports the University’s purpose “to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship with special emphasis on the needs of aviation, aerospace engineering, and related fields”.

Admission Requirements

To enter this program, students must have completed four years of high school science and mathematics, demonstrating a high level of competency. Successful candidates for this program will be prepared to enter Calculus I and Chemistry for Engineers.

Spacecraft Systems Area of Concentration

The Engineering Physics degree with an area of concentration in Spacecraft Systems is specifically designed for students with interests in space physics, applied mathematics, and aerospace engineering sciences. The student MAY declare a Minor in Applied Mathematics. The math courses required within the BSEP may fulfill the requirements of the Applied Math Minor but the student will be held to Minor Policies, specifically they must complete the minor with a 2.00 GPA or higher. Students of this AOC benefit from a broad education in many disciplines of engineering and physics and graduate as versatile systems engineers and space scientists.

Spacecraft Instrumentation Area of Concentration

The Engineering Physics degree with an area of concentration in Spacecraft Instrumentation is specifically designed for students with interests in space physics, applied mathematics, and electrical engineering. The student MAY declare a Minor in Applied Mathematics. The math courses required within the BSEP may fulfill the requirements of the Applied Math Minor but the student will be held to Minor Policies, specifically they must complete the minor with a 2.00 GPA or higher. Students of this AOC benefit from in-depth training in electrical engineering and space physics, and graduate as
engineers with instrumentation expertise and space scientists.

**Degree Requirements**

The Bachelor of Science in Engineering Physics degree program requires 128 credit hours. A minimum cumulative grade point average of 2.0 is needed for all required EP, PS, ES, CEC, and CS courses, including engineering electives. The program can be completed in eight semesters. The courses necessary to earn this degree are listed below.

Students should be aware that several courses in each academic year may have pre-requisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

**Remaining on Track for Engineering Physics**

A grade of C or better is required in MA 241/242/243 and PS 226/227/228 as a pre-requisite for entry into all subsequent EP and PS courses. Additionally, Engineering Physics students must attain a CGPA of 2.5 or higher in these six courses. Failure to satisfy the above requirement will prevent the student from continuing in the program.

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education section of this catalog. These minimum requirements are applicable to all degree programs.

**Suggested Plan of Study - Spacecraft Systems Area of Concentration**

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**Suggested Plan of Study - Spacecraft Instrumentation Area of Concentration**

**Year One**

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<tr>
<td>MA 442</td>
<td>Mathematical Methods for Engineering and Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PS 290</td>
<td>Physics Laboratory Practicum</td>
<td>0</td>
</tr>
<tr>
<td>Credits Subtotal</td>
<td></td>
<td>31.0</td>
</tr>
</tbody>
</table>

Credits Total: 128
Any of the Embry-Riddle courses listed in the General Education Requirements list can be taken assuming prerequisite requirements are met. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified above in the Engineering Physics vertical outline.

These are the courses that are different from those in the Space Systems Area of Concentration.

Any 3xx-4xx course with one of the following prefixes is an acceptable engineering elective: AE/CEC/CIV/CS/EE/EGR/EP/ES/ME/SE/SYS.

Students may also complete CHM 110L.

B.S. in Global Conflict Studies

The Bachelor of Science in Global Conflict Studies, offers students a variety of courses that use a multidisciplinary approach to provide an understanding of the root causes of human conflict; a knowledge of the history of the major regions of the world and their interactions; the theory behind the management of conflict; the major global security challenges of the day; and a foundation in the methodology, technology, and political processes that attempt to prevent or resolve conflicts. Study-abroad opportunities, language acquisition, and cross-cultural internships provide students with a unique learning experience. The addition of bilingual or multilingual skills in a strategic language gives students the edge to be competitive in the marketplace.

Global Conflict Studies provides a foundation that prepares students who want to live and work in a multicultural environment as: an employee of a homeland defense and security enterprise; a member of the U.S. military; a foreign service officer in the U.S. State Department; an intelligence analyst for the Central Intelligence Agency, the U.S. military or in the private sector; a member of US AID; a volunteer for the Peace Corps; an employee for an international corporation; and a worker for the United Nations, the International Red Cross, or similar nongovernment entities. Global Conflict Studies majors can also succeed at the graduate level in a variety of related fields including history, political science, economics, human resiliency, and conflict resolution.

Degree Requirements

The Bachelor of Science in Global Conflict Studies requires successful completion of a minimum of 120 credit hours and is normally completed in eight semesters. Students can also pursue two of Embry-Riddle’s many minors, including Arabic Studies, Asian Studies, Business Administration, Communication and Broadcast Media, Forensic Accounting, Terrorism Studies, or Homeland Security. Students are also required to complete a 3 hour capstone project and either a 300-hour internship/cooperative education experience or 3 hours of senior thesis.

B.S. in Global Conflict Studies with Two Breadth Areas

| General Education | 36 |
| Global Conflict Studies Core | 30 |
| Breadth Area | 30 |
| Program Support | 24 |
| Total Credits | 120 |

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education section of this catalog. These minimum requirements are applicable to all degree programs.

| Communications Theory and Skills | 9 |
| Computer Science/Information Technology | 3 |
| Humanities/Social Sciences Upper Level | 3 |
| Humanities/Social Science Lower or Upper Elective | 3 |
| Humanities Lower Level | 3 |
| Mathematics | 6 |
| Physical and Life Sciences | 6 |
| Social Sciences Lower Level | 3 |
| Total Credits | 36 |

Core Requirements

| GCS 201 Introduction to Global Conflict Studies | 3 |
| SS 115 Introduction to International Relations | 3 |
| Select nine of the following: |
| CYB 485 War, Terrorism and Diplomacy in Cyberspace | 27 |
Suggested Plan of Study

**Freshman Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
</tr>
<tr>
<td>SS 115</td>
<td>Introduction to International Relations</td>
<td>3</td>
</tr>
<tr>
<td>BA 120</td>
<td>Introduction to Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>MA 120</td>
<td>Quantitative Methods I</td>
<td>3</td>
</tr>
<tr>
<td>SS 110</td>
<td>World History</td>
<td>3</td>
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<tr>
<td>or SS 120</td>
<td>U.S. History</td>
<td></td>
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<tr>
<td>GCS 201</td>
<td>Introduction to Global Conflict Studies</td>
<td>3</td>
</tr>
<tr>
<td>UNIV 101</td>
<td>College Success</td>
<td>1</td>
</tr>
<tr>
<td>HU 14X Elective</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PS 116</td>
<td>Foundations in the Sciences</td>
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<td>MA 220</td>
<td>Quantitative Methods II</td>
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**Sophomore Year**

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</thead>
<tbody>
<tr>
<td>COM 219</td>
<td>Speech</td>
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<tr>
<td>Physical Science Elective with lab</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Upper Level Social Science Electives</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>GCS 304</td>
<td>Political Violence</td>
<td>3</td>
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<tr>
<td>GCS 475</td>
<td>Senior Thesis in Global Conflict Studies</td>
<td>3</td>
</tr>
<tr>
<td>or Co-op (CEGCS 396 or 397)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>or COM 222</td>
<td>Business Communication</td>
<td></td>
</tr>
<tr>
<td>GCS 308</td>
<td>Transnational Crime</td>
<td>3</td>
</tr>
<tr>
<td>GCS 300</td>
<td>International Conflict Resolution</td>
<td>3</td>
</tr>
<tr>
<td>GCS 302</td>
<td>Gender Security</td>
<td>3</td>
</tr>
<tr>
<td>GCS 306</td>
<td>Theories of Nations and Nationalism</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Credits Subtotal</strong></td>
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**Junior Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>GCS 302</td>
<td>Gender Security</td>
<td>3</td>
</tr>
<tr>
<td>GCS 304</td>
<td>Political Violence</td>
<td>3</td>
</tr>
<tr>
<td>GCS 306</td>
<td>Theories of Nations and Nationalism</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
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**Senior Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS 302</td>
<td>Gender Security</td>
<td>3</td>
</tr>
<tr>
<td>GCS 304</td>
<td>Political Violence</td>
<td>3</td>
</tr>
<tr>
<td>GCS 306</td>
<td>Theories of Nations and Nationalism</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
</tr>
</tbody>
</table>

*Students may not use Core courses to fulfill Upper Level Humanities/Social Science Requirement.*
B.S. in Homeland Security

Bachelor of Science

The Department of Security Studies and International Affairs (SSIA) offers a Bachelor of Science degree in Homeland Security (HS) that is based on the needs of the U.S. government and its citizens as well as the needs of the private sector. The HS degree combines the University’s General Education requirements with a solid core of homeland security courses as well as minors in forensic accounting, international relations, terrorism studies, or cybersecurity or several other minors available to the student. In addition, this degree allows the student to take maximum advantage of transfer credits and electives in order to explore breadth in related areas of study.

The Homeland Security degree is designed for students who have an interest in obtaining a strong foundation in many of the domains of the growing homeland security enterprise, including terrorism studies, law and policy, emergency management, risk analysis, intelligence, physical security, environmental security, asymmetric warfare, and decision making/strategic planning. In addition, students can choose one of two ways to specialize their homeland security education; either through (1) taking two minors or (2) one minor and at least a 15 credit “coherent block of courses” (with permission from the HS program coordinator). Senior capstone projects require students to work with local organizations to solve real homeland security or emergency management challenges. Internships or cooperative work experiences optimize the student’s professional preparation and credentials. The goal of the degree is to produce highly marketable graduates with entry-level skills such as the ability to perform risk analyses, write emergency management and continuity of operations plans, design and evaluate exercises, design and perform physical security evaluations, design and deliver professional briefings, and understand how to identify and protect critical infrastructure. Graduates of this program will find employment opportunities in federal or state government, universities, and the military or in the private sector. In addition, the HS program is ideal preparation for further study in graduate school, including law, public policy, or emergency management, intelligence analysis, business, criminal justice, political science, national security studies, international affairs, etc.

Degree Requirements

The Bachelor of Science degree in Homeland Security requires successful completion of a minimum of 124 credit hours and is normally completed in eight semesters as outlined below. The breadth area requirement can be accomplished in a couple of ways, for example:

- Completing two minors (to total a minimum of 30 credit hours)
- Completing one minor and a second coherent set of coursework of at least 15 credits approved through the advising process (to total a minimum of 30 credit hours)

All Homeland Security majors must complete a senior capstone course (HS 490) and a 3 credit (that is at least 300 hours) internship or co-op sometime following their freshman year. All university requirements for eligibility apply and the HS program works with Career Services to administrate all internship experiences.

Students transferring into the program who have earned academic credits in homeland security-related coursework or professional experience may be granted credit hours to be applied to the degree program with approval from the program coordinator.

B.S. in Homeland Security with Two Breadth Areas

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>36</td>
</tr>
<tr>
<td>Homeland Security Core</td>
<td>48</td>
</tr>
<tr>
<td>Breadth Area</td>
<td>30</td>
</tr>
<tr>
<td>Program Support</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>124</strong></td>
</tr>
</tbody>
</table>

College of Arts and Sciences
### General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences (PSY 101 or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (recommend MA 120 and MA 220)</td>
<td>6</td>
</tr>
<tr>
<td>Physical Science (lab must be included)</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

**Homeland Security Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYB 155</td>
<td>Foundations of Information Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 110</td>
<td>Introduction to Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 215</td>
<td>Introduction to Industrial Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 220</td>
<td>National Security Enterprise</td>
<td>3</td>
</tr>
<tr>
<td>HS 310</td>
<td>Fundamentals of Emergency Management</td>
<td>3</td>
</tr>
<tr>
<td>HS 315</td>
<td>Critical Infrastructure Security, Resilience, and Risk Analysis</td>
<td>3</td>
</tr>
<tr>
<td>HS 320</td>
<td>Homeland Security Law and Policy</td>
<td>3</td>
</tr>
<tr>
<td>HS 325</td>
<td>Terrorism: Origin, Ideologies, and Goals</td>
<td>3</td>
</tr>
<tr>
<td>HS 350</td>
<td>Intelligence Systems and Structures in Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 360</td>
<td>Strategic Planning and Decision Making in Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 405</td>
<td>Emergent Topics in Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 410</td>
<td>Exercise Design and Evaluation in Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>HS 490</td>
<td>Senior Capstone in Homeland Security</td>
<td>3</td>
</tr>
<tr>
<td>CEHS 396</td>
<td>Cooperative Education (CEHS 396)</td>
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<tr>
<td>Specified Electives</td>
<td>6</td>
<td></td>
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<tr>
<td>GCS 302</td>
<td>Gender Security</td>
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</table>

**Total Credits**

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

* Students with a 2.5 CGPA or higher may enroll in the cooperative education or internship program at the equivalent of three or more credits to be taken during or after their sophomore year. Student must see their advisor and meet with the Career Services Office prior to enrollment. Students unable to take CEHS 396 may substitute HS 491 (Thesis) with prior approval of HS Program Coordinator.

**Program Support**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIV 101</td>
<td>College Success</td>
<td>1</td>
</tr>
<tr>
<td>SF 201</td>
<td>Introduction to Health, Occupational, and Transportation Safety or SF 210</td>
<td>3</td>
</tr>
<tr>
<td>GEO 210</td>
<td>Introduction to Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics (or equivalent)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

**Breadth Area**

All Homeland Security majors are required to complete coursework to compliment the HS core courses. Students are strongly encouraged to complete their breadth requirement by two minors (minimum 30 credits total) or one minor and a “coherent block of credits” (minimum 30 credits total) which is determined with consent of Homeland Security advisor. All minors are located in the Minor Course of Studies section of this catalog.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 290</td>
<td>Introduction to Environmental Security</td>
<td></td>
</tr>
<tr>
<td>HS 340</td>
<td>Aviation Transportation Security</td>
<td></td>
</tr>
<tr>
<td>HS 342</td>
<td>Maritime Security</td>
<td></td>
</tr>
<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
<td></td>
</tr>
<tr>
<td>SF 355</td>
<td>Industrial Hygiene and Toxicology</td>
<td></td>
</tr>
<tr>
<td>SF 355</td>
<td>Industrial Hygiene and Toxicology</td>
<td></td>
</tr>
<tr>
<td>SF 405</td>
<td>Applications in Industrial Hygiene</td>
<td></td>
</tr>
<tr>
<td>SF 462</td>
<td>Health, Safety, and Aviation Law</td>
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</tr>
</tbody>
</table>

* 48 credits total
## Suggested Plan of Study

### Freshman Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>3 English Composition</td>
</tr>
<tr>
<td>CYB 235</td>
<td>3 Computer and Network Technologies</td>
</tr>
<tr>
<td>or CS 118</td>
<td>Fundamentals of Computer Programming</td>
</tr>
<tr>
<td>or CS 120</td>
<td>Introduction to Computing in Aviation</td>
</tr>
<tr>
<td>or BA 120</td>
<td>Introduction to Computer Based Systems</td>
</tr>
<tr>
<td>HS 110</td>
<td>3 Introduction to Homeland Security</td>
</tr>
<tr>
<td>CYB 155</td>
<td>3 Foundations of Information Security</td>
</tr>
<tr>
<td>HU 14X Elective</td>
<td>3</td>
</tr>
<tr>
<td>MA 120</td>
<td>3 Quantitative Methods I</td>
</tr>
<tr>
<td>Physical Science Lecture with lab</td>
<td>4</td>
</tr>
<tr>
<td>SF 201</td>
<td>3 Introduction to Health, Occupational, and Transportation Safety</td>
</tr>
<tr>
<td>or SF 210</td>
<td>Introduction to Aerospace Safety</td>
</tr>
<tr>
<td>HS 215</td>
<td>3 Introduction to Industrial Security</td>
</tr>
<tr>
<td>PSY 101</td>
<td>3 Introduction to Psychology</td>
</tr>
<tr>
<td>UNIV 101</td>
<td>1 College Success</td>
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<td><strong>Credits Subtotal</strong></td>
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### Sophomore Year

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>COM 219</td>
<td>3 Speech</td>
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<tr>
<td>COM 221</td>
<td>3 Technical Report Writing</td>
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<tr>
<td>or COM 222</td>
<td>Business Communication</td>
</tr>
<tr>
<td>Specified Electives (See published list)</td>
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<tr>
<td>HS 220</td>
<td>3 National Security Enterprise</td>
</tr>
<tr>
<td>HS 310</td>
<td>3 Fundamentals of Emergency Management</td>
</tr>
<tr>
<td>Lower or Upper Level Humanities or Social Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>MA 220</td>
<td>3 Quantitative Methods II</td>
</tr>
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<td>Physical Science Lecture</td>
<td>3</td>
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<tr>
<td>GEO 210</td>
<td>3 Introduction to Geographic Information Systems</td>
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### Junior Year

<table>
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<tbody>
<tr>
<td>HS 315</td>
<td>3 Critical Infrastructure Security, Resilience, and Risk Analysis</td>
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<tr>
<td>HS 320</td>
<td>3 Homeland Security Law and Policy</td>
</tr>
<tr>
<td>HS 325</td>
<td>3 Terrorism: Origin, Ideologies, and Goals</td>
</tr>
<tr>
<td>HS 350</td>
<td>3 Intelligence Systems and Structures in Homeland Security</td>
</tr>
<tr>
<td>HS 360</td>
<td>3 Strategic Planning and Decision Making in Homeland Security</td>
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<tr>
<td>MA 222</td>
<td>3 Business Statistics</td>
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<td>CEHS 396 or HS 491</td>
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<td><strong>Credits Subtotal (Two Minors)</strong></td>
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### Senior Year

<table>
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<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>Upper Level Humanities or Social Science Elective</td>
<td>3</td>
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<tr>
<td>HS 405</td>
<td>3 Emergent Topics in Homeland Security</td>
</tr>
<tr>
<td>HS 410</td>
<td>3 Exercise Design and Evaluation in Homeland Security</td>
</tr>
<tr>
<td>HS 490</td>
<td>3 Senior Capstone in Homeland Security</td>
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<tr>
<td>Breadth Area (Two Minors)</td>
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<td><strong>Credits Total:</strong></td>
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</tr>
</tbody>
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### B.S. in Human Factors Psychology

The Bachelor of Science degree in Human Factors Psychology emphasizes human behavior, ergonomics, and human capabilities. The program seeks to develop a student with the capacity to design, conduct, and apply human factors research to the design of simple and complex systems. The goal of the program is to educate and graduate professionals who are equipped for employment as human factors specialists or to continue their education in graduate school.

Human Factors Psychology is an applied discipline that develops knowledge concerning the abilities and limitations of humans to sense, store, and process information, as well as to act. This knowledge is applied to the design, use, and maintenance of human/machine systems. Depending on its goals, the system is then optimized with respect to human performance. The environmental factors affecting system performance are recognized as important...
and are considered systematically. When relevant data are not available, they must be uncovered through research efforts. This requires considerable skill in experimental design and quantitative methodology. Students will receive training in the content and techniques of human factors, including statistical and quantitative procedures, experimental design and survey methods.

**Degree Requirements**

The Bachelor of Science in Human Factors Psychology can be earned in eight semesters assuming appropriate background and fulltime enrollment. Successful completion of a minimum of 123 credit hours is required, with a CGPA of 2.0 or higher. For Human Factors Psychology majors, all HF and PSY courses must be passes with a grade of C or better.

Students are encouraged to choose a minor field of study. Minors that complement Human Factors are Air Traffic Control, Aviation Safety, Computer Science, Flight, and Mathematics. Most minors can be accommodated within the 18 hours of open electives required in the program.

Students will be encouraged to have an applied practicum experience. This requirement may be fulfilled in several ways, including co-ops, internships, or working on an on-campus research team. Practicums provide opportunities to gain practical experience in real-world settings. A practicum experience is highly regarded by employers and increases the student’s employment potential after graduation. Typically, students will engage in practical experience activities toward the end of the degree program so they can take maximum advantage of their undergraduate experience.

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences (PSY 101)</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>6</td>
</tr>
<tr>
<td>Physical and Life Sciences (one course must include a laboratory)</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credits</td>
<td>36</td>
</tr>
</tbody>
</table>

Embry-Riddle courses in general education may be chosen from those listed below, assuming prerequisites are met. Courses from other institutions are acceptable if they fall into these broad categories.

**Core Requirements**

**College Success**

UNIV 101 College Success 1

**Advanced Communication**

For the Advanced Communication requirement, Human Factors majors are required to take one Advanced Communication class for a total of three credits. This exists in addition to the nine credits (three classes) taken for the Communication General Education Requirement.

Select one of the following: 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 320</td>
<td>Mass Communication Law and Ethics</td>
</tr>
<tr>
<td>COM 322</td>
<td>Aviation and Aerospace Communication</td>
</tr>
<tr>
<td>COM 350</td>
<td>Environmental Communication</td>
</tr>
<tr>
<td>COM 360</td>
<td>Media Relations I</td>
</tr>
<tr>
<td>COM 362</td>
<td>Communication and Organizational Culture</td>
</tr>
<tr>
<td>COM 364</td>
<td>Visual Design</td>
</tr>
<tr>
<td>COM 410</td>
<td>Advanced Professional Writing</td>
</tr>
<tr>
<td>COM 411</td>
<td>Web Design Workshop</td>
</tr>
<tr>
<td>COM 412</td>
<td>Advanced Technical Writing</td>
</tr>
<tr>
<td>COM 415</td>
<td>Nonverbal Communication</td>
</tr>
<tr>
<td>COM 460</td>
<td>Media Relations II</td>
</tr>
<tr>
<td>HU 330</td>
<td>Values and Ethics</td>
</tr>
<tr>
<td>HU 335</td>
<td>Technology and Modern Civilization</td>
</tr>
<tr>
<td>HU 338</td>
<td>Traversing the Borders: Interdisciplinary Explorations</td>
</tr>
<tr>
<td>HU 363</td>
<td>Communication and Society</td>
</tr>
<tr>
<td>HU 375</td>
<td>The Nature of Language</td>
</tr>
<tr>
<td>HU 415</td>
<td>Nonverbal Communication</td>
</tr>
</tbody>
</table>
### Computer Science

Six credit hours from any CS course or from the additional courses listed below. These courses are in addition to those taken as General Education.

Select two of the following: 6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 120</td>
<td>Introduction to Computer Based Systems</td>
</tr>
<tr>
<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
</tr>
<tr>
<td>CEC 220</td>
<td>Digital Circuit Design</td>
</tr>
<tr>
<td>CEC 222</td>
<td>Digital Circuit Design Laboratory</td>
</tr>
<tr>
<td>CYB 235</td>
<td>Computer and Network Technologies</td>
</tr>
<tr>
<td>EGR 115</td>
<td>Introduction to Computing for Engineers</td>
</tr>
<tr>
<td>EGR 120</td>
<td>Graphical Communications</td>
</tr>
<tr>
<td>SE 300</td>
<td>Software Engineering Practices</td>
</tr>
</tbody>
</table>

### Psychology and Human Factors

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF 300</td>
<td>Human Factors I: Principles and Fundamentals</td>
</tr>
<tr>
<td>HF 302</td>
<td>Human Factors II: Analytic Methods and Techniques</td>
</tr>
<tr>
<td>HF 306</td>
<td>Human Factors III: Performance Processes</td>
</tr>
<tr>
<td>HF 310</td>
<td>Human-Computer Interaction</td>
</tr>
<tr>
<td>HF 312</td>
<td>Ergonomics and Bioengineering</td>
</tr>
<tr>
<td>HF 400</td>
<td>Human Factors IV: System Design</td>
</tr>
<tr>
<td>PSY 310</td>
<td>Sensation and Perception</td>
</tr>
<tr>
<td>PSY 312</td>
<td>Research Analysis in Psychology</td>
</tr>
<tr>
<td>PSY 315</td>
<td>Cognitive Psychology</td>
</tr>
<tr>
<td>PSY 322</td>
<td>Research Design</td>
</tr>
<tr>
<td>PSY 335</td>
<td>Physiological Psychology</td>
</tr>
</tbody>
</table>

### Practicum

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF 490</td>
<td>Practicum in Human Factors Psychology</td>
</tr>
</tbody>
</table>

| Total Credits      | 51 |

### Specified Electives

Take three courses from each of the following two groups of courses (18 credit hours total).

#### Group I: Applied Systems in Human Factors 9

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF 315</td>
<td>Automation and Systems Issues in Aviation</td>
</tr>
<tr>
<td>HF 321</td>
<td>Psychopharmacology</td>
</tr>
<tr>
<td>HF 325</td>
<td>Human Factors and System Safety</td>
</tr>
<tr>
<td>HF 326</td>
<td>Human Performance in Extreme Environments</td>
</tr>
<tr>
<td>HF 330</td>
<td>Human Factors in Space</td>
</tr>
<tr>
<td>HF 352</td>
<td>Human Factors in Entertainment Systems</td>
</tr>
<tr>
<td>HF 410</td>
<td>Human Factors Engineering: Crew Station Design</td>
</tr>
<tr>
<td>HF 412</td>
<td>Simulating Humans in Complex Systems</td>
</tr>
<tr>
<td>HF 415</td>
<td>Human Factors in Simulation Systems</td>
</tr>
<tr>
<td>HF 422</td>
<td>Applied Ergonomic Design, Analysis, and Evaluation</td>
</tr>
<tr>
<td>HF 440</td>
<td>Aerospace Physiology</td>
</tr>
</tbody>
</table>

#### Group II: Psychological Foundations of Human Factors 9

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 320</td>
<td>Aviation Psychology</td>
</tr>
<tr>
<td>PSY 330</td>
<td>Learning and Motivation</td>
</tr>
<tr>
<td>PSY 340</td>
<td>Industrial-Organizational Psychology</td>
</tr>
<tr>
<td>PSY 345</td>
<td>Training and Development</td>
</tr>
<tr>
<td>PSY 350</td>
<td>Social Psychology</td>
</tr>
<tr>
<td>PSY 352</td>
<td>Personality: A Systems Approach</td>
</tr>
<tr>
<td>PSY 365</td>
<td>Abnormal Psychology</td>
</tr>
<tr>
<td>Other courses with approval of advisor.</td>
<td></td>
</tr>
</tbody>
</table>

| Total Specified Elective Credits | 18 |

### Open Elective Credits 18

| Total Elective Credits | 36 |

| Total Degree Credits | 123 |

### Suggested Plan of Study

Students should be aware that several courses in each academic year may have prerequisites and/or co-requisites. Please check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.
### Year One

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>UNIV 101</td>
<td>1</td>
</tr>
<tr>
<td>COM 122</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>3</td>
</tr>
<tr>
<td>CS 120</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>3</td>
</tr>
<tr>
<td>CS 120</td>
<td>3</td>
</tr>
<tr>
<td>MA 111</td>
<td>3</td>
</tr>
<tr>
<td>MA 112</td>
<td>3</td>
</tr>
<tr>
<td>BIO 120</td>
<td>3</td>
</tr>
<tr>
<td>BIO 120L</td>
<td>0-1</td>
</tr>
<tr>
<td>PSY 101</td>
<td>3</td>
</tr>
<tr>
<td>HF 300</td>
<td>3</td>
</tr>
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</table>

**Credits Subtotal:** 28.0-29.0

### Year Two

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 221</td>
<td>3</td>
</tr>
<tr>
<td>HF 302</td>
<td>4</td>
</tr>
<tr>
<td>PSY 312</td>
<td>4</td>
</tr>
<tr>
<td>PSY 312L</td>
<td>0</td>
</tr>
<tr>
<td>PSY 335</td>
<td>3</td>
</tr>
<tr>
<td>Physical Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>HF/PSY Specified Elective</td>
<td>3</td>
</tr>
<tr>
<td>Open Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

**Credits Subtotal:** 28.0-29.0

### Year Three

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF 306</td>
<td>4</td>
</tr>
<tr>
<td>HF 310</td>
<td>3</td>
</tr>
<tr>
<td>HF 312</td>
<td>3</td>
</tr>
<tr>
<td>HF 490</td>
<td>3</td>
</tr>
<tr>
<td>PSY 322</td>
<td>4</td>
</tr>
</tbody>
</table>

**Credits Subtotal:** 32.0

### Year Four

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF 400</td>
<td>4</td>
</tr>
<tr>
<td>PSY 315</td>
<td>3</td>
</tr>
<tr>
<td>PSY 310</td>
<td>3</td>
</tr>
<tr>
<td>PSY 310</td>
<td>3</td>
</tr>
<tr>
<td>HF/PSY Specified Electives</td>
<td>12</td>
</tr>
<tr>
<td>Open Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

**Credits Subtotal:** 31.0

**Credits Total:** 123.0-124.0

---

### B.S. in Interdisciplinary Studies

**Program Plan of Study and Requirements**

The Interdisciplinary Studies program consists of core requirements, in addition to two or three minors. Students who complete two minors must also have a breadth area, a group of courses closely related to one or more of their minors. The program allows students to design their own degree programs based on their interests and aptitudes and gives them experience in planning their own futures. Interdisciplinary Studies seeks to produce students with an entrepreneurial spirit who cross boundaries, make creative connections, and become leaders in aviation, aerospace, and related industries. The core requirements in this program help students become global thinkers who understand that information and skills gleaned from one area of life can be applied to other areas and prepare students to connect their minors and breadth area in meaningful and useful ways. The program responds directly to calls by global corporate leaders for graduates who understand both technology and human beings. To that end, core courses aim to enhance communication and analytical abilities and to help students gain an understanding of the humanities, business, aviation, ethics, globalization, and communication. The interdisciplinary nature of the degree allows graduates to be more adaptable to the changing market demands. The degree culminates in a senior capstone requirement, either a co-op experience, providing students with “real-world” experience, or Senior Thesis, offering
students an opportunity to build an impressive career portfolio.

Students meet regularly with the interdisciplinary studies program coordinator or faculty advisors to check course descriptions and prerequisites and/or co-requisites to ensure appropriate sequencing and to develop and revise their individual plan for degree completion. This plan involves evaluating their career objectives and selecting two to three appropriate minors, with an area of breadth if selecting two minors.

**Degree Requirements**

The Bachelor of Science degree in Interdisciplinary Studies requires successful completion of a minimum of 120 credit hours. Included in the 120 credit hours must be 40 credit hours of upper-division courses (300-400 level).

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>6</td>
</tr>
<tr>
<td>Physical and Life Sciences</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

**Communication Theory and Skills**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>Speech</td>
<td>3</td>
</tr>
<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>COM 222</td>
<td>Business Communication</td>
<td>3</td>
</tr>
</tbody>
</table>

**Humanities**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower-Level</td>
<td></td>
</tr>
<tr>
<td>HU 140 Western Humanities I: Antiquity and the Middle Ages</td>
<td></td>
</tr>
<tr>
<td>HU 141 Western Humanities II: Renaissance to Postmodern</td>
<td></td>
</tr>
<tr>
<td>HU 142 Studies in Literature</td>
<td></td>
</tr>
<tr>
<td>HU 143 Introduction to Rhetoric</td>
<td></td>
</tr>
<tr>
<td>HU 144 Studies in Art</td>
<td></td>
</tr>
<tr>
<td>HU 145 Themes in the Humanities</td>
<td></td>
</tr>
<tr>
<td>HU 146 Music Appreciation and Criticism</td>
<td></td>
</tr>
</tbody>
</table>

**Social Sciences**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower-Level</td>
<td></td>
</tr>
<tr>
<td>EC 200 An Economic Survey</td>
<td></td>
</tr>
<tr>
<td>EC 210 Microeconomics</td>
<td></td>
</tr>
<tr>
<td>EC 211 Macroeconomics</td>
<td></td>
</tr>
<tr>
<td>PSY 101 Introduction to Psychology</td>
<td></td>
</tr>
<tr>
<td>SS 110 World History</td>
<td></td>
</tr>
<tr>
<td>SS 120 U.S. History</td>
<td></td>
</tr>
<tr>
<td>SS 130 History of Aviation in America</td>
<td></td>
</tr>
</tbody>
</table>

**Upper-Level**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 302 Evolution of Scientific Thought</td>
<td></td>
</tr>
<tr>
<td>SS 311 U.S Military History 1775-1900</td>
<td></td>
</tr>
<tr>
<td>SS 321 U.S. Military History 1900-Present</td>
<td></td>
</tr>
<tr>
<td>SS 325 International Studies</td>
<td></td>
</tr>
<tr>
<td>SS 326 Russian-U.S. Relations</td>
<td></td>
</tr>
<tr>
<td>SS 331 Current Issues in America</td>
<td></td>
</tr>
<tr>
<td>SS 333 U.S. - Asian Relations</td>
<td></td>
</tr>
<tr>
<td>SS 334 Contemporary Africa and the World</td>
<td></td>
</tr>
<tr>
<td>SS 336 The Modern Middle East in World Affairs</td>
<td></td>
</tr>
<tr>
<td>SS 337 Globalization and World Politics</td>
<td></td>
</tr>
<tr>
<td>SS 340 Modern U.S. Foreign Policy</td>
<td></td>
</tr>
<tr>
<td>SS 353 Early U.S. Foreign Policy</td>
<td></td>
</tr>
<tr>
<td>SS 363 Inter-American Relations</td>
<td></td>
</tr>
</tbody>
</table>

**Interdisciplinary Core Requirements**

**Aviation/Aerospace Foundation**

Select one of the following: 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
<td></td>
</tr>
<tr>
<td>SP 110</td>
<td>Introduction to Space Flight</td>
<td></td>
</tr>
<tr>
<td>SS 130</td>
<td>History of Aviation in America</td>
<td></td>
</tr>
</tbody>
</table>

Private Pilot Certificate

**Management Foundation**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td></td>
</tr>
</tbody>
</table>

**Global Focus**

Select two of the following: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>BA 335</td>
<td>International Business</td>
<td></td>
</tr>
<tr>
<td>BA 427</td>
<td>Management of Multicultural Workforce</td>
<td></td>
</tr>
<tr>
<td>GCS 300</td>
<td>International Conflict Resolution</td>
<td></td>
</tr>
<tr>
<td>GCS 302</td>
<td>Gender Security</td>
<td></td>
</tr>
<tr>
<td>GCS 306</td>
<td>Theories of Nations and Nationalism</td>
<td></td>
</tr>
<tr>
<td>HU 300</td>
<td>World Literature</td>
<td></td>
</tr>
<tr>
<td>HU 341</td>
<td>World Philosophy</td>
<td></td>
</tr>
<tr>
<td>HU 345</td>
<td>Comparative Religions</td>
<td></td>
</tr>
<tr>
<td>HU 363</td>
<td>Communication and Society</td>
<td></td>
</tr>
<tr>
<td>SS 322</td>
<td>Modern Russian History</td>
<td></td>
</tr>
<tr>
<td>SS 325</td>
<td>International Studies</td>
<td></td>
</tr>
<tr>
<td>SS 326</td>
<td>Russian-U.S. Relations</td>
<td></td>
</tr>
<tr>
<td>SS 333</td>
<td>U.S.- Asian Relations</td>
<td></td>
</tr>
<tr>
<td>SS 334</td>
<td>Contemporary Africa and the World</td>
<td></td>
</tr>
<tr>
<td>SS 336</td>
<td>The Modern Middle East in World Affairs</td>
<td></td>
</tr>
<tr>
<td>SS 337</td>
<td>Globalization and World Politics</td>
<td></td>
</tr>
</tbody>
</table>

**Study Abroad course(s) with permission of advisor**

**Philosophical Perspectives**

Select one of the following: 3

Cannot duplicate courses from any other category

- HU 330 Values and Ethics
- HU 341 World Philosophy
- HU 345 Comparative Religions

**Enhanced Communication/Humanities**

Select three of the following: 9

Cannot duplicate courses from any other core category

One course must be an Upper Level Communications course

- COM 319 Advanced Speech
- COM 320 Mass Communication Law and Ethics
- COM 322 Aviation and Aerospace Communication
- COM 325 Mass Media and Current Events
- COM 326 Social Media Communication
- COM 350 Environmental Communication
- COM 360 Media Relations I
- COM 362 Communication and Organizational Culture
- COM 410 Advanced Professional Writing
- COM 411 Web Design Workshop
- COM 412 Advanced Technical Writing
- COM 415 Nonverbal Communication
- COM 460 Media Relations II
- COM 399 Special Topics in Communication
- COM 475 Video Production
- COM 499 Special Topics in Communication

**Research Methods**

Select one of the following: 3

- BA 355 Marketing Research
- COM 270 Communication Research Theory and Methods
- COM 415 Nonverbal Communication
- HF 300 Human Factors I: Principles and Fundamentals
- HU 415 Nonverbal Communication
- PSY 322 Research Design

**Capstone Experience**

Select one of the following: 3

- CE 396/397 Cooperative Education
- HU 475 Senior Thesis

**Total Credits: 30**
Interdisciplinary Studies Minor/Breadth Area

Requirements

Minors

Students must select two or three minor areas of study. If they choose two minors, they must also complete a breadth area. Required credits for minors vary.

Breadth Area

If students choose to complete two, rather than three minors, they must have a breadth area consisting of a coherent block of 15 credits, six (6) of which must be upper-level courses. Breadth areas must be approved by the IS advisor.

Total Credits

45/54

Open Electives

0-9

Total Degree Credits

120

Suggested Plan of Study - Common Year One and Year Two

Three Minors choice

Year One

<table>
<thead>
<tr>
<th>Credits</th>
<th>Year Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
</tr>
<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
</tr>
<tr>
<td>or SP 110</td>
<td>Introduction to Space Flight</td>
</tr>
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<td>Speech</td>
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<tr>
<td>CS 118</td>
<td>Fundamentals of Computer Programming</td>
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<tr>
<td>or EGR 115</td>
<td>Introduction to Computing for Engineers</td>
</tr>
<tr>
<td>or BA 120</td>
<td>Introduction to Computer Based Systems</td>
</tr>
<tr>
<td>or CS 223</td>
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<tr>
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<td>BA 201</td>
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<td>HU 330 Values and Ethics</td>
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<tr>
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<td></td>
<td>BA 355 Marketing Research</td>
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<td>or COM 270 Communication Research Theory and Methods</td>
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<td>or HF 300 Human Factors I: Principles and Fundamentals</td>
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<td>or PSY 322 Research Design</td>
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Suggested Plan of Study - Common Year One and Year Two

Three Minors choice

Year One

<table>
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<tr>
<th>Credits</th>
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<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
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<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
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<td>Introduction to Space Flight</td>
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<td>or SS 130</td>
<td>History of Aviation in America</td>
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<td>CS 118</td>
<td>Fundamentals of Computer Programming</td>
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<td>HU 330 Values and Ethics</td>
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<td>or HU 341 World Philosophy</td>
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<td>or HU 345 Comparative Religions</td>
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<td>Enhanced Communication/ Humanities Electives</td>
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<td>CE 396 Coop</td>
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<td>Enhanced Communication/ Humanities Elective</td>
</tr>
<tr>
<td></td>
<td>HU 475 Senior Thesis (if unable to complete Coop/Internship)</td>
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</tbody>
</table>
Open Electives (dependent on Minors or Breadth area) 5-9

Credits Subtotal 29.0-42.0

Credits Total: 120

B.S. in Space Physics

The Bachelor of Science in Space Physics is designed to produce graduates who want to pursue careers in space-related professions or who want to pursue advanced studies in diverse areas of science and engineering. This program supports the University’s purpose “to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship with special emphasis on the needs of aviation, aerospace engineering, and related fields.”

As defined by NASA, “Space Physics is the scientific study of magnetic and electric phenomena that occur in outer space, in the upper atmosphere of planets, and on the Sun. Space physicists use ground-based instruments, balloons, rockets, satellites, and deep space probes to study these phenomena where they occur.” Examples of such studies include space shuttle aurora observations, ground-based solar studies, ground-based ionospheric studies, balloon flights to the edge of the atmosphere, and sounding rocket flights into near space.

The program shares its facilities and some coursework with the Engineering Physics and Astronomy & Astrophysics programs.

Admission Requirements

To enter this program, students must have completed four years of high school science and mathematics, demonstrating a high level of competency. Successful candidates for this program will be prepared to enter Calculus I and Chemistry for Engineers.

Degree Requirements

The Bachelor of Science in Space Physics degree program requires 121 credit hours. A minimum cumulative grade point average of 2.0 is needed for all required EP and PS courses, including technical electives. The program can be completed in eight semesters. The courses necessary to earn this degree are listed below. Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

A grade of C or better is required to satisfy lower-level prerequisites for entry into all EP and PS courses.

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

Suggested Plan of Study

Year One

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>EP 101</td>
<td>Current Topics in Space Science</td>
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</tr>
<tr>
<td>MA 241</td>
<td>Calculus and Analytical Geometry I</td>
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<tr>
<td>MA 242</td>
<td>Calculus and Analytical Geometry II</td>
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<tr>
<td>CHM 140</td>
<td>Chemistry for Engineers</td>
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<tr>
<td>CHM 140L</td>
<td>Chemistry for Engineers Laboratory</td>
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<tr>
<td></td>
<td>Communication Theory and Skills</td>
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<tr>
<td>PS 226</td>
<td>Physics I</td>
<td>3</td>
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<tr>
<td>PS 226L</td>
<td>Physics I Laboratory</td>
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<td>Lower-Level Humanities</td>
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<td>Lower-Level Social Sciences</td>
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Year Two

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<td>EGR 115</td>
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<td>MA 243</td>
<td>Calculus and Analytical Geometry III</td>
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<td>MA 345</td>
<td>Differential Equations and Matrix Methods</td>
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<td>Communication Theory and Skills</td>
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<td>PS 227</td>
<td>Physics II</td>
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<td>PS 228</td>
<td>Physics III</td>
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<td>PS 228L</td>
<td>Physics III Laboratory</td>
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<td>Lower or Upper-Level Humanities or Social Science Elective</td>
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</table>
Open Electives  
Credits Subtotal  30.0

**Year Three**
- EP 320  Electro-Optical Engineering  3
- EP 393  Spaceflight Dynamics  3
- EP 400  Thermodynamics and Statistical Mechanics  3
- MA 441  Mathematical Methods for Engineering and Physics I  3
- MA 442  Mathematical Methods for Engineering and Physics II  3
- PS 303  Modern Physics  3
- PS 305  Modern Physics Laboratory  1
- PS 320  Classical Mechanics  3
- Open Elective  6
- Upper-Level Humanities or Social Science Elective  3

Credits Subtotal  31.0

**Year Four**
- EP 410  Space Physics  3
- EP 411  Space Physics II  3
- EP 440  Engineering Electricity and Magnetism  3
- EP 455  Quantum Mechanics  3
- EP 492  Senior Project  3
- PS 400  Senior Physics Laboratory I  3
- PS 405  Atomic Nuclear Physics  3
- Technical Electives  6

Credits Subtotal  30.0

Credits Total:  121

* Embry-Riddle courses in the General Education categories of Communication Theory and Skills, Humanities and Social Sciences and the Technical Electives may be chosen from the approved list of courses, assuming prerequisite requirements are met. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified in the Space Physics vertical outline.

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**Accelerated Arts and Sciences Options**

**Accelerated Masters Options**
- B.S./M.S. in Engineering Physics (p. 145)
- B.S. in Human Factors Psychology/M.S. in Human Factors (p. 143)

**B.S. in Human Factors Psychology/ M.S. in Human Factors**

In conjunction with the Bachelor of Science in Human Factors Psychology and the traditional master’s degree in Human Factors, the Department of Human Factors and Systems also offers a combined master’s degree program in Human Factors. The combined master’s program offers upper-level undergraduates in the major the chance to begin their graduate work while completing their bachelor’s degree program. All undergraduate Human Factors students who meet eligibility requirements that include a CGPA of 3.20, junior-year standing and completion of the GRE may apply for consideration for admission.

Student applications will be reviewed for the program, and students accepted into the five-year master’s program will be notified of such at the end of their junior year. During their senior undergraduate year, they will take HFS 510 and HFS 610 Five-year master’s students are required to complete 30 credits of graduate work to complete the degree program.

All undergraduate Psychology and Human Factors courses must be passed with a “C” or better to count towards degree completion. Graduate courses used to satisfy both the BS and MS degree requirements must be passed with a “B” or better.

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

**Communication Theory and Skills**  9
**Lower-Level Humanities**  3
**Lower-Level Social Sciences (PSY 101)**  3
**Lower or Upper-Level Humanities or Social Sciences**  3
Upper-Level Humanities or Social Sciences 3  
Computer Science 3  
Mathematics 6  
Physical and Life Sciences (one course must include a laboratory) 6  

Total Credits 36

Embry-Riddle courses in general education may be chosen from the approved list of General Education courses, assuming prerequisites are met. Courses from other institutions are acceptable if they fall into these broad categories.

Core Requirements

College Success

UNIV 101 College Success 1

Advanced Communication

For the Advanced Communication requirement, Human Factors majors are required to take one Advanced Communication class for a total of three credits. This exists in addition to the nine credits (three classes) taken for the Communication General Education Requirement.

Select one of the following: 3

- COM 320 Mass Communication Law and Ethics
- COM 322 Aviation and Aerospace Communication
- COM 350 Environmental Communication
- COM 360 Media Relations I
- COM 362 Communication and Organizational Culture
- COM 364 Visual Design
- COM 410 Advanced Professional Writing
- COM 411 Web Design Workshop
- COM 412 Advanced Technical Writing
- COM 415 Nonverbal Communication
- COM 460 Media Relations II
- HU 330 Values and Ethics
- HU 338 Traversing the Borders: Interdisciplinary Explorations
- HU 363 Communication and Society
- HU 375 The Nature of Language
- HU 415 Nonverbal Communication
- HU 420 Applied Cross-Cultural Communication

Computer Science

Six credit hours from any CS or the additional courses listed below. These courses are in addition to those taken as General Education.

Select two of the following: 6

- BA 120 Introduction to Computer Based Systems
- BA 230 Advanced Computer Based Systems
- CEC 220 Digital Circuit Design
- CEC 222 Digital Circuit Design Laboratory
- CYB 235 Computer and Network Technologies
- EGR 115 Introduction to Computing for Engineers
- EGR 120 Graphical Communications
- SE 300 Software Engineering Practices

Psychology and Human Factors

HF 300 Human Factors I: Principles and Fundamentals 3
- HF 302 Human Factors II: Analytic Methods and Techniques 4
- HF 306 Human Factors III: Performance Processes 4
- HF 310 Human-Computer Interaction 3
- HF 312 Ergonomics and Bioengineering 3
- HF 400 Human Factors IV: System Design 4
- PSY 310 Sensation and Perception 3
- PSY 312 Research Analysis in Psychology 4
- PSY 315 Cognitive Psychology 3
- PSY 322 Research Design 4
- PSY 335 Physiological Psychology 3

Practicum

HF 490 Practicum in Human Factors Psychology 3

Total Credits 51

Specified Electives

Take two courses from each of the following two groups of courses (12 credit hours total).

Group I: Applied Systems in Human Factors 6

- HF 315 Automation and Systems Issues in Aviation
- HF 321 Psychopharmacology
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>HF 325</td>
<td>Human Factors and System Safety</td>
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<td>HF 326</td>
<td>Human Performance in Extreme Environments</td>
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<td>HF 330</td>
<td>Human Factors in Space</td>
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<td>HF 352</td>
<td>Human Factors in Entertainment Systems</td>
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<td>HF 410</td>
<td>Human Factors Engineering: Crew Station Design</td>
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<td>HF 412</td>
<td>Simulating Humans in Complex Systems</td>
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<tr>
<td>HF 415</td>
<td>Human Factors in Simulation Systems</td>
<td></td>
</tr>
<tr>
<td>HF 422</td>
<td>Applied Ergonomic Design, Analysis, and Evaluation</td>
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<tr>
<td>HF 440</td>
<td>Aerospace Physiology</td>
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<td><strong>Group II: Psychological Foundations of Human Factors</strong></td>
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<td>PSY 320</td>
<td>Aviation Psychology</td>
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<td>PSY 340</td>
<td>Industrial-Organizational Psychology</td>
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<td>PSY 345</td>
<td>Training and Development</td>
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<td>PSY 350</td>
<td>Social Psychology</td>
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<td>PSY 365</td>
<td>Abnormal Psychology</td>
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<td>Other courses with approval of advisor.</td>
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<td>HFS 510</td>
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<tr>
<td>HFS 610</td>
<td>Research Design and Analysis II</td>
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<td><strong>Total Credits at End of Year Four</strong></td>
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### Graduate-Level Studies

Two graduate-level HFS courses are taken in the senior year as described above. Thirty credits remain.

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<td>HFS 515</td>
<td>Ergonomics</td>
<td>3</td>
</tr>
<tr>
<td>HFS 600</td>
<td>Human Factors in Systems</td>
<td>3</td>
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<tr>
<td>HFS 612</td>
<td>Human Factors Methods</td>
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<td>HFS 615</td>
<td>Sensation and Perception</td>
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<td>HFS 620</td>
<td>Memory and Cognition</td>
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<td>HFS 635</td>
<td>Human-Computer Interaction</td>
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<td>HFS 675</td>
<td>Multivariate Statistics: Factor Analysis and Data Reduction</td>
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### HFS Graduate Electives *

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<th>Option</th>
<th>Course Title</th>
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<tr>
<td>I</td>
<td>HFS 700</td>
<td>Thesis</td>
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<td>II</td>
<td>Six Upper-Level credits of HFS electives</td>
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<td>(500-600 level)</td>
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### Total Degree Credits

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<th>Credits</th>
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<tbody>
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<td>153</td>
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</table>

* Please refer to the graduate section of this catalog for a listing of available graduate-level electives (p. 157).

### B.S./M.S. in Engineering Physics

This accelerated program allows exceptional students to complete both the Bachelor of Science in Engineering Physics (BSEP) and Master of Science in Engineering Physics (MSEP) degrees. Students enrolled in the BSEP program may apply for entry into the accelerated program when they attain junior standing. Students must have a minimum CGPA of 3.2 in EP/ES/MA/PS courses for selection.

### Degree Requirements

Students in this program must meet the following requirements:

- Maintain at least a 3.0 CGPA throughout the academic program.
- Maintain at least a 3.0 CGPA for the graduate credits.
- Complete a total of 149 credit hours as listed below.
- The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements listed in this catalog; the Master of Science degree will be conferred upon completion of all master’s degree requirements listed in this catalog.

### General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These
minimum requirements are applicable to all degree programs.

Undergraduate Education Requirements
Multiple areas of concentration exist in the undergraduate Engineering Physics program. For a full description of the EP program see the “B.S. in Engineering Physics” section of this catalog. In this B.S./M.S. accelerated program option, up to nine hours of graduate coursework may be taken to fulfill undergraduate technical elective requirements or substitute for undergraduate classes. These graduate hours will also count towards fulfilling the MS degree requirements provided that the student is enrolled in the accelerated MS option and receives a B or better in the course. Graduate courses taken for technical elective credit must be approved.

A student in this program will take all the specified undergraduate courses for their area of concentration, with the substitution of MA502 in the place of MA442. In addition, they will take EP501 and one other approved graduate EP elective in place of undergraduate technical electives.

The total number of credit hours for the undergraduate EP program is 128, to which are added the following:

<table>
<thead>
<tr>
<th>Graduate-Level Studies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EP 509: Advanced Space Physics</td>
<td>3</td>
</tr>
<tr>
<td>EP 600: Experimental Methods in Space Science</td>
<td>3</td>
</tr>
<tr>
<td>EP 605: Spacecraft Power and Thermal Design</td>
<td>3</td>
</tr>
</tbody>
</table>

And the selection of either a thesis or non-thesis option with a total of 12 credit hours included in either option:

<table>
<thead>
<tr>
<th>Option I - Thesis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EP 700: Thesis</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option II - Non-Thesis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Elective</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 21

Total BS/MS Degree Credits 149

Combined Arts and Sciences Programs

Introduction
The combined program options allow exceptional students to complete a baccalaureate degree in Communication, Global Conflict Studies, Homeland Security, Human Factors, or Interdisciplinary Studies, and an M.B.A. or M.S. degree. The objective of these degrees is to provide the opportunity for students to build a well-rounded undergraduate education and then further prepare themselves as professional managers in the aviation/aerospace industry.

Combined Programs
B.S. in Aerospace Engineering/MSHF (p. 146)
B.S. in Communication/M.B.A. (p. 148)
B.S. in Computational Math/M.B.A. (p. 149)
B.S. in Computational Math/M.S.A.F (p. 149)
B.S. in Global Conflict Studies/M.B.A. (p. 150)
B.S. in Global Conflict Studies/M.S. in Human Security and Resilience (p. 151)
B.S. in Homeland Security/M.B.A. (p. 151)
B.S. in Homeland Security/M.S. in Cybersecurity Management and Policy (p. 152)
B.S. in Homeland Security/M.S. in Human Security and Resilience (p. 152)
B.S. in Human Factors Psychology/M.B.A. (p. 153)
B.S. in Interdisciplinary Studies/M.B.A. (p. 153)

Aerospace Engineering/MSHF
In the Accelerated BSAE/MSHF, students may take up to 12 credits of graduate course work during their BSAE senior year. Two graduate courses (six credits) may fulfill the undergraduate technical elective requirements. These six credits will count towards both the BS and MS degree requirements provided the student maintains enrollment in the accelerated program and receives a "B" or better in the courses. For these graduate level courses taken for undergraduate technical elective credit, it is recommended that students take HFS 510 Research Design and Analysis I and HFS 610 Research Design and Analysis II during the fall and spring semesters of their undergraduate senior year respectively. These courses are part of a three course series. If they are not completed during those semesters, completing the program may be delayed. These six credits will appear on the undergraduate
transcript. These six credits will not be part of the Master's transcript until the time of graduation. In addition, students are encouraged to take up to two additional graduate courses as undergraduates to reduce the overall duration of the program. These additional courses should be core courses approved by the BSAE and MSHF program coordinators.

Students enrolled in the Bachelor of Science in Aerospace Engineering program may apply for admission into this accelerated program after they have completed their third year of BSAE courses (approximately 90 credit hours). The application for the Accelerated BSAE/MSHF program must be submitted to the BSAE Undergraduate Program Coordinator to verify the minimum requirement (CGPA of 3.0 or higher). Once approved, the application will be forwarded to the MSHF Graduate Program Coordinator along with the student's unofficial transcript, a personal statement and resume.

Once accepted into the accelerated program, a CGPA of 3.0 or higher in undergraduate courses and a CGPA of 3.0 or higher in graduate courses must be maintained for continued enrollment. Students will be dropped from the program if their CGPA in either falls below 3.0. Students are future-admitted to the MSHF program as non-degree students and are limited to 12 graduate credits prior to completing their BSAE requirements. The Bachelor of Science in Aerospace Engineering will be conferred upon completion of all bachelor's degree requirements listed in this catalog. The student is then formally admitted to the MSHF program. The Master's degree will be conferred upon completion of all Master's degree requirements listed in this Catalog. Degree Credits BSAE: 129 (6 credits from MSHF courses) Degree Credits MSHF: 36 (6 credits taken for BSAE level credit) Total Degree Credits: 159. If the student chooses to leave the program before completion of the MSHF program and has acquired the minimal hours required for graduation with the BSAE, any MSHF transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

BSAE Technical Electives

One upper level Technical Elective must be an AE course. All non-duplicating AE upper-level undergraduate and graduate courses are acceptable. The remaining upper-level Technical Elective needs to be selected from the BSAE Approved Technical Electives list, in the areas of Engineering and Science, maintained by the AE Department.

Accepted students may complete these requirements as identified in the accelerated program. The objective of this combined accelerated program is to produce graduates who are prepared for leadership positions within the Aerospace Industry and/or further academic study at the doctoral level. This program augments the student's undergraduate technical electives with graduate-level courses and/or thesis work to focus on future research.

### MSHF Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFS 510</td>
<td>Research Design and Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>HFS 515</td>
<td>Ergonomics</td>
<td>3</td>
</tr>
<tr>
<td>HFS 600</td>
<td>Human Factors in Systems</td>
<td>3</td>
</tr>
<tr>
<td>HFS 610</td>
<td>Research Design and Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>HFS 612</td>
<td>Human Factors Methods</td>
<td>3</td>
</tr>
<tr>
<td>HFS 615</td>
<td>Sensation and Perception</td>
<td>3</td>
</tr>
<tr>
<td>HFS 635</td>
<td>Human-Computer Interaction</td>
<td>3</td>
</tr>
<tr>
<td>HFS 620</td>
<td>Memory and Cognition</td>
<td>3</td>
</tr>
<tr>
<td>HFS 675</td>
<td>Multivariate Statistics: Factor Analysis and Data Reduction</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 27

### Electives Non-Thesis = 9 credits, Thesis = 3 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFS 500</td>
<td>Systems Concepts, Theory, and Tools</td>
<td>3</td>
</tr>
<tr>
<td>HFS 520</td>
<td>Team Performance</td>
<td>3</td>
</tr>
<tr>
<td>HFS 521</td>
<td>Modeling Humans in Complex Systems</td>
<td>3</td>
</tr>
<tr>
<td>HFS 526</td>
<td>Aerospace Physiology</td>
<td>3</td>
</tr>
<tr>
<td>HFS 527</td>
<td>Psychopharmacology</td>
<td>3</td>
</tr>
<tr>
<td>HFS 590</td>
<td>Graduate Seminar</td>
<td>3</td>
</tr>
<tr>
<td>HFS 614</td>
<td>Human Factors in Medicine</td>
<td>3</td>
</tr>
<tr>
<td>HFS 616</td>
<td>Human Factors of Transportation</td>
<td>3</td>
</tr>
<tr>
<td>HFS 618</td>
<td>HF in Aging: Behavioral and Biological Foundations</td>
<td>3</td>
</tr>
<tr>
<td>HFS 622</td>
<td>Human Factors in Entertainment Systems</td>
<td>3</td>
</tr>
<tr>
<td>HFS 624</td>
<td>User Experience</td>
<td>3</td>
</tr>
<tr>
<td>HFS 625</td>
<td>Applied Testing and Selection</td>
<td>3</td>
</tr>
<tr>
<td>HFS 626</td>
<td>Human Factors Principles of Visual Communication</td>
<td>3</td>
</tr>
</tbody>
</table>
HFS 630  Applied Cognitive Science  3
HFS 640  Aviation/Aerospace Psychology  3
HFS 650  Human Factors of Aviation/ Aerospace Applications  3
HFS 680  Graduate Seminar: Current Applications in Human Factors  3
HFS 690  Graduate Student Capstone  3
HFS 696  Graduate Internship in Human Factors and Systems  1-3
HFS 699  Special Topics in Human Factors and Systems  1-6

*For Students participating in Internships, a maximum of two (2) WW online courses (MSHF) may be taken that would be applicable towards the student’s DB MSHF degree. Prior approval from the HF Graduate Program Coordinator is required for each course option.

MSHF 606 for HFS 620, MSHF 624 for HFS 515, MSHF 612 or MSHF 618 for electives. WW waiver may be required.

These options are being provided to ERAU BSAE/MSHF students interested in interning with Industry, especially during the Summer months. It is envisioned that students interning non-for-credit (HFS 690), interning for credit (HFS 696), or interning not-for-credit while researching/working on their Thesis (HFS 700) can potentially take a WW course to maximize their opportunity to complete the MSHF degree within a two (2) year timeframe.

Communication/MBA

Suggested Course of Study
The Business Administration minor must be selected as the minor field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the open electives noted in the B.S. in Communication undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

Mathematics
MA 111  College Mathematics for Aviation I  3
MA 222  Business Statistics  3

Social Sciences
EC 210  Microeconomics  3
EC 211  Macroeconomics (or Lower-Level Social Sciences)  3

Minor in Business Administration
ACC 210  Financial Accounting  3
BA 220  Marketing  3
BA 230  Advanced Computer Based Systems  3
BA 332  Corporate Finance I  3

Open Electives
One class MUST be:
BA 201  Principles of Management  3

Business Administration Transition
Nine credits are required from the list below:
BA 511  Operations Research  3
BA 514  Strategic Marketing Management in Aviation  3
BA 520  Organizational Behavior, Theory, and Applications in Aviation  3

Year Five
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:
ACC 517  Accounting for Decision Making  3
BA 518  Managerial Finance  3
BA 523  Advanced Aviation Economics  3
BA 635  Business Policy and Decision Making  3

Specified Electives  12

Total Degree Credits ** 144

** Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Communication, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.
**Computational Math/MBA**

**Suggested Course of Study**

The Business Administration minor or Finance Minor must be selected as the minor field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the open electives noted in the B.S. in Computational Math undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

**Social Sciences**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>EC 211</td>
<td>Macroeconomics (or Lower-Level Social Sciences)</td>
<td></td>
</tr>
</tbody>
</table>

**Option 1 - Minor in Business Administration**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
</tbody>
</table>

**Option 2 - Minor in Finance**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ACC 312</td>
<td>Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
<tr>
<td>BA 434</td>
<td>Corporate Finance II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Degree Credits**: **144**

**Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.**

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Computational Math, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Computational Math/MSAF**

**Suggested Course of Study**

The Business Administration minor or the Finance Minor must be selected as the minor field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the open electives noted in the B.S. in Computational Math undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the Master of Science in Aviation Finance.

**Social Sciences**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210</td>
<td>Microeconomics (or)</td>
<td>3</td>
</tr>
<tr>
<td>EC 211</td>
<td>Macroeconomics (or Lower-Level Social Sciences)</td>
<td></td>
</tr>
</tbody>
</table>

**Option 1 - Minor in Business Administration**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
</tbody>
</table>

**Option 2 - Minor in Finance**
**ACC 210** Financial Accounting 3
**ACC 312** Managerial Accounting 3
**BA 201** Principles of Management 3
**BA 332** Corporate Finance I 3
**BA 434** Corporate Finance II 3

**Business Administration Transition**
**ACC 517** Accounting for Decision Making 3
**BA 518** Managerial Finance (or) 3
**FIN 518** Managerial Finance
**BA 523** Advanced Aviation Economics 3

**Year Five**
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 615 Investments (or)</td>
<td>3</td>
</tr>
<tr>
<td>FIN 615 Investments</td>
<td></td>
</tr>
<tr>
<td>BA 618 Advanced Corporate Finance (or)</td>
<td>3</td>
</tr>
<tr>
<td>FIN 618 Advanced Corporate Finance</td>
<td></td>
</tr>
<tr>
<td>FIN 620 Air Transport Economic Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>

**Optional Electives**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 514 Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 609 Airline Operations and Management</td>
<td></td>
</tr>
<tr>
<td>FIN 621 International Aviation Finance</td>
<td>3</td>
</tr>
<tr>
<td>FIN 622 Aircraft and Airline Financing</td>
<td></td>
</tr>
<tr>
<td>FIN 623 Aircraft Funding Legal and Financial Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

**Concluding Degree Requirement**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN 699 Special Topics in Finance (or)</td>
<td>1-6</td>
</tr>
<tr>
<td>FIN 696 Graduate Internship in Finance</td>
<td></td>
</tr>
</tbody>
</table>

**Total Degree Credits** 144

**Global Conflict Studies/MBA**

**Suggested Course of Study**

The Business Administration undergraduate courses as well as the transition classes listed outline below must be completed to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

**Mathematics**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 120</td>
<td>3</td>
</tr>
<tr>
<td>MA 220</td>
<td>3</td>
</tr>
</tbody>
</table>

**Humanities/Social Sciences - Lower or Upper Level**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210 Microeconomics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Business Administration Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210 Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 201 Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220 Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 332 Corporate Finance I</td>
<td>3</td>
</tr>
<tr>
<td>BA 437 Strategic Management and Consulting</td>
<td>3</td>
</tr>
</tbody>
</table>

**Business Administration Transition**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514 Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 520 Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year 5**
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517 Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 518 Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635 Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

**Specified Electives** 12

**Total Degree Credits** 147

**Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.**

If the student chooses to leave the program before the completion of the MSAF program and has acquired the minimal hours required for graduation with the BS in Computational Math, any MSAF transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.
These 15 credits fulfill one BSGCS 15-credit breadth area.

Two of these courses can fulfill BSGCS electives.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Global Conflict Studies, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

Global Conflict Studies/MSHSR

Students enrolled in the Bachelor of Science in Global Conflict Studies (BSGCS) degree program at the Daytona Beach College of Arts & Sciences have the opportunity to pursue the Master of Science in Human Security & Resilience (MSHSR) in an accelerated degree program format. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate elective requirements. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MSHSR option and receives a "B" or better in the course. Students must complete a minimum of 120 undergraduate/graduate course credits for their Bachelor of Science degree.

Undergraduate students may apply to the accelerated MS option by submitting an application to the MSHSR Program Coordinator, including obtaining the approval of the BSGCS Program Coordinator and SSIA Department Chair. Students must have completed 88 credit hours toward the BSGCS degree and must have a 3.2 minimum GPA to be admitted to the accelerated program; students will be dropped from the program if their GPA falls below 3.0. The BSGCS degree will be conferred upon completion of all bachelor's degree requirements; the MSHSR degree will be conferred upon completion of all master's degree requirements.

Any three 500-level MSHSR courses can be used to satisfy the BSGCS elective requirements. A total of 141 credits, including 30 graduate level credits, is required for this option.

Homeland Security/MBA

Suggested Course of Study

The Business Administration undergraduate and transition classes recommend in the outline below are taken in place of one of the areas of concentration within the B.S. in Homeland Security program to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

<table>
<thead>
<tr>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111 College Mathematics for Aviation I 3</td>
</tr>
<tr>
<td>or MA 120 Quantitative Methods I 3</td>
</tr>
<tr>
<td>MA 112 College Mathematics for Aviation II 3</td>
</tr>
<tr>
<td>or MA 220 Quantitative Methods II 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Sciences - Lower Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 101 Introduction to Psychology 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humanities/Social Sciences - Lower or Upper Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210 Microeconomics 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Administration Courses 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210 Financial Accounting 3</td>
</tr>
<tr>
<td>BA 201 Principles of Management 3</td>
</tr>
<tr>
<td>BA 220 Marketing 3</td>
</tr>
<tr>
<td>BA 332 Corporate Finance I 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Administration Transition 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 Operations Research 3</td>
</tr>
<tr>
<td>BA 514 Strategic Marketing Management in Aviation 3</td>
</tr>
<tr>
<td>BA 520 Organizational Behavior, Theory, and Applications in Aviation 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed</td>
</tr>
<tr>
<td>ACC 517 Accounting for Decision Making 3</td>
</tr>
<tr>
<td>BA 518 Managerial Finance 3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics 3</td>
</tr>
<tr>
<td>BA 635 Business Policy and Decision Making 3</td>
</tr>
</tbody>
</table>
Specified Electives  
Total Degree Credits 12  
151
1. These 12 credits are taken in lieu of one BSHS 15-credit minor/cohesive block.
2. Any of these courses can be taken in lieu of the BSHS "Any 300/400 course" elective

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Homeland Security, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

B.S. in Homeland Security/M.S. in Cybersecurity Management & Policy

Exceptional students enrolled in the Bachelor of Science in Homeland Security (BSHS) degree program at DB College of Arts & Sciences have the opportunity to pursue the Master of Science in Cybersecurity Management & Policy (MSCMP) (http://catalog.erau.edu/worldwide/arts-sciences/masters/cybersecurity-mgmt-policy) in an accelerated degree program format. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate elective requirements and specified courses. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MSCMP option and receives a "B" or better in the course. Students must complete a minimum of 120 undergraduate/graduate course credits for their Bachelor of Science degree.

Undergraduate students may apply to the accelerated MS option by submitting an application to the MSCMP Program Coordinator, including obtaining the approval of the BSHS Program Coordinator and SSIA Department Chair. Students must have completed 88 credit hours toward the BSHS degree and must have a 3.2 minimum GPA to be admitted to the accelerated program; students will be dropped from the program if their GPA falls below 3.0. The BSHS degree will be conferred upon completion of all bachelor's degree requirements; the MSCMP degree will be conferred upon completion of all master's degree requirements.

The following graduate level MSCMP courses can be taken to satisfy the BSHS Requirements:

MCMP 520 (Security Engineering and Management) can be taken in lieu of HS 320 (Law & Policy)
Any 500-level HSR course can be taken in lieu of the BSHS 300/400-level elective

A total of 148 credits, including 30 graduate level credits, is required for this option.

BSHS students who also minor in Cybersecurity have the following additional option:

MCMP 501 (Internet, Security & Governance) can be taken in lieu of CYB 485 (War, Terror & Diplomacy in Cyberspace)

A Total of 145 credits, including 30 graduate level credits, is required for this option.

B.S. in Homeland Security/M.S. in Human Security & Resilience

Exceptional students enrolled in the Bachelor of Science in Homeland Security (BSHS) degree program at DB College of Arts & Sciences have the opportunity to pursue the Master of Science in Human Security & Resilience (MSHSR) (http://catalog.erau.edu/worldwide/arts-sciences/masters/human-security-resilience) in an accelerated degree program format. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate elective requirements and specified courses. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MSHSR option and receives a "B" or better in the course. Students must complete a minimum of 120 undergraduate/graduate course credits for their Bachelor of Science degree.

Undergraduate students may apply to the accelerated MS option by submitting an application to the MSHSR Program Coordinator, including obtaining the approval of the BSHS Program Coordinator and SSIA Department Chair. Students must have completed 88 credit hours toward the BSHS degree and must have a 3.2 minimum GPA to be admitted to the accelerated program; students will be dropped from the program if their GPA falls below 3.0. The BSHS degree will be conferred upon completion of all bachelor's degree requirements; the MSHSR degree will be conferred upon completion of all master's degree requirements.
completion of all bachelor's degree requirements; the MSHSR degree will be conferred upon completion of all master's degree requirements.

The following graduate level MSHSR courses can be taken to satisfy the BSHS requirements:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHSR 530</td>
<td>Environmental Security</td>
<td></td>
</tr>
<tr>
<td>MHSR 520</td>
<td>Conflict Resolution</td>
<td></td>
</tr>
<tr>
<td>Any 500-level HSR course</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A Total of 145 credits, including 30 graduate level credits, is required for this option.

### Human Factors Psychology/MBA

#### Suggested Course of Study

The Business Administration undergraduate and transition classes recommended in the outline below are taken in place of the open electives within the B.S. in Human Factors Psychology to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

#### Mathematics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>MA 112</td>
<td>College Mathematics for Aviation II</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Social Sciences

One class must be:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Specified Electives

One course MUST be:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 340</td>
<td>Industrial-Organizational Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Business Administration Courses

(In place of open elective courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Business Administration Transition

Nine credits are required from the list below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year Five

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Specified Electives

12

#### Total Degree Credits

147

* PSY 340 taken in lieu of BA 201

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Human Factors Psychology, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

### Interdisciplinary Studies/MBA

#### Suggested Course of Study

The Business Administration minor must be selected as one of the three minor fields of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete.

The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

#### Mathematics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>
Social Sciences
EC 210  Microeconomics  3
EC 211  Macroeconomics  3
or EC 200  An Economic Survey
Select one of the following:  3
SS 110  World History
SS 120  U.S. History
SS 130  History of Aviation in America
PSY 101  Introduction to Psychology

Two Minor Courses of Study
Minor requirements are based on the catalog 38-40 of the declaring year; must earn a 2.0 GPA or higher in each minor

Minor in Business Administration
ACC 210  Financial Accounting  3
BA 220  Marketing  3
BA 332  Corporate Finance I  3

Business Administration Transition
Nine credits are required from the list below.
BA 511  Operations Research  3
BA 514  Strategic Marketing Management in Aviation  3
BA 520  Organizational Behavior, Theory, and Applications in Aviation  3

Year Five
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional courses that have not been completed.
ACC 517  Accounting for Decision Making  3
BA 518  Managerial Finance  3
BA 523  Advanced Aviation Economics  3
BA 635  Business Policy and Decision Making  3

Specified Electives  12

Total Degree Credits  144

** More hours may be required if the recommendations above are not followed and due to hours required in the additional minors selected.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Interdisciplinary Studies, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

M.S. in Engineering Physics

Introduction
The Master of Science in Engineering Physics degree program provides graduate-level education and training in space science and space systems engineering. The goal is to provide graduates with the skills that will allow them to make an immediate contribution to the space-related industries or to proceed to doctoral studies in a wide variety of disciplines. This program’s objectives are:

- Fundamental understanding of scientific and engineering approaches to conceiving and designing complex spacecraft systems.
- Development of the diverse set of research skills required to evolve the state of the art in the areas of space science and engineering.

The program specifically emphasizes scientific instrumentation, applied optics, remote sensing, spacecraft subsystems (power, attitude, and thermal control), and a wide variety of topics in space science and engineering.

This program is heavily research oriented, with a majority of the faculty in the Department of Physical Sciences actively involved in scholarly activities in the space sciences and engineering. The research areas include experimental programs with satellite systems, sounding rockets, ground-based remote-sensing experiments, and a parallel program of theoretical studies in the areas of space systems engineering, upper atmospheric physics, space physics, and plasma and magnetospheric physics.

Degree Requirements
The curriculum consists of 15 credits of required coursework, with an additional 15 credits of electives and/or thesis research.

The core courses emphasize the heavily technical nature of the space sciences and require an undergraduate degree in Physics, Engineering, or a related field (such as Mathematics or Chemistry) for preparation.
Master of Science in Engineering Physics

<table>
<thead>
<tr>
<th>Option</th>
<th>Core Courses</th>
<th>Electives</th>
<th>Thesis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis</td>
<td>15</td>
<td>6</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>Non-Thesis</td>
<td>15</td>
<td>15</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

**Core Courses**
- EP 501 Numerical Methods for Engineers and Scientists 3
- EP 505 Spacecraft Dynamics and Control 3
- EP 509 Advanced Space Physics 3
- EP 600 Experimental Methods in Space Science 3
- EP 605 Spacecraft Power and Thermal Design 3

**Electives (others available on a rotating basis)**
- AE 508 Intermediate Heat Transfer 3
- AE 514 Introduction to the Finite Element Method 3
- AE 520 Perturbation Methods in Engineering 3
- AE 524 Rocket Engine Propulsion Systems 3
- BA 511 Operations Research 3
- EP 696 Graduate Internship in Engineering Physics 3
- EP 699 Special Topics in Engineering Physics 3
- MA 502 Boundary Value Problems 3
- MA 504 Theory of the Potential 3
- MA 506 Probability and Statistical Inference 3
- MA 510 Fundamentals of Optimization 3
- SE 500 Software Engineering Discipline 3
- SE 545 Specification and Design of Real-Time Systems 3
- SE 585 Metrics and Statistical Methods for Software Engineering 3
- SE 610 Software Systems Architecture and Design 3
- SE 655 Performance Analysis of Real-Time Systems 3

**Thesis**
- EP 700 Thesis 1-9

---

**M.S. in Data Science**

**Introduction**
The Master of Science in Data Science degree program is designed to prepare students to use the latest computational and analytic tools to solve data intensive problems that arise in business, industry or government. The goal is to provide the students with the knowledge and skills of data collection, pre-processing, analysis, visualization and ethical implication associated with large heterogeneous data arising within the various domain areas.

All the core courses within the degree program are project-based allowing for hands-on experience culminating in a final capstone project or an internship in the student’s chosen domain area. The program offers the flexibility for the students to choose one of the five tracks (Aviation Safety, Aviation Business, High Performance Computing and Big Data, Cybersecurity and Homeland Security) to specialize in depending on their interest. The students have to choose the track by the start of the second semester into the program.

**Degree Requirements**
The curriculum consists of 15 credits of required coursework, with an additional 3 credits of track-specific required course and 12 credits of electives and/or thesis research.

The core courses provide the foundation of the Data Science principles and require an undergraduate degree in a technical field (a degree with at least four semesters of college-level Math) for preparation. Students with a non-technical undergraduate degree will be required to complete additional modules.

**Program Core**
- MA 506 Probability and Statistical Inference 3
- MA 540 Data Mining 3
- MA 544 Data Visualization 3
- MA 615 Data Driven Modeling 3
- CS 540 Database and Data Retrieval 3

**Total Credits** 15
### High Performance Computing & Big Data Track

**Required Course**
- MA 553 High Performance Scientific Computing 3

**Electives - Select 9 hrs from the following:**
- MA 510 Fundamentals of Optimization 1
- MA 605 Statistical Quality Analysis 1
- MA 625 Computing for Data Compression, Image and Signal Processing 1
- MA 630 Complex Networks and Applications 1

Total Credits 12

### Aviation Business Track

**Required Course**
- BA 612 Data Analytics for Aviation Business 3

**Electives - Select 9 hrs from the following:**
- ACC 517 Accounting for Decision Making 1
- BA 518 Managerial Finance 1
- BA 511 Operations Research 1
- BA 523 Advanced Aviation Economics 1
- BA 610 Airline Optimization and Simulation Systems 1
- BA 645 Airport Operations and Management 1

Total Credits 12

### Cybersecurity Track

**Required Course**
- CS 602 Big Data Analytics for Cybersecurity 3

**Electives - Select 9 hrs from the following:**
- CS 525 Current Topics in Cybersecurity 1
- CS 527 System Exploitation and Penetration Testing 1
- CS 528 Multi-Agent Systems 1
- CS 529 Computer Security 1
- CS 532 Software Security Assessment 1
- CS 538 Applied Cryptography 1

Total Credits 12

### Aviation Safety Track

**Required Course**
- MSA 628 Data Analytics for Aviation Safety 3

**Electives - Select 9 hrs from the following:**
- MSA 516 Applications in Crew Resource Management 1
- MSA 604 Human Factors in the Aviation/Aerospace Industry 1
- MSA 611 Aviation/Aerospace System Safety 1
- MSA 621 Aviation/Aerospace Safety Program Management 1

Total Credits 12

### Homeland Security Track

**Required Course**
- HS 602 Data Analytics for Counterterrorism 3

**Electives - Select 9 hrs from the following:**
- MHSR 501 The Internet, Security, and Governance 1
- MHSR 510 Introduction to Human Security 1
- MHSR 530 Environmental Security 1
- MHSR 540 Foundations of Resilience 1
- MHSR 520 Principles of International Conflict Resolution 1
- MHSR 615 1

Total Credits 12

### Capstone Project or Thesis

**Track specific elective (Thesis)**
- MA 680 Data Science Capstone Project 3

Totals 30

### Year One

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 506</td>
<td>Probability and Statistical Inference</td>
<td>3</td>
</tr>
<tr>
<td>MA 544</td>
<td>Data Visualization</td>
<td>3</td>
</tr>
<tr>
<td>CS 540</td>
<td>Database and Data Retrieval</td>
<td>3</td>
</tr>
<tr>
<td>MA 540</td>
<td>Data Mining</td>
<td>3</td>
</tr>
<tr>
<td>SPEC</td>
<td>Specified Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

Credits Subtotal 18.0

### Year Two

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 553</td>
<td>High Performance Scientific Computing</td>
<td>3</td>
</tr>
</tbody>
</table>
MA 615 Data Driven Modeling 3
MA 680 Data Science Capstone Project 3
Specified Elective 3
Credits Subtotal 12.0
Credits Total: 30.0

M.S. in Human Factors

Introduction
The Department of Human Factors offers graduate instruction leading to the Master of Science degree in Human Factors. This program is designed to meet the highest academic standards, fully preparing students for doctoral-level studies while at the same time preparing students for immediate employment in the real world of cost-sensitive and operationally driven aviation/aerospace and technical environments.

The masters program will produce a graduate with the capacity to design, conduct, and apply human factors methods research in support of simple and complex systems. Graduates will work as a human factors professionals in government, academic and private organizations. A variety of research, consulting, and internship opportunities are available throughout the program.

Students receive education in the principles of human factors and experimental psychology, including statistical and quantitative procedures, experimental design, and survey methods.

A combined Human Factors program is available. Please see the undergraduate Human Factors program for details.

Degree Requirements

<table>
<thead>
<tr>
<th>Option</th>
<th>Core Courses</th>
<th>Electives</th>
<th>Thesis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis</td>
<td>27</td>
<td>3</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>Non-Thesis</td>
<td>27</td>
<td>9</td>
<td>0</td>
<td>36</td>
</tr>
</tbody>
</table>

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFS 510</td>
<td>Research Design and Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>HFS 515</td>
<td>Ergonomics</td>
<td>3</td>
</tr>
<tr>
<td>HFS 600</td>
<td>Human Factors in Systems</td>
<td>3</td>
</tr>
<tr>
<td>HFS 610</td>
<td>Research Design and Analysis II</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFS 612</td>
<td>Human Factors Methods</td>
<td>3</td>
</tr>
<tr>
<td>HFS 615</td>
<td>Sensation and Perception</td>
<td>3</td>
</tr>
<tr>
<td>HFS 620</td>
<td>Memory and Cognition</td>
<td>3</td>
</tr>
<tr>
<td>HFS 635</td>
<td>Human-Computer Interaction</td>
<td>3</td>
</tr>
<tr>
<td>HFS 675</td>
<td>Multivariate Statistics: Factor Analysis and Data Reduction</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electives</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td></td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td></td>
</tr>
<tr>
<td>HFS 500</td>
<td>Systems Concepts, Theory, and Tools</td>
<td></td>
</tr>
<tr>
<td>HFS 520</td>
<td>Team Performance</td>
<td></td>
</tr>
<tr>
<td>HFS 521</td>
<td>Modeling Humans in Complex Systems</td>
<td></td>
</tr>
<tr>
<td>HFS 526</td>
<td>Aerospace Physiology</td>
<td></td>
</tr>
<tr>
<td>HFS 527</td>
<td>Psychopharmacology</td>
<td></td>
</tr>
<tr>
<td>HFS 590</td>
<td>Graduate Seminar</td>
<td></td>
</tr>
<tr>
<td>HFS 614</td>
<td>Human Factors in Medicine</td>
<td></td>
</tr>
<tr>
<td>HFS 616</td>
<td>Human Factors of Transportation</td>
<td></td>
</tr>
<tr>
<td>HFS 618</td>
<td>HF in Aging: Behavioral and Biological Foundations</td>
<td></td>
</tr>
<tr>
<td>HFS 622</td>
<td>Human Factors in Entertainment Systems</td>
<td></td>
</tr>
<tr>
<td>HFS 624</td>
<td>User Experience</td>
<td></td>
</tr>
<tr>
<td>HFS 625</td>
<td>Applied Testing and Selection</td>
<td></td>
</tr>
<tr>
<td>HFS 626</td>
<td>Human Factors Principles of Visual Communication</td>
<td></td>
</tr>
<tr>
<td>HFS 630</td>
<td>Applied Cognitive Science</td>
<td></td>
</tr>
<tr>
<td>HFS 640</td>
<td>Aviation/Aerospace Psychology</td>
<td></td>
</tr>
<tr>
<td>HFS 650</td>
<td>Human Factors of Aviation/ Aerospace Applications</td>
<td></td>
</tr>
<tr>
<td>HFS 680</td>
<td>Graduate Seminar: Current Applications in Human Factors</td>
<td></td>
</tr>
<tr>
<td>HFS 690</td>
<td>Graduate Student Capstone</td>
<td></td>
</tr>
<tr>
<td>HFS 696</td>
<td>Graduate Internship in Human Factors and Systems (highly recommended)</td>
<td></td>
</tr>
<tr>
<td>HFS 699</td>
<td>Special Topics in Human Factors and Systems</td>
<td></td>
</tr>
<tr>
<td>HFS 705</td>
<td>Small N Designs and Non-Parametric Analysis</td>
<td></td>
</tr>
<tr>
<td>MSA 611</td>
<td>Aviation/Aerospace System Safety</td>
<td></td>
</tr>
</tbody>
</table>

College of Arts and Sciences
Ph.D. in Engineering Physics

The Ph.D. in Engineering Physics program provides advanced education and research opportunities to exceptional students by providing a research environment that fosters collaboration and creative thinking, with research findings published in nationally recognized journals. Areas of research emphasis include the measurement, theory, and modeling of the near-space and space neutral and plasma environment; studies of the sun and stellar activity; orbital stability and dynamics; engineering spacecraft instrumentation and remote sensing measurements; and the design and implementation of electro-optical and radar systems.

Learn more about the program at the Ph.D. in Engineering Physics (http://daytonabeach.erau.edu/degrees/phd-program/engineering-physics) website.

Admission

The minimum entry requirement to this program is a Bachelor’s degree in physics, engineering, or an appropriately related field. A minimum CGPA of 3.2/4.0 is required.

Applicants are required to submit

- General GRE (verbal plus quantitative) scores
- A statement (2 to 5 pages) outlining the background of the applicant and motivations and goals for graduate studies
- Official copies of transcripts
- Three letters of recommendation
- All applicants whose native language is not English, and who were educated at schools where English was not the language of instruction in all disciplines, must provide their official TOEFL or IELTS scores.

Application Deadline:

- April 15 for U.S. students
- March 15 for International students

Requirements

The Ph.D. in Engineering Physics program requires 45 credit hours beyond a master’s degree. Additional 30 credit hours are required for students with a Bachelor’s degree. The program requirements include:

- 12 credit hours in core courses
- 6 credit hours of electives (minimum)
- 27 credit hours of dissertation (minimum)
- The successful completion of a two-day written qualification examination
- The successful presentation of a dissertation research proposal
- The successful completion of a written dissertation
- The successful completion of a written dissertation and oral defense

The objective of this Ph.D. program is to provide advanced education and research opportunities to exceptional students by providing a research environment which fosters collaboration, creative thinking and publishing of findings in nationally recognized journals.

A CGPA of 3.0 is required for a student to remain in good academic standing and for graduation. If a student receives two grades less than a B or one grade less than a C, that student is subject to dismissal from the program. All requirements for the
degree must be completed within seven years from the date the student enters the program.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP 701</td>
<td>Analytical Techniques in Engineering Physics (Core)</td>
<td>3</td>
</tr>
<tr>
<td>EP 702</td>
<td>Theoretical Mechanics and Astrodynamics (Core)</td>
<td>3</td>
</tr>
<tr>
<td>EP 703</td>
<td>Electrodynamics of Space Environment (Core)</td>
<td>3</td>
</tr>
<tr>
<td>EP 704</td>
<td>Stochastic Systems in Engineering Physics (Core)</td>
<td>3</td>
</tr>
<tr>
<td>EP 705</td>
<td>Optimal Dynamical Systems</td>
<td>3</td>
</tr>
<tr>
<td>EP 706</td>
<td>Electro-Optical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EP 707</td>
<td>Nonlinear Dynamical Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EP 709</td>
<td>Upper Atmospheric Physics</td>
<td>3</td>
</tr>
<tr>
<td>EP 710</td>
<td>Space Plasma Physics</td>
<td>3</td>
</tr>
<tr>
<td>EP 711</td>
<td>Computational Atmospheric Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EP 712</td>
<td>Geophysical Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EP 799</td>
<td>Special Topics in Engineering Physics</td>
<td>3</td>
</tr>
<tr>
<td>EP 800</td>
<td>Dissertation</td>
<td>3-9</td>
</tr>
</tbody>
</table>

Dissertation Proposal (prospectus)
This is an opportunity for the students to demonstrate to their dissertation committee that they understand the current research in their area of interest and can formulate a thesis topic and a workable approach to the research. Committee members should have opportunities for in-depth discussions in the preparation of the proposal. The proposal is an opportunity for the student to demonstrate their verbal and written communication skills. Acceptance of the dissertation proposal is a significant milestone in the dissertation process.

Dissertation Process
The purpose of the dissertation process is to give the Ph.D. candidate an authentic experience in performing and reporting research which leads to generating new knowledge. For the Ph.D. in Engineering Physics, the general areas of research will be Spacecraft Engineering, Space Physics, Upper Atmospheric Physics, and Astrophysics. The dissertation process begins with a preliminary search of the scientific & engineering literature around certain possible research topics. Then, in conjunction with the dissertation advisor (DA), a specific topic is chosen. The candidate then writes a prospectus (a research proposal) which is presented and discussed with the full Dissertation Committee (DC). Once all comments and suggestions are addressed, the candidate begins to work full-time on i) a more specific literature search, ii) formulation of tools for simulations, experimentation, or analysis required, iii) informally discuss progress on the research with the DA and the DC and, iv) when completed, writes up the work in clear, technical English prose. The dissertation is then presented verbally in an advertised, public seminar, followed by a more thorough examination and defense with the DA and the DC. It is the expectation of the Ph.D. Program that each dissertation will lead to one or more peer-reviewed journal articles or proceedings papers.

Dissertation Committee(s)
Every student will be required to form a dissertation committee after they have passed their qualifying (comprehensive) examination and before they defend their dissertation proposal. The committee will be comprised of a minimum of four members all of whom must be approved by the Ph.D. Program Committee. It will be chaired by the student’s research advisor. One committee member will be external to the Ph.D. program. The committee will be charged with monitoring student progress and examining student performance in their research through their dissertation proposal defense, seminars, their written dissertation and their dissertation verbal defense. When requested (by the student or advisor), the committee will also evaluate other student accomplishments related to research, such as accepted or published peer-reviewed journal and proceedings papers. The committee will meet at least once a semester.

Seminars
At least once a year, students will be asked to give seminars on research topics that are pertinent to their research activities. Such seminars help demonstrate both scientific maturity as well as verbal communication skills. Student progress will be monitored and appropriate feedback will be given both to the student (self-improvement) and to the dissertation committee (evaluation).
Dissertation Defense

A dissertation is a major writing accomplishment and one that is heavily reviewed by the student’s dissertation committee. It is also a major presentation accomplishment because students are under pressure to respond quickly and accurately to all questions fielded by the committee and by others attending.

Dissemination of Student Research Results

Students will be strongly encouraged to present the results of their research at national (and international) conferences, to hone their presentation skills, to solicit feedback from other experts in the field and to strengthen their ties to the University and research communities. Students will also be strongly encouraged to write the results of their research for publication in high-quality, peer-reviewed journals or proceedings.

Ph.D. in Human Factors

The Ph.D. in Human Factors is an 84 credit, five-year program for students entering with a BS degree or a minimum of 48 credits (3 years) for students entering with a MS degree. The program focuses on core educational elements of the discipline including sensation, perception, cognition, user experience, and statistics. Research areas include aviation/aerospace human factors, medical human factors and technology-enhanced learning, user experience, applied training, and aging. After completing 36 hours of coursework, students will be required to pass a qualifying examination to be admitted to doctoral candidacy. Each student will work with a research advisor, who will serve as their dissertation chair and mentor.

Description

The objective of this Ph.D. program is to provide highly-qualified students an opportunity to complete a rigorous program in Human Factors, equipping students with advanced knowledge, skills and techniques in research that are relevant to Human Factors. The emphasis in the curriculum is highly quantitative in nature, providing these students with a robust skill set for research development and data analysis.

The program is open to students who have earned a bachelor or master’s degree in Human Factors, Psychology or other closely-related fields. These students will have an exemplary academic record, demonstrated independent research skills and who wish to pursue research positions in academics, government or industry when they graduate.

Consistent with the University mission and niche, the areas of research focus for the Ph.D. program are aviation human factors, safety and interactive design. Human Factors and Systems Department provides a comprehensive graduate level curriculum, as well as the research infrastructure and resources to support for federal, state and industrial projects and contracts. Students have a rich pool of courses to choose from, providing flexibility to individualize their course of study to match their research focus.

Graduates of the Ph.D. in Human Factors are expected to have an in-depth understanding of the fundamental principles of the field. They will develop a comprehensive knowledge structure and problem-solving skills for complex system design and evaluation. Students with this degree are expected to be proficient in communication skills, formulate and conduct experiments and models using advanced tools and technology, developing innovative and original basic and applied research skills. Graduates pursue careers in academia, government and industrial research organizations, taking leadership responsibility and making significant contributions for pushing the boundaries of theory and application of Human Factors.

Application Process

Applicants to the Ph.D. program in Human Factors must have an overall satisfactory academic record with a minimum cumulative grade point average (CGPA) of 3.2 on a 4.0 scale for their last 60 credit hours of the bachelor degree and have taken the Graduate Record Examination (GRE) within 5 years of application. Applicants must have a minimum score of 300. Applicants must also submit a complete application package before the January 15 deadline. The application should include a statement of purpose (two to five pages), official copies of transcripts and three letters of recommendation.

International applicants whose primary language is not English must take the TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Test System) and meet the minimum requirements as required by the University.
Degree Requirements
The degree in Human Factors will be conferred in recognition of academic accomplishment and demonstrated ability to conduct innovative scientific research independently. A minimum of 84 credit hours of coursework beyond the bachelor’s degree, or a minimum of 48 credit hours of coursework beyond a Master’s degree is required for the Ph.D. in Human Factors. All courses must be graduate level and must be approved by the student’s advisor prior to registration.

Each Ph.D. student must pass the qualifying exam within one year after he/she has completed the required Master’s level course work or three years after entry, in order to achieve Ph.D. candidacy. The Graduate Program Committee will invite eligible students to sit for the qualifying exam. Only students who are in good standing, and who have been identified through their individual work with a faculty member as qualified to enter into Ph.D. candidacy, will be allowed to take the qualifying examination. A student who fails to pass the qualifying exam will be dismissed from the Ph.D. program.

A minimum of 30 credit hours of dissertation research must be completed after passing the qualifying exam. A dissertation proposal must be developed and the student must defend his/her dissertation proposal within one year after completing the qualifying examination. Prior to the defense of the dissertation proposal, a dissertation committee will be formed, as required by the university. The Award of the Ph.D. is based on the submission of a satisfactory dissertation, approved by the dissertation committee.

Further information about dissertation requirements can be found under Ph.D. Regulations and Procedures. (p. 57)

Core Requirements

Quantitative Core Courses

<table>
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<tr>
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<th>Credits</th>
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<tbody>
<tr>
<td>HFS 510</td>
<td>Research Design and Analysis I</td>
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<tr>
<td>HFS 610</td>
<td>Research Design and Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>HFS 675</td>
<td>Multivariate Statistics: Factor Analysis and Data Reduction</td>
<td>3</td>
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Human Factors Core Courses

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<tr>
<td>HFS 515</td>
<td>Ergonomics</td>
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<tr>
<td>HFS 600</td>
<td>Human Factors in Systems</td>
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<tr>
<td>HFS 615</td>
<td>Sensation and Perception</td>
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Human Factors Specified and Open Electives

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<tr>
<td>HFS 620</td>
<td>Memory and Cognition</td>
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<tr>
<td>HFS 612</td>
<td>Human Factors Methods</td>
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<tr>
<td>HFS 635</td>
<td>Human-Computer Interaction</td>
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</tr>
<tr>
<td>HFS 715</td>
<td>Supervised Teaching Experience</td>
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<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>HFS 500</td>
<td>Systems Concepts, Theory, and Tools</td>
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</tr>
<tr>
<td>HFS 520</td>
<td>Team Performance</td>
<td></td>
</tr>
<tr>
<td>HFS 521</td>
<td>Modeling Humans in Complex Systems</td>
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</tr>
<tr>
<td>HFS 525</td>
<td>Human and Social/Organizational Factors in Emerging Technologies</td>
<td></td>
</tr>
<tr>
<td>HFS 526</td>
<td>Aerospace Physiology</td>
<td></td>
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<tr>
<td>HFS 527</td>
<td>Psychopharmacology</td>
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<tr>
<td>HFS 590</td>
<td>Graduate Seminar</td>
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</tr>
<tr>
<td>HFS 614</td>
<td>Human Factors in Medicine</td>
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<tr>
<td>HFS 616</td>
<td>Human Factors of Transportation</td>
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<tr>
<td>HFS 618</td>
<td>HF in Aging: Behavioral and Biological Foundations</td>
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<td>HFS 622</td>
<td>Human Factors in Entertainment Systems</td>
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<tr>
<td>HFS 624</td>
<td>User Experience</td>
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<td>HFS 625</td>
<td>Applied Testing and Selection</td>
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<td>HFS 626</td>
<td>Human Factors Principles of Visual Communication</td>
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<tr>
<td>HFS 630</td>
<td>Applied Cognitive Science</td>
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<tr>
<td>HFS 637</td>
<td>Managing Human Errors in Complex Systems</td>
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</tr>
<tr>
<td>HFS 640</td>
<td>Aviation/Aerospace Psychology</td>
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<tr>
<td>HFS 650</td>
<td>Human Factors of Aviation/ Aerospace Applications</td>
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<tr>
<td>HFS 680</td>
<td>Graduate Seminar: Current Applications in Human Factors</td>
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<tr>
<td>HFS 690</td>
<td>Graduate Student Capstone</td>
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<tr>
<td>HFS 696</td>
<td>Graduate Internship in Human Factors and Systems</td>
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<td>HFS 699</td>
<td>Special Topics in Human Factors and Systems</td>
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<tr>
<td>HFS 700</td>
<td>Thesis</td>
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Total Credits 30

Total Credits 24

College of Arts and Sciences
### Dissertation

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>HFS 800</td>
<td>30</td>
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<tr>
<td><strong>Total Credits</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

**Total Degree Credits**  84

Other graduate courses may be available, but must be approved by the Graduate Program Coordinator.
College of Aviation

Dr. Alan Stolzer, Dean

The College of Aviation is comprised of Graduate Studies, and the departments of Aeronautical Science, Aviation Maintenance Science, Applied Aviation Sciences, and the Flight Training Department, which is the flight laboratory component for the Aeronautical Science degree. This cohesive unit takes advantage of the various talents and expertise of faculty and staff in these related programs. By having these programs in one complex composed of the Aviation Building, the Simulation Center, the Flight Laboratory, and the Aviation Maintenance complex, the College provides an atmosphere in which students are able to immerse themselves in an environment designed to provide them with the best resources available for the highest quality degree possible.

The College of Aviation complex is comprised of modern, beautiful buildings that house the academic departments, classrooms, and laboratories, including the High Altitude Normobaric Hypoxia, Air Traffic Simulation, Spaceflight Operations, Unmanned Aircraft Systems, and Aviation Maintenance laboratories, which provide a unique experience for students in various curricula. The Simulation Center contains the most advanced ab-initio aircraft simulation devices on the planet: aircraft-specific Cessna 172, Diamond Twin Star, and Canadair Regional Jet (CRJ) flight training devices and a Level D full-motion simulator. Each of these devices precisely simulates the aircraft, including the flying qualities and sounds, and each has powerful, realistic visuals.

The College of Aviation complex also serves as a living laboratory that can research all elements of an air transportation system, including dynamic modeling of air traffic control interfaces, airline operations, and safety systems through its highly sophisticated aircraft and air traffic simulation laboratories. These simulations can then be incorporated into the real world, where a fleet of airplanes can bring the simulation scenarios to life in an actual in-flight laboratory.


The College of Aviation has an enrollment of approximately 2,500 students, many of whom are in the Aeronautical Science degree, the largest residential program of any kind in the nation. The College has a fleet of 71 aircraft, including the Cessna C-172 and Diamond DA 42. The entire C-172 and Diamond DA 42 fleet is equipped with all-glass flight decks using the Garmin G1000 all-glass avionics suite and includes the ADS-B onboard collision avoidance system.

Embry-Riddle has positioned the College of Aviation to serve its students with distinction while investigating and developing new education and programs for pilots, air traffic managers, meteorologists, aviation maintenance technicians, unmanned aircraft system operators, safety professionals, and spaceflight operators of the new century.

Degrees

Associates
A.S. in Aviation Maintenance Science (p. 164)

Bachelors
B.S. in Aeronautical Science (p. 165)
B.S. in Aeronautics (p. 167)
B.S. in Aerospace and Occupational Safety (p. 170)
B.S. in Air Traffic Management (p. 172)
B.S. in Aviation Maintenance Science (p. 173)
B.S. in Meteorology (p. 181)
B.S. in Spaceflight Operations (p. 183)
B.S. in Unmanned Aircraft Systems Science (p. 186)

Accelerated Masters
B.S. in Aeronautics/Master of Science in Aeronautics (p. 189)

Combined Programs
B.S. in Aeronautics/MBA (p. 189)
B.S. in Aviation Maintenance Science/MBA (p. 190)
B.S. in Aviation Maintenance Science/MSA (p. 191)

Masters
M.S. in Aeronautics (p. 193)
M.S. in Occupational Safety Management (p. 199)

Ph.D.
Ph.D. in Aviation (p. 200)

Certificates
Aircraft Dispatcher Certification (p. 202)

**A.S. in Aviation Maintenance Science**

At the heart of every flight of every commercial, private, or military aircraft is the work of the professional aviation maintenance expert. Without the devotion of these very special people, the air travel system would cease to function. The demand for degreed aircraft maintenance specialists in the aviation/aerospace world has never been greater than it is today. The Aviation Maintenance Science (AMS) program at Embry-Riddle produces these aviation professionals, the best in the world.

The Aviation Maintenance Science associate’s degree is made up of general education courses and technical courses and labs that lead to FAA Airframe and Powerplant (A&P) mechanic’s certification. The degree is composed of 66 credit hours, 18 hours of general education coursework, and 48 hours of airframe and powerplant technical courses. The associate’s degree will flow seamlessly into the AMS bachelor of science degree.

The courses taken in the Aviation Maintenance Science Department lead to a student being approved for the A&P certification exams. Credit will be granted for any student who enters the University already in possession of the A&P certification. International certification, which may be equivalent to the Airframe and Powerplant certification, will be evaluated on a case-by-case basis and, if approved, may be used for academic credit.

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education ([https://catalog.erau.edu/daytona-beach/general-education](https://catalog.erau.edu/daytona-beach/general-education)) section of this catalog. These minimum requirements are applicable to all degree programs.

**General Education Core courses:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>Speech or COM 22 Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>CS 120</td>
<td>Introduction to Computing in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>HU 140</td>
<td>Series (Lower-Level Humanities)</td>
<td>3</td>
</tr>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>or MA 140</td>
<td>College Algebra</td>
<td></td>
</tr>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Total Credits</strong></td>
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</table>

**Aviation Maintenance Science Courses (leading to A&P certification)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS 115</td>
<td>Aviation Mathematics and Physics</td>
<td>2</td>
</tr>
<tr>
<td>AMS 116</td>
<td>Fundamentals of Electricity</td>
<td>4</td>
</tr>
<tr>
<td>AMS 117</td>
<td>Tools, Materials and Processes</td>
<td>4</td>
</tr>
<tr>
<td>AMS 118</td>
<td>Aircraft Familiarization and Regulations</td>
<td>2</td>
</tr>
<tr>
<td>AMS 261</td>
<td>Aircraft Metallic Structures</td>
<td>3</td>
</tr>
<tr>
<td>AMS 262</td>
<td>Aircraft Composite Structures</td>
<td>3</td>
</tr>
<tr>
<td>AMS 263</td>
<td>General Aviation Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 264</td>
<td>General Aviation Aircraft Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 271</td>
<td>Aircraft Reciprocating Powerplant and Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 272</td>
<td>Powerplant Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
<td>2</td>
</tr>
<tr>
<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
</tr>
<tr>
<td>AMS 365</td>
<td>Transport Category Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 366</td>
<td>Transport Category Aircraft Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
</tr>
<tr>
<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
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</table>

Tuition for the AMS courses is less than for the other courses in the degree, and is billed separately from the University block tuition. Contact the AMS program coordinator for additional information.
### Suggested Plan of Study

#### Semester 1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
</tr>
<tr>
<td>CS 120</td>
<td>Introduction to Computing in Aviation</td>
<td>3</td>
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<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
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<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
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#### Semester 2

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<tbody>
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<td>AMS 115</td>
<td>Aviation Mathematics and Physics</td>
<td>2</td>
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<tr>
<td>AMS 116</td>
<td>Fundamentals of Electricity</td>
<td>4</td>
</tr>
<tr>
<td>AMS 117</td>
<td>Tools, Materials and Processes</td>
<td>4</td>
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<tr>
<td>AMS 118</td>
<td>Aircraft Familiarization and Regulations</td>
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<th>Course Title</th>
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<td>AMS 261</td>
<td>Aircraft Metallic Structures</td>
<td>3</td>
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<tr>
<td>AMS 262</td>
<td>Aircraft Composite Structures</td>
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<td>AMS 263</td>
<td>General Aviation Aircraft Systems</td>
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<tr>
<td>AMS 264</td>
<td>General Aviation Aircraft Electrical and Instrument Systems</td>
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#### Semester 4

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<td>AMS 365</td>
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<td>AMS 366</td>
<td>Transport Category Aircraft Electrical and Instrument Systems</td>
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</tr>
<tr>
<td>AMS 271</td>
<td>Aircraft Reciprocating Powerplant and Systems</td>
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<td>AMS 272</td>
<td>Powerplant Electrical and Instrument Systems</td>
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<td>Lower-Level Humanities Elective</td>
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#### Semester 5

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<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
<td>2</td>
</tr>
<tr>
<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
</tr>
<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
</tr>
<tr>
<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>Speech</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td></td>
<td><strong>15.0</strong></td>
</tr>
</tbody>
</table>

#### or Technical Report Writing

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td></td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td></td>
<td><strong>15.0</strong></td>
</tr>
<tr>
<td><strong>Credits Total</strong></td>
<td></td>
<td><strong>66.0</strong></td>
</tr>
</tbody>
</table>

### B.S. in Aeronautical Science (Professional Pilot)

The Aeronautical Science degree program blends flight training with rigorous academic study in a unique manner that provides a strong foundation for a career as a leader in the aviation industry, including airlines, corporate and commercial aviation, or the military. This approach to aviation education gives the student added value over traditional flight training programs by focusing on the skills, knowledge, and professionalism required by today’s industry. The curriculum provides skills in mathematics, physics, communications, business, and aeronautics, including FAA certification as a multi-engine instrument-rated commercial pilot. The last two years of matriculation include extensive professional-level Aeronautical Science and flight courses that prepare the graduate for a career as a professional pilot, including airline flight crew operations. Critical-thinking and problem-solving skills are developed via computer simulations in aircraft performance, navigation, and aircraft systems operation. Effective resource management, human factors, teamwork, and safety awareness are constantly emphasized throughout the curriculum.

### Degree Requirements

The Bachelor of Science degree in Aeronautical Science may be attained in eight semesters. To earn the degree, successful completion of a minimum of 120 credit hours is required. The purpose of the Aeronautical Science degree program is to prepare the graduate for a productive career as a professional pilot and for responsible citizenship in support of aviation and aerospace industries. Upon completion of the curriculum, the student will possess an FAA Commercial Pilot Certificate with multi-engine and instrument ratings. Optional advanced flight training includes upset training, certification as a flight instructor and instrument flight instructor, and training as a flight crewmember in a jet aircraft simulator.
**FAA Exemption for the Restricted Airline Transport Pilot Certificate**

Upon graduation, the Daytona Beach Aeronautical Science degree can qualify a graduate for the Restricted Airline Transport (R-ATP) certificate under FAR Part 61.160. Note that satisfying the AS degree requirements alone may not qualify the graduate for the R-ATP. This is a Federal Aviation Administration (FAA) exemption to the regulations and subject to change. For detailed information, please contact the Aeronautical Science Program Coordinator or the Flight Department.

**Bachelor of Science Degree in Aeronautical Science**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>37</td>
</tr>
<tr>
<td>Aeronautical Science Core</td>
<td>57</td>
</tr>
<tr>
<td>Flight Core</td>
<td>4</td>
</tr>
<tr>
<td>Open Electives - Upper Level 300-400</td>
<td>12</td>
</tr>
<tr>
<td>Open Electives</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>120</strong></td>
</tr>
</tbody>
</table>

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences (PSY 101)</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (MA 111, MA 112)</td>
<td>6</td>
</tr>
<tr>
<td>Physical and Life Sciences (PS 113, PS 113L, WX 201)</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>37</strong></td>
</tr>
</tbody>
</table>

**Aeronautical Science Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASC 101</td>
<td>Aeronautical Science Student Success Seminar</td>
<td>1</td>
</tr>
<tr>
<td>AS 121</td>
<td>Private Pilot Operations</td>
<td>5</td>
</tr>
<tr>
<td>AS 221</td>
<td>Instrument Pilot Operations</td>
<td>3</td>
</tr>
<tr>
<td>AS 254</td>
<td>Aviation Legislation</td>
<td>3</td>
</tr>
<tr>
<td>AS 309</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AS 310</td>
<td>Aircraft Performance</td>
<td>3</td>
</tr>
<tr>
<td>AS 311</td>
<td>Aircraft Engines - Turbine</td>
<td>3</td>
</tr>
<tr>
<td>AS 321</td>
<td>Commercial Pilot Operations</td>
<td>3</td>
</tr>
<tr>
<td>AS 350</td>
<td>Domestic and International Navigation</td>
<td>3</td>
</tr>
<tr>
<td>AS 356</td>
<td>Aircraft Systems and Components</td>
<td>3</td>
</tr>
<tr>
<td>AS 357</td>
<td>Flight Physiology</td>
<td>3</td>
</tr>
<tr>
<td>AS 387</td>
<td>Crew Resource Management</td>
<td>3</td>
</tr>
<tr>
<td>AS 408</td>
<td>Flight Safety</td>
<td>3</td>
</tr>
<tr>
<td>AS 411</td>
<td>Jet Transport Systems</td>
<td>3</td>
</tr>
<tr>
<td>AS 420</td>
<td>Flight Technique Analysis</td>
<td>3</td>
</tr>
<tr>
<td>AS 435</td>
<td>Electronic Flight Management Systems</td>
<td>3</td>
</tr>
<tr>
<td>AS 472</td>
<td>Operational Applications in Aeronautical Science</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>WX 301</td>
<td>Aviation Weather</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
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</table>

**Flight Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA 121</td>
<td>Private Single Flight</td>
<td>1</td>
</tr>
<tr>
<td>FA 221</td>
<td>Instrument Single Flight</td>
<td>1</td>
</tr>
<tr>
<td>FA 321</td>
<td>Commercial Single Flight</td>
<td>1</td>
</tr>
<tr>
<td>FA 323</td>
<td>Commercial Multi Add On</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>4</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Open Electives**

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Level Open Electives - 300-400</td>
<td>12</td>
</tr>
<tr>
<td>Open Electives - Any Level</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>

**Total Credit Hours**

<table>
<thead>
<tr>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td><strong>120</strong></td>
</tr>
</tbody>
</table>

Flight education is a continuous process that normally begins sometime during the student’s first year of attendance and will progress until culminating in a multi-engine commercial certificate with an instrument rating. The curriculum is designed to allow students to meet core objectives in a reasonable amount of time.

Various factors influence students’ progress. These factors include student academic preparation, student availability, student determination and dedication, the availability of aircraft and instructor training.
pilots, and the cooperation of the weather. Consequently, some students will finish before others. After completing the core curriculum, students may take an additional semester or more to acquire additional advanced certificates and ratings.

Refer to the Undergraduate Academic Regulations and Procedures section for academic credit for flight training at other institutions. After matriculation to Embry-Riddle, all flight training must be completed on-campus to earn the Aeronautical Science degree.

Cooperative Education credits may only be used as open electives.

Suggested Plan of Study

Year One

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASC 101 Aeronautical Science Student Success Seminar 1</td>
</tr>
<tr>
<td>AS 121 Private Pilot Operations 5</td>
</tr>
<tr>
<td>AS 221 Instrument Pilot Operations 3</td>
</tr>
<tr>
<td>COM 122 English Composition 3</td>
</tr>
<tr>
<td>FA 121 Private Single Flight 1</td>
</tr>
<tr>
<td>FA 221 Instrument Single Flight 1</td>
</tr>
<tr>
<td>MA 111 College Mathematics for Aviation I 3</td>
</tr>
<tr>
<td>MA 112 College Mathematics for Aviation II 3</td>
</tr>
<tr>
<td>HU 14x Lower Level Humanities 3</td>
</tr>
<tr>
<td>PSY 101 Introduction to Psychology 3</td>
</tr>
<tr>
<td>WX 201 Survey of Meteorology 3</td>
</tr>
</tbody>
</table>

Credits Subtotal 29.0

Year Two

<table>
<thead>
<tr>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AS 309 Aerodynamics 3</td>
</tr>
<tr>
<td>AS 321 Commercial Pilot Operations 3</td>
</tr>
<tr>
<td>BA 201 Principles of Management 3</td>
</tr>
<tr>
<td>COM 219 Speech 3</td>
</tr>
<tr>
<td>COM 221 Technical Report Writing 3</td>
</tr>
<tr>
<td>CS Elective 3</td>
</tr>
<tr>
<td>FA 321 Commercial Single Flight 1</td>
</tr>
<tr>
<td>HU/SS Lower or Upper Level Elective 3</td>
</tr>
<tr>
<td>PS 113 Introductory Physics I 3</td>
</tr>
<tr>
<td>PS 113L Introductory Physics I Laboratory 1</td>
</tr>
<tr>
<td>WX 301 Aviation Weather 3</td>
</tr>
</tbody>
</table>

Credits Subtotal 29.0

Year Three

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 254 Aviation Legislation 3</td>
</tr>
<tr>
<td>or AS 405 Aviation Law 3</td>
</tr>
<tr>
<td>AS 310 Aircraft Performance 3</td>
</tr>
<tr>
<td>AS 311 Aircraft Engines - Turbine 3</td>
</tr>
<tr>
<td>AS 350 Domestic and International Navigation 3</td>
</tr>
<tr>
<td>AS 356 Aircraft Systems and Components 3</td>
</tr>
<tr>
<td>AS 357 Flight Physiology 3</td>
</tr>
<tr>
<td>AS 387 Crew Resource Management 3</td>
</tr>
<tr>
<td>AS 435 Electronic Flight Management Systems 3</td>
</tr>
<tr>
<td>FA 323 Commercial Multi Add On 1</td>
</tr>
<tr>
<td>Open Elective - Upper Level 3</td>
</tr>
<tr>
<td>Open Elective - Any Level 4</td>
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</tbody>
</table>

Credits Subtotal 32.0

Year Four

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 408 Flight Safety 3</td>
</tr>
<tr>
<td>AS 411 Jet Transport Systems 3</td>
</tr>
<tr>
<td>AS 420 Flight Technique Analysis 3</td>
</tr>
<tr>
<td>AS 472 Operational Applications in Aeronautical Science 3</td>
</tr>
<tr>
<td>HU/SS Upper Level Elective 3</td>
</tr>
<tr>
<td>Open Electives - Upper Level 6</td>
</tr>
<tr>
<td>Open Electives - Any Level 9</td>
</tr>
</tbody>
</table>

Credits Subtotal 30.0

Credits Total: 120.0

B.S. in Aeronautics

The Aeronautics degree is designed specifically for students who work, have worked, or desire to work in aviation-related careers. For students with existing aviation-related knowledge and skills, this degree acknowledges a student’s valuable acquired experience through the award of advanced standing prior-learning credit. The curriculum then builds on those skills and knowledge. The program also provides an opportunity for those students new to aviation to acquire aviation-specific knowledge through aviation-related coursework. This combination of a student’s aviation learning, aviation courses, business, computer science, economics, humanities, communications, social sciences, mathematics, and physical sciences, along with professional development elective courses and a minor course of study, will prepare graduates for a career in an aviation-related field.
Aviation Area of Concentration
The Aviation Area of Concentration is the degree component that lets students select courses from various aviation-related fields. In addition, the AOC portion of the degree is where credit for prior aviation learning is applied. Thirty hours of credit are needed to satisfy the requirements of this portion of the Aeronautics degree. All or part of the credit needed for this degree requirement may be awarded based on prior aviation training or experience. To complete the AOC, in addition to any prior learning credit, students may select from courses in Aeronautical Science, Air Traffic Management, Applied Meteorology (aviation-related), Aviation Maintenance Science, Commercial Space Operations, Cooperative Education, Cybersecurity, Flight, Geosciences, Homeland Security, Safety (aviation-related), Simulation, Space Studies or Unmanned Aircraft Systems Science.

Evidence of Prior Aviation Learning
Applicants who qualify for admission to and matriculate in the degree program may be eligible for credit for prior learning. Applicants must be able to prove competence in an aviation occupation with authentic documentary evidence. Training and experience in closely related occupations can be combined.

Just as official transcripts are required to transfer credit from one university to another, original or authenticated documentation of prior learning from professional training and experience must be presented to qualify for award of Aviation Area of Concentration credit. Documentary evidence must be from objective third-party sources and must clearly describe the applicant’s professional training, duties, and achievements in detail. Advanced standing credit will be awarded in accordance with the applicable Embry-Riddle Aeronautical University Curriculum Manual.

Duplicate Credit
Many Embry-Riddle courses are designed to teach the same skills and knowledge that Aeronautics students have acquired through experience and training. Students who complete courses in the same aviation specialty for which they were granted Aviation Area of Concentration credit would be duplicating coverage of the same subject matter. Credit for completion of such courses will not be applied to degree requirements. Credit for prior learning granted in the Aeronautics degree program may not be transferable to any other Embry-Riddle degree program.

Minor
Students must select and complete one minor field of study. Total credits in the minor will vary depending on which minor is chosen. Students typically select a minor that will enhance their aviation career. Courses required for the minor field of study will be used to fill Area of Concentration, Professional Development, or Open Elective degree requirements, depending on discipline selected. More than one minor may be completed while fulfilling core degree requirements. See Minor Courses of Study in this catalog.

Aeronautics Curriculum
The curriculum to be followed by each student will vary depending on any AOC prior learning or transfer credits granted.

General Education Requirements
For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td></td>
</tr>
<tr>
<td>Communication Theory and Skills *</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities *</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences *</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Science *</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (College Algebra or Higher, and MA 112 or MA 222)</td>
<td>6</td>
</tr>
<tr>
<td>Physical and Life Sciences. One course must include a laboratory.</td>
<td>6</td>
</tr>
<tr>
<td>Total Credits</td>
<td>36</td>
</tr>
</tbody>
</table>
Embry-Riddle Aeronautical University – Daytona Beach Campus Catalog 2019-20

* Embry-Riddle courses in the general education categories of Communication Theory and Skills, Mathematics, Computer Science, Physical and Life Sciences, Humanities, and Social Sciences may be chosen from approved list of General Education courses, assuming prerequisite requirements are met and with the permission of the advisor. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified above in the Aeronautics vertical outline. Other courses may also be used with the permission of a department chair.

** Students need to ascertain Mathematics and Physical Sciences pre/corequisites that are required for other courses. For example, PS 113, PS 117, and MA 112 are required for many upper-division AS and WX courses.

Curriculum

<table>
<thead>
<tr>
<th>General Education</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation Area of Concentration</td>
<td>30</td>
</tr>
<tr>
<td>Select from (100-400) courses in AMS, AS, AT, CEA, CSO, CYB, FA, GEO, HS, SF, SIM, SP, UA, WX</td>
<td></td>
</tr>
<tr>
<td>AS 120 Principles of Aeronautical Science or AS 121 Private Pilot Operations</td>
<td></td>
</tr>
<tr>
<td>AS 254 Aviation Legislation</td>
<td></td>
</tr>
<tr>
<td>AS 405 Aviation Law</td>
<td></td>
</tr>
<tr>
<td>AS 474 Operational Applications in Aeronautics</td>
<td></td>
</tr>
<tr>
<td>SF 210 Introduction to Aerospace Safety</td>
<td></td>
</tr>
</tbody>
</table>

Program Support |

| 7 |
| ASC 101 Aeronautical Science Student Success Seminar or UNIV 101 College Success | |
| BA 201 Principles of Management or ACC 210 Financial Accounting | |

Select one of the following:

| 6 |
| EC 200 An Economic Survey or EC 210 Microeconomics or EC 211 Macroeconomics | |
| HU 14X Humanities Lower Level or Social Science Lower Level | |
| SF 210 Introduction to Aerospace Safety | |

Professional Development Electives | 33 |

Select from upper-level (300-400) courses in ACC, AMS, AS, AT, BA, CSO, CYB, EC, FA, GEO, HS, SF, SIM, SP, UA, WX

| 14 |
| Open Electives | |
| Total Credits | 120 |

Suggested Plan of Study

Due to the requirement for one minor and the inherent flexibility of this degree, it is imperative to work closely with your academic advisor to ensure degree requirements are met.

** Year One **

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 120 Principles of Aeronautical Science or AS 121 Private Pilot Operations</td>
</tr>
<tr>
<td>UNIV 101 College Success or ASC 101 Aeronautical Science Student Success Seminar</td>
</tr>
<tr>
<td>Aviation Area of Concentration* (Only if taking AS 120)</td>
</tr>
<tr>
<td>BA 201 Principles of Management or ACC 210 Financial Accounting</td>
</tr>
<tr>
<td>COM 122 English Composition</td>
</tr>
<tr>
<td>MA 111 College Mathematics for Aviation I or MA 112 College Mathematics for Aviation II or MA 222 Business Statistics</td>
</tr>
<tr>
<td>EC 200 An Economic Survey or EC 210 Microeconomics or EC 211 Macroeconomics</td>
</tr>
<tr>
<td>HU 14X Humanities Lower Level or Social Science Lower Level</td>
</tr>
<tr>
<td>SF 210 Introduction to Aerospace Safety</td>
</tr>
</tbody>
</table>

Credits Subtotal | 31.0-33.0

** Year Two **

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 254 Aviation Legislation</td>
</tr>
<tr>
<td>CS Elective</td>
</tr>
<tr>
<td>COM 219 Speech</td>
</tr>
<tr>
<td>COM 221 Technical Report Writing</td>
</tr>
<tr>
<td>HU/SS Lower or Upper Level Elective</td>
</tr>
<tr>
<td>PS Elective</td>
</tr>
<tr>
<td>PS Lab ** (Lab may count as Open Elective credit)</td>
</tr>
<tr>
<td>Aviation Area of Concentration</td>
</tr>
<tr>
<td>Professional Development Elective</td>
</tr>
</tbody>
</table>
B.S. in Aerospace and Occupational Safety

The Applied Aviation Sciences Department offers a Bachelor of Science degree in Aerospace and Occupational Safety that is based on the needs of the marketplace. It combines a solid core designed to meet the Aviation Accreditation Board International (AABI) standards and the University’s General Education requirements. With a complete offering of Safety and Health Management, Aviation Forensics and Occupational Safety courses, students will be prepared to work in the aviation industry as well as in non-aerospace industries.

The Aerospace and Occupational Safety degree is designed for students interested in obtaining a strong safety foundation. The goal of the degree is to produce graduates who are prepared to provide safety expertise in a variety of aviation, aerospace, and other occupational settings. This program will produce professionals who are skilled in providing safety management expertise along with technical guidance in compliance issues involving FAA, EPA, OSHA, DOT, and industrial hygiene, and workplace standards.

Degree Requirements

The Bachelor of Science degree in Aerospace and Occupational Safety requires successful completion of a minimum of 122 credit hours and is normally completed in eight semesters.

Students are required to complete 37 hours of General Education courses, 18 hours of Safety electives, as well as 12 hours of open electives courses. There are several focus areas that allow a student to concentrate in one or more areas of specialization.

Students enrolled in the Air Force, Army, or Naval ROTC programs may substitute AF, MY, or NSC courses for open elective courses.

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

General Education

<table>
<thead>
<tr>
<th>Course Area</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences (EC 200)</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Humanities or Social Sciences (PSY 101)</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (MA 111, MA 112)</td>
<td>6</td>
</tr>
<tr>
<td>Physical and Life Sciences PS 113 and</td>
<td>6</td>
</tr>
<tr>
<td>(CHM 101, PS 117 or BIO 120)</td>
<td></td>
</tr>
<tr>
<td>Physical and Life Sciences Lab (CHM 101L,</td>
<td>1</td>
</tr>
<tr>
<td>BIO 120L or PS 113L or PS 117L)</td>
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</tr>
<tr>
<td><strong>Total Credits</strong></td>
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</table>

Aerospace and Occupational Safety Core

<table>
<thead>
<tr>
<th>Course Area</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIV 101 College Success</td>
<td>1</td>
</tr>
<tr>
<td>AS 120 Principles of Aeronautical Science</td>
<td>3</td>
</tr>
<tr>
<td>or BA 317 Organizational Behavior</td>
<td></td>
</tr>
<tr>
<td>or BA 324 Aviation Labor Relations</td>
<td></td>
</tr>
<tr>
<td>or HF 325 Human Factors and System Safety</td>
<td></td>
</tr>
<tr>
<td>or HS 215 Introduction to Industrial Security</td>
<td></td>
</tr>
<tr>
<td>BA 201 Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>37</strong></td>
</tr>
</tbody>
</table>
MA 222: Business Statistics 3
SF 201: Introduction to Health, Occupational, and Transportation Safety 3
SF 205: Principles of Accident Investigation 3
SF 210: Introduction to Aerospace Safety 3
SF 315: Environmental Compliance and Safety 3
SF 316: Workers Compensation, Insurance, and Risk Management 3
SF 320: Human Factors in Aviation Safety 3
SF 345: Safety Program Management 3
SF 355: Industrial Hygiene and Toxicology 3
SF 365: Fire Protection 3
SF 410: Design of Engineering Hazard Controls 3
SF 420: Analysis of Observational Data 3
SF 445: System Safety in Aviation 3
SF 455: Digital Safety Data Analysis 3
SF 462: Health, Safety, and Aviation Law 3
SF 470: Applications of Safety Management Capstone 3

Total Credits 55

Aerospace and Occupational Safety Electives 18
Open Electives 12

Total Degree Requirements 122

Suggested Plan of Study

Students should be aware that several courses in each academic year may have prerequisites and/or co-requisites. Please check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

**Year One**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIV 101: College Success 1</td>
</tr>
<tr>
<td>COM 122: English Composition 3</td>
</tr>
<tr>
<td>COM 219: Speech 3</td>
</tr>
<tr>
<td>BA 201: Principles of Management 3</td>
</tr>
<tr>
<td>CS 120: Introduction to Computing in Aviation 3</td>
</tr>
<tr>
<td>MA 111: College Mathematics for Aviation I 3</td>
</tr>
</tbody>
</table>

**Year Two**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 120: Principles of Aeronautical Science 3</td>
</tr>
<tr>
<td>or BA 317: Organizational Behavior</td>
</tr>
<tr>
<td>or BA 324: Aviation Labor Relations</td>
</tr>
<tr>
<td>or HF 325: Human Factors and System Safety</td>
</tr>
<tr>
<td>or HS 215: Introduction to Industrial Security</td>
</tr>
<tr>
<td>COM 221: Technical Report Writing 3</td>
</tr>
<tr>
<td>CHM 101: Basic Chemistry 3</td>
</tr>
<tr>
<td>or BIO 120: Foundations of Biology I</td>
</tr>
<tr>
<td>or PS 117: Introductory Physics II</td>
</tr>
<tr>
<td>EC 200: An Economic Survey 3</td>
</tr>
<tr>
<td>MA 112: College Mathematics for Aviation II 3</td>
</tr>
<tr>
<td>SF 315: Environmental Compliance and Safety 3</td>
</tr>
<tr>
<td>HU 14x Lower Level Humanities 3</td>
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<tr>
<td>Aerospace and Occupational Safety Elective 6</td>
</tr>
<tr>
<td>Open Elective 3</td>
</tr>
</tbody>
</table>

Credits Subtotal 30.0

**Year Three**

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 222: Business Statistics 3</td>
</tr>
<tr>
<td>SF 316: Workers Compensation, Insurance, and Risk Management 3</td>
</tr>
<tr>
<td>SF 320: Human Factors in Aviation Safety 3</td>
</tr>
<tr>
<td>SF 345: Safety Program Management 3</td>
</tr>
<tr>
<td>SF 355: Industrial Hygiene and Toxicology 3</td>
</tr>
</tbody>
</table>

Credits Subtotal 30.0
B.S. in Air Traffic Management

The Applied Aviation Sciences Department offers a Bachelor of Science degree in Air Traffic Management (ATM). This degree is designed to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship in the field of air traffic management. The degree provides global leadership in the field of air traffic management and offers coursework and laboratory experiences that prepare students for immediate productivity and career growth with the Federal Aviation Administration, the Department of Defense, and commercial air traffic facilities. It is the intent of the Bachelor of Science in Air Traffic Management to accomplish this goal by:

- Emphasizing academic excellence in the teaching of all courses and programs.
- Pursuing research and creative activities that maintain and extend knowledge in the field of Air Traffic Management.
- Supporting each student's personal development by encouraging participation in internships and co-op programs.

Degree Requirements

The Bachelor of Science degree in Air Traffic Management requires successful completion of a minimum of 120 credit hours, normally completed in eight semesters. This includes a minor course of study or breadth area as approved by the Program Coordinator, Air Traffic Management.

General Education Requirements*

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory &amp; Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
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</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (MA 111 and MA 112)</td>
<td>6</td>
</tr>
<tr>
<td>Physical and Life Sciences (WX 201 required)</td>
<td>6</td>
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<tr>
<td><strong>Total Credits</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

* Embry-Riddle courses in the general education categories of Communication Theory and Skills, Computer Science, Humanities, Social Sciences, Mathematics, and Physical Sciences may be chosen from those listed below, assuming prerequisite requirements are met. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified in the Air Traffic Management vertical outline.

Suggested Plan of Study

Students should be aware that several courses in each academic year might have prerequisites and/or corequisites. Please check the course descriptions in this catalog before registering for classes to ensure requisite sequencing.
### Year One

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 202</td>
<td>3</td>
</tr>
<tr>
<td>MA 111</td>
<td>3</td>
</tr>
<tr>
<td>MA 112</td>
<td>3</td>
</tr>
<tr>
<td>WX 201</td>
<td>3</td>
</tr>
<tr>
<td>Communication Theory and Skills</td>
<td>6</td>
</tr>
<tr>
<td>Computer Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Lower-Level Elective</td>
<td>3</td>
</tr>
<tr>
<td>Open Elective</td>
<td>3</td>
</tr>
<tr>
<td>Physical Sciences with Laboratory</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
</tr>
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</table>

### Year Two

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>AT 305</td>
<td>3</td>
</tr>
<tr>
<td>AT 306</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>3</td>
</tr>
<tr>
<td>BA 310</td>
<td>3</td>
</tr>
<tr>
<td>SF 210</td>
<td>3</td>
</tr>
<tr>
<td>Communication Theory and Skills</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Science</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Science</td>
<td>3</td>
</tr>
<tr>
<td>Upper or Lower-Level Humanities or Social Science</td>
<td>3</td>
</tr>
<tr>
<td>Open Elective</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
</tr>
</tbody>
</table>

### Year Three

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 307</td>
<td>3</td>
</tr>
<tr>
<td>AT 315</td>
<td>3</td>
</tr>
<tr>
<td>AT 401</td>
<td>3</td>
</tr>
<tr>
<td>AT 405</td>
<td>3</td>
</tr>
<tr>
<td>BA 315</td>
<td>3</td>
</tr>
<tr>
<td>WX 301</td>
<td>3</td>
</tr>
<tr>
<td>Open Elective Upper-Level</td>
<td>6</td>
</tr>
<tr>
<td>Open Elective</td>
<td>3</td>
</tr>
<tr>
<td>Minor Requirement</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
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</table>

### Year Four

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 406</td>
<td>3</td>
</tr>
<tr>
<td>AT 425</td>
<td>3</td>
</tr>
<tr>
<td>Minor or breadth area - approved</td>
<td>15-24</td>
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<tr>
<td>Open Elective (subject to Minor requirements)</td>
<td>3-9</td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td><strong>24.0-39.0</strong></td>
</tr>
</tbody>
</table>

**Credits Total:** 120

---

**B.S. in Aviation Maintenance Science**

At the heart of every flight of every commercial, private, or military aircraft is the work of the professional aviation maintenance expert. Without the devotion of these very special people, the air travel system would cease to function. The demand for degreed aircraft maintenance specialists in the aviation/aerospace world has never been greater than it is today. The Aviation Maintenance Science (AMS) program at Embry-Riddle produces these aviation professionals, the best in the world.

The Aviation Maintenance Science bachelor’s degree is made up of general education courses, technical courses, and labs that lead to FAA Airframe and Powerplant (A&P) mechanic’s certification, and a group of courses known as an area of concentration (AOC). There are three areas of concentration, from which a student picks one, as follows:

- Maintenance Management
- Flight
- Safety Science
- Avionics Cybertechnology and Security
The degree is composed of 126 credit hours.

The Maintenance Management AOC is optimized for those who wish to use their maintenance skills as a platform for advancing into a management position in one of the many aviation maintenance environments.

The Flight AOC is for those students who wish to combine a maintenance background with the qualifications of a commercial pilot.

The Safety Science AOC combines both occupational and aviation-specific safety courses with the technical coursework that leads to FAA Airframe and Powerplant certifications.

Finally, the Avionics Cybertechnology and Security AOC prepare students to attain several other certifications related to avionics systems troubleshooting and repair and empowers them to meet the challenges of securing these systems from outside interferences that can cripple an aircraft.

The AMS is a STEM degree accredited by the Southern Association of Colleges and Schools and the Aviation Accreditation Board International (AABI, formerly Council on Aviation Accreditation), 3410 Skyway Drive, Auburn, AL 86830, telephone: (334) 844-2431.

The technical track courses taken in the Aviation Maintenance Science Department lead to the attainment of the FAA issued A&P certifications. Credit will be granted for any student who enters the University already in possession of the A&P certification.

International certification, which may be equivalent to the Airframe and Powerplant certification, will be evaluated on a case-by-case basis and, if approved, may be used for academic credit.

<table>
<thead>
<tr>
<th></th>
<th>Flight</th>
<th>Maintenance Management</th>
<th>Safety Science</th>
<th>Avionics Cybertechnology and Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education Core</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Area of Concentration</td>
<td>36*</td>
<td>36</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>A&amp;P Technical Courses</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>Upper Level Open Electives</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>126</td>
<td>126</td>
<td>127</td>
</tr>
</tbody>
</table>

1 If a student transfers to Embry-Riddle with the A&P mechanic’s certification, 48 credit hours will be awarded and entered on the student’s transcript, 36 as lower-level credits and 12 as upper-level credits.

* The Flight Area of Concentration in the AMS degree requires a student, once they have matriculated, to take their flight training with Embry-Riddle.

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills (COM 122, COM 219, COM 221)</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Lower-Level Social Sciences (PSY 101)</td>
<td>3</td>
</tr>
<tr>
<td>Lower or Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Upper-Level Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Computer Science (CS 120)</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics *</td>
<td>6</td>
</tr>
</tbody>
</table>
Physical Sciences **

Total Credits 36

* Mathematics required courses - Maintenance Management AOC, MA 111 or MA 140 and MA 222. Avionics Cybertechnology and Security, Flight and Safety Science AOCs, MA 111 and MA 112.

** Physical Sciences required courses - Avionics Cybertechnology and Security and Maintenance Management AOCs, any two lower level physical science courses with at least one laboratory. Flight and Safety Science AOC, PS 113 and PS 117 (One Laboratory required).

Aviation Maintenance Science Courses (leading to A&P certification)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS 115</td>
<td>Aviation Mathematics and Physics</td>
<td>2</td>
</tr>
<tr>
<td>AMS 116</td>
<td>Fundamentals of Electricity</td>
<td>4</td>
</tr>
<tr>
<td>AMS 117</td>
<td>Tools, Materials and Processes</td>
<td>4</td>
</tr>
<tr>
<td>AMS 118</td>
<td>Aircraft Familiarization and Regulations</td>
<td>2</td>
</tr>
<tr>
<td>AMS 261</td>
<td>Aircraft Metallic Structures</td>
<td>3</td>
</tr>
<tr>
<td>AMS 262</td>
<td>Aircraft Composite Structures</td>
<td>3</td>
</tr>
<tr>
<td>AMS 263</td>
<td>General Aviation Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 264</td>
<td>General Aviation Aircraft Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 271</td>
<td>Aircraft Reciprocating Powerplant and Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 272</td>
<td>Powerplant Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
<td>2</td>
</tr>
<tr>
<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
</tr>
<tr>
<td>AMS 365</td>
<td>Transport Category Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 366</td>
<td>Transport Category Aircraft Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
</tr>
<tr>
<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 48

Tuition for the AMS courses is less than for the other courses in the degree, and is billed separately from the University block tuition. Contact the AMS program coordinator for additional information.

Suggested Plan of Study - Common Year One and Year Two

See specific area of concentration for Year Three and Year Four suggested plan of study.

**Year One**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS 115</td>
<td>Aviation Mathematics and Physics</td>
<td>2</td>
</tr>
<tr>
<td>AMS 116</td>
<td>Fundamentals of Electricity</td>
<td>4</td>
</tr>
<tr>
<td>AMS 117</td>
<td>Tools, Materials and Processes</td>
<td>4</td>
</tr>
<tr>
<td>AMS 118</td>
<td>Aircraft Familiarization and Regulations</td>
<td>2</td>
</tr>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>Speech</td>
<td>3</td>
</tr>
<tr>
<td>CS 120</td>
<td>Introduction to Computing in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>AMS 261</td>
<td>Aircraft Metallic Structures</td>
<td>3</td>
</tr>
<tr>
<td>AMS 262</td>
<td>Aircraft Composite Structures</td>
<td>3</td>
</tr>
<tr>
<td>AMS 263</td>
<td>General Aviation Aircraft Systems</td>
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</tr>
<tr>
<td>AMS 264</td>
<td>General Aviation Aircraft Electrical and Instrument Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 365</td>
<td>Transport Category Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 366</td>
<td>Transport Category Aircraft Electrical and Instrument Systems</td>
<td>3</td>
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<tr>
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<td>Aircraft Reciprocating Powerplant and Systems</td>
<td>3</td>
</tr>
<tr>
<td>AMS 272</td>
<td>Powerplant Electrical and Instrument Systems</td>
<td>3</td>
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<tr>
<td>PS 113</td>
<td>Introductory Physics I</td>
<td>3</td>
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<tr>
<td>MA 112</td>
<td>College Mathematics for Aviation II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Credits Subtotal:** 30.0

**Year Two Credits Total:** 60.0

### Avionics Cybertechnology & Security Area of Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMSA 490</td>
<td>Aviation Technical Operations</td>
<td>3</td>
</tr>
<tr>
<td>AMS 380</td>
<td>Radio Communication Theory &amp; Application</td>
<td>2</td>
</tr>
<tr>
<td>AMS 384</td>
<td>General Aviation Avionics Systems Integration</td>
<td>4</td>
</tr>
<tr>
<td>AMS 388</td>
<td>Air Transport Avionics Systems Line Maintenance</td>
<td>6</td>
</tr>
<tr>
<td>CS 223</td>
<td>Scientific Programming in C</td>
<td>3</td>
</tr>
<tr>
<td>CYB 155</td>
<td>Foundations of Information Security</td>
<td>3</td>
</tr>
<tr>
<td>CS 225</td>
<td>Computer Science II</td>
<td>4</td>
</tr>
<tr>
<td>CS 344</td>
<td>C Programming and UNIX</td>
<td>3</td>
</tr>
<tr>
<td>CS 303</td>
<td>Network Security</td>
<td>3</td>
</tr>
<tr>
<td>CS 427</td>
<td>System Exploitation and Penetration Testing</td>
<td>3</td>
</tr>
<tr>
<td>CYB 474</td>
<td>Issues in Aviation Cybersecurity</td>
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</table>

**Total Credits:** 37

### Suggested Plan of Study – Avionics Cybertechnology and Security Area of Concentration

**Year Three Credits Total:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
<td>2</td>
</tr>
<tr>
<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
</tr>
<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
</tr>
<tr>
<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
<td>3</td>
</tr>
<tr>
<td>CS 225</td>
<td>Computer Science II</td>
<td>4</td>
</tr>
<tr>
<td>CS 303</td>
<td>Network Security</td>
<td>3</td>
</tr>
<tr>
<td>CS 344</td>
<td>C Programming and UNIX</td>
<td>3</td>
</tr>
<tr>
<td>MA 112</td>
<td>College Mathematics for Aviation II</td>
<td>3</td>
</tr>
<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physics and Life Science Lower Level Elective</td>
<td>3</td>
</tr>
</tbody>
</table>
Social Science Lower Level (SS 110, SS 120 or SS 130)  
3

Credits Subtotal  
34.0

Year Four
AMSA 490  
Aviation Technical Operations  
3
AM 380  
Radio Communication Theory & Application  
2
AM 384  
General Aviation Avionics Systems Integration  
4
AM 388  
Air Transport Avionics Systems Line Maintenance  
6
CYB 474  
Issues in Aviation Cybersecurity  
3
CS 427  
System Exploitation and Penetration Testing  
3
Physics and Life Science Lower Level Elective  
3
Humanities or Social Science Upper Level Elective  
3
Upper Level Open Electives  
6
Credits Subtotal  
33.0
Credits Total:  
67.0

Flight Area of Concentration
FA 121  
Private Single Flight  
1
FA 221  
Instrument Single Flight  
1
FA 321  
Commercial Single Flight  
1
FA 323  
Commercial Multi Add On  
1
AS 121  
Private Pilot Operations  
5
AMSA 490  
Aviation Technical Operations  
3
AS 221  
Instrument Pilot Operations  
3
AS 309  
Aerodynamics  
3
AS 310  
Aircraft Performance  
3
AS 321  
Commercial Pilot Operations  
3
AS 350  
Domestic and International Navigation  
3
AS 357  
Flight Physiology  
3
WX 201  
Survey of Meteorology  
3
WX 301  
Aviation Weather  
3
Total Credits  
36

Suggested Plan of Study - Flight Area of Concentration
Flight Track
Year Three

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
<td>2</td>
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<tr>
<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
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<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
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<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
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</tr>
<tr>
<td>AS 121</td>
<td>Private Pilot Operations</td>
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<tr>
<td>AS 221</td>
<td>Instrument Pilot Operations</td>
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<tr>
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Total Credits: 36
COM 221  Technical Report Writing  3  
PS 117  Introductory Physics II  3  
WX 201  Survey of Meteorology  3  
          Lower-Level Social Science Elective  3  

**Credits Subtotal**  34.0

**Year Four**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
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<td>Aerodynamics</td>
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<td>AS 310</td>
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<td>Commercial Pilot Operations</td>
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<td>WX 301</td>
<td>Aviation Weather</td>
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**Upper-Level Open Electives**  6

**Upper-Level Humanities or Social Science Elective**  3

**Credits Subtotal**  32.0

**Credits Total:**  66.0

**Maintenance Management Area of Concentration**

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<td>ACC 210</td>
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<td>Aviation Technical Operations</td>
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<tr>
<td>BA 201</td>
<td>Principles of Management</td>
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<tr>
<td>BA 220</td>
<td>Marketing</td>
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<tr>
<td>BA 225</td>
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<td>BA 314</td>
<td>Human Resource Management</td>
<td>3</td>
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<td>BA 320</td>
<td>Business Information Systems</td>
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<tr>
<td>BA 324</td>
<td>Aviation Labor Relations</td>
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<tr>
<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
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</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
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**Total Credits**  36

**Suggested Plan of Study - Maintenance Management Area of Concentration**

**Year Three**

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<td>Aircraft Turbines Powerplants and Systems</td>
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<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
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<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
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**Credits**
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<td>PS 117</td>
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**Year Four**

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<th>Course Title</th>
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<td>Aviation Technical Operations</td>
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<tr>
<td>BA 225</td>
<td>Business Law</td>
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<td>BA 314</td>
<td>Human Resource Management</td>
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<td>BA 320</td>
<td>Business Information Systems</td>
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<td>BA 324</td>
<td>Aviation Labor Relations</td>
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<tr>
<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
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<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
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<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
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**Safety Science Area of Concentration**

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<tr>
<td>AMSA 490</td>
<td>Aviation Technical Operations</td>
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<tr>
<td>SF 201</td>
<td>Introduction to Health, Occupational, and Transportation Safety</td>
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</tr>
<tr>
<td>or SF 210</td>
<td>Introduction to Aerospace Safety</td>
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</tr>
<tr>
<td>SF 205</td>
<td>Principles of Accident Investigation</td>
<td>3</td>
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<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
<td>3</td>
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<tr>
<td>SF 316</td>
<td>Workers Compensation, Insurance, and Risk Management</td>
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<tr>
<td>SF 320</td>
<td>Human Factors in Aviation Safety</td>
<td>3</td>
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<td>SF 345</td>
<td>Safety Program Management</td>
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<tr>
<td>SF 365</td>
<td>Fire Protection</td>
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<tr>
<td>SF 462</td>
<td>Health, Safety, and Aviation Law</td>
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**Choose one focus from the options below:**

**Aviation Focus Course List:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>SF 330</td>
<td>Aircraft Accident Investigation</td>
</tr>
<tr>
<td>SF 375</td>
<td>Propulsion Plant Investigation</td>
</tr>
<tr>
<td>SF 335</td>
<td>Mechanical and Structural Factors in Aviation Safety</td>
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<tr>
<td>or SF 435</td>
<td>Aircraft Crash Survival Analysis and Design</td>
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**Occupational Safety Focus Course List:**

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<th>Course Title</th>
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<tbody>
<tr>
<td>HS 215</td>
<td>Introduction to Industrial Security</td>
</tr>
<tr>
<td>SF 355</td>
<td>Industrial Hygiene and Toxicology</td>
</tr>
<tr>
<td>SF 410</td>
<td>Design of Engineering Hazard Controls</td>
</tr>
<tr>
<td>or SF 440</td>
<td>Design of Engineering Hazard Controls II</td>
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**Total Credits**

36
Suggested Plan of Study - Aviation Focus

### Year Three

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
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<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
<td>4</td>
</tr>
<tr>
<td>AMS 375</td>
<td>Repair Station Operations</td>
<td>3</td>
</tr>
<tr>
<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
<td>3</td>
</tr>
<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>PS 117</td>
<td>Introductory Physics II</td>
<td>3</td>
</tr>
<tr>
<td>SF 201</td>
<td>Introduction to Health, Occupational, and Transportation Safety</td>
<td>3</td>
</tr>
<tr>
<td>or SF 210</td>
<td>Introduction to Aerospace Safety</td>
<td></td>
</tr>
<tr>
<td>SF 205</td>
<td>Principles of Accident Investigation</td>
<td>3</td>
</tr>
<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
<td>3</td>
</tr>
<tr>
<td>SF 330</td>
<td>Aircraft Accident Investigation</td>
<td>3</td>
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<td>Lower-Level Social Sciences (SS 110, 120, 130)</td>
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<td><strong>33.0</strong></td>
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### Year Four

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<th>Credits</th>
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<tbody>
<tr>
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<td>Aviation Technical Operations</td>
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<tr>
<td>SF 316</td>
<td>Workers Compensation, Insurance, and Risk Management</td>
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</tr>
<tr>
<td>SF 320</td>
<td>Human Factors in Aviation Safety</td>
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<tr>
<td>SF 335</td>
<td>Mechanical and Structural Factors in Aviation Safety</td>
<td>3</td>
</tr>
<tr>
<td>or SF 435</td>
<td>Aircraft Crash Survival Analysis and Design</td>
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<td>SF 345</td>
<td>Safety Program Management</td>
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<td>SF 365</td>
<td>Fire Protection</td>
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<tr>
<td>SF 375</td>
<td>Propulsion Plant Investigation</td>
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<tr>
<td>SF 462</td>
<td>Health, Safety, and Aviation Law</td>
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**Credits Total:** 66.0

Suggested Plan of Study - Aviation Occupational Safety Focus

### Year Three

<table>
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<tr>
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<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AMS 273</td>
<td>Propeller Systems</td>
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<td>AMS 274</td>
<td>Aircraft Turbines Powerplants and Systems</td>
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<td>AMS 376</td>
<td>Powerplant Line Maintenance</td>
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<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
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<td>PS 117</td>
<td>Introductory Physics II</td>
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<td>Introduction to Health, Occupational, and Transportation Safety</td>
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<tr>
<td>or SF 210</td>
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<tr>
<td>SF 205</td>
<td>Principles of Accident Investigation</td>
<td>3</td>
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<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
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**Credits Total:** 66.0
**B.S. in Meteorology**

The Applied Aviation Sciences Department offers a Bachelor of Science degree in Meteorology. This program offers students with a passion for weather the opportunity to study, observe, and research atmospheric phenomena ranging from tornadoes to climate change in our computer-equipped classrooms and state-of-the-art Weather Center, which receives over 500 gigabytes of world-wide weather information each day. Students will master the essentials of meteorology by incorporating foundational calculus, physics, and computer science concepts into real-world atmospheric applications. The goal of the Meteorology program is to offer coursework, laboratory, and research experiences that prepare students for immediate productivity and career growth. Graduates will be competitive for professional careers working as: National Weather Service Meteorologists, TV weather broadcasters, airline meteorologists, private industry meteorologists, university researchers, emergency managers, and military weather officers. Students completing this degree will meet all American Meteorological Society guidelines for a degree in meteorology as well as all U.S. Office of Personnel Management Qualification Standards for a Meteorologist.

**Degree Requirements**

The Bachelor of Science degree in Meteorology requires successful completion of a minimum of 120 credit hours and can typically be attained in eight semesters. All students must complete the general education courses, program support courses, and meteorology core courses in order to graduate with a Bachelor of Science in Meteorology. All students entering the Meteorology program must take a math placement test or show suitable advanced placement. Because many courses have prerequisites or co-requisites, students should prepare to begin the required calculus sequence and physics sequence as soon as they are eligible. All students must complete a capstone course (WX 482) during their senior year. The student must meet all requirements in the four program areas to graduate. These include: General Education, Program Support, Meteorology Core, and Open Electives.

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>General Education</td>
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</tr>
<tr>
<td>Program Support</td>
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<tr>
<td>Meteorology Core</td>
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**Curriculum**

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<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>HS 215</td>
<td>Introduction to Industrial Security</td>
<td>3</td>
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<tr>
<td></td>
<td>Lower-Level Social Sciences (SS 110, 120, 130)</td>
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<tr>
<td>Year Four</td>
<td>AMSA 490</td>
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<td></td>
<td>SF 316</td>
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<td></td>
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### General Education Requirements
For a full description of Embry-Riddle General Guidelines please see the General Education section of the catalog.

<table>
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<td>COM 219</td>
<td>Speech</td>
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<td>MA 241</td>
<td>Calculus and Analytical Geometry I</td>
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<td>CS 118</td>
<td>Fundamentals of Computer Programming (preferred)</td>
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<td>MA 242</td>
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<td>PS 150</td>
<td>Physics for Engineers I</td>
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<td>PS 160</td>
<td>Physics for Engineers II</td>
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<tr>
<td>Lower-Level Social Sciences</td>
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</table>

**Total Credits:** 38

### Program Support Requirements
Program support courses are intended to provide foundational concepts to enhance college success or to prepare students for advanced meteorology courses.

<table>
<thead>
<tr>
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<td>MA 345</td>
<td>Differential Equations and Matrix Methods</td>
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<tr>
<td>CHM 110</td>
<td>General Chemistry I</td>
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**Total Credits:** 17

### Meteorology Core Requirements

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<td>GEO 215</td>
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<td>WX 201</td>
<td>Survey of Meteorology</td>
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<tr>
<td>WX 261</td>
<td>Applied Climatology</td>
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<td>WX 272</td>
<td>Meteorological Instruments and Data Analysis</td>
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<td>WX 301</td>
<td>Aviation Weather</td>
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<td>Operational Analysis and Forecasting</td>
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<td>WX 361</td>
<td>Global Climate Change</td>
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<tr>
<td>or WX 381</td>
<td>Climate Dynamics</td>
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<td>WX 367</td>
<td>Thermodynamic Meteorology</td>
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<td>WX 368</td>
<td>Physical Meteorology</td>
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<tr>
<td>WX 374</td>
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<td>WX 375</td>
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<td>WX 378</td>
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<td>WX 422</td>
<td>Statistical Applications for Meteorological Data Analysis</td>
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<td>WX 482</td>
<td>Research Methods in Meteorology</td>
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</table>

**Total Credits:** 51

### Open Electives

Open Electives allow the student, with the guidance of an academic advisor, to select from a wide range of possible courses, which would help prepare for their individual career path. Suggested electives include additional WX courses, AS courses, BA courses, CS courses, COM courses, MA courses, and PS courses. Students will select at least 14 credits of open electives. Students seeking graduate school in meteorology or atmospheric science should consider a minor in mathematics (applied or computational) or computer science. Students seeking to become a broadcast meteorologist should consider a minor in Communication and Broadcast Media.

### Suggested Plan of Study
Students should be aware that several courses in each academic year may have prerequisites and/or co-requisites. Please check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.
### Year One

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
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<tr>
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<tr>
<td>CS 118 Fundamentals of Computer Programming</td>
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<tr>
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<td>MA 242 Calculus and Analytical Geometry II</td>
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<td>PS 150 Physics for Engineers I</td>
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<tr>
<td>CHM 110 General Chemistry I</td>
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<td>CHM 110L General Chemistry I Laboratory</td>
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<td>WX 201 Survey of Meteorology</td>
<td>3</td>
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<td>MA 345 Differential Equations and Matrix Methods</td>
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<td>WX 272 Meteorological Instruments and Data Analysis</td>
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<td>WX 327 Operational Analysis and Forecasting</td>
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<td>WX 367 Thermodynamic Meteorology</td>
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### Year Three

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<td>GEO 215 Introduction to Geosience</td>
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<td>WX 368 Physical Meteorology</td>
<td>3</td>
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<td>WX 374 Dynamic Meteorology I</td>
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<td>WX 375 Dynamic Meteorology II</td>
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<td>WX 422 Statistical Applications for Meteorological Data Analysis</td>
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<td>WX 462 Numerical Weather Prediction</td>
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<td>WX 466 Advanced Synoptic Analysis and Forecasting</td>
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<td>WX 478 Mesoscale Meteorology</td>
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<td>WX 482 Research Methods in Meteorology</td>
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### B.S. in Spaceflight Operations

The Bachelor of Science degree in Spaceflight Operations (SFO) is a unique program focused on the policy, operations, safety, training, human factors, and planning elements of commercial and private space operations. The new degree program consists of a core curriculum, two possible specializations, and electives, for a total of 120-122 credits. Class and credit requirements are detailed below.

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<th>Credits</th>
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<td>Electives</td>
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<td><strong>24-26</strong></td>
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### General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

The general education component of the Spaceflight Operations degree follows the general guidelines for ERAU undergraduate programs for a total of 39 credits.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
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<td>Communications Theory and Skills (COM 122, COM 219, COM 221)</td>
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<td>Lower-Level Humanities</td>
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</table>
Lower-Level Social Sciences (PSY 101) 3
Lower or Upper-Level Humanities or Social Sciences 3
Upper-Level Humanities or Social Sciences 3
Computer Science 3
Mathematics (MA 111, MA 112 or equivalent) 6
Physical and Life Sciences (PS 113, PS 113L, and BIO 120, BIO 120L) 8
Total Credits 38

Core Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tr>
<td>BA 424</td>
<td>Project Management in Aviation Operations</td>
<td>3</td>
</tr>
<tr>
<td>CSO 101</td>
<td>Space Programs Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CSO 230</td>
<td>Space Policy and Law - History</td>
<td>3</td>
</tr>
<tr>
<td>CSO 330</td>
<td>Spaceflight and Operations Training</td>
<td>3</td>
</tr>
<tr>
<td>CSO 351</td>
<td>Fundamentals of Space Policy and Regulation</td>
<td>3</td>
</tr>
<tr>
<td>CSO 410</td>
<td>Space Operations Planning and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CSO 490</td>
<td>Senior Space Operations Project</td>
<td>3</td>
</tr>
<tr>
<td>HF 306</td>
<td>Human Factors I: Principles and Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>HF 300</td>
<td>Human Factors in Space or HF 326</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
<tr>
<td>SF 210</td>
<td>Introduction to Aerospace Safety</td>
<td>3</td>
</tr>
<tr>
<td>SP 300</td>
<td>Satellite and Spacecraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>SP 400</td>
<td>Introduction to Space Navigation</td>
<td>3</td>
</tr>
</tbody>
</table>
Total Credits 37

Electives
For greater breadth in the curriculum, the Spaceflight Operation degree requires 20 credits as open electives. It is recommended that the student select a minor that relates to the Spaceflight field to satisfy these elective requirements and to help strengthen their transcript record.

Areas of Specialization
The two specializations within the Spaceflight Operations degree program have distinctly different course makeup and prerequisite requirements. Each requires a choice of seven courses within the specialization, as listed below (24-26 credit hours total).

**Space Policy and Operations** 24

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CSO 310</td>
<td>International Space Policy and Law</td>
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</tr>
<tr>
<td>CSO 460</td>
<td>Applied Spaceflight Policy and Regulation</td>
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</table>

Electives (students must choose 6 courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
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<tr>
<td>BA 201</td>
<td>Principles of Management</td>
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<tr>
<td>BA 318</td>
<td>Entrepreneurship I</td>
<td>3</td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>HF 306</td>
<td>Human Factors III: Performance Processes</td>
<td>4</td>
</tr>
<tr>
<td>HF 325</td>
<td>Human Factors and System Safety</td>
<td>3</td>
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<tr>
<td>HF 410</td>
<td>Human Factors Engineering: Crew Station Design</td>
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<tr>
<td>HS 110</td>
<td>Introduction to Homeland Security</td>
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<tr>
<td>SF 345</td>
<td>Safety Program Management</td>
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**Operations Science and Technology** 26

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CS 223</td>
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<tr>
<td>CSO 390</td>
<td>Payloads and Integration</td>
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<tr>
<td>EGR 101</td>
<td>Introduction to Engineering</td>
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Electives (students must choose 6 courses)

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<td>Fundamentals of Computer Programming</td>
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<td>HF 312</td>
<td>Ergonomics and Bioengineering</td>
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<tr>
<td>HF 440</td>
<td>Aerospace Physiology</td>
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<tr>
<td>PS 224</td>
<td>Astronomy</td>
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<tr>
<td>SIM 200</td>
<td>Aviation Simulation Systems</td>
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<td>SP 220</td>
<td>Life Support Systems</td>
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Suggested Plan of Study - Space Policy and Operations Specialization

**Year One**

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<tr>
<th>Credits</th>
<th>First Semester</th>
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<tbody>
<tr>
<td>UNIV 101</td>
<td>College Success</td>
</tr>
<tr>
<td>CSO 101</td>
<td>Space Programs Seminar</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
</tr>
<tr>
<td>PSY 101</td>
<td>Introduction to Psychology</td>
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<tr>
<td></td>
<td>Communication Theory and Skills</td>
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<td>PS 113</td>
<td>Introductory Physics I</td>
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<td>PS 113L</td>
<td>Introductory Physics I Laboratory</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
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<td>MA 112</td>
<td>College Mathematics for Aviation II</td>
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<tr>
<td>SF 210</td>
<td>Introduction to Aerospace Safety</td>
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<tr>
<td>BIO 120 &amp; 120L</td>
<td>Foundations of Biology I</td>
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<td>First Semester</td>
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<td>ACC 210</td>
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<td>HF 300</td>
<td>Human Factors I: Principles and Fundamentals</td>
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<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
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<td>MA 222</td>
<td>Business Statistics</td>
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<td>HF 330</td>
<td>Human Factors in Space</td>
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<td>Human Performance in Extreme Environments</td>
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<td>Introduction to Space Navigation</td>
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Suggested Plan of Study - Operations Science and Technology Specialization

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Suggested Plan of Study - Operations Science and Technology Specialization
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<td>CS 118 Fundamentals of Computer Programming</td>
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<td>COM 221 Technical Report Writing</td>
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### Year Three

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<tbody>
<tr>
<td>COM 219 Speech</td>
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<tr>
<td>CSO 351 Fundamentals of Space Policy and Regulation</td>
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<td>Upper Level HU</td>
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<table>
<thead>
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<tbody>
<tr>
<td>CSO 390 Payloads and Integration</td>
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<tr>
<td>Upper HU/SS</td>
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<tr>
<td>CS Elective</td>
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### Year Four

<table>
<thead>
<tr>
<th>First Semester</th>
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<tbody>
<tr>
<td>CSO 330 Spaceflight and Operations Training</td>
<td>3</td>
</tr>
<tr>
<td>CSO 410 Space Operations Planning and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>SP 400 Introduction to Space Navigation</td>
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<td>Electives</td>
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<table>
<thead>
<tr>
<th>Second Semester</th>
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<tbody>
<tr>
<td>BA 424 Project Management in Aviation Operations</td>
<td>3</td>
</tr>
<tr>
<td>CSO 490 Senior Space Operations Project</td>
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</tr>
<tr>
<td>CSO Elective</td>
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<tr>
<td>Credits Subtotal</td>
<td>30.0</td>
</tr>
</tbody>
</table>

| Credits Total:                                      | 120.0|

### Electives

For greater breadth in the curriculum, the SFO degree includes twenty credits as open electives. It is recommended that the student select a minor that relates to the spaceflight field to satisfy these elective requirements and to help strengthen their transcript record.

### B.S. in Unmanned Aircraft Systems Science

The Unmanned Aircraft Systems (UAS) Science degree provides the necessary education and training for aspiring professionals in the diverse field of unmanned aviation operations. The degree provides a solid foundation for several UAS applications areas, including hazardous operations, surveillance and data collection, secure operations, long duration operations, highly-repetitive operations, and autonomous operations. Graduates will be well grounded in all aspects of UAS operations, ranging from simple inspection missions to planning and executing complex long-term missions in ways that insure safe and professional operations at all levels.

### Admission Requirements

Students entering this program should have a basic background in math and physics. Students wishing to strengthen their background in math and the basic sciences before enrolling in the prescribed courses should contact the department chair or the program coordinator for guidance.

Due to International Traffic in Arms Regulations (ITAR) imposed by the United States’ Department of State, this degree will only be open to U.S. citizens.

### Degree Requirements

The Bachelor of Science in Unmanned Aircraft Systems may be attained in eight semesters. To earn the degree, successful completion of 122 credit hours is required.

<table>
<thead>
<tr>
<th>General Education</th>
<th>37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aeronautical Knowledge</td>
<td>16</td>
</tr>
<tr>
<td>Geospatial Data Acquisition and Processing</td>
<td>16</td>
</tr>
<tr>
<td>Operations and Leadership</td>
<td>15</td>
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<tr>
<td>Technical Skills Development</td>
<td>8</td>
</tr>
<tr>
<td>Program Support</td>
<td>12</td>
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<tr>
<td>Service Learning</td>
<td>2-6</td>
</tr>
</tbody>
</table>
Open Electives 12-16
Total Credits 122

General Education Requirements
For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

Communication Theory and Skills * 9
Lower-Level Humanities * 3
Lower or Upper-Level Humanities or Social Sciences 3
Upper-Level Humanities/Social Science 3
CS 118 Fundamentals of Computer Programming 3
MA 111 College Mathematics for Aviation I 3
MA 112 College Mathematics for Aviation II 3
PS 113 Introductory Physics I 3
Choose one of the following (BIO 120, CHM 110, PS 224 or GEO 215) 3
Choose one of the following (BIO 120L, CHM 110L, PS 113L, PS 117L, PS 224L) 1
PSY 101 Introduction to Psychology 3
Total Credits 37

Aeronautical Knowledge
ASC 101 Aeronautical Science Student Success Seminar 1
AS 121 Private Pilot Operations 5
AS 220 Unmanned Aircraft Systems 3
AS 309 Aerodynamics 3
UA 101 Remote Pilot Operations 1
WX 201 Survey of Meteorology 3
Total Credits 16

Geospatial Data Acquisition and Processing
AS 235 Unmanned Aircraft Systems Operation and Cross-Country Data Entry 3
AS 368 UAS Sensing Systems 3
AS 390 Application of UAS Technology 3
GEO 210 Introduction to Geographic Information Systems 3
GEO 310 Advanced Geographic Information Systems 3
UA 201 Mapping Applications and Data Collection with UAS 1
Total Credits 16

Operations and Leadership
BA 201 Principles of Management 3
AS 222 Unmanned Aircraft Systems Security 3
AS 322 Operational and Industrial Aspects of UAS 3
AS 323 Crew Resource Management for UAS 3
AS 473 UAS Flight Simulation 3
Total Credits 15

Technical Skills Development
AS 365 UAS Electronic Flight Management 3
AS 416 UAS Field Service and Sustainment 3
UA 301 Complex UAS Flight Operations 1
UA 401 UAS Mission Application 1
Total Credits 8

Program Support
AT 310 Air Traffic Control Tower for Non-ATC 3
EGR 115 Introduction to Computing for Engineers 3
HF 300 Human Factors I: Principles and Fundamentals 3
ME 311 Robotics Technologies for Unmanned Systems 3
Total Credits 12

Service Learning
AS 399 Special Topics in Aeronautical Science 1-3
AS 499 Special Topics in Aeronautical Science 1-3
Total Credits 2-6
Open Electives
Open Electives (6 hrs must be Upper Level) 12-16
Total Credits 12-16
Total Credit Hours 122

Note: Refer to Undergraduate Academic Regulations and Procedures section for credit for flight training at other institutions.

After matriculation to Embry-Riddle, all flight training must be completed on-campus to earn the Unmanned Aircraft Systems Science degree.

Suggested Plan of Study

### Year One

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ASC 101</td>
<td>Aeronautical Science Student Success Seminar</td>
<td>1</td>
</tr>
<tr>
<td>AS 121</td>
<td>Private Pilot Operations</td>
<td>5</td>
</tr>
<tr>
<td>AS 220</td>
<td>Unmanned Aircraft Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
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<tr>
<td>CS 118</td>
<td>Fundamentals of Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>MA 112</td>
<td>College Mathematics for Aviation II</td>
<td>3</td>
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<td></td>
<td>HU 14X Humanities Elective</td>
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<tr>
<td>WX 201</td>
<td>Survey of Meteorology</td>
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<tr>
<td>UA 101</td>
<td>Remote Pilot Operations</td>
<td>1</td>
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### Year Two

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>AS 222</td>
<td>Unmanned Aircraft Systems Security</td>
<td>3</td>
</tr>
<tr>
<td>AS 235</td>
<td>Unmanned Aircraft Systems Operation and Cross-Country Data Entry</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>Speech</td>
<td>3</td>
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<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td>EGR 115</td>
<td>Introduction to Computing for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>GEO 210</td>
<td>Introduction to Geographic Information Systems</td>
<td>3</td>
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<td>GEO 310</td>
<td>Advanced Geographic Information Systems</td>
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</tr>
<tr>
<td>PS 113</td>
<td>Introductory Physics I</td>
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<tr>
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### Year Three

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>AS 309</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AS 322</td>
<td>Operational and Industrial Aspects of UAS</td>
<td>3</td>
</tr>
<tr>
<td>AS 323</td>
<td>Crew Resource Management for UAS</td>
<td>3</td>
</tr>
<tr>
<td>AS 365</td>
<td>UAS Electronic Flight Management</td>
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<tr>
<td>AS 368</td>
<td>UAS Sensing Systems</td>
<td>3</td>
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<tr>
<td>AS 390</td>
<td>Application of UAS Technology</td>
<td>3</td>
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<tr>
<td>AT 310</td>
<td>Air Traffic Control Tower for Non ATC</td>
<td>3</td>
</tr>
<tr>
<td>HF 300</td>
<td>Human Factors I: Principles and Fundamentals</td>
<td>3</td>
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<td></td>
<td>HU/SS Lower or Upper Level Elective</td>
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<td></td>
<td>Open Elective - Upper Level</td>
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<tr>
<td>UA 201</td>
<td>Mapping Applications and Data Collection with UAS</td>
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<td><strong>Credits Subtotal</strong></td>
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### Year Four

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<thead>
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<th>Course</th>
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<tbody>
<tr>
<td>AS 399</td>
<td>Special Topics in Aeronautical Science</td>
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<tr>
<td>AS 416</td>
<td>UAS Field Service and Sustainment</td>
<td>3</td>
</tr>
<tr>
<td>AS 473</td>
<td>UAS Flight Simulation</td>
<td>3</td>
</tr>
<tr>
<td>AS 499</td>
<td>Special Topics in Aeronautical Science</td>
<td>2-6</td>
</tr>
<tr>
<td>ME 311</td>
<td>Robotics Technologies for Unmanned Systems</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Open Elective - Upper Level</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Open Elective *</td>
<td>6-10</td>
</tr>
<tr>
<td>UA 301</td>
<td>Complex UAS Flight Operations</td>
<td>1</td>
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<tr>
<td>UA 401</td>
<td>UAS Mission Application</td>
<td>1</td>
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<tr>
<td><strong>Credits Subtotal</strong></td>
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</table>

* Open Elective credit required may vary based on total credit taken for Service Learning courses (AS 399/AS 499).
Accelerated Aviation Options
Accelerated program offers well-qualified students the opportunity to start a Master’s degree while still completing their Bachelor’s degree, and allow for the crossing of disciplines. Students earn B.S. once all requirements for that degree are met, while still working to complete their M.S.

B.S. in Aeronautics/Master of Science in Aeronautics (https://catalog.erau.edu/daytona-beach/aviation/masters/acc-aeronautics)

B.S./M.S. in Aeronautics
Accelerated BS in Aeronautics/ MS in Aeronautics
This program is for exceptional students who are committed to continuing their education through the Master’s degree. This fast-paced program allows qualifying students the opportunity to complete both the Bachelor of Science in Aeronautics (BSA) and the Master of Science in Aeronautics (MSA) in five academic years.

Students who are accepted in the BSA-MSA 4+1 program, will spend three academic years in undergraduate-level study and then, during their senior year, will be allowed to take up to three graduate-level courses from their select MSA specialization to replace an equal number of Professional Development elective courses in the BSA degree. Before selecting the 3 courses to be taken, students must confer with an advisor to ensure that the courses selected are suitable and align with their selected MSA specialization (a grade of B or better must be achieved). Upon completion of the BSA requirements the Bachelor of Science degree in Aeronautics will be conferred and students will be enrolled in the MSA degree. In any graduate course taken by an undergraduate student, a grade of B or better must be earned. If a grade of C or F is earned in any of the graduate courses taken in lieu of the Professional Development elective courses in the BSA degree, the student will be removed from the MSA program and may continue to complete the BSA degree only.

View BSA requirements (http://catalog.erau.edu/daytona-beach/aviation/bachelors/aeronautics).

Combined Aviation Programs
Combined programs offer well-qualified students the opportunity to start a Master’s degree while still completing their Bachelor’s degree, and allow for the crossing of disciplines. Students earn B.S. once all requirements for that degree are met, while still working to complete their M.S.

B.S. in Aeronautics/MBA (https://catalog.erau.edu/daytona-beach/business/combined/aeronautics_mba)
B.S. in Aviation Maintenance Science/MBA (https://catalog.erau.edu/daytona-beach/business/combined/ams_mba)
B.S. in Aviation Maintenance Science/MSA (https://catalog.erau.edu/daytona-beach/business/combined/ams_msa)

Aeronautics/MBA
Suggested Course of Study
Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of 9 of the 14 credits of open electives noted in the B.S. in Aeronautics undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Aeronautics, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

Mathematics
MA 111 College Mathematics for Aviation I 3
MA 222 Business Statistics 3

Social Sciences
EC 200 An Economic Survey
EC 210 Microeconomics
**Aviation Maintenance Science/MBA**

**Suggested Course of Study**

The Maintenance Management Area of Concentration must be selected as the field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the upper level open electives (6 credits) noted in the B.S. in Aviation Maintenance Science undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

**Communication Theory & Skills**
- COM 122  English Composition  3
- COM 219  Speech  3
- COM 221  Technical Report Writing  3

**Computer Science**
- CS 120  Introduction to Computing in Aviation  3

**Mathematics**
- MA 111  College Mathematics for Aviation I  3
- MA 140  College Algebra  3
- MA 222  Business Statistics  3

**Social Sciences**
- PSY 101  Introduction to Psychology  3

**Maintenance Management Concentration**  36
- ACC 210  Financial Accounting  3
- AMSA 490  Aviation Technical Operations  3
- BA 201  Principles of Management  3
- BA 220  Marketing  3
- BA 225  Business Law  3
- BA 230  Advanced Computer Based Systems  3
- BA 314  Human Resource Management  3
- BA 320  Business Information Systems  3
- BA 324  Aviation Labor Relations  3
- BA 325  Social Responsibility and Ethics in Management  3
- BA 332  Corporate Finance I  3

---

**EC 211**  Macroeconomics (or Lower-Level Social Sciences)

**Computer Science**
- Computer Science Elective  3

**Minor in Business Administration**
- ACC 210  Financial Accounting  3
- BA 220  Marketing  3
- BA 230  Advanced Computer Based Systems  3
- BA 332  Corporate Finance I  3

**Open Electives**
One class MUST be:
- BA 201  Principles of Management  3

**Business Administration Transition**
- BA 511  Operations Research  3
- BA 514  Strategic Marketing Management in Aviation  3
- BA 520  Organizational Behavior, Theory, and Applications in Aviation  3

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:
- ACC 517  Accounting for Decision Making  3
- BA 518  Managerial Finance  3
- BA 523  Advanced Aviation Economics  3
- BA 635  Business Policy and Decision Making  3

**Specified Electives**  12

**Total Degree Credits**  **144**

---

**Communication Theory & Skills**
- COM 122  English Composition  3
- COM 219  Speech  3
- COM 221  Technical Report Writing  3

**Computer Science**
- CS 120  Introduction to Computing in Aviation  3

**Mathematics**
- MA 111  College Mathematics for Aviation I  3
- MA 140  College Algebra  3
- MA 222  Business Statistics  3

**Social Sciences**
- PSY 101  Introduction to Psychology  3

**Maintenance Management Concentration**  36
- ACC 210  Financial Accounting  3
- AMSA 490  Aviation Technical Operations  3
- BA 201  Principles of Management  3
- BA 220  Marketing  3
- BA 225  Business Law  3
- BA 230  Advanced Computer Based Systems  3
- BA 314  Human Resource Management  3
- BA 320  Business Information Systems  3
- BA 324  Aviation Labor Relations  3
- BA 325  Social Responsibility and Ethics in Management  3
- BA 332  Corporate Finance I  3

---

**Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.**

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Aeronautics, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.
BA 411  Logistics Management for Aviation/Aerospace  3

**Business Administration Transition**

BA 511  Operations Research  3
BA 520  Organizational Behavior, Theory, and Applications in Aviation  3
BA 523  Advanced Aviation Economics  3

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

ACC 517  Accounting for Decision Making  3
BA 514  Strategic Marketing Management in Aviation  3
BA 518  Managerial Finance  3
BA 635  Business Policy and Decision Making  3

Specified Electives  12

**Total Degree Credits**  **150**

** Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Aviation Maintenance Science, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**B.S. in Aviation Maintenance Science/MSA**

This program is for exceptional students who are committed to continuing their education through the Master's degree. This fast-paced program allows qualifying students the opportunity to complete both the Bachelor of Science in Aviation Maintenance Science (BSAMS) degree and the Master of Science in Aeronautics (MSA) in five academic years.

Accepted students can then take up to three (3) MSA courses, in lieu of an equal number of undergraduate Professional Development/Upper-level Elective credit courses. Before selecting the three MSA courses, students must confer with an advisor to ensure that the MSA courses selected are compatible with their BSAMS Area of Concentration and that they are in alignment with their chosen MSA specialization. A course grade of B or better must be earned on all graduate-level courses to be considered as satisfactory progress toward the MSA degree. If a grade of C or F is earned in any of the MSA courses approved by the MSA Program Coordinator, the student will be removed from the program and allowed to continue his or her education in the BSAMS degree as initially intended.

**Suggested Curriculum for Accelerated Master’s Program**

**BSAMS degree**

General Education  36
Aviation Maintenance Science Courses  48
(Leading to A&P certification)
MSA Courses taken for Upper Level Open Electives  6

**AMS Area of Concentration - Flight (36 Credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AMSA 490</td>
<td>Aviation Technical Operations</td>
<td>3</td>
</tr>
<tr>
<td>AS 121</td>
<td>Private Pilot Operations</td>
<td>5</td>
</tr>
<tr>
<td>AS 221</td>
<td>Instrument Pilot Operations</td>
<td>3</td>
</tr>
<tr>
<td>AS 309</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AS 310</td>
<td>Aircraft Performance</td>
<td>3</td>
</tr>
<tr>
<td>AS 321</td>
<td>Commercial Pilot Operations</td>
<td>3</td>
</tr>
<tr>
<td>AS 350</td>
<td>Domestic and International Navigation</td>
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<tr>
<td>MSA 515</td>
<td>Aviation/Aerospace Simulation Systems</td>
<td>3</td>
</tr>
<tr>
<td>or MSA 516</td>
<td>Applications in Crew Resource Management</td>
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<table>
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<tr>
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<tr>
<td>WX 201</td>
<td>Survey of Meteorology</td>
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<td>WX 301</td>
<td>Aviation Weather</td>
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**Flight Track**

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<tr>
<td>FA 121</td>
<td>Private Single Flight</td>
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<td>FA 221</td>
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<tr>
<td>FA 321</td>
<td>Commercial Single Flight</td>
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<tr>
<td>FA 323</td>
<td>Commercial Multi Add On</td>
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**Total Credits**  **36**
These three (3) MSA courses will appear on the undergraduate transcript. These three (3) MSA courses will not be part of the master's transcript until the time of graduation.

**AMS Area of Concentration - Maintenance Management (36 Credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
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</tr>
<tr>
<td>AMSA 490</td>
<td>Aviation Technical Operations</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
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<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>MSA 508</td>
<td>Advanced Airport Modeling</td>
<td>3</td>
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<tr>
<td>BA 314</td>
<td>Human Resource Management</td>
<td>3</td>
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<tr>
<td>BA 320</td>
<td>Business Information Systems</td>
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<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 36

* These three (3) MSA courses will appear on the undergraduate transcript. These three (3) MSA courses will not be part of the master's transcript until the time of graduation.

**AMS Area of Concentration - Safety Science (36 Credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMSA 490</td>
<td>Aviation Technical Operations</td>
<td>3</td>
</tr>
<tr>
<td>SF 201</td>
<td>Introduction to Health, Occupational, and Transportation Safety</td>
<td>3</td>
</tr>
<tr>
<td>or SF 210</td>
<td>Introduction to Aerospace Safety</td>
<td></td>
</tr>
<tr>
<td>SF 205</td>
<td>Principles of Accident Investigation</td>
<td>3</td>
</tr>
<tr>
<td>SF 315</td>
<td>Environmental Compliance and Safety</td>
<td>3</td>
</tr>
<tr>
<td>SF 316</td>
<td>Workers Compensation, Insurance, and Risk Management</td>
<td>3</td>
</tr>
<tr>
<td>SF 320</td>
<td>Human Factors in Aviation Safety</td>
<td>3</td>
</tr>
<tr>
<td>MSA 516</td>
<td>Applications in Crew Resource Management</td>
<td>3</td>
</tr>
<tr>
<td>SF 365</td>
<td>Fire Protection</td>
<td>3</td>
</tr>
<tr>
<td>SF 462</td>
<td>Health, Safety, and Aviation Law</td>
<td>3</td>
</tr>
<tr>
<td>MSA 516</td>
<td>Applications in Crew Resource Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose one focus from the options below:

**Aviation Focus Course List:**
- SF 330 Aircraft Accident Investigation 3
- SF 375 Propulsion Plant Investigation 3
- SF 335 Mechanical and Structural Factors in Aviation Safety 3
- or SF 435 Aircraft Crash Survival Analysis and Design 3

**Occupational Safety Focus Course List:**
- HS 215 Introduction to Industrial Security 3
- SF 355 Industrial Hygiene and Toxicology 3
- SF 410 Design of Engineering Hazard Controls 3
- or SF 440 Design of Engineering Hazard Controls II 3

Total Credits: 36

* These three (3) MSA courses will appear on the undergraduate transcript. These three (3) MSA courses will not be part of the master's transcript until the time of graduation.

**Master of Science in Aeronautics (MSA) remaining required (24 Credit hours)**

Up to 9 credit hours of MSA Specialization/elective courses shown above in red are included in the totals below.

**MSA Required Core Courses: 12 Credit hours**
- MSA 602 The Air Transportation System 3
- MSA 662 Statistical Analysis for Aviation/Aerospace 3
- MSA 670 Research Methods in Aviation/Aerospace 3
- MSA 674 Project Management in Aviation/Aerospace 3
- or MSA 60-Human Factors in the Aviation/Aerospace Industry 3
- MSA Specialization Courses 9
- MSA Second Specialization Courses or elective courses 9
- MSA 691 Graduate Capstone Research Project (or Thesis 6 hours) 3

Total MSA Credits: 33

Total credits for Accelerated Degree Program: 150
M.S. in Aeronautics (MSA)

Introduction
The Master of Science in Aeronautics (MSA) degree program is a broad-based, flexible degree program designed to provide both the aviation/aerospace professional and students who are interested in a career in aviation with a rigorous academic approach to an aviation/aerospace oriented multidisciplinary degree. It provides an unequaled opportunity for pilot flight crew members, air traffic control personnel, flight operations specialists, meteorologists, Industry technical representatives, unmanned aircraft systems operators, and aviation educators to enhance their knowledge and pursue additional career opportunities. The MSA degree is designed to provide the student with a broad research background and technical knowledge in the core curriculum and the opportunity to select from eleven different specializations to pursue their chosen career path in the aviation field.

The MSA program consists of 33 credits. Students must complete the MSA core requirements consisting of 12 credits, and then complete the 9 credits that make up the selected specialization in one of the following: Air Traffic Management, Aviation/Aerospace Education Technology, Aviation/Aerospace Management, Aviation/Aerospace Operations, Aviation/Aerospace Safety Systems, Human Factors, Aeronautics, Space Studies, Unmanned Aerospace Systems, or small Unmanned Aircraft Systems.

The four (4) core courses should be taken as the first four courses in the degree program.

Students must also complete 12 credits of coursework that includes either a Thesis (6 credits), or a Graduate Capstone Project (GCP) (3 credits). Remaining credits are made up of graduate level aeronautical science electives. MSA students can also complete courses leading to a multiple specializations. Additional specializations must be declared prior to the completion of the degree program.

Students wishing to complete a dual specialization must have 9 unduplicated credits in each of the specialization and will complete a total of 33 (GCP) or 36 (Thesis) credit hours in order to graduate. Additional specializations may also be taken.

Degree Requirements

Aeronautics Specialization

MSA Core Requirements

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI/MSA 602 The Air Transportation System</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA 670 Research Methods in Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA 604 Human Factors in the Aviation/Aerospace Industry</td>
<td>3</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>ASCI/MSA 674 Project Management in Aviation/Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

Specialization Requirements

Select three of the following:

<table>
<thead>
<tr>
<th>Electives</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI 509 Advanced Aerodynamics (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 623 Aircraft Design and Development (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
<tr>
<td>UNSY 501 Application of Unmanned Systems (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives

Select one of the following options:

<table>
<thead>
<tr>
<th>Option I: Capstone</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI/MSA 691 Graduate Capstone Research Project</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA Electives (500-600 Level)*</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option II: Thesis</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI 700A Thesis I (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 700B Thesis II (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA Electives (500-600 Level)*</td>
<td>6</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>MSA 700 Thesis</td>
<td>6</td>
</tr>
<tr>
<td>ASCI/MSA Electives (500-600 Level)*</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Credits

* ASCI courses must be approved by Program Coordinator prior to enrollment.
## Air Traffic Management Specialization

### For students with no ATC experience or education. (For AT-CTI students)

<table>
<thead>
<tr>
<th>Required Undergraduate Foundation</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 202 Introduction to Air Traffic Management</td>
<td>3</td>
</tr>
<tr>
<td>AT 305 Introduction to Terminal Radar Operations</td>
<td>3</td>
</tr>
<tr>
<td>AT 401 Advanced Terminal Radar Operations</td>
<td>3</td>
</tr>
</tbody>
</table>

### MSA Core Requirements

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSA 602 The Air Transportation System</td>
<td>3</td>
</tr>
<tr>
<td>MSA 604 Human Factors in the Aviation/Aerospace Industry</td>
<td>3</td>
</tr>
<tr>
<td>or MSA 674 Project Management in Aviation/Aerospace</td>
<td></td>
</tr>
<tr>
<td>MSA 662 Statistical Analysis for Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>MSA 670 Research Methods in Aviation/Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

### Specialization Requirements

<table>
<thead>
<tr>
<th>Required Course</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSA 520 Introduction to Air Traffic Control Tower</td>
<td>3</td>
</tr>
<tr>
<td>MSA 617 En route Radar Operations</td>
<td>3</td>
</tr>
<tr>
<td>MSA 618 En route Non-Radar Operations</td>
<td>3</td>
</tr>
</tbody>
</table>

### Electives

- MSA 508 Advanced Airport Modeling
- ASCI/MSA 515 Aviation/Aerospace Simulation Systems
- ASCI 615/MSA 608 Aviation/Aerospace Accident Investigation and Analysis
- MSA 616 Leadership and Critical Decision Making in the Aviation Industry
- MSA 636 Advanced Aviation/Aerospace Planning Systems

### Select one of the following options: 12

#### Option I: Capstone

- ASCI/MSA 691 Graduate Capstone Research Project | 3 |
- ASCI/MSA Electives from the above list of elective courses. or any ASCI/MSA Electives (500-600)* | 9 |

#### Option II: Thesis

- ASCI 700A Thesis I (Available at Worldwide Campus Only) | 3 |
- ASCI 700B Thesis II (Available at Worldwide Campus Only) | 3 |
- ASCI/MSA Electives from the above list of electives or any ASCI/MSA Electives (500-600 Level).* | 6 |

### Total Credits

- 42

* ASCI courses must be approved by Program Coordinator prior to enrollment.

## Air Traffic Management Specialization (Non-CTI)

### For Students with prior ATC Experience

### MSA Core Requirements

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI/MSA 602 The Air Transportation System</td>
<td>3</td>
</tr>
<tr>
<td>ASCI MSA 662 Statistical Analysis for Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>OR ASCI/MSA 674 Project Management in Aviation/Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

### Specialization Requirements

<table>
<thead>
<tr>
<th>Specialization courses offered through the Worldwide Campus Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Courses</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>ASCI 606 Global Air Traffic Control and Management (Available at Worldwide Campus Only)</td>
</tr>
</tbody>
</table>

Select two of the following:

- ASCI 624 Global Aviation Leadership: Critical Decision Making in Air Traffic Systems (Available at Worldwide Campus Only) | 3 |
- ASCI 625 The Role of Airports in Global Air Traffic Management (Available at Worldwide Campus Only) | 3 |
- ASCI 626 Air Traffic Control Human Factors (Available at Worldwide Campus Only) | 3 |

### Select one of the following options: 12

#### Option I: Capstone

- ASCI/MSA 691 Graduate Capstone Research Project | 3 |
- ASCI/MSA Electives from the above list of elective courses. or any ASCI/MSA Electives (500-600)* | 9 |
### Aviation/Aerospace Management Specialization

#### MSA Core Requirements

**Required Courses**
- ASCI/MSA 602 The Air Transportation System 3
- ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace 3
- ASCI/MSA 670 Research Methods in Aviation/Aerospace 3
- ASCI/MSA 674 Project Management in Aviation/Aerospace 3

**Specialization Requirements**
- Select three of the following:
  - MSA 508 Advanced Airport Modeling 3
  - ASCI/MSA 609 Aircraft Maintenance Management 3
  - MSA 616 Leadership and Critical Decision Making in the Aviation Industry 3
  - MSA 636 Advanced Aviation/Aerospace Planning Systems 3
  - ASCI/MSA 641 Production and Procurement Management in the Aviation/Aerospace Industry 3
  - ASCI/MSA 642 International Aviation Policy 3
  - ASCI/MSA 644 Integrated Logistics Support in Aviation/Aerospace 3

**Electives**
- Select one of the following options:
  - ASCI/MSA 514 Computer Based Instruction 3
  - MSA 518 Online Learning Environment 3
  - ASCI/MSA 550 Aviation Education Foundations 3
  - ASCI/MSA 614 Advanced Aviation/Aerospace Curriculum Development 3
  - ASCI/MSA 654 Adult Teaching and Learning Techniques 3

### Aviation/Aerospace Education Technology Specialization

#### MSA Core Requirements

**Required Courses**
- ASCI/MSA 602 The Air Transportation System 3
- ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace 3
- ASCI/MSA 670 Research Methods in Aviation/Aerospace 3
- ASCI/MSA 674 Project Management in Aviation/Aerospace 3

**Specialization Requirements**
- Select three of the following:
  - MSA 508 Advanced Airport Modeling 3
  - ASCI/MSA 609 Aircraft Maintenance Management 3
  - MSA 616 Leadership and Critical Decision Making in the Aviation Industry 3
  - MSA 636 Advanced Aviation/Aerospace Planning Systems 3
  - ASCI/MSA 641 Production and Procurement Management in the Aviation/Aerospace Industry 3
  - ASCI/MSA 642 International Aviation Policy 3
  - ASCI/MSA 644 Integrated Logistics Support in Aviation/Aerospace 3

**Electives**
- Select one of the following options:
  - ASCI/MSA 514 Computer Based Instruction 3
  - MSA 518 Online Learning Environment 3
  - ASCI/MSA 550 Aviation Education Foundations 3
  - ASCI/MSA 614 Advanced Aviation/Aerospace Curriculum Development 3
  - ASCI/MSA 654 Adult Teaching and Learning Techniques 3

### Total Credits

- 33

---

* ASCI courses must be approved by Program Coordinator prior to enrollment.
ASCI/MSA 691 Graduate Capstone Research Project 3  
ASCI/MSA Electives (500-600 Level)* 9  
**Option II: Thesis**  
ASCI 700A Thesis I (Available at Worldwide Campus Only) 3  
ASCI 700B Thesis II (Available at Worldwide Campus Only) 3  
ASCI/MSA Electives (500-600 Level)* 6  
Or  
MSA 700 Thesis 6  
ASCI/MSA Electives (500-600 Level)* 6  
**Total Credits** 33  

* ASCI courses must be approved by Program Coordinator prior to enrollment.

**Aviation/Aerospace Operations Specialization**

**MSA Core Requirements**

<table>
<thead>
<tr>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Courses</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>ASCI/MSA 602 The Air Transportation System 3</td>
</tr>
<tr>
<td>ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace 3</td>
</tr>
<tr>
<td>ASCI/MSA 670 Research Methods in Aviation/Aerospace 3</td>
</tr>
<tr>
<td>ASCI/MSA 604 Human Factors in the Aviation/Aerospace Industry 3</td>
</tr>
<tr>
<td>Or</td>
</tr>
<tr>
<td>ASCI/MSA 674 Project Management in Aviation/Aerospace 3</td>
</tr>
</tbody>
</table>

**Specialization Requirements**  
**Select three of the following:** 9  
MSA 508 Advanced Airport Modeling 3  
ASCI/MSA 515 Aviation/Aerospace Simulation Systems 3  
ASCI/MSA 516 Applications in Crew Resource Management 3  
M 616 Leadership and Critical Decision Making in the Aviation Industry 3  
ASCI/MSA 619 Airport Safety and Certification 3  
ASCI/MSA 620 Air Carrier Operations 3  
MSA 622 Corporate Aviation Operations 3  
Note: One BA/MGMT Courses may be selected with permission of the Program Coordinator.

**Electives**

**Select one of the following options:** 12  
**Option I: Capstone**  
ASCI/MSA 691 Graduate Capstone Research Project 3  
ASCI/MSA Electives (500-600 Level)* 9  
**Option II: Thesis**  
ASCI 700A Thesis I (Available at Worldwide Campus Only) 3  
ASCI 700B Thesis II (Available at Worldwide Campus Only) 3  
ASCI/MSA Electives (500-600 Level)* 6  
Or  
MSA 700 Thesis 6  
ASCI/MSA Electives (500-600 Level)* 6  
**Total Credits** 33  

* ASCI courses must be approved by Program Coordinator prior to enrollment.

**Aviation/Aerospace Safety Systems Specialization**

**MSA Core Requirements**

<table>
<thead>
<tr>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Courses</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>ASCI/MSA 602 The Air Transportation System 3</td>
</tr>
<tr>
<td>ASCI/MSA 604 Human Factors in the Aviation/Aerospace Industry 3</td>
</tr>
<tr>
<td>ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace 3</td>
</tr>
<tr>
<td>ASCI/MSA 670 Research Methods in Aviation/Aerospace 3</td>
</tr>
<tr>
<td>Or</td>
</tr>
<tr>
<td>ASCI/MSA 674 Project Management in Aviation/Aerospace 3</td>
</tr>
</tbody>
</table>

**Specialization Requirements**  
**Select three of the following:** 9  
ASCI/MSA 516 Crew Resource Management 3  
ASCI/MSA 611 Aviation/Aerospace System Safety 3  
ASCI 615/MSA 608 Aviation/Aerospace Accident Investigation and Analysis 3  
ASCI/MSA 619 Airport Certification and Operations Safety 3  
ASCI/MSA 621 Safety Program Management Electives 3  

**Select one of the following options:** 12  
**Option I: Capstone**  
ASCI/MSA 691 Graduate Capstone Research Project 3  
ASCI/MSA Electives (500-600 Level)* 9  
**Option II: Thesis**  
ASCI 700A Thesis I (Available at Worldwide Campus Only) 3  
ASCI 700B Thesis II (Available at Worldwide Campus Only) 3  
ASCI/MSA Electives (500-600 Level)* 6  
Or  
MSA 700 Thesis 6  
ASCI/MSA Electives (500-600 Level)* 6  
**Total Credits** 33  

* ASCI courses must be approved by Program Coordinator prior to enrollment.
| Option II: Thesis | MSA 700 Thesis | 6 |
| ASCI 700A Thesis I (Available at Worldwide Campus Only) | ASCI/MSA Electives (500-600 Level)* | 6 |
| ASCI 700B Thesis II (Available at Worldwide Campus Only) | **Total Credits** | 33 |
| ASCI/MSA Electives (500-600 Level)* | * ASCI courses must be approved by Program Coordinator prior to enrollment. |

**Human Factors in Aviation Systems Specialization**

**MSA Core Requirements**

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI/MSA 602 The Air Transportation System</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA 604 Human Factors in the Aviation/Aerospace Industry</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>ASCI/MSA 670 Research Methods in Aviation/Aerospace</td>
<td>3</td>
</tr>
</tbody>
</table>

**Specialization Requirements**

Select three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNSY 515 sUAS Operation Fundamentals (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
<tr>
<td>UNSY 520 sUAS Practical Application and Assessment (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
<tr>
<td>UNSY 620 sUAS Operational Planning and Safety Management (Available at Worldwide Campus Only)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives**

Select one of the following options:

| Option I: Capstone | 12 |
| ASCI/MSA 691 Graduate Capstone Research Project | 3 |
| ASCI/MSA Electives (500-600 Level)* | 9 |

| Option II: Thesis | 9 |
| ASCI 700A Thesis I (Available at Worldwide Campus Only) | 3 |
| ASCI 700B Thesis II (Available at Worldwide Campus Only) | 3 |
| ASCI/MSA Electives (500-600 Level)* | 6 |

Or

| MSA 700 Thesis | 6 |
| ASCI/MSA Electives (500-600 Level)* | 6 |

| Total Credits | 33 |

* ASCI courses must be approved by Program Coordinator prior to enrollment.
### ASCI/MSA Electives (500-600 Level)*  
**Total Credits**  
33

* ASCI courses must be approved by Program Coordinator prior to enrollment.

### Space Studies Specialization

#### MSA Core Requirements

**Required Courses**  
12
- ASCI/MSA 602 The Air Transportation System  
3  
- ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace  
3  
- ASCI/MSA 670 Research Methods in Aviation/Aerospace  
3  
- ASCI/MSA 604 Human Factors in the Aviation/Aerospace Industry  
3  
Or
- ASCI/MSA 674 Project Management in Aviation/Aerospace  
3

**Specialization Requirements**  
9
- ASCI/MSA 601 Applications in Space: Commerce, Defense, and Exploration  
3  
Select two of the following:
- ASCI/MSA 511 Earth Observation and Remote Sensing  
3  
- ASCI/MSA 512 Space Mission and Launch Operations  
3  
- ASCI/MSA 513 Space Habitation and Life Support Systems  
3

**Electives**  
Select one of the following options:

#### Option I: Capstone

- ASCI/MSA 691 Graduate Capstone Research Project  
3  
- ASCI/MSA Electives (500-600 Level)*  
9

#### Option II: Thesis

- ASCI 700A Thesis I (Available at Worldwide Campus Only)  
3  
- ASCI 700B Thesis II (Available at Worldwide Campus Only)  
3  
- ASCI/MSA Electives (500-600 Level)*  
6  
Or
- MSA 700 Thesis  
6  
- MSA/ASCI Electives (500-600 Level)*  
6

**Total Credits**  
33

* ASCI courses must be approved by Program Coordinator prior to enrollment.

### Unmanned Aerospace Systems Specialization

#### MSA Core Requirements

**Required Courses**  
12
- ASCI/MSA 602 The Air Transportation System  
3  
- ASCI/MSA 662 Statistical Analysis for Aviation/Aerospace  
3  
- ASCI/MSA 670 Research Methods in Aviation/Aerospace  
3  
- ASCI/MSA 604 Human Factors in the Aviation/Aerospace Industry  
3  
Or
- ASCI/MSA 674 Project Management in Aviation/Aerospace  
3

**Specialization Requirements**  
Select three of the following:

- UNSY 530/MSA 533 Unmanned Aerospace Systems  
3  
- UNSY/MSA 531 Robotics and Control  
3  
- UNSY/MSA 637 Unmanned Aerospace Systems Operations and Payloads  
3  
- UNSY/MSA 638 Human Factors in Unmanned Aerospace Systems  
3

**Electives**  
Select one of the following options:

#### Option I: Capstone

- ASCI/MSA 691 Graduate Capstone Research Project  
3  
- ASCI/MSA Electives (500-600 Level)*  
9

#### Option II: Thesis

- ASCI 700A Thesis I (Available at Worldwide Campus Only)  
3  
- ASCI 700B Thesis II (Available at Worldwide Campus Only)  
3  
- ASCI/MSA Electives (500-600 Level)*  
6  
Or
- MSA 700 Thesis  
6  
- MSA/ASCI Electives (500-600 Level)*  
6

**Total Credits**  
33

* ASCI courses must be approved by Program Coordinator prior to enrollment.
BSA-MSA 4+1 Program: A Unique Opportunity

This program is for exceptional students who are committed to continuing their education through the Master’s degree. This fast-paced program allows qualifying students the opportunity to complete both the Bachelor of Science in Aeronautics (BSA) and the Master of Science in Aeronautics (MSA) in five academic years.

Students who are accepted in the BSA-MSA 4+1 program, will spend three academic years in undergraduate-level study and then, during their senior year, will be allowed to take up to three graduate-level courses from their selected MSA specialization to replace an equal number of Professional Development elective courses in the BSA degree. Before selecting the 3 courses to be taken, students must confer with an advisor to ensure that the courses selected are suitable and align with their selected MSA specialization (a grade of B or better must be achieved). Upon completion of the BSA requirements, students will be enrolled in the MSA and can complete their degree in one year. In any graduate course taken by an undergraduate student, a grade of B or better must be earned. If a grade of C or F is earned in any of the courses taken in lieu of the Professional Development elective courses in the BSA degree, the student will be removed from the program and may continue to complete the BSA degree only.

This special program will challenge students and develop their knowledge and understanding of concepts in aeronautical science while integrating their skills in aviation and aerospace applications. As a minimum, the applicant must have at least a 3.00 GPA and have demonstrated superior academic capability.

**M.S. in Occupational Safety Management**

The Master of Science in Occupational Safety Management (MSOSM) provides the theoretical foundation, research, and application skills required to effectively anticipate, recognize, evaluate, prevent, and control workplace safety, health, and environmental hazards and to manage comprehensive occupational safety and health programs. One of the unique features is that it is offered on the Daytona Campus where students will have the opportunity to observe maintenance and other, related aviation facilities providing support for a large fleet of aircraft. These experiences will provide a perspective transferable to aviation and other industries. The program and courses are evaluated both internally by peers and externally by subject matter experts and modified regularly to ensure students are engaged with current topics to meet the demands of industry. Applicants should have a strong academic record with a CGPA of approximately 3.0 or higher. No admissions examination is required.

The degree is a Board of Certified Safety Professionals (BCSP) Qualified Academic Program (QAP). Graduates of a QAP are eligible to apply for the Graduate Safety Practitioner® (GSP®), a BCSP-approved credential necessary to apply for the Certified Safety Professional® (CSP®). It is only available to SH&E graduates from degree programs which meet BCSP QAP standards.

**Thesis Option**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 510</td>
<td>Industrial Hygiene and Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>SF 530</td>
<td>Safety, Health and Environmental Legislation, Litigation &amp; Compliance</td>
<td>3</td>
</tr>
<tr>
<td>SF 540</td>
<td>Disaster Preparedness and Emergency Response</td>
<td>3</td>
</tr>
<tr>
<td>or SF 570</td>
<td>Fire Safety Management</td>
<td></td>
</tr>
<tr>
<td>SF 580</td>
<td>Environmental Protection for the Safety, Health and Environmental Manager</td>
<td>3</td>
</tr>
<tr>
<td>SF 590</td>
<td>Hazard Control Methods in Occupational Safety and Health</td>
<td>3</td>
</tr>
<tr>
<td>SF 600</td>
<td>Occupational Safety and Health Management</td>
<td>3</td>
</tr>
<tr>
<td>SF 619</td>
<td>Human Factors and Ergonomics</td>
<td>3</td>
</tr>
<tr>
<td>SF 630</td>
<td>System Safety Programs</td>
<td>3</td>
</tr>
<tr>
<td>MSA 662</td>
<td>Statistical Analysis for Aviation/ Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>MSA 670</td>
<td>Research Methods in Aviation/ Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>SF 700A</td>
<td>MSOSM Thesis I</td>
<td>3</td>
</tr>
<tr>
<td>SF 700B</td>
<td>MSOSM Thesis II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>
program consists of 60 credit hours above a Master's degree. Of those 60 hours, a minimum of 54 hours must be completed at Embry-Riddle. The program also requires, as a prerequisite to all courses in the program, a graduate-level, minimum 3-hour course in Descriptive and Inferential Statistics. (MSA 662, ASCI 662 or equivalent course in statistics.)

Coursework

Students are required to take four courses from Group A:

- DAV 721 Quantitative Research Methods in Aviation 3
- DAV 725 Research Methods 3
- DAV 726 Quantitative and Qualitative Data Analysis 3
- DAV 724 Advanced Quantitative Data Analysis - Data Mining and Modeling 3

Students will complete eight courses from Group B and Group C:

Group B courses:

- DAV 711 Foundations of Aviation 3
- DAV 712 Aviation Safety Management Systems 3

Ph.D. in Aviation

Learn more about the Ph.D in Aviation (http://aviationphd.erau.edu) at the Daytona Beach College of Aviation website.

Program of Study

The Ph.D. in Aviation will allow students to pursue interests in aviation in a diverse, intellectually versatile and multidisciplinary environment and to effect a global impact on the aviation discipline and industry. The program has been designed with the intent of preparing students with the cognitive and research skills necessary to solve acute problems facing the field of aviation and to advance the discipline.

Broad-based / Flexible Degree

Embry-Riddle’s Ph.D. in Aviation is a flexible degree program, in that it is offered primarily online but includes three, six-day residencies at designated campuses. The degree is open to aviation professionals, including flight crew members, air traffic controllers, industry technical representatives, aviation educators, government employees and others wishing to advance their knowledge and enhance their careers with a Ph.D. in Aviation.

Program Educational Goals

Graduates of the Ph.D. in Aviation degree program will:

1. Contribute at the high levels of performance and productivity in academic, business, or scientific fields of aviation
2. Conduct and disseminate scholarly research addressing contemporary or future problems in the global aviation industry
3. Actively participate in national and international bodies to sustain continuous improvement in aviation
4. Perform professionally and effectively across multicultural and multidisciplinary units in aviation

Curriculum

The program consists of 60 credit hours above a Master's degree. Of those 60 hours, a minimum of 54 hours must be completed at Embry-Riddle. The program also requires, as a prerequisite to all courses in the program, a graduate-level, minimum 3-hour course in Descriptive and Inferential Statistics. (MSA 662, ASCI 662 or equivalent course in statistics.)
DAV 713 | The Economic Environment of Aviation | 3
DAV 714 | The Legal Environment of Aviation | 3
DAV 715 | Human Factors in Aviation | 3
DAV 716 | Management of Systems Engineering | 3
DAV 717 | Instructional Design in Aviation | 3
DAV 719 | Regulatory Environment of Aviation Safety | 3

Group C courses:
DAV 732 | Aviation Organizational Dynamics | 3
DAV 733 | Multicultural Team Operations in Aviation | 3
DAV 734 | Operations Research & Decision-Making | 3
DAV 735 | Current Practices and Future Trends in Aviation | 3
DAV 736 | User-Centered Design in Aviation | 3
DAV 737 | Topics in Safety Management Systems | 3

Residency
Students are required to attend three, six-day annual residencies at the Daytona campus.
DAV 701 | Residency Seminar I | 2
DAV 702 | Residency Seminar II | 2
DAV 703 | Residency Seminar III | 2

Qualify Examination
Students must pass the Qualifying Examination to be admitted to candidacy. The exam is administered over a two-day period and tests the student’s mastery of completed course subject matter and preparation to conduct dissertation research.
DAV 801 | Qualifying Examination | 0

Dissertation
Once the student has successfully completed the Qualifying Examination, the student will register for DAV 901 Dissertation Research 1. The student must complete 18 credit hours of dissertation courses, at a minimum, and register for at least 3 hours of dissertation courses each semester (i.e., continuous enrollment) until the dissertation has been completed.

DAV 901 | Dissertation Research 1 | 3
DAV 902 | Dissertation Research 2 | 3
DAV 903 | Dissertation Research 3 | 3
DAV 904 | Dissertation Research 4 | 3
DAV 905 | Dissertation Research 5 | 3
DAV 906 | Dissertation Research 6 | 3

Specializations
Students can select one of four specializations.

Aviation Safety
In addition to completing all other required coursework, students must take the following courses to specialize in Aviation Safety.

DAV 712 | Aviation Safety Management Systems | 3
DAV 716 | Management of Systems Engineering | 3
DAV 719 | Regulatory Environment of Aviation Safety | 3
DAV 737 | Topics in Safety Management Systems | 3

Aviation Human Factors
In addition to completing all other required coursework, students must take the following courses to specialize in Aviation Human Factors.

DAV 715 | Human Factors in Aviation | 3
DAV 716 | Management of Systems Engineering | 3
DAV 736 | User-Centered Design in Aviation | 3

Aviation Operations
In addition to completing all other required coursework, students must take the following courses to specialize in Aviation Operations.

DAV 732 | Aviation Organizational Dynamics | 3
DAV 733 | Multicultural Team Operations in Aviation | 3
DAV 734 | Operations Research & Decision-Making | 3
DAV 735 | Current Practices and Future Trends in Aviation | 3

Intradisciplinary
The Intradisciplinary Specialization is for students who wish to work outside of the traditional
academic boundaries, combining coursework from any specialization, while meeting basic course requirements. Students will complete all four Group A courses, and eight courses from Group B and Group C.

**Aircraft Dispatcher Certification**

For the student interested in airline flight operations management, Embry-Riddle offers a program to prepare the student for Aircraft Dispatcher certification testing. The FAA awards the Aircraft Dispatcher Airman Certificate to graduates of the approved program after the successful completion of a standardized written examination and a practical test.

Licensed dispatchers are employed by airlines to manage the ground-based tasks vital to a successful airline flight. Dispatchers share responsibility with the captain for preflight planning and preparation of the dispatch release, and they are included in the decision loop on equipment failures, weather variations, or traffic delays for monitoring the progress of the flight, issuing safety-of-flight information to the crew, and canceling or re-dispatching the flight.

To carry out these tasks properly, dispatchers must be knowledgeable in aircraft performance capabilities, meteorology, operating regulations, air traffic control, and instrument flight procedures. They must also be able to make sound decisions that incorporate the company’s economic and scheduling considerations.

**Certification Requirements**

The Aircraft Dispatcher Certification program preparation is based on the successful completion of the following courses and the applicable prerequisites.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 221</td>
<td>Instrument Pilot Operations</td>
<td>3</td>
</tr>
<tr>
<td>AS 310</td>
<td>Aircraft Performance</td>
<td>3</td>
</tr>
<tr>
<td>AS 321</td>
<td>Commercial Pilot Operations</td>
<td>3</td>
</tr>
<tr>
<td>or AS 350</td>
<td>Domestic and International Navigation</td>
<td></td>
</tr>
<tr>
<td>AS 410</td>
<td>Airline Dispatch Operations</td>
<td>3</td>
</tr>
<tr>
<td>AT 202</td>
<td>Introduction to Air Traffic Management</td>
<td>3</td>
</tr>
<tr>
<td>WX 201</td>
<td>Survey of Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>WX 301</td>
<td>Aviation Weather</td>
<td>3</td>
</tr>
</tbody>
</table>

* AS 410 serves as the capstone course for the Aircraft Dispatcher program. Students cannot receive a signoff until they have completed and passed all required courses for the Aircraft Dispatcher Program. Students must be 21 years of age to take this examination.

This program is offered in the pursuit of a degree and not as separate training. To receive credit for any of the courses listed above toward the Aircraft Dispatcher certification program, the student must sign up in each required course, maintain a record of satisfactory attendance throughout each course, and obtain a grade of at least 70 percent. For more information, contact the Aeronautical Science Department.
David B. O'Maley
College of Business

Dr. Mike Williams, Dean

Our aim is to provide a world-class business and management education in an aviation/aerospace context. We have assembled a community of faculty scholars with global reputations and reach, who have designed curricula at the graduate and undergraduate levels that set the standard in aviation/aerospace management education. Our faculty and students have the opportunity to focus on cutting-edge solutions to real-world problems and opportunities found in aviation, aerospace and transportation-related industries and organizations. Our dedication to excellence is manifested by our accreditation by ACBSP (the Association of Collegiate Business Schools and Programs) and the Aviation Accreditation Board International (AABI), 3410 Skyway Drive, Auburn, AL, 36830; Telephone 334-844-2431, http://www.aabi.aero/programs.html for all our degree programs.

The David B. O'Maley College of Business offers two Bachelor of Science degrees, which are Bachelor of Science in Business Administration and Bachelor of Science in Aviation Business Administration. These degree programs offer graduates the specialized knowledge desired in the aviation industry along with the management and business general knowledge valuable to employers in any industry. The Bachelor of Science in Business Administration combines a rigorous business/management core with depth of focus through the three majors in Management, Marketing and Accounting/Finance. The Bachelor of Science in Aviation Business Administration offers a major in Air Transportation, and a major in Supply Chain Management in Aviation and Aerospace.

The Master in Business Administration is intended to give individuals who already hold undergraduate degrees, often in technical areas like engineering, the tools necessary to become a credible professional manager in aviation, aerospace, or related industries. The MBA program of study combines common general management courses with specializations in Airline Management, Airport Management, Aviation Systems Management, Finance, and Supply Chain Management. For those seeking an MBA with a specific industry focus, the MBA in Aviation Management is now offered exclusively on the Daytona Beach Campus.

The Master of Science in Aviation Finance is intended for students wishing to pursue a dedicated curriculum in aviation finance through coursework that presents key material with applications in aviation/aerospace.

The Doctor of Philosophy in Aviation Business Administration has been designed to accommodate working professionals who seek to advance their knowledge and conduct high-quality research in aviation business while being employed. Industry, military and government professionals with academic credentials, potentials and passion for aviation business research would find this Ph.D. program very attractive and rewarding. The flexible, mainly off-campus and hybrid delivery of this program enables the candidate students to continue their profession while pursuing their doctoral degrees. Domestic or international students with a prior Master’s degree in a related business are eligible to be accepted into the Ph.D. program in both hybrid and traditional residential modes.

Degrees

Bachelors
B.S. in Aviation Business Administration (p. 205)
B.S. in Business Administration (p. 207)

Accelerated Masters Option
B.S./Master of Business Administration (p. 210)

Combined Masters Options
B.S. in Aeronautics/M.B.A. (p. 189)
B.S. in Aerospace Engineering/M.B.A (p. 214).
B.S. in Aviation Maintenance Science/M.B.A (p. 190)
B.S. in Civil Engineering/M.B.A (p. 215).
B.S. in Communication/M.B.A. (p. 148)
B.S. in Computational Math/M.B.A. (p. 149)
B.S. in Computational Math/M.S. in Aviation Finance (p. 149)
B.S. in Computer Engineering/M.B.A (p. 218).
B.S. in Computer Science/M.B.A (p. 218).
B.S. in Electrical Engineering/M.B.A (p. 219).
B.S. in Global Conflict Studies/M.B.A. (p. 150)
B.S. in Homeland Security/M.B.A. (p. 151)
B.S. in Human Factors Psychology/M.B.A. (p. 153)
B.S. in Interdisciplinary Studies/M.B.A. (p. 153)
B.S. in Mechanical Engineering/M.B.A (p. 222).
B.S. in Software Engineering/M.B.A (p. 222).

Masters
Master of Business Administration (p. 222)
Master of Business Administration in Aviation Management (p. 227)
Master of Science in Aviation Finance (p. 228)

Dual Masters
Master of Science in Engineering and Master of Business Administration (p. 228)

Ph.D.
Ph.D. in Aviation Business Administration (p. 229)

Transfer Student Program

Introduction
This program is an excellent chance for transfer students to complete their higher education with a Bachelor of Science degree in Aviation Business Administration or with a Bachelor of Science degree in Business Administration from the David B. O'Maley College of Business. The objective of the program is to provide transfer students with a detailed plan for entering into our business degree programs, easing the process, and ultimately receiving their Bachelor of Science degree in business administration from one of the oldest and premier aviation education institutions in the world.

Admission Requirements
Students entering the David B. O'Maley College of Business with an associate degree from a regionally accredited institution may transfer credits towards either of the business degree programs as outlined below. Admissions requirements for transfer applicants apply and transfer courses are evaluated on a course by course basis.

Associate Degree Required Courses Listed below are the required course competencies that will transfer into the Bachelor of Science degree in Aviation Business Administration or the Bachelor of Science degree in Business Administration.

Communication Theory and Skills (9 Credits)
- English Composition and Literature with a major writing component
- Speech

- Technical Report Writing or Business Communications

Lower Level Social Sciences* (6 Credits)
- Microeconomics
- Macroeconomics

* If a student has taken an economics survey course, transfer credit for the survey course is normally given for macroeconomics.

Lower Level Humanities (3 credits)
- Humanities course must have a writing component.

Physical/Life Sciences (6 credits)
- One science course must have a laboratory component.

Mathematics (6 credits)
- College Algebra-Trigonometry
- Pre-Calculus
- Quantitative Methods

Computer Science (3 credits)
- Computer Based Systems (Microsoft Office skills are required.)

Other Courses (15 credits)
- Principles of Management
- Marketing
- Financial Accounting
- Business Law
- Statistics

Open Elective Courses
The David B. O'Maley College of Business welcomes any transfer student that has previous college credit or military credit after graduating from high school. Students wishing to transfer into the aforementioned business degree programs that do not have an associate degree as outlined above have the opportunity to have their completed courses evaluated for transfer credit. It is our goal that students are not required to take duplicate courses for which they have previously received credit. Course substitutions may be available. It is the responsibility of the student to provide the necessary documents for course evaluation.
For more information, please contact University Admissions.

B.S. in Aviation Business Administration

The Bachelor of Science degree in Aviation Business Administration requires successful completion of a minimum of 120 credit hours and is normally completed in eight semesters. Designed for students interested in obtaining a strong aviation business foundation, the degree lets the students select the major in either Air Transportation or Supply Chain Management in Aviation and Aerospace. Students should declare their major at the beginning of their sophomore year. Students who participate in the Cooperative Education program may substitute up to 6 credit hours, if approved, toward the specified courses required in their major.

This program is accredited by the Association of Collegiate Business Schools and Programs (ACBSP).

Students enrolled in the Air Force, Army, or Naval ROTC programs may substitute AF, MY, or NSC courses for the open elective courses.

Students should be aware that several courses in each academic year may require prerequisite subject knowledge and/or class standing. Check the course descriptions before registering for classes to ensure appropriate placement.

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>36</td>
</tr>
<tr>
<td>Program Support</td>
<td>12</td>
</tr>
<tr>
<td>Business Core</td>
<td>36</td>
</tr>
<tr>
<td>Major</td>
<td>21</td>
</tr>
<tr>
<td>Open Electives</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>120</strong></td>
</tr>
</tbody>
</table>

General Education*

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Theory and Skills</td>
<td>9</td>
</tr>
<tr>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
</tbody>
</table>

Lower-Level Social Sciences (EC 210) 3
Lower or Upper-Level Humanities or Social Sciences (EC 211) 3
Upper-Level Humanities or Social Sciences 3
Computer Science 3
Mathematics 6
Physical and Life Sciences 6
Total Credits 36

* Embry-Riddle courses in the general education categories of Communication Theory and Skills, Mathematics, Computer Science, Physical and Life Sciences, Humanities, and Social Sciences may be chosen from approved list of General Education courses, assuming prerequisite requirements are met and with the permission of the advisor. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified above in the Aviation Business Administration vertical outline. Other courses may also be used with the permission of a department chair.

Program Support

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
<td>3</td>
</tr>
<tr>
<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
<tr>
<td>BA 352</td>
<td>Business Quantitative Methods</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

Business Core

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ACC 312</td>
<td>Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BA 317</td>
<td>Organizational Behavior</td>
<td>3</td>
</tr>
<tr>
<td>BA 320</td>
<td>Business Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
<tr>
<td>BA 335</td>
<td>International Business</td>
<td>3</td>
</tr>
<tr>
<td>BA 420</td>
<td>Management of Production and Operations</td>
<td>3</td>
</tr>
</tbody>
</table>

David B. O'Maley College of Business
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BA 490</td>
<td>Strategic Management</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

**Open Electives**

Students select a minor or complete open electives of their choice.

**Total Credits** 15

**Air Transportation Major**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 215</td>
<td>Transportation Principles</td>
<td>3</td>
</tr>
<tr>
<td>BA 310</td>
<td>Airport Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 315</td>
<td>Airline Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 426</td>
<td>International Aviation Management</td>
<td>3</td>
</tr>
<tr>
<td>EC 420</td>
<td>Economics of Air Transportation</td>
<td>3</td>
</tr>
<tr>
<td><strong>Specified Electives</strong></td>
<td></td>
<td><strong>6</strong></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

**Supply Chain Management in Aviation and Aerospace Major**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 215</td>
<td>Transportation Principles</td>
<td>3</td>
</tr>
<tr>
<td>BA 363</td>
<td>Supply Chain Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 410</td>
<td>Management of Air Cargo</td>
<td>3</td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td>3</td>
</tr>
<tr>
<td>Select three from the following:</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>BA 318</td>
<td>Entrepreneurship I</td>
<td></td>
</tr>
<tr>
<td>BA 321</td>
<td>Aviation/Aerospace Systems Analysis Methods</td>
<td></td>
</tr>
<tr>
<td>BA 326</td>
<td>Marketing Management</td>
<td></td>
</tr>
<tr>
<td>BA 336</td>
<td>Electronic Commerce</td>
<td></td>
</tr>
<tr>
<td>BA 422</td>
<td>Life Cycle Analysis for Systems and Programs in Aviation/Aerospace</td>
<td></td>
</tr>
<tr>
<td>BA 424</td>
<td>Project Management in Aviation Operations</td>
<td></td>
</tr>
<tr>
<td>BA 430</td>
<td>International Trade and Regulations</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

Note: Students may select two of the above mentioned courses in combination with a relevant and COB approved internship (CEAM) to satisfy the elective course requirement for the major.

**Total Degree Requirements** 120

**Suggested Plan of Study - Common Year One and Year Two**

**Year One**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
<td>3</td>
</tr>
<tr>
<td>BA 101</td>
<td>Introduction to Business Programs and Careers</td>
<td>1</td>
</tr>
<tr>
<td>BA 120</td>
<td>Introduction to Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>COM 122</td>
<td>English Composition</td>
<td>3</td>
</tr>
<tr>
<td>COM 219</td>
<td>Speech</td>
<td>3</td>
</tr>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>MA 120</td>
<td>Quantitative Methods I</td>
<td>3</td>
</tr>
<tr>
<td>MA 220</td>
<td>Quantitative Methods II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credits Subtotal</strong></td>
<td></td>
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**Year Two**

<table>
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<tr>
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<tbody>
<tr>
<td>BA XXX AOC Required course</td>
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<tr>
<td>BA 225</td>
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<td>BA 230</td>
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<tr>
<td>BA 317</td>
<td>Organizational Behavior</td>
<td>3</td>
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<tr>
<td>BA 352</td>
<td>Business Quantitative Methods</td>
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<tr>
<td>COM 222</td>
<td>Business Communication</td>
<td>3</td>
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<tr>
<td>EC 211</td>
<td>Macroeconomics</td>
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<tr>
<td>MA 222</td>
<td>Business Statistics</td>
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<td>HU 14X Elective</td>
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<td>Physical Science Lecture</td>
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**Credits Total:** 62.0

**Air Transportation Major**

**Year Three**

<table>
<thead>
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<tbody>
<tr>
<td>ACC 312</td>
<td>Managerial Accounting</td>
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<tr>
<td>BA 320</td>
<td>Business Information Systems</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>
BA 325  Social Responsibility and Ethics in Management  3  
BA 332  Corporate Finance I  3  
| AOC Required Course | 9  |
| Humanities Upper Level Elective | 3  |
| Physical Science Lecture | 3  |
| Open Elective | 3  |
| Credits Subtotal | 30.0 |

**Year Four**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>BA 335  International Business</td>
<td>3</td>
</tr>
<tr>
<td>BA 420  Management of Production and Operations</td>
<td>3</td>
</tr>
<tr>
<td>BA 490  Strategic Management</td>
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</tr>
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<td></td>
<td>AOC Required course</td>
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</table>

* AOC Specified Electives  
  Pick two of the following: BA 318 or BA 321 or BA 326 or BA 336 or BA 422 or BA 424 or BA 430

**B.S. in Business Administration**

The Bachelor of Science degree in Business Administration requires successful completion of a minimum of 120 credit hours and is normally completed in eight semesters. Designed for students interested in obtaining a strong business foundation, the degree lets the student select a major in either:

1. Accounting and Finance  
2. Management, or  
3. Marketing,

Students should declare their major at the beginning of their sophomore year. Students who participate in the Cooperative Education program may substitute up to 6 credit hours, if approved, toward the specified courses required in their major.

This program is accredited by the Association of Collegiate Business Schools and Programs (ACBSP).

Students enrolled in the Air Force, Army, or Naval ROTC programs may substitute AF, MY, or NSC courses for the open elective courses.

Students should be aware that several courses in each academic year may require prerequisite subject knowledge and/or class standing. Check the course descriptions before registering for classes to ensure appropriate placement.

**General Education Requirements**

For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These
minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>General Education</th>
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</thead>
<tbody>
<tr>
<td>Program Support</td>
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<tr>
<td>Business Core</td>
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<td>Major</td>
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General Education*

<table>
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<tr>
<td>Lower-Level Humanities</td>
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<tr>
<td>Lower-Level Social Sciences (EC 210)</td>
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<td>Upper-Level Humanities or Social Sciences</td>
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<td>Computer Science</td>
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<tr>
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<tr>
<td>Total Credits</td>
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</table>

Embry-Riddle courses in the general education categories of Communication Theory and Skills, Mathematics, Computer Science, Physical and Life Sciences, Humanities, and Social Sciences may be chosen from those listed above, assuming prerequisite requirements are met and with the permission of the advisor. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified above in the Aviation Business Administration vertical outline. Other courses may also be used with the permission of a department chair.

Program Support

| AS 120 | Principles of Aeronautical Science | 3  |
| BA 230 | Advanced Computer Based Systems    | 3  |
| MA 222 | Business Statistics                | 3  |
| BA 352 | Business Quantitative Methods      | 3  |
|        | Total Credits                      | 12 |

Business Core

| ACC 210 | Financial Accounting               | 3  |
| ACC 312 | Managerial Accounting              | 3  |
| BA 201  | Principles of Management           | 3  |
|         | Total Credits                      | 6  |

Open Electives

Students select a minor or complete open electives of their choice.

|        | Total Credits | 15 |

Accounting and Finance Major

| ACC 338 | Intermediate Accounting I          | 3  |
| ACC 348 | Intermediate Accounting II         | 3  |
| BA 334  | Investment Analysis                | 3  |
| BA 434  | Corporate Finance II               | 3  |
| Specified Elective **                  | 3  |
| Major Elective                         | 6  |
|        | Total Credits                      | 21 |

** Any ACC/BA/EC Upper-Level course not required in Business core or Major.

Major Electives

Students must complete a combination of six hours from the courses listed below.

| ACC 340 | International Accounting         | 3  |
| ACC 351 | Auditing Principles and Procedures | 3  |
| BA 318  | Entrepreneurship I               | 3  |
| BA 345  | Business Law II                  | 3  |
| BA 418  | Airport Administration and Finance | 3  |
|        | Total Credits                    | 6  |

Management Major

| BA 314 | Human Resource Management        | 3  |
| BA 326 | Marketing Management             | 3  |

** Select one of the following:
### Marketing Major

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BA 326</td>
<td>Marketing Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 330</td>
<td>Professional Selling</td>
<td>3</td>
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<tr>
<td>BA 355</td>
<td>Marketing Research</td>
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<td><strong>Specified Electives</strong></td>
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**Select two of the following**

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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BA 318</td>
<td>Entrepreneurship I</td>
<td></td>
</tr>
<tr>
<td>BA 336</td>
<td>Electronic Commerce</td>
<td></td>
</tr>
<tr>
<td>BA 405</td>
<td>General Aviation Marketing</td>
<td></td>
</tr>
<tr>
<td>BA 411</td>
<td>Logistics Management for Aviation/Aerospace</td>
<td></td>
</tr>
<tr>
<td>BA 438</td>
<td>Entrepreneurship II</td>
<td></td>
</tr>
<tr>
<td>BA 450</td>
<td>Airline/Airport Marketing</td>
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<tr>
<td>BA 499</td>
<td>Special Topics in Management</td>
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</table>

**Total Credits**: 21

**Any ACC/BA/EC Upper-Level course not required in Business core or Major, or COM 415 or HF 300**

### Suggested Plan of Study

#### Year One

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
<td>3</td>
</tr>
<tr>
<td>BA 120</td>
<td>Introduction to Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
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<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
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<tr>
<td>EC 210</td>
<td>Microeconomics</td>
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<td>EC 211</td>
<td>Macroeconomics</td>
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**Credits Subtotal**: 30.0

#### Year Two

<table>
<thead>
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<td>Marketing</td>
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<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
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<td>BA 352</td>
<td>Business Quantitative Methods</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
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</tr>
<tr>
<td><strong>Communication Theory and Skills</strong></td>
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<td>6</td>
</tr>
<tr>
<td><strong>Open Elective</strong></td>
<td></td>
<td>3</td>
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<tr>
<td><strong>Physical and Life Sciences</strong></td>
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<td>3</td>
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<tr>
<td><strong>Course from major (see below)</strong></td>
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**Credits Subtotal**: 30.0

#### Year Three

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
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<td>Managerial Accounting</td>
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<td>BA 317</td>
<td>Organizational Behavior</td>
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<td>BA 320</td>
<td>Business Information Systems</td>
<td>3</td>
</tr>
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<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
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<tr>
<td><strong>Open Elective</strong></td>
<td></td>
<td>3</td>
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<tr>
<td><strong>Physical Sciences</strong></td>
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<td><strong>Courses from major (see below)</strong></td>
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**Credits Subtotal**: 30.0

#### Year Four

<table>
<thead>
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<th>Course Title</th>
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<tbody>
<tr>
<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
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<td>BA 335</td>
<td>International Business</td>
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<td>BA 420</td>
<td>Management of Production and Operations</td>
<td>3</td>
</tr>
<tr>
<td>BA 490</td>
<td>Strategic Management</td>
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<tr>
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<tr>
<td><strong>Courses from major (see below)</strong></td>
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**Credits Subtotal**: 30.0

**Credits Total**: 120.0

*See general education in the introduction*
or BA 334 Investment Analysis

<table>
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### Year Three

<table>
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<tbody>
<tr>
<td>BA 405 General Aviation Marketing</td>
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<td>BA 411 Logistics Management for Aviation/Aerospace</td>
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### Year Four

<table>
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<tbody>
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<table>
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<tr>
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### B.S./Master of Business Administration

#### Introduction

This program allows the exceptional student to complete both the Bachelor of Science degree in Business Administration (BSBA) and Master of Business Administration (MBA) degrees. Students in this program may still declare a major area of study for the BSBA and specialization for the MBA. The objective of this combined degree track is to provide the opportunity for students to build a well-rounded undergraduate business education and then further prepare themselves as professional managers in the aviation/aerospace industry.

#### Admission Requirements

Students interested in pursuing one of these combined program must:

- Maintain at least a 3.2 cumulative GPA throughout the undergraduate BSBA course of study.
- Maintain at least a 3.0 cumulative GPA throughout the graduate MBA course of study.
- Take the Graduate Management Admission Test (GMAT)* during their junior year, earning a score at least at the 50th percentile, and apply for admission to the program through the Office of Graduate Admissions.
- Complete a minimum of 100 credit hours, including the required Business Administration undergraduate core and major classes, before enrollment in the Master of Business Administration graduate transition classes is allowed.

Students who participate in the Cooperative Education program during their undergraduate studies may substitute up to 6 credit hours, if approved, toward specified elective courses in a major.

This program is accredited by the Association of Collegiate Business Schools and Programs (ACBSP).
Students enrolled in the Air Force (AF), Army (MY), or Naval (NSC) ROTC programs may substitute AF, MY, or NSC courses for the open elective courses.

Students should be aware that several courses in each academic year may require prerequisite subject knowledge and/or class standing. Check the course descriptions at the back of this catalog before registering for classes to ensure appropriate placement.

*The GMAT requirement may be waived by the Graduate Program Coordinator for exceptional students.

General Education Requirements
For a full description of Embry-Riddle General Education guidelines, please see the General Education (p. 92) section of this catalog. These minimum requirements are applicable to all degree programs.

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
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<tr>
<td>Business Core</td>
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<tr>
<td>B.S. in Business Administration Major</td>
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<tr>
<td>Open Electives</td>
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<tr>
<td>MBA Transition Courses</td>
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<td>Graduate MBA courses</td>
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General Education*

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<td>Computer Science</td>
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<td>Physical and Life Sciences</td>
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</table>

Embry-Riddle courses in the general education categories of Communication Theory and Skills, Mathematics, Computer Science, Physical and Life Sciences, Humanities, and Social Sciences may be chosen from approved list of General Education courses, assuming prerequisite requirements are met and with the permission of the advisor. Courses from other institutions are acceptable if they fall into these broad categories and are at the level specified above in the Aviation Business Administration vertical outline. Other courses may also be used with the permission of a department chair.

Program Support

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
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<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
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<td>MA 222</td>
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Business Core

<table>
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<tr>
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<th>Course Title</th>
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<td>Business Information Systems</td>
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<tr>
<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
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<td>BA 332</td>
<td>Corporate Finance I</td>
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<tr>
<td>BA 335</td>
<td>International Business</td>
<td>3</td>
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<tr>
<td>BA 420</td>
<td>Management of Production and Operations</td>
<td>3</td>
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<td>BA 490</td>
<td>Strategic Management</td>
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</table>

Bachelor of Science in Business Administration Major Option

Required Major Credits 21
Open Electives 6

MBA Transition Courses

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
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</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
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Graduate Level Studies

<table>
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<tr>
<td>MBA Business Core*</td>
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<tr>
<td>Course Code</td>
<td>Course Title</td>
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<tr>
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</tr>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
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<td>BA 635</td>
<td>Business Policy and Decision Making</td>
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<td><strong>Total Credits</strong></td>
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</table>

* The remaining 4 classes beyond the MBA Transition courses.

**MBA Specified Electives**

Students must complete a combination of 12 hours from the courses listed below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>BA 590</td>
<td>Graduate Seminar</td>
<td></td>
</tr>
<tr>
<td>BA 603</td>
<td>Aerospace Production and Operations Management</td>
<td></td>
</tr>
<tr>
<td>BA 604</td>
<td>International Management and Aviation Policy</td>
<td></td>
</tr>
<tr>
<td>BA 607</td>
<td>Human Resource Development</td>
<td></td>
</tr>
<tr>
<td>BA 609</td>
<td>Airline Operations and Management</td>
<td></td>
</tr>
<tr>
<td>BA 610</td>
<td>Airline Optimization and Simulation Systems</td>
<td></td>
</tr>
<tr>
<td>BA 615</td>
<td>Investments</td>
<td></td>
</tr>
<tr>
<td>BA 616</td>
<td>Electronic Commerce</td>
<td></td>
</tr>
<tr>
<td>BA 618</td>
<td>Advanced Corporate Finance</td>
<td></td>
</tr>
<tr>
<td>BA 625</td>
<td>Airline Marketing</td>
<td></td>
</tr>
<tr>
<td>BA 630</td>
<td>Aviation/Aerospace Systems Analysis</td>
<td></td>
</tr>
<tr>
<td>BA 636</td>
<td>Venture Creation - an Entrepreneurial Approach to Starting and Building a New Enterprise</td>
<td></td>
</tr>
<tr>
<td>BA 645</td>
<td>Airport Operations and Management</td>
<td></td>
</tr>
<tr>
<td>BA 646</td>
<td>Air Cargo Logistics Management</td>
<td></td>
</tr>
<tr>
<td>BA 650</td>
<td>Airline/Airport Relations</td>
<td></td>
</tr>
<tr>
<td>BA 651</td>
<td>Strategic Airport Planning</td>
<td></td>
</tr>
<tr>
<td>BA 655</td>
<td>Aviation Law and Insurance</td>
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<tr>
<td>BA 696</td>
<td>Graduate Internship in Aviation Business Administration</td>
<td></td>
</tr>
<tr>
<td>BA 699</td>
<td>Special Topics in Business Administration</td>
<td></td>
</tr>
<tr>
<td>BA 700</td>
<td>Thesis</td>
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<tr>
<td></td>
<td><strong>Total Credits</strong></td>
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</tr>
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**Total MBA Degree Requirements** 24

**Suggested Program of Study**

**Year One**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 120</td>
<td>Principles of Aeronautical Science</td>
<td>3</td>
</tr>
<tr>
<td>BA 120</td>
<td>Introduction to Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>EC 211</td>
<td>Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Communication Theory and Skills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Lower-Level Humanities</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
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**Year Two**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 225</td>
<td>Business Law</td>
<td>3</td>
</tr>
<tr>
<td>BA 317</td>
<td>Organizational Behavior</td>
<td>3</td>
</tr>
<tr>
<td>BA 320</td>
<td>Business Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Communication Theory and Skills</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA Upper-Level (see advisor)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physical and Life Sciences</td>
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<tr>
<td></td>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
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**Year Three**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 312</td>
<td>Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
<tr>
<td>BSBA Major Credits</td>
<td><strong>12</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Humanities or Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Open Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physical Sciences</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Credits Subtotal</strong></td>
<td><strong>30.0</strong></td>
</tr>
</tbody>
</table>

**Year Four**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 335</td>
<td>International Business</td>
<td>3</td>
</tr>
</tbody>
</table>

**Students may petition for an internship credit with prior approval of the Associate Dean or graduate program coordinator as appropriate.**
BA 420 Management of Production and Operations 3
BA 490 Strategic Management 3
BA 511 Operations Research 3
BA 514 Strategic Marketing Management in Aviation 3
BA 520 Organizational Behavior, Theory, and Applications in Aviation 3

BSBA Major Credits 9
MBA Transition Courses
Open Elective 3

Credits Subtotal 30.0
Credits Total: 120.0

The BSBA undergraduate degree is awarded once 120 hours and the MBA transition classes are successfully completed.

Year Five

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MBA Business Core</td>
<td>12</td>
</tr>
<tr>
<td>MBA Specified Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

Credits Subtotal 24.0
Credits Total: 24.0

Total Program Credits 144

David B. O'Maley College of Business Combined Masters Programs

Introduction
The objective of the combined programs is to provide the opportunity for students to build a well-rounded undergraduate education and then further prepare themselves as professional managers in the aviation/aerospace industry.

B.S. in Aeronautics/M.B.A. (p. 189)
B.S. in Aerospace Engineering/M.B.A (p. 214).
B.S. in Aviation Maintenance Science/M.B.A (p. 190)
B.S. in Civil Engineering/M.B.A (p. 215).
B.S. in Communication/M.B.A. (p. 148)
B.S. in Computational Math/M.B.A. (p. 149)
B.S. in Computational Math/M.S. in Aviation Finance (p. 149)
B.S. in Computer Engineering/M.B.A (p. 218).
B.S. in Computer Science/M.B.A (p. 218).
B.S. in Electrical Engineering/M.B.A (p. 219).
B.S. in Global Conflict Studies/M.B.A. (p. 150)
B.S. in Homeland Security/M.B.A. (p. 151)
B.S. in Human Factors Psychology/M.B.A. (p. 153)
B.S. in Interdisciplinary Studies/M.B.A. (p. 153)
B.S. in Mechanical Engineering/M.B.A (p. 222).
B.S. in Software Engineering/M.B.A (p. 222).

Admission Requirements

Students interested in pursuing one these programs must:

- Maintain at least a 3.2 cumulative GPA throughout the undergraduate course of study.
- Maintain at least a 3.0 cumulative GPA throughout the graduate course of study.
- Take the Graduate Management Admission Test (GMAT)* during their junior year, earning a score at least at the 50th percentile, and apply for admission to the program through the Office of Graduate Admissions.
- Complete a minimum of 100 credit hours, including the required Business Administration minor courses, prior to enrollment in Business graduate transition courses.

Students should review the undergraduate degree program sections for the recommended course of study and program requirements.

*The GMAT requirement may be waived by the Graduate Program Coordinator for exceptional students.

Aeronautics/MBA

Suggested Course of Study

Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of 9 of the 14 credits of open electives noted in the B.S. in Aeronautics undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Aeronautics, any MBA transition
courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Mathematics**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Social Sciences**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 200</td>
<td>An Economic Survey</td>
<td></td>
</tr>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td></td>
</tr>
<tr>
<td>EC 211</td>
<td>Macroeconomics (or Lower-Level Social Sciences)</td>
<td>3</td>
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**Computer Science**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Computer Science Elective</td>
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</tbody>
</table>

**Minor in Business Administration**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
</tbody>
</table>

**Open Electives**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td></td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
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</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td></td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives 12

**Total Degree Credits** 144

**Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.**

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Aeronautics, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Aerospace Engineering/MBA**

This program does not require any Business Administration courses to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Three or Four**

Technical Elective

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
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</table>

**Year Four**

Technical Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
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</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
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</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives 12

**Total Degree Credits** 156

**Aviation Maintenance Science/MBA**

**Suggested Course of Study**

The Maintenance Management Area of Concentration must be selected as the field of study to prepare the student for this degree option. Entry in this program will be approved by the College of
Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the upper level open electives (6 credits) noted in the B.S. in Aviation Maintenance Science undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

**Communication Theory & Skills**
- COM 122 English Composition 3
- COM 219 Speech 3
- COM 221 Technical Report Writing 3

**Computer Science**
- CS 120 Introduction to Computing in Aviation 3

**Mathematics**
- MA 111 College Mathematics for Aviation I 3
- MA 140 College Algebra 3
- MA 222 Business Statistics 3

**Social Sciences**
- PSY 101 Introduction to Psychology 3

**Maintenance Management Concentration** 36
- ACC 210 Financial Accounting 3
- AMSA 490 Aviation Technical Operations 3
- BA 201 Principles of Management 3
- BA 220 Marketing 3
- BA 225 Business Law 3
- BA 230 Advanced Computer Based Systems 3
- BA 314 Human Resource Management 3
- BA 320 Business Information Systems 3
- BA 324 Aviation Labor Relations 3
- BA 325 Social Responsibility and Ethics in Management 3
- BA 332 Corporate Finance I 3
- BA 411 Logistics Management for Aviation/Aerospace 3

**Business Administration Transition**
- BA 511 Operations Research 3
- BA 520 Organizational Behavior, Theory, and Applications in Aviation 3
- BA 523 Advanced Aviation Economics 3

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:
- ACC 517 Accounting for Decision Making 3
- BA 514 Strategic Marketing Management in Aviation 3
- BA 518 Managerial Finance 3
- BA 635 Business Policy and Decision Making 3

**Specified Electives** 12

**Total Degree Credits** **150**

**Civil Engineering/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

Technical Electives
- BA 511 Operations Research 3
- BA 523 Advanced Aviation Economics 3
  or BA 520 Organizational Behavior, Theory, and Applications in Aviation 3

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:
- ACC 517 Accounting for Decision Making 3
- BA 511 Operations Research 3
Communication/MBA

Suggested Course of Study
The Business Administration minor must be selected as the minor field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the open electives noted in the B.S. in Communication undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111</td>
<td>College Mathematics for Aviation I</td>
<td>3</td>
</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
<td>3</td>
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</tbody>
</table>

Social Sciences

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>EC 211</td>
<td>Macroeconomics (or Lower-Level Social Sciences)</td>
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</tbody>
</table>

Minor in Business Administration

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 230</td>
<td>Advanced Computer Based Systems</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
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Open Electives

One class MUST be:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Business Administration Transition

Nine credits are required from the list below:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Five

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives 12

Total Degree Credits ** 144

** Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Communication, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

Computational Math/MBA

Suggested Course of Study
The Business Administration minor or Finance Minor must be selected as the minor field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the open electives noted in the B.S. in Computational Math undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.
### Social Sciences
- EC 210 Microeconomics 3
- EC 211 Macroeconomics (or Lower-Level Social Sciences)

#### Option 1 - Minor in Business Administration
- ACC 210 Financial Accounting 3
- BA 201 Principles of Management 3
- BA 220 Marketing 3
- BA 225 Business Law 3
- BA 332 Corporate Finance I 3

#### Option 2 - Minor in Finance
- ACC 210 Financial Accounting 3
- ACC 312 Managerial Accounting 3
- BA 201 Principles of Management 3
- BA 332 Corporate Finance I 3
- BA 434 Corporate Finance II 3

#### Business Administration Transition
- BA 511 Operations Research 3
- BA 514 Strategic Marketing Management in Aviation 3
- BA 520 Organizational Behavior, Theory, and Applications in Aviation 3

#### Year Five

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:
- ACC 517 Accounting for Decision Making 3
- BA 518 Managerial Finance 3
- BA 523 Advanced Aviation Economics 3
- BA 635 Business Policy and Decision Making 3

#### Specified Electives
12

**Total Degree Credits** **144**

**Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.**

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Computational Math, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

### Computational Math/MSAF

#### Suggested Course of Study

The Business Administration minor or the Finance minor must be selected as the minor field of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. The Business Administration transition courses listed are to be taken in place of the open electives noted in the B.S. in Computational Math undergraduate degree plan. Not following the suggested course of study will require the student to take additional courses to prepare for the Master of Science in Aviation Finance.

#### Social Sciences
- EC 210 Microeconomics (or) 3
- EC 211 Macroeconomics (or Lower-Level Social Sciences)

#### Option 1 - Minor in Business Administration
- ACC 210 Financial Accounting 3
- BA 201 Principles of Management 3
- BA 220 Marketing 3
- BA 225 Business Law 3
- BA 332 Corporate Finance I 3

#### Option 2 - Minor in Finance
- ACC 210 Financial Accounting 3
- ACC 312 Managerial Accounting 3
- BA 201 Principles of Management 3
- BA 332 Corporate Finance I 3
- BA 434 Corporate Finance II 3

#### Business Administration Transition
- ACC 517 Accounting for Decision Making 3
- BA 518 Managerial Finance (or) 3
- FIN 518 Managerial Finance 3
- BA 523 Advanced Aviation Economics 3

#### Year Five

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:
- BA 615 Investments (or) 3
FIN 615 Investments
BA 618 Advanced Corporate Finance (or) 3
FIN 618 Advanced Corporate Finance
FIN 620 Air Transport Economic Modeling 3

Optional Electives
BA 514 Strategic Marketing Management in Aviation 3
BA 609 Airline Operations and Management 3
FIN 621 International Aviation Finance 3
FIN 622 Aircraft and Airline Financing 3
FIN 623 Aircraft Funding Legal and Financial Analysis 3

Concluding Degree Requirement
FIN 699 Special Topics in Finance (or) 1-6
FIN 696 Graduate Internship in Finance

Total Degree Credits ** 144

** Additional courses may be required if the recommendations above are not followed or if an additional minor is taken.

If the student chooses to leave the program before the completion of the MSAF program and has acquired the minimal hours required for graduation with the BS in Computational Math, any MSAF transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

Computer Science/MBA

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

Business Administration Transition
Year Four
Electives
BA 511 Operations Research 3
BA 523 Advanced Aviation Economics 3
or BA 520 Organizational Behavior, Theory, and Applications in Aviation

Year Five
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

ACC 517 Accounting for Decision Making 3
BA 511 Operations Research 3
BA 514 Strategic Marketing Management in Aviation 3
BA 518 Managerial Finance 3
BA 520 Organizational Behavior, Theory, and Applications in Aviation 3

Specified Electives 12

Total Degree Credits 154

Computer Engineering/MBA

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

Business Administration Transition
Year Four
Electives
BA 511 Operations Research 3
BA 523 Advanced Aviation Economics 3
or BA 520 Organizational Behavior, Theory, and Applications in Aviation

Year Five
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

ACC 517 Accounting for Decision Making 3
BA 511 Operations Research 3
BA 514 Strategic Marketing Management in Aviation 3
BA 518 Managerial Finance 3
BA 520 Organizational Behavior, Theory, and Applications in Aviation 3

Specified Electives 12

Total Degree Credits 154
Electrical Engineering/MBA

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

Business Administration Transition

Year Four

Specified Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>or BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Five

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives 12

Total Degree Credits 147-149

Global Conflict Studies/MBA

Suggested Course of Study

The Business Administration undergraduate courses as well as the transition classes listed outline below must be completed to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 120</td>
<td>Quantitative Methods I</td>
<td>3</td>
</tr>
<tr>
<td>MA 220</td>
<td>Quantitative Methods II</td>
<td>3</td>
</tr>
<tr>
<td>Humanities/Social Sciences - Lower or Upper Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC 210</td>
<td>Microeconomics</td>
<td>3</td>
</tr>
</tbody>
</table>

Business Administration Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 210</td>
<td>Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
</tr>
<tr>
<td>BA 332</td>
<td>Corporate Finance I</td>
<td>3</td>
</tr>
<tr>
<td>BA 437</td>
<td>Strategic Management and Consulting</td>
<td>3</td>
</tr>
</tbody>
</table>

Business Administration Transition

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

Year 5

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives 12

Total Degree Credits 147

1 These 15 credits fulfill one BSGCS 15-credit breadth area.
2 Two of these courses can fulfill BSGCS electives.

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Global Conflict Studies, any
MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Homeland Security/MBA**

**Suggested Course of Study**

The Business Administration undergraduate and transition classes recommend in the outline below are taken in place of one of the areas of concentration within the B.S. in Homeland Security program to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111  College Mathematics for Aviation I</td>
<td></td>
</tr>
<tr>
<td>or MA 120  Quantitative Methods I</td>
<td></td>
</tr>
<tr>
<td>MA 112  College Mathematics for Aviation II</td>
<td></td>
</tr>
<tr>
<td>or MA 220  Quantitative Methods II</td>
<td></td>
</tr>
</tbody>
</table>

**Social Sciences - Lower Level**

<table>
<thead>
<tr>
<th>Social Sciences</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 101  Introduction to Psychology</td>
<td></td>
</tr>
</tbody>
</table>

**Humanities/Social Sciences - Lower or Upper Level**

<table>
<thead>
<tr>
<th>Humanities/Social Sciences</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210  Microeconomics</td>
<td></td>
</tr>
</tbody>
</table>

**Business Administration Courses**

1. These 12 credits are taken in lieu of one BSHS 15-credit minor/cohesive block.
2. Any of these courses can be taken in lieu of the BSHS "Any 300/400 course" elective

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Homeland Security, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Human Factors Psychology/MBA**

**Suggested Course of Study**

The Business Administration undergraduate and transition classes recommended in the outline below are taken in place of the open electives within the B.S. in Human Factors Psychology to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 111  College Mathematics for Aviation I</td>
<td></td>
</tr>
<tr>
<td>or MA 120  Quantitative Methods I</td>
<td></td>
</tr>
<tr>
<td>MA 112  College Mathematics for Aviation II</td>
<td></td>
</tr>
<tr>
<td>or MA 220  Quantitative Methods II</td>
<td></td>
</tr>
</tbody>
</table>

**Social Sciences**

<table>
<thead>
<tr>
<th>Social Sciences</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 210  Microeconomics</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humanities/Social Sciences</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY 101  Introduction to Psychology</td>
<td></td>
</tr>
</tbody>
</table>

**Business Administration Courses**

1. These 12 credits are taken in lieu of one BSHS 15-credit minor/cohesive block.
2. Any of these courses can be taken in lieu of the BSHS "Any 300/400 course" elective

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Homeland Security, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.
ACC 210  Financial Accounting  3
BA 220  Marketing  3
BA 332  Corporate Finance I  3

**Business Administration Transition**
Nine credits are required from the list below:
BA 511  Operations Research  3
BA 514  Strategic Marketing Management in Aviation  3
BA 520  Organizational Behavior, Theory, and Applications in Aviation  3

**Year Five**
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional courses that have not been completed:
ACC 517  Accounting for Decision Making  3
BA 518  Managerial Finance  3
BA 523  Advanced Aviation Economics  3
BA 635  Business Policy and Decision Making  3

Specified Electives  12

**Total Degree Credits**  147

*  PSY 340 taken in lieu of BA 201

If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the B.S. in Human Factors Psychology, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Interdisciplinary Studies/MBA**

**Suggested Course of Study**
The Business Administration minor must be selected as one of the three minor fields of study to prepare the student for this degree option. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The undergraduate course options shown below are the recommended classes for students to prepare for this degree option. Not following the suggested course of study will require the student to take additional courses to prepare for the MBA.

**Mathematics**
MA 111  College Mathematics for Aviation I  3
MA 222  Business Statistics  3

**Social Sciences**
EC 210  Microeconomics  3
EC 211  Macroeconomics  3
or EC 200  An Economic Survey  3

Select one of the following:
SS 110  World History  3
SS 120  U.S. History  3
SS 130  History of Aviation in America  3
PSY 101  Introduction to Psychology  3

**Two Minor Courses of Study**
Minor requirements are based on the catalog of the declaring year; must earn a 2.0 GPA or higher in each minor

**Minor in Business Administration**
ACC 210  Financial Accounting  3
BA 220  Marketing  3
BA 332  Corporate Finance I  3

**Business Administration Transition**
Nine credits are required from the list below.
BA 511  Operations Research  3
BA 514  Strategic Marketing Management in Aviation  3
BA 520  Organizational Behavior, Theory, and Applications in Aviation  3

**Year Five**
Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional courses that have not been completed.
ACC 517  Accounting for Decision Making  3
BA 518  Managerial Finance  3
BA 523  Advanced Aviation Economics  3
BA 635  Business Policy and Decision Making  3

Specified Electives  12

**Total Degree Credits**  144

** More hours may be required if the recommendations above are not followed and due to hours required in the additional minors selected.**
If the student chooses to leave the program before the completion of the MBA program and has acquired the minimal hours required for graduation with the BS in Interdisciplinary Studies, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

**Mechanical Engineering/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

<table>
<thead>
<tr>
<th>Technical Electives</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>BA 511 Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Specified Electives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517 Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 511 Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514 Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 518 Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520 Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635 Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specified Electives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Specified Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

**Total Degree Credits** 156

**Software Engineering/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

<table>
<thead>
<tr>
<th>Specified Electives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>or BA 520 Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Specified Electives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517 Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 511 Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514 Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 518 Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520 Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635 Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

| Specified Electives                  | 12    |

**Total Degree Credits** 154

**Master of Business Administration (MBA)**

**Introduction**

The Master of Business Administration degree program is designed to emphasize the application of modern management concepts, methods, and tools to the challenges of aviation and general business. The special intricacies of aviation are woven into a strong, traditional business foundation and examined in greater detail through a wide variety of specified electives. By combining these focused electives into a distinct set, students may select a unique area of specialization in the MBA program.

The demand for professional managers continues to grow in response to the increasing need to improve the efficient and effective use of scarce resources, of operating in an atmosphere of heightened national
and international competition, of accommodating the expansion of emerging nations, and of responding to the call to preserve our fragile environment. The MBA curriculum is oriented toward the needs of the strategic decision-maker in the management hierarchy.

Versatility and analytical resourcefulness are two of the key aims of the MBA. For students wishing to study a wide range of aviation subject matter, the MBA allows flexibility in elective choices across a range of aviation fields and business subject matter. For those wishing to specialize in a unique area of aviation or aerospace, part of the program can be individually molded to satisfy personal interests. Students may select from specializations in Airport Management, Airline Management, Aviation System Management, Finance, and Supply Chain Management. Students are allowed to select only one specialization. For those wishing for an MBA with a specific industry focus, the MBA in Aviation Management is now offered exclusively on the Daytona Beach Campus.

Embry-Riddle has partnered with ISTAT (International Society for Transport Aircraft Trading) foundation to offer the ISTAT U certificate in aviation leasing and financing. Students pursuing the MBA degree can complete the ISTAT certificate as part of the MBA degree program. For further details please contact the MBA program coordinator.

In order to earn the ISTAT U certificate, students must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN 623</td>
<td>Aircraft Funding Legal and Financial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>FIN 624</td>
<td>Aircraft Transaction and Risk Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 6

For Admissions criteria see, https://catalog.erau.edu/daytona-beach/admissions/masters/program-specific-criteria/

Degree Requirements

Master of Business Administration

**Aviation Business Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 21

**Specified Electives**

Students must complete a combination of 12 hours from the courses listed below:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 603</td>
<td>Aerospace Production and Operations Management</td>
</tr>
<tr>
<td>BA 604</td>
<td>International Management and Aviation Policy</td>
</tr>
<tr>
<td>BA 609</td>
<td>Airline Operations and Management</td>
</tr>
<tr>
<td>BA 610</td>
<td>Airline Optimization and Simulation Systems</td>
</tr>
<tr>
<td>BA 615</td>
<td>Investments</td>
</tr>
<tr>
<td>BA 616</td>
<td>Electronic Commerce</td>
</tr>
<tr>
<td>BA 618</td>
<td>Advanced Corporate Finance</td>
</tr>
<tr>
<td>BA 625</td>
<td>Airline Marketing</td>
</tr>
<tr>
<td>BA 630</td>
<td>Aviation/Aerospace Systems Analysis</td>
</tr>
<tr>
<td>BA 632</td>
<td>Seminar in Aviation Labor Relations</td>
</tr>
<tr>
<td>BA 636</td>
<td>Venture Creation - an Entrepreneurial Approach to Starting and Building a New Enterprise</td>
</tr>
<tr>
<td>BA 645</td>
<td>Airport Operations and Management</td>
</tr>
<tr>
<td>BA 646</td>
<td>Air Cargo Logistics Management</td>
</tr>
<tr>
<td>BA 650</td>
<td>Airline/Airport Relations</td>
</tr>
<tr>
<td>BA 651</td>
<td>Strategic Airport Planning</td>
</tr>
<tr>
<td>BA 655</td>
<td>Aviation Law and Insurance</td>
</tr>
<tr>
<td>BA 683</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>BA 696</td>
<td>Graduate Internship in Aviation Business Administration</td>
</tr>
<tr>
<td>BA 699</td>
<td>Special Topics in Business Administration</td>
</tr>
<tr>
<td>BA 700</td>
<td>Thesis</td>
</tr>
</tbody>
</table>

Total Credits: 12
## Total Credits Required

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 636</td>
<td>Venture Creation - an Entrepreneurial Approach to Starting and Building a New Enterprise</td>
<td>3</td>
</tr>
<tr>
<td>BA 646</td>
<td>Air Cargo Logistics Management</td>
<td>3</td>
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<tr>
<td>BA 650</td>
<td>Airline/Airport Relations</td>
<td>3</td>
</tr>
<tr>
<td>BA 655</td>
<td>Aviation Law and Insurance</td>
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</tr>
<tr>
<td>BA 683</td>
<td>Supply Chain Management</td>
<td>3</td>
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<tr>
<td>BA 696</td>
<td>Graduate Internship in Aviation Business Administration</td>
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<td>BA 699</td>
<td>Special Topics in Business Administration</td>
<td>3</td>
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<tr>
<td>BA 700</td>
<td>Thesis</td>
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<tr>
<td>MSA 508</td>
<td>Advanced Airport Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MSA 613</td>
<td>Airport Operations Safety</td>
<td>3</td>
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</tbody>
</table>

Total Credits Required: **33**

** Students may petition for an internship credit with prior approval of the Associate Dean or graduate program coordinator as appropriate.

## Master of Business Administration Specialization in Airport Management

### Aviation Business Core

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
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<td>BA 518</td>
<td>Managerial Finance</td>
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<td>Organizational Behavior, Theory, and Applications in Aviation</td>
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<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
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Total Credits: **21**

### Specialization Required Courses

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>BA 645</td>
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<td>BA 625</td>
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Total Credits Required: **33**

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## Master of Business Administration Specialization in Airline Management

### Aviation Business Core

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</thead>
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<td>Accounting for Decision Making</td>
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<td>BA 511</td>
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<td>Organizational Behavior, Theory, and Applications in Aviation</td>
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<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
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Total Credits: **21**

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<tr>
<th>Course</th>
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<tr>
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<tr>
<td>BA 650</td>
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<td>BA 604</td>
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<td>Venture Creation - an Entrepreneurial Approach to Starting and Building a New Enterprise</td>
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</table>

**Total Credits Required** 33

** Students may petition for an internship credit with prior approval of the Associate Dean or graduate program coordinator as appropriate.

Master of Business Administration Specialization in Supply Chain Management

**Aviation Business Core**

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<tr>
<th>Course Code</th>
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<td>ACC 517</td>
<td>Accounting for Decision Making</td>
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<td>Managerial Finance</td>
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<tr>
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<tbody>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
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<td>BA 523</td>
<td>Advanced Aviation Economics</td>
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<td>BA 635</td>
<td>Business Policy and Decision Making</td>
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**Specialization Required Courses**

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BA 683</td>
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**One course from these Elective courses**

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<td>Aviation Law and Insurance</td>
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<td>Course Title</td>
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<tr>
<td>BA 696</td>
<td>Graduate Internship in Aviation Business Administration **</td>
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<td>BA 699</td>
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</tbody>
</table>

**Total Credits Required** 33

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Master of Business Administration Specialization in Aviation System Management

**Aviation Business Core**

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<tbody>
<tr>
<td>ACC 517</td>
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<tr>
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<td>Managerial Finance</td>
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<td>Advanced Aviation Economics</td>
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<td>BA 635</td>
<td>Business Policy and Decision Making</td>
</tr>
</tbody>
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**Total Credits** 21

**Specialization Required Courses**

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
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</tr>
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<td>BA 630</td>
<td>Aviation/Aerospace Systems Analysis</td>
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<td>MSA 609</td>
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<tr>
<td>MSA 641</td>
<td>Production and Procurement Management in the Aviation/Aerospace Industry</td>
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</table>

**Total Credits Required** 33

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Master of Business Administration Specialization in Finance

**Aviation Business Core**

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<tr>
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Electives
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### Master of Business Administration in Aviation Management (MBA in AM)

**Introduction**

Offered exclusively at the Daytona Beach Residential Campus, this degree offering is for those students wishing to pursue a dedicated curriculum offering in the field of aviation management. The courses within the program deliver the required MBA core content while investigating trends in the key industry segments in the world of aviation.

**Admissions Requirements**

Students interested in pursuing this degree option must meet the same admission standards as the MBA program.

**Degree Requirements**

**Aviation Business Core**

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<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits**

<table>
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</table>

**Aviation Management Courses**

<table>
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<tr>
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<tbody>
<tr>
<td>BA 604</td>
<td>International Management and Aviation Policy</td>
<td>3</td>
</tr>
<tr>
<td>BA 609</td>
<td>Airline Operations and Management</td>
<td>3</td>
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</table>
Students may petition the Program Coordinator for permission to substitute the required specified electives to declare a specialization as shown with the MBA program.

**M.S. in Aviation Finance (MSAF)**

For additional information about the Master of Science in Aviation Finance (http://daytonabeach.erau.edu/cob/degrees/graduate-degrees/aviation-finance), please refer to the College website.

This degree offering is for those students wishing to pursue a dedicated curriculum in the field of aviation finance. The courses in the program deliver the required knowledge of the business and operational aspects of the aviation / aerospace industry while presenting the needed classes in economics, accounting and financial practices and models used by firms not just in the aviation industry but business across the globe.

The target for the degree would be students who completed an undergraduate degree in business, accounting, finance or economics, or related transportation fields of study looking for a rewarding and challenging career in the aviation / aerospace industries. Students from other majors may be accepted into the program, but would first need to successfully complete 15 hours of undergraduate classes in economics, accounting, finance and business statistics before commencing graduate level classes. Furthermore, for entry into the program, besides needing to meet current ERAU graduate admission requirements, students would be required to take the GRE exam to complete entry requirements.

Embry-Riddle has partnered with ISTAT (International Society for Transport Aircraft Trading) foundation to offer the ISTAT U certificate in aviation leasing and financing. Students pursuing the MSAF degree can complete the ISTAT certificate as part of the MSAF degree program. For further details please contact the MSAF program coordinator.

In order to earn the ISTAT U certificate, students must complete the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN 623</td>
<td>Aircraft Funding Legal and Financial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>FIN 624</td>
<td>Aircraft Transaction and Risk Modeling</td>
<td>3</td>
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</table>

**Required Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>FIN 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>FIN 615</td>
<td>Investments</td>
<td>3</td>
</tr>
<tr>
<td>FIN 618</td>
<td>Advanced Corporate Finance</td>
<td>3</td>
</tr>
<tr>
<td>FIN 620</td>
<td>Air Transport Economic Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>

**Optional Electives (choose 4 courses)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 609</td>
<td>Airline Operations and Management</td>
<td>3</td>
</tr>
<tr>
<td>FIN 621</td>
<td>International Aviation Finance</td>
<td>3</td>
</tr>
<tr>
<td>FIN 622</td>
<td>Aircraft and Airline Financing</td>
<td>3</td>
</tr>
<tr>
<td>FIN 623</td>
<td>Aircraft Funding Legal and Financial Analysis</td>
<td>3</td>
</tr>
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<td>FIN 624</td>
<td>Aircraft Transaction and Risk Modeling</td>
<td>3</td>
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</tbody>
</table>

**Concluding Degree Requirement**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>FIN 699</td>
<td>Special Topics in Finance</td>
<td>1-6</td>
</tr>
<tr>
<td>or FIN 696 Graduate Internship in Finance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits Required**

33

* In order to earn the ISTAT U certificate, students must complete both FIN 623 & FIN 624

**Dual Masters in Engineering and Business Administration**

Dual Master of Science (MS) in Engineering and Master of Business Administration (MBA) option (this option is available for every Master of Science in Engineering degree program listed in the catalog)

For exceptional students enrolled in an engineering Master of Science degree program, the College of Engineering and the David B. O'Maley College of Business offer the opportunity to simultaneously
pursue a Master of Science in Engineering (Aerospace, Civil, Computer, Cybersecurity, Electrical and Computer, Mechanical, Software, Systems, Unmanned Autonomous Systems) and a Master of Business Administration.

With this option, the student will take a total of 30 credits to obtain a MS in Engineering and an additional 21 credits to obtain an MBA. Twelve (12) credits from the MS in Engineering will count towards the MBA's total requirement of 33 credits. One of those courses has to be BA 511 and the remaining 3 courses have to be approved by both the MBA program coordinator and the respective MS in Engineering program coordinator. See specific description below.

Graduate students may apply to the Dual MS in Engineering and MBA option by submitting an application to both, the respective engineering and business graduate program coordinator. Students must have completed 12 credit hours toward the respective MS in Engineering degree and must have a 3.0 minimum GPA to be admitted to the dual degree program. Students will be dropped from the program if their GPA falls below 3.0. In addition, students will also have to complete the MBA Prep-Series successfully before being admitted to the MBA program.

**Dual Degree Program Description:**

**MS in Engineering Degree Requirements (for each discipline) (30 credits):**

These courses include required and elective credits as specified by each graduate engineering program and as per respective graduate program coordinator approval.

**BA 511 - Operations Research (3 credits), which can satisfy one of the electives or a math requirement for MS in engineering students.**

**MBA Degree Requirements (21 additional credits):**

<table>
<thead>
<tr>
<th>BA 517</th>
<th>Accounting for Decision Making</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>or BA 636</td>
<td>Venture Creation - an Entrepreneurial Approach to Starting and Building a NewEnterprise</td>
<td></td>
</tr>
<tr>
<td>1 Business Elective from the list below:</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BA 604</td>
<td>International Management and Aviation Policy</td>
<td></td>
</tr>
<tr>
<td>BA 609</td>
<td>Airline Operations and Management</td>
<td></td>
</tr>
<tr>
<td>BA 610</td>
<td>Airline Optimization and Simulation Systems</td>
<td></td>
</tr>
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<td>BA 615</td>
<td>Investments</td>
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</tr>
<tr>
<td>BA 618</td>
<td>Advanced Corporate Finance</td>
<td></td>
</tr>
<tr>
<td>BA 630</td>
<td>Aviation/Aerospace Systems Analysis</td>
<td></td>
</tr>
<tr>
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<td>Airport Operations and Management</td>
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<td>BA 646</td>
<td>Air Cargo Logistics Management</td>
<td></td>
</tr>
<tr>
<td>BA 650</td>
<td>Airline/Airport Relations</td>
<td></td>
</tr>
<tr>
<td>BA 683</td>
<td>Supply Chain Management</td>
<td></td>
</tr>
<tr>
<td>BA 696</td>
<td>Graduate Internship in Aviation Business Administration</td>
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</tr>
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</table>

*Total for MS in Engineering and MBA: 51*

* 30 MS Engineering credits, (9 Engineering credits and BA 511 count toward both degrees) and 21 MBA credits.

**Ph.D. in Aviation Business Administration**

**Ph.D. in Aviation Business Administration**
The objective of this Ph.D. program in Aviation Business Administration is to educate Ph.D. level students and professionals in conducting state of the art research in this important field of study.

The degree of Doctor of Philosophy in Aviation Business Administration will be conferred in recognition of creative accomplishment and the ability to investigate scientific or business research problems independently. The doctorate degree also recognizes the potential for completion of advanced coursework that helps students build a solid foundation for Ph.D. - level research.
Flexible Degree
The Doctor of Philosophy in Aviation Business Administration has been designed to accommodate working professionals who seek to advance their knowledge and conduct high-quality research in pertinent aviation business disciplines. Industry, military and government professionals with strong academic credentials, and a passion for aviation business research, will find this Ph.D. program both attainable and rewarding. Delivery of the program, which includes both a one-week “residency” in Daytona Beach, Florida and on-line courses through the Worldwide Campus, allows the candidates to continue their profession while pursuing a doctoral degree. Domestic or international students with a prior Master’s degree in business or other related discipline are eligible to be accepted into the Ph.D. in Aviation Business Administration program.

Admission Requirements
Applicants to the Ph.D. program in Aviation Business Administration must:

- Have completed a Master’s degree in Business Administration or closely related discipline.
- Have superior academic records as determined by the College of Business Doctoral Degree Program committee.
- Have taken either the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) within the last 5 years and have acceptable scores on both quantitative and verbal sections as determined by the Doctoral Degree Program committee.
- Applicants from countries where English is not the official language need to show proficiency in English by taking and satisfying the University’s approved tests including TOEFL, IELTS and other requirements.
- Submit a complete application package including resume, official transcripts, two (2) Letters of Recommendation, statement of purpose, statement of research interests, and a description of aviation, aerospace or relevant industry experience.

Curriculum
The Ph.D. program requires the completion of 60 credit hours of graduate study. These credit hours are spread over aviation business core classes, research methods and quantitative models, electives and Ph.D. thesis as follows.

Aviation Business Core Courses (15 credit hours)
All Ph.D. students need to take the following courses.

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<tr>
<th>Course</th>
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<tr>
<td>BA 705</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
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<tr>
<td>BA 710</td>
<td>Advanced Marketing in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 715</td>
<td>Advanced Aviation Accounting</td>
<td>3</td>
</tr>
<tr>
<td>BA 720</td>
<td>Advanced Managerial Finance in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 725</td>
<td>Advance Organizational Behavior in Aviation</td>
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Research Methods/Quantitative Models (9 credits)
All Ph.D. students need to take the following courses. These courses help the students with the analytical skills necessary for their research.

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<tbody>
<tr>
<td>BA 805</td>
<td>Statistics and Multivariate Analysis</td>
<td>3</td>
</tr>
<tr>
<td>BA 810</td>
<td>Advanced Topics in Business Quantitative Methods</td>
<td>3</td>
</tr>
<tr>
<td>BA 815</td>
<td>Seminars in Research Methods</td>
<td>3</td>
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Research Seminars (12 credits)
All Ph.D. students need to take 4 elective research seminars to help them further develop research skills necessary for completion of their dissertation and beyond. These classes are in the format of research seminars. These seminars are research oriented topics and follows a flexible delivery dependent on professors teaching the courses. The objective is to familiarize the students to conduct research in a specialized topic. Research topics are a collaborative effort between the student, faculty, and their peers if a team-based activity is prescribed. In these seminars, students are expected to conduct a literature review, criticize previous research work and identify limitations, propose and conduct a rational course of action, and submit a completed research paper. It is expected that these papers are suitable for at least conference presentations and/ or proceedings. Suggested research seminar topics may include:

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<tbody>
<tr>
<td>BA 830</td>
<td>Research Seminar/Special Topics in Airline Management</td>
<td>3</td>
</tr>
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</table>
BA 835  Research Seminar/Special Topics in Air Cargo and Logistics  3
BA 840  Research Seminar/Special Topics in Aviation Operations  3
BA 845  Research Seminar/Special Topics in MIS Applications in Aviation  3
BA 850  Research Seminar/Special Topics in Airport Management  3
BA 855  Research Seminar/Special Topics in Aviation Supply Chain Management  3
BA 860  Research Seminar/Special Topics in Aviation Entrepreneurship  3
BA 865  Research Seminar/Special Topics in Globalization in Aviation  3
BA 870  Research Seminar/Special Topics in Leadership in Aviation  3
BA 875  Research Seminar/Special Topics in Aviation Human Factors  3
BA 880  Research Seminar/Special Topics in Aviation Law  3
BA 885  Research Seminar/Special Topics in Advanced Aviation Finance  3
BA 890  Research Seminar/Special Topics in Advanced Aviation Economics  3
BA 895  Research Seminar/Special Topics in Aviation Business Administration  3

Dissertation (24 credits)
All students need to conduct aviation business related research leading to original contribution to the knowledge in the field supervised by their dissertation advisors. The following sections provide detailed information on format, progress, expectations and delivery of dissertation.

Ph.D. Degree Program Format and Duration
The students are expected to take 6 credit hours per semester. Summer A and Summer B are treated as one semester. Students may register for up to 3 credit hours for summer semesters.
A semester is defined as a 12 week sessions with start dates coinciding with Daytona Beach Campus residential-based semesters. All courses are presented using the technology prescribed by Daytona Beach College of Business faculty and offered through our Worldwide technology services.

While the typical time for completing the Ph.D. degree in Aviation Business Administration will be three to four years, it will be the policy of the Daytona Beach David B. O'Maley College of Business that the total duration of the doctoral study should not exceed seven years. Exceptions will be allowed when justified.

Course Delivery Mode
The Ph.D. program is designed to accommodate working professionals who wish to pursue their degree using a distance-mediated format facilitated through our Worldwide Campus. Course offerings will include online content containing a variety of delivery techniques, and variable by course. Such techniques may include recorded lectures, interactive discussion boards, course projects, synchronous discussions, etc.

Residency
Each student is required to complete one week on campus residency each year independent of their levels or stage in the Ph.D. program. These residencies allow students the opportunity to network face to face with peers and instructors. The residencies are scheduled during mid-August and are approximately one week long (Monday to Friday).

Some of the activities during these residencies include:

- Introduction to the College and Daytona Beach campus
- Introduction to technology, delivery modes, software, databases
- Research seminars offered by faculty
- Research presentations by the students
- Interaction with advisers and committee chairs
- Face to face classes
- Introduction and seminars on:
  - Critical thinking
  - Writing skills
  - How to perform in research seminars
  - Literature reviews
  - Preparation for qualifying exams
  - Working with advisors on dissertations

Qualifying Examinations
Students are required to take and pass written qualifying examinations to demonstrate their ability
to pursue the Ph.D. degree. Qualifying examinations are designed to evaluate students’ mastery of the fundamentals of aviation business that support their research endeavor. Participation in the Ph.D. Qualifying Examination requires a GPA of 3.0 or above in the course work. It is recommended that students take the qualifying exam within two semesters after the course work. Students should plan up to one week to complete the online exam. Passing the qualifying examination will require that the student achieves a satisfactory score on each section. A student must pass the qualifying examination in not more than two attempts. A student who fails to achieve acceptable scores in all trials will be dismissed from the program at the end of that semester.

The qualifying examinations are developed and administered by the Daytona Beach David B. O’Maley College of Business faculty with subject matter expertise drawn from appropriate sources. A Ph.D. student who passes the qualifying examinations is eligible to register for dissertation research credit and is classified as a Ph.D. candidate. The Ph.D. candidates are required to work with the Doctoral Degree Program Committee, to select a qualified dissertation advisor(s), and form their committee before taking any dissertation research credit.

**Dissertation Advisor and Committee**

Upon entry into the Ph.D. in Aviation Business Administration Program, the Doctoral Degree Program Committee advises students on course selection and develop a plan of study. Upon completion of the Qualifying Exams and elevation to candidacy status, candidates must select a qualified dissertation advisor(s) from the faculty of the David B. O’Maley College of Business in Daytona Beach, College of Arts and Sciences in Prescott, or College of Business at Worldwide.

Any appropriately qualified tenured or tenure-track business faculty with a relevant terminal (doctoral) degree and expertise in a research area closely related to the candidate’s area of interest may serve as the dissertation advisor(s) for a Ph.D. candidate student. The Daytona Beach David B. O’Maley College of Business Doctoral Degree Program Committee provides administration of the Advisor Process and grants final approval for those selected to be Ph.D. dissertation advisors. A student must work with their dissertation advisor(s) to form a proposed calendar of program events, milestones, and a dissertation committee, all of which receives final approval from the Doctoral Degree Program Committee. This dissertation committee is composed of four appropriately qualified faculty members from Embry-Riddle Aeronautical University.

In the event that a student is involved in collaborative research with an outside institution and/or company, one qualified member from these entities may serve on the dissertation committee, in addition to the four faculty members from ERAU. The student’s dissertation advisor(s) typically serves as the chair of the dissertation committee or may request the Doctoral Degree Program Committee assign another faculty with closer research expertise to the candidate’s proposed research interests.

The Ph.D. candidates are expected to meet with their dissertation advisor(s) and/or committees once a semester at a time convenient to all parties. The Doctoral Degree Program Committee schedules all such meetings and are announced at least 4 weeks in advance.

**Proposal Examinations**

The purpose of the proposal examinations (also known as preliminary examinations) is to evaluate students’ readiness for conducting their proposed research. The preliminary examinations assess the students’ ability to use their knowledge to perform high quality, independent and creative research, and assure their potentials for successful completion of the Ph.D. dissertation. The examining committee is composed of the student’s dissertation committee as well as a representative from the Dean of the David B. O’Maley College of Business at Daytona Beach. A Ph.D. student must take the preliminary examination within one year after completing the qualifying examinations.

The preliminary examination consists of a written research proposal and an oral presentation made to the examining committee. At least one month before the preliminary examination, the student must provide written copies of the research proposal to each of the members of the examining committee. The purpose of this proposal is for the student, with the guidance of the dissertation advisor(s), to define the focus of the research and to enable the examining committee to offer maximum assistance and advice to the student. The proposal should
contain a clear statement of the proposed topic of aviation business research; a review of the literature relating to the problem; and an outline of the proposed methodology for solution to the problem. The proposal also should include an estimated cost of needed resources; and a schedule that identifies key milestones and events for measuring the progress of the intended effort. The preliminary examination evaluates the student’s readiness for completing the proposed research. Students who fail to meet the expectation of the committee will be informed of the areas of weakness and given one additional opportunity to amend and correct their proposal. Students who fail to show improvements in the research proposal in their second trial will be dismissed from the program at the end of that semester.

Dissertation Defense
The purpose of the defense examination is to evaluate the student’s overall research effort and written dissertation to determine whether or not the candidate is qualified to receive a Ph.D. degree in Aviation Business Administration. At least one month before the defense, the student must provide written copies of the final draft of the dissertation to each of the members of the examining committee. The dissertation defense is the candidate’s oral presentation of the final work of the dissertation. There will be an additional representative from the Daytona Beach Campus Chief Academic Officer’s (CAO) office and/or an external subject matter expert present in the defense. During the defense presentation, the results presented in his or her dissertation may be formally challenged by the dissertation committee. The defense is administered by the student’s dissertation committee in accordance with the guidelines of the Daytona Beach David B. O’Maley College of Business and the University. The major areas of emphasis of this examination are the quality and originality of the candidate’s research and his/her knowledge and understanding of the general areas of study related to the field. Like the preliminary exam committee, a student’s dissertation examining committee consists of the dissertation committee and representatives from Daytona Beach CAO’s office and the Dean of the Daytona Beach David B. O’Maley College of Business. The Ph.D. candidate’s dissertation advisor(s) and/or the Doctoral Degree Program Committee may invite other members from inside or outside ERAU to attend the defense. It is expected that the students at the minimum, cite at least one peer reviewed journal and conference paper as the lead author in their defense disseminated from their research work.

Students who fail to pass their defense can be asked to re-work part of their dissertation and to re-defend the results or may be dismissed from the program. The candidate’s dissertation advisor(s) will coordinate any needed remediation resulting from a failed defense.

Annual Progress Review
The students should maintain a minimum GPA of 3.0 in all class work. After passing the qualification exam, the candidates must provide to the examination committee an annual progress report. The progress report summarizes the main accomplishments and progress in the previous year and identifies the work plan for the future work. The progress should be signed by the candidate and his/her dissertation advisor(s). The progress report should be submitted before the end of the second week in December each year. The dissertation committee will review the progress of the Ph.D. candidate once a year. The purpose of the review is to ensure that candidates continue to make satisfactory progress toward their degree objectives. All major recommendations from this annual review will be forwarded to the candidate with an assessment of achievements and of areas where improvements are expected. A copy of this report is sent to the Doctoral Degree Program Committee.

Dismissal Policy
Based on the recommendation from the Doctoral Degree Program Committee, a student will be dismissed from the program if the overall GPA is less than 3.0 for two successive semesters. Also, a student will be dismissed from the program if they twice fail the qualifying exam, fail the preliminary examinations, fails to pass the final dissertation defense (after remediation attempts), or if the seven-year program time limit is exceeded.
College of Engineering

Dr. Maj Mirmirani, Dean

The College of Engineering offers the following degrees at the undergraduate level: Aerospace Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Mechanical Engineering, Software Engineering, and Computer Science. These programs are known for their depth, rigor and emphasis on project-based learning. Understanding and appreciation of the contemporary social, economic, and global issues an educated person is expected to have is acquired through a comprehensive general education curriculum, study abroad programs, internships/coops, student competition projects, and other co-curricular and undergraduate research opportunities.

The bachelor degree programs in Aerospace Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Mechanical Engineering, and Software Engineering are accredited by the Engineering Accreditation Commission of ABET, www.abet.org. The bachelor degree program in Computer Science is accredited by the Computing Accreditation Commission of ABET.

The College also offers Master’s degrees in all its undergraduate engineering disciplines and doctoral degrees in Aerospace Engineering, Electrical Engineering and Computer Science, and Mechanical Engineering. In addition, the College offers innovative Master’s degree programs in Unmanned and Autonomous Systems Engineering and Cybersecurity Engineering.

Accelerated and Combined programs offer well-qualified students the opportunity to start a Master’s degree while still completing their Bachelor’s degree, and allow for the crossing of disciplines. Students earn B.S. once all requirements for that degree are met, while still working to complete their M.S.

The College has also responded to Industry’s request regarding Airworthiness Engineering. The Certificate of Study program and the Master’s degree program educates the working Engineer.

The mission of the College is to:
- Prepare students for successful careers as leaders, innovators, and entrepreneurs in aerospace and related engineering fields;
- Advance engineering through collaborative research; and
- Serve society and the engineering profession from our global perspective, teaching the value of integrity, social responsibility, and a commitment to service.

The vision of the College is:
To be recognized as a world leader in aerospace and aviation research and for innovative engineering education.

Degrees

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B.S. in Computer Science (p. 242)
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B.S. in Mechanical Engineering (p. 253)
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M.S. in Cybersecurity Engineering (p. 258)
M.S. in Electrical and Computer Engineering (p. 259)
M.S. in Mechanical Engineering (p. 259)
M.S. in Software Engineering (p. 260)
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Combined Masters Options
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B.S. in Aerospace Engineering/ MSHF (p. 146)
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B.S. in Computer Science/ MBA (p. 218)
B.S. in Computer Engineering/ MBA (p. 218)
B.S. in Electrical Engineering/ MBA (p. 219)
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Masters
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M.S. in Electrical and Computer Engineering (p. 271)
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M.S. in Engineering and Master of Business Administration (p. 228)

Ph.D.
Ph.D. in Aerospace Engineering (p. 281)
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Ph.D. in Mechanical Engineering (p. 288)

Engineering Fundamentals Program

First-Year Engineering Experience

All first-year engineering students at Embry-Riddle Aeronautical University (ERAU), whether they aspire to become Aerospace, Civil, Computer, Electrical, Mechanical, or Software Engineers, will enroll in a common set of courses. This first-year engineering curriculum provides students with a broad overview of the engineering profession, engages them in hands-on projects, and teaches them the fundamental skills required to be successful throughout the engineering curriculum. Engineering Fundamentals, Mathematics, Computing, and Physical Science courses are integrated into the first-year engineering curriculum to prepare students to work in teams solving real-world problems that span across many engineering and engineering-related disciplines.

The Common First-Year experience provides a number of benefits for students as they advance toward graduation. First, it gives students who are not sure which engineering discipline is right for them, or students who may decide to change majors, time to better understand the different engineering disciplines before engaging in discipline-specific courses. Second, it helps communicate a common language and set of experiences for all students to draw upon as they advance into more complex topics. Finally, it provides a real-world experience working in collaborative, cross-disciplinary environments, learning how to work in teams to complete a common goal.

The first-year engineering curriculum is taught by the Department of Engineering Fundamentals whose mission is to deliver impactful, clear and relevant course content that introduces engineering students to the engineering profession and to utilize the tools, both software and cognitive, crucial for their success. Engineering Fundamentals faculty are trained and focused on teaching excellence and conduct research on engineering education to improve the engineering learning experience. The Engineering Fundamentals faculty maximize the first-year engineering experience through innovative and empirically-based pedagogy such as: flipped classrooms, hybrid learning, small learning communities, inquiry learning, entrepreneurial mindset, service learning projects, and challenging team-based projects.

Advising

The College of Engineering (COE) Advising Center focuses on advising and retaining all engineering students starting from the time they matriculate until they complete their degree. Each student, per their selected degree, will be mentored by a faculty member till graduation.

Students entering the first-year engineering curriculum should be able to demonstrate a competence in mathematics and science. They should be prepared to enter Calculus I, having demonstrated proficiency in algebra and trigonometry. If necessary, students can prepare for the first year of engineering by taking MA 140 (College Algebra) and MA 142 (Trigonometry) or MA 143 (Pre-Calculus Essentials) before taking MA 241 (Calculus and Analytical Geometry I).

Common First-Year

Year One

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>COM 122</td>
<td>English Composition</td>
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</tr>
<tr>
<td>COM 219</td>
<td>Speech</td>
<td>3</td>
</tr>
<tr>
<td>EGR 101</td>
<td>Introduction to Engineering</td>
<td>2</td>
</tr>
<tr>
<td>EGR 115</td>
<td>Introduction to Computing for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or CS 223</td>
<td>Scientific Programming in C</td>
<td></td>
</tr>
</tbody>
</table>
MA 241 Calculus and Analytical Geometry I 4
MA 242 Calculus and Analytical Geometry II 4
PS 150 Physics for Engineers I 3
PS 160 Physics for Engineers II 3
UNIV 101 College Success 1

Lower-Level Humanities * 3
Lower-Level Social Sciences * 3

Credits Subtotal 32.0

Credits Total: 32.0

* COM 219 is required in every degree for graduation. However, students are advised to postpone COM 219 during their first year in favor of one of the following courses based on their field of interest:
  • Aerospace Engineering, Civil Engineering, or Mechanical Engineering: EGR 120.
  • Computer Engineering or Software Engineering: CS 225, first year, COM 219 second year
  • Electrical Engineering: CEC 220/CEC 222, first year, COM 219 second year
  • Please refer to the specific Area of Concentration (AOC) in the Computer Science degree for specific science requirements.

** CS 223 is required for students enrolled in CE, CS, EE, or SE degree programs.
EGR 115 is required for students enrolled in AE, CIV, or ME.

*General Education Courses For Engineers
Lower Level Humanities and Social Sciences courses may be chosen from those listed in the General Education Program Courses section (https://catalog.erau.edu/daytona-beach/general-education/#generaleducationprogramcourses), assuming prerequisite and other listed requirements are met. Courses that students have taken at other institutions may be acceptable if they fall into these categories and are at the level specified in the particular engineering program.

Still Exploring Engineering First Year Students
Engineering students exploring which degree program to select may enroll in the engineering Common Year courses as advised by COE advisor. This enables students interested in engineering to explore the content of all COE programs during their first year. All courses in the above list apply towards any engineering degree. During the sophomore year, Still Exploring Engineering students will need to select a degree program. Pre-college preparation in math and physics is essential for success in engineering. If it is necessary to enroll in more basic math and physics courses to ensure that preparation, still exploring engineering students should understand it will take longer than the projected four years to complete their chosen engineering degree.

B.S. in Aerospace Engineering
The Bachelor of Science in Aerospace Engineering program exists in partial fulfillment of the University’s purpose “to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship with special emphasis on the needs of aviation, aerospace engineering, and related fields.” The program’s focus is primarily on the engineering of mission-oriented vehicles for atmospheric and space flight.

Within a few years of graduation the alumni of the BS AAE program are expected to have successful engineering careers as productive members or leaders within teams or organizations or as independent innovators, to have applied creative thinking and practical problem-solving skills to the solution of problems or to the development of processes or products for the aerospace industry, or to be engaged in advanced studies.

Furthermore these alumni are expected to be responsible and ethical members of society and the engineering profession, and to pursue personal development through continuing education and active participation in professional organizations.

In order to achieve these objectives, the following student outcomes have been adopted:

1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

To enter this program, students should have demonstrated competence in mathematics, physics, and chemistry in high school.


Degree Requirements
The Bachelor of Science in Aerospace Engineering program requires successful completion of a minimum of 129 credit hours. The program may be completed in eight semesters assuming appropriate background and full-time enrollment. A CGPA of 2.0 or higher and a grade of "C" or better within three attempts including audits and withdrawals in all courses is required for degree completion.

Remaining on Track for AE
Aerospace Engineering students must attain a CGPA of 2.5 or higher in those courses prescribed by the College of Engineering, First-Year Engineering Experience, Common First-Year Courses and in its EGR, MA and PS courses. Failure to satisfy the above requirements will delay the student from continuing in the program.

Suggested Plan of Study
Students should be aware that most courses in each academic year have prerequisites and/or corequisites (check the course descriptions before registering for classes to ensure required sequencing). See the AE flowchart(s) from the department for the recommended plan of study.

NOTE: Students in the Aerospace Engineering program desiring to complete a minor must complete at least six credit hours of coursework applied to the minor that are not specifically required in the student’s degree program.

Year One

<table>
<thead>
<tr>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>See the College of Engineering, Engineering Fundamentals Program for course selection</td>
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</table>

Year Two

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<tr>
<th>Credits</th>
<th>Description</th>
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<tbody>
<tr>
<td>32.0</td>
<td>Credits Subtotal</td>
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</table>

<table>
<thead>
<tr>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>AE 201 Aerospace Flight Vehicles</td>
</tr>
<tr>
<td>3</td>
<td>CHM 110 General Chemistry I</td>
</tr>
<tr>
<td>1</td>
<td>CHM 110L General Chemistry I Laboratory</td>
</tr>
<tr>
<td>3</td>
<td>COM 221 Technical Report Writing</td>
</tr>
<tr>
<td>3</td>
<td>ES 201 Statics</td>
</tr>
<tr>
<td>3</td>
<td>ES 202 Solid Mechanics</td>
</tr>
<tr>
<td>3</td>
<td>ES 204 Dynamics</td>
</tr>
<tr>
<td>3</td>
<td>ES 305 Thermodynamics</td>
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<tr>
<td>4</td>
<td>MA 243 Calculus and Analytical Geometry III</td>
</tr>
<tr>
<td>4</td>
<td>MA 345 Differential Equations and Matrix Methods</td>
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<tr>
<td>3</td>
<td>PS 250 Physics for Engineers III</td>
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<td>PS 253 Physics Laboratory for Engineers</td>
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Year Three

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<th>Credits</th>
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<tbody>
<tr>
<td>3</td>
<td>AE 307 Incompressible Aerodynamics</td>
</tr>
<tr>
<td>3</td>
<td>AE 308 Compressible Aerodynamics</td>
</tr>
<tr>
<td>3</td>
<td>AE 313 Space Mechanics</td>
</tr>
<tr>
<td>1</td>
<td>AE 314 Experimental Aerodynamics</td>
</tr>
<tr>
<td>1</td>
<td>AE 315 Experimental Aerodynamics Laboratory</td>
</tr>
<tr>
<td>3</td>
<td>AE 316 Aerospace Engineering Materials</td>
</tr>
<tr>
<td>3</td>
<td>AE 318 Aerospace Structures I</td>
</tr>
<tr>
<td>3</td>
<td>AE 403 Jet Propulsion</td>
</tr>
<tr>
<td>3</td>
<td>AE 413 Airplane Stability &amp; Control</td>
</tr>
<tr>
<td>3</td>
<td>COM 219 Speech</td>
</tr>
<tr>
<td>Course Code</td>
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<tr>
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<tr>
<td>EE 327</td>
<td>Electrical Engineering Fundamentals*</td>
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<td>EE 328</td>
<td>Electrical Engineering Fundamentals Laboratory*</td>
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<td>MA 441</td>
<td>Mathematical Methods for Engineering and Physics I</td>
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**Year Four**

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<tbody>
<tr>
<td>AE 416</td>
<td>Aerospace Structures and Instrumentation</td>
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</tr>
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<td>AE 417</td>
<td>Aerospace Structures and Instrumentation Laboratory*</td>
<td>1</td>
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<tr>
<td>AE 418</td>
<td>Aerospace Structures II</td>
<td>3</td>
</tr>
<tr>
<td>AE 420</td>
<td>Aircraft Preliminary Design</td>
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<tr>
<td>AE 421</td>
<td>Aircraft Detail Design</td>
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<tr>
<td>AE 432</td>
<td>Flight Dynamics and Control</td>
<td>3</td>
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<tr>
<td>AE 442</td>
<td>Experimental Dynamics and Control</td>
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<tr>
<td>Humanities or Social Sciences Lower-Level Elective</td>
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**Astronautics Option**

**Year Three**

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<tbody>
<tr>
<td>AE 307</td>
<td>Incompressible Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 308</td>
<td>Compressible Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 313</td>
<td>Space Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>AE 314</td>
<td>Experimental Aerodynamics</td>
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<tr>
<td>AE 315</td>
<td>Experimental Aerodynamics Laboratory</td>
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<tr>
<td>AE 316</td>
<td>Aerospace Engineering Materials</td>
<td>3</td>
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<td>AE 318</td>
<td>Aerospace Structures I</td>
<td>3</td>
</tr>
<tr>
<td>AE 414</td>
<td>Space Propulsion</td>
<td>3</td>
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<td>AE 426</td>
<td>Spacecraft Attitude Dynamics</td>
<td>3</td>
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<tr>
<td>COM 219</td>
<td>Speech</td>
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</table>

**Propulsion Option**

**Year Three**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>AE 307</td>
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<tr>
<td>AE 308</td>
<td>Compressible Aerodynamics</td>
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<td>AE 314</td>
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<td>AE 315</td>
<td>Experimental Aerodynamics Laboratory</td>
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<td>AE 316</td>
<td>Aerospace Engineering Materials</td>
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<td>AE 318</td>
<td>Aerospace Structures I</td>
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<td>AE 403</td>
<td>Jet Propulsion</td>
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<tr>
<td>AE 413</td>
<td>Airplane Stability &amp; Control</td>
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<td>COM 219</td>
<td>Speech</td>
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</tr>
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<td><strong>Credits Total:</strong></td>
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</table>
EE 327  Electrical Engineering Fundamentals  *  3
EE 328  Electrical Engineering Fundamentals Laboratory  *  1
MA 441  Mathematical Methods for Engineering and Physics I  3

Credits Subtotal  33.0

Year Four
AE 416  Aerospace Structures and Instrumentation  1
AE 417  Aerospace Structures and Instrumentation Laboratory  *  1
AE 418  Aerospace Structures II  3
AE 432  Flight Dynamics and Control  3
AE 435  Air-Breathing Propulsion Preliminary Design  4
AE 440  Air-Breathing Propulsion Detail Design  4
AE 442  Experimental Dynamics and Control  *  1
AE 443  Experimental Dynamics and Control Laboratory  1

Credits Subtotal  30.0

Credits Total:  129.0

Technical Electives
One upper-level Technical Elective needs to be selected from the BSAE Approved Technical Electives list, in the areas of Engineering and Science, maintained by the AE Department. The second upper-level Technical Elective must be an AE course. All non-duplicating AE upper-level undergraduate and graduate courses are acceptable.

Footnotes
* Lecture/Lab courses must be taken at the same time.

B.S. in Civil Engineering
The demand for civil engineers is strong and is expected to grow rapidly in the future — especially in the areas of aviation planning and infrastructure. Space utilization and exploration initiatives are certain to produce further demand for civil engineers with an understanding of the aviation and aerospace industries. The Civil Engineering program at Embry-Riddle is uniquely designed to produce graduates with the types of skills and experiences that employers in these lucrative fields find highly desirable.

Graduates of the Civil Engineering program will leave the University with an understanding of the classical areas of civil engineering with emphasis on transportation, geotechnical, environmental, and structural design in aviation and aerospace fields developed through a carefully planned series of courses and laboratories. Small class size and personal attention allow the interjection of practical interdisciplinary design projects throughout the curriculum. The Civil Engineering Program Educational Objectives are:

In a few years after graduation, Civil Engineering alumni are expected to have successful engineering careers as productive members or leaders within teams, or organizations, or as independent entrepreneurs, or will be engaged in advanced studies. As creative thinkers and practical problem solvers they will have contributed to finding solutions to civil, aerospace, or aviation design and construction projects to the betterment of modern society.

Furthermore, Civil Engineering alumni are expected to be responsible and ethical members of society and the engineering profession and to pursue professional licensure and personal development through continuing education and active participation in professional organizations.

The Civil Engineering program is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

Admission Requirements
To enter this program, students should have demonstrated competence in mathematics, physics, and chemistry in high school. They should be prepared to enter Calculus I, having demonstrated
proficiency in algebra and trigonometry. Students who wish to strengthen their background in mathematics and physical science should consult the program chair for guidance before enrolling in the prescribed courses.

Degree Requirements
The Bachelor of Science in Civil Engineering program requires successful completion of a minimum of 129 semester hours. The program may be completed in eight regular semesters, assuming appropriate background and full-time enrollment. A minimum cumulative grade point average of 2.0 is needed for all required CIV, AE, EE, EGR, and ES courses, including engineering electives.

Suggested Plan of Study
Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

See the Common Year One outline in the Engineering Fundamentals Program Introduction.

<table>
<thead>
<tr>
<th>Year One</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>See the Common Year One outline in the College of Engineering introduction.</td>
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<table>
<thead>
<tr>
<th>Year Two</th>
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<thead>
<tr>
<th>Civil Transportation Electives</th>
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<tbody>
<tr>
<td>CIV 330 Computer Applications in Transportation</td>
</tr>
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</table>
CIV 443  Traffic Data Collection Method and Computer Application in Traffic Engineering  3
CIV 447  Airport Design I  3
CIV 457  Airport Design II  3
CIV 499  Directed Design Project  1-6

**Civil Structures Electives**
CIV 431  Reinforced Concrete Design  3
CIV 432  Structural Steel Design  3
CIV 499  Directed Design Project  1-6

**Civil Geotechnical Electives**
CIV 421  Geotechnical and Foundation Engineering  3
CIV 422  Design of Pavement Structures  3
CIV 424  Rehabilitation of Pavement Structures  3
CIV 499  Directed Design Project  1-6

**Civil Environmental Electives**
CIV 415  Sustainable Food Production and Aquaponics  3
CIV 417  Air Pollution  3
CIV 499  Directed Design Project  1-6

**Technical Electives**
All CIV courses are acceptable. Other courses are to be selected from an approved list of courses maintained by the Civil Engineering program coordinator.

Up to 3 credits of Co-operative education may be used as Technical elective credits with department or Co-op advisor approval.

In a few years of completing their undergraduate degree, graduates of the Bachelor of Science in Computer Engineering:

- Have established themselves in successful engineering careers in aviation, aerospace, and related fields and/or are pursuing advanced degrees.
- Are serving society and their professions as involved and responsible citizens, leaders, and role models.
- Are problem solvers, systems thinkers, and innovators.

The program curriculum is designed to facilitate accomplishment of these objectives by program graduates. The program includes significant project work designed to prepare students to work as part of a team on the development of complex systems involving both software and hardware. It allows the student opportunities to develop capabilities in teamwork, designing to requirements, and quality assurance techniques.


**Degree Requirements**

The Bachelor of Science in Computer Engineering can be earned in eight semesters assuming appropriate background and full-time enrollment. Successful completion of a minimum of 127 credit hours is required. A minimum cumulative grade point average of 2.0 is needed for all required CEC, CS, EE, SE and EGR courses that fulfill any degree requirement. To enter this program, students should have demonstrated competence in mathematics, physics, and computer programming in high school, and they should be prepared to enter Calculus and Analytical Geometry I and Computer Science I. If necessary, students can prepare for the program by taking MA 143 before taking MA 241. Students should check the course descriptions before registering for classes to ensure requisite sequencing.

See the Common Year One outline in the Engineering Fundamentals Program Introduction. CS 223 is a required course for this degree program.
Accelerated MSECE Option

Exceptional students in undergraduate engineering programs, including the Bachelor of Science in Computer Engineering program, are invited to apply to the Accelerated Master of Science Option in Electrical and Computer Engineering. This program enables students to pursue a MSECE degree with only one additional year of studies beyond the BS degree. For additional details, see the Accelerated MSECE section of the catalog.

Suggested Plan of Study

**Year One**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course Name</th>
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<tr>
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<td>See the common Year One outline in the College of Engineering introduction.</td>
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<tr>
<td></td>
<td>CEC 220 Digital Circuit Design</td>
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<td>3</td>
<td>CEC 222 Digital Circuit Design Laboratory</td>
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<tr>
<td>1</td>
<td>CEC 320 Microprocessor Systems</td>
</tr>
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<td>3</td>
<td>CEC 322 Microprocessor Systems Laboratory</td>
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<tr>
<td>3</td>
<td>COM 221 Technical Report Writing</td>
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<tr>
<td>3</td>
<td>CS 222 Introduction to Discrete Structures</td>
</tr>
<tr>
<td>3</td>
<td>CS 225 Computer Science II (3 credits lecture, 1 credit laboratory)</td>
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<tr>
<td></td>
<td>or COM 219 Speech</td>
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<td>EE 223 Linear Circuits Analysis I</td>
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<td>EE 224 Electrical Engineering Laboratory I</td>
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<td>MA 243 Calculus and Analytical Geometry III</td>
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<td>MA 345 Differential Equations and Matrix Methods</td>
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<td>PS 250 Physics for Engineers III</td>
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**Year Three**

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<td>CEC 300 Computing in Aerospace and Aviation</td>
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<td>CEC 315 Signals and Systems</td>
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<td>3</td>
<td>CEC 330 Digital Systems Design with Aerospace Applications</td>
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<td>CEC 450 Real-Time Systems</td>
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**Year Four**

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<tr>
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<tr>
<td></td>
<td>CS 420 Operating Systems</td>
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<td>3</td>
<td>EC 225 Engineering Economics</td>
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<tr>
<td>3</td>
<td>EE 302 Electronic Devices and Circuits</td>
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<td>EE 304 Electronic Circuits Laboratory</td>
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<td>1</td>
<td>MA 412 Probability and Statistics</td>
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<td>3</td>
<td>SE 300 Software Engineering Practices (3 credits lecture, 1 credit lab)</td>
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<td></td>
<td>HU/SS Elective</td>
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<td></td>
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<tr>
<td>33.0</td>
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</table>

* Students in the Computer Engineering program are encouraged to take CS 225 during the first year, postponing COM 219 until the second year.

** EE 401/EE 402, CEC 410/CEC 411, other CEC/EE (300/400) with the approval of the program coordinator.

*** Specified electives are courses to be selected, with the approval of the program coordinator, to support acquiring a minor, an identified concentration of domain knowledge (for example, aerospace, aviation, business, communications, human factors, mathematics, etc.) or further depth in computer engineering or related disciplines.

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**B.S. in Computer Science**

The curriculum for the Bachelor of Science degree in Computer Science includes courses in software development, computer organization, database systems, and software engineering. The program provides a blend of theory and applications that prepare students for a variety of computer science and software engineering positions in scientific and business fields, and lays the foundation for graduate studies in computer science and software engineering.
engineering. The Computer Science program allows students interested in this area of computing to complement their computing knowledge with one other application area chosen from the different areas of concentration.

In a few years of completing their undergraduate degree, graduates of the Bachelor of Science in Computer Science:

- Design, implement, and evaluate computing solutions relevant to aerospace, aviation, and related fields.
- Are serving society and their professions as involved and responsible citizens, leaders, and role models.
- Are problem solvers, systems thinkers, and innovators.

The Bachelor of Science in Computer Science is accredited by the Computing Accreditation Commission of ABET, http://www.abet.org.

There are four Areas of Concentration (AOC) to choose from: Business Administration, Cybersecurity Engineering, Homeland Security, and Human Factors. The courses in the AOC allow students to broaden their general education or pursue specific interests. Upper-level courses involve students in team projects that emphasize industrial processes and practices.

Standard Track
The Computer Science degree may be attained without selecting an Area of Concentration. This option is designed to fulfill the requirements of a traditional computer science program while producing graduates who are able to succeed in a wide range of employment situations.

Business Administration Area of Concentration
The Computer Science degree with an Area of Concentration in Business Administration enables graduates to operate at the intersection of business administration, management, computer science, and software engineering. This program provides students with an in-depth knowledge associated with computing and management fundamentals. Program graduates can pursue graduate studies in computing or management, or careers in the computing industry, management, or entrepreneurship.

Cybersecurity Engineering Area of Concentration
The Computer Science degree with an Area of Concentration in Cybersecurity Engineering produces graduates who have solid knowledge of computer science and cybersecurity. The curriculum emphasizes securing and defending networks and communications through secure system design and implementation. Graduates will have a very strong computer science core followed by a strong core in cybersecurity engineering and will be ready to work in a wide range of institutions belonging to government or industry.

Homeland Security Area of Concentration
The Computer Science degree with an Area of Concentration in Homeland Security produces graduates who operate at the intersection of homeland security, computer and data network security, computer science, and software engineering. Graduates will have a very strong core composed of elements from homeland security, computer science, and software engineering, and will be ready to work in government or industry in the homeland security or other security-related careers.

Human Factors Area of Concentration
Human Factors is an interdisciplinary field that incorporates aspects of psychology, systems engineering, and computer science toward the improvement of the interface between operator and equipment. The intention is to improve designs to make them safer, more reliable, and easier to use for the system operator by understanding the capabilities and limitations of the operator.

Graduates of the Computer Science degree with an Area of Concentration in Human Factors operate at the intersection of human factors, computer science, and the quality assurance area. This degree program integrates computing, human factors, and software engineering. Students will have a very strong core of computing, as well as exposure to in-depth human factors and quality assurance.

Degree Requirements
The Bachelor of Science degree can be earned in eight semesters assuming appropriate background and full-time enrollment. Successful completion of a minimum of 120 - 122 credit hours is required, depending on Area of Concentration. A minimum
cumulative grade point average of 2.0 is needed for all required CEC, CS, EE, SE and EGR courses that fulfill any degree requirement.

Students entering this program should have demonstrated a competence in Mathematics and Science (preferably Physics). They should be prepared to enter Calculus I, having demonstrated proficiency in Algebra and Trigonometry. Students can prepare for this program by taking MA 143 before taking MA 241.

The Computer Science program is designed to prepare students to work as part of a team on the development of software systems. Software engineering concepts are integrated through the curriculum. The curriculum includes courses in general education, math, science, and computing. The latter is divided into computing fundamentals, advanced concepts, applied computing, and software engineering. In addition, a student may select an area of concentration in a domain area of interest.

Students should be aware that several courses in each academic year may have prerequisites and/or corequisites (check the course descriptions before registering for classes to ensure requisite sequencing).

See the Common Year One outline in the Engineering Fundamentals Program Introduction. CS 223 is a required course for this degree program.

### Computer Science Core

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CEC 220</td>
<td>Digital Circuit Design</td>
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</tr>
<tr>
<td>CEC 470</td>
<td>Computer Architecture</td>
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<tr>
<td>COM 122</td>
<td>English Composition</td>
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<td>COM 219</td>
<td>Speech</td>
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<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
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</tr>
<tr>
<td>CS 222</td>
<td>Introduction to Discrete Structures</td>
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</tr>
<tr>
<td>CS 223</td>
<td>Scientific Programming in C</td>
<td>3</td>
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<tr>
<td>CS 225</td>
<td>Computer Science II</td>
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<tr>
<td>CS 315</td>
<td>Data Structures and Analysis of Algorithms</td>
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<tr>
<td>CS 332</td>
<td>Organization of Programming Languages</td>
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<td>CS 344</td>
<td>C Programming and UNIX</td>
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<tr>
<td>CS 420</td>
<td>Operating Systems</td>
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<tr>
<td>CS 490</td>
<td>Computer Science Capstone Design I</td>
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<td>EGR 101</td>
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<td>MA 241</td>
<td>Calculus and Analytical Geometry I</td>
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<td>SE 300</td>
<td>Software Engineering Practices</td>
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<td>Social Sciences Lower-Level Elective</td>
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**Total Credits: 70**

### Standard Track

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<tr>
<td>CS 317</td>
<td>Files and Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>MA 348</td>
<td>Numerical Analysis I</td>
<td>3</td>
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<tr>
<td>MA 412</td>
<td>Probability and Statistics</td>
<td>3</td>
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<tr>
<td>or MA 222</td>
<td>Business Statistics</td>
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<tr>
<td>SE 320</td>
<td>Software Construction</td>
<td>3</td>
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<td>SE 420</td>
<td>Software Quality Assurance</td>
<td>3</td>
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<tr>
<td>PS Science I</td>
<td></td>
<td>3</td>
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<tr>
<td>PS Science II</td>
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**Total Credits: 52**

### Business Administration Area of Concentration

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<td>Financial Accounting</td>
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<tr>
<td>BA 201</td>
<td>Principles of Management</td>
<td>3</td>
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<tr>
<td>BA 220</td>
<td>Marketing</td>
<td>3</td>
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<td>BA 225</td>
<td>Business Law</td>
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<td>BA 317</td>
<td>Organizational Behavior</td>
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<td>BA 325</td>
<td>Social Responsibility and Ethics in Management</td>
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<tr>
<td>BA 422</td>
<td>Life Cycle Analysis for Systems and Programs in Aviation/Aerospace</td>
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<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
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<tr>
<td>MA 348</td>
<td>Numerical Analysis I</td>
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<td>PS Science I *</td>
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<tr>
<td>PS Science II *</td>
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<td>PS Science III with Laboratory *</td>
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<td>CE/CS/EE/SE Upper-Level Elective</td>
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**Cybersecurity Engineering Area of Concentration**

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<td>Microprocessor Systems Laboratory</td>
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<td>CS 303</td>
<td>Network Security</td>
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<tr>
<td>CS 426</td>
<td>Digital Forensics</td>
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<tr>
<td>CS 427</td>
<td>System Exploitation and Penetration Testing</td>
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<tr>
<td>CS 428</td>
<td>Applied Cryptography</td>
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<td>CS 432</td>
<td>Information and Computer Security</td>
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<td>CYB 155</td>
<td>Foundations of Information Security</td>
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<td>CYB 465</td>
<td>Cybercrime and Cyberlaw</td>
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<td>MA 412</td>
<td>Probability and Statistics</td>
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**Human Factors Area of Concentration**

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<tr>
<td>HF 300</td>
<td>Human Factors I: Principles and Fundamentals</td>
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<td>HF 302</td>
<td>Human Factors II: Analytic Methods and Techniques</td>
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<td>HF 306</td>
<td>Human Factors III: Performance Processes</td>
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<tr>
<td>HF 310</td>
<td>Human-Computer Interaction</td>
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<tr>
<td>HF 400</td>
<td>Human Factors IV: System Design</td>
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</tr>
<tr>
<td>MA 222</td>
<td>Business Statistics</td>
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</tr>
<tr>
<td>or MA 412 Probability and Statistics</td>
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<td>PSY 312</td>
<td>Research Analysis in Psychology</td>
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<tr>
<td>or PSY 322 Research Design</td>
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<td>PS Science II *</td>
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<td>PS Science III with Laboratory *</td>
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**Total Degree Requirements**

120-122
Students may satisfy the science requirements by choosing one of the course sequences identified below.
  • PS 150, PS 160, and PS 250/PS 253 -OR- CHM 140/PS 113L or PS 117L
  • Other combinations of science topics may be approved by the program coordinator.

** 300/400 level elective courses with the approval of the program coordinator.

B.S in Computer Science – Business Administration AOC

Suggested Plan of Study

Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Please check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

See the Common Year One (https://catalog.erau.edu/daytona-beach/engineering/engineering-fundamentals/#commonfirstyear) outline in the Engineering Fundamentals Program Introduction. CS 223 (https://catalog.erau.edu/daytona-beach/engineering/bachelors/computer-engineering) is a required course for this degree program.

Year One

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
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Year Two

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<td>CS 222 Introduction to Discrete Structures</td>
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<td>CS 225 Computer Science II</td>
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<td>or COM 219 Speech</td>
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<td>or CHM 140 Chemistry for Engineers</td>
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<td>PS 253 Physics Laboratory for Engineers</td>
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<td>or PS 113L Introductory Physics I Laboratory</td>
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<td>PS 117L Introductory Physics II Lab</td>
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Year Three

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<td>CS 332 Organization of Programming Languages</td>
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<td>CS 315 Data Structures and Analysis of Algorithms</td>
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<td>ACC 210 Financial Accounting</td>
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<tr>
<td>BA 220 Marketing</td>
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<td>BA 225 Business Law</td>
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Year Four

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<td>CS 490 Computer Science Capstone Design I</td>
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<tr>
<td>CS 491 Computer Science Capstone Design II</td>
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<td>BA 317 Organizational Behavior</td>
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<tr>
<td>BA 325 Social Responsibility and Ethics in Management</td>
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<tr>
<td>BA 422 Life Cycle Analysis for Systems and Programs in Aviation/Aerospace</td>
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### B.S in Computer Science – Cybersecurity AOC

**Suggested Plan of Study**

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<thead>
<tr>
<th>Year One</th>
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<tr>
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<td>CEC 220</td>
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<td>CS 222</td>
<td>Introduction to Discrete Structures</td>
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<td>CS 225 or COM 219</td>
<td>Computer Science II</td>
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<tr>
<td>MA 412 or MA 222</td>
<td>Probability and Statistics</td>
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<tr>
<td>PS 250 or CHM 140</td>
<td>Physics for Engineers III</td>
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<tr>
<td>SE 300</td>
<td>Software Engineering Practices (with lab)</td>
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<td>COM 221</td>
<td>Technical Report Writing</td>
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<td>CS 344</td>
<td>C Programming and UNIX</td>
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<td>CEC 320</td>
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<td>CEC 470</td>
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<td>Network Security</td>
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<td>CS 332</td>
<td>Organization of Programming Languages</td>
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<td>CS 420</td>
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<td>CYB 155</td>
<td>Foundations of Information Security</td>
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<td>CYB 465</td>
<td>Cybercrime and Cyberlaw</td>
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<td>Digital Forensics</td>
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<tr>
<td>CS 432</td>
<td>Information and Computer Security</td>
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<td>CS 490</td>
<td>Computer Science Capstone Design I</td>
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<tr>
<td>CS 427</td>
<td>System Exploitation and Penetration Testing</td>
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<td>CS 428</td>
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### B.S in Computer Science – Homeland Security AOC

**Suggested Plan of Study**

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<tr>
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<td>CS 225 or COM 219</td>
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<td>MA 412 or MA 222</td>
<td>Probability and Statistics</td>
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<td>PS 250 or PS 113L or PS 117L</td>
<td>Physics Laboratory for Engineers Introductory Physics I Laboratory</td>
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<td>SE 300</td>
<td>Software Engineering Practices (with lab)</td>
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<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
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<tr>
<td>CS 344</td>
<td>C Programming and UNIX</td>
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<td>MA 300/400 level Elective</td>
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<tr>
<td>CEC 320</td>
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<td>CEC 322</td>
<td>Microprocessor Systems Laboratory</td>
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### B.S in Computer Science – Human Factors AOC

#### Suggested Plan of Study

**Year One**

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<thead>
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<td>HS 215</td>
<td>Introduction to Industrial Security</td>
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**Year Two**

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<tr>
<td>CS 332</td>
<td>Organization of Programming Languages</td>
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<tr>
<td>CS 315</td>
<td>Data Structures and Analysis of Algorithms</td>
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<tr>
<td>CS 303</td>
<td>Network Security</td>
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<tr>
<td>HS 280</td>
<td>Professional Skills in Homeland Security</td>
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<tr>
<td>HS 315</td>
<td>Critical Infrastructure Security, Resilience, and Risk Analysis</td>
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<td>MA 300/400 level Electives</td>
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**Year Three**

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<td>Data Structures and Analysis of Algorithms</td>
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**Year Four**

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<td>CS 420</td>
<td>Operating Systems</td>
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<td>CS 490</td>
<td>Computer Science Capstone Design I</td>
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<td>CS 491</td>
<td>Computer Science Capstone Design II</td>
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<td>HS 310</td>
<td>Fundamentals of Emergency Management</td>
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<td>HS 320</td>
<td>Homeland Security Law and Policy</td>
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<td>HS 325</td>
<td>Terrorism: Origin, Ideologies, and Goals</td>
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### Year Four

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<td>CS 491</td>
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<tr>
<td>HF 310</td>
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### Year Three

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<td>Files and Database Systems</td>
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<td>CS 315</td>
<td>Data Structures and Analysis of Algorithms</td>
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<td>CS 332</td>
<td>Organization of Programming Languages</td>
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<tr>
<td>SE 320</td>
<td>Software Construction</td>
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**Credits Subtotal:** 32.0-34.0

### Year Four

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<td>Software Quality Assurance</td>
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<td>CS 420</td>
<td>Operating Systems</td>
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<td>CS 490</td>
<td>Computer Science Capstone Design I</td>
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<td>HF/PSY Upper Level Elective</td>
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**Credits Subtotal:** 27.0

**Credits Total:** 122

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**B.S. in Electrical Engineering**

The Bachelor of Science degree in Electrical Engineering provides the student with the opportunity to acquire a broad background in circuit theory, communication systems, computers, control systems, electromagnetic fields, energy sources, and related fields.
and systems, and electronic devices. Emphasis on design places the Embry-Riddle Electrical Engineering student in a unique position to increase employment opportunities after graduation.

Three tracks are available in the Electrical Engineering program: Avionics, Aerospace Systems, and Non-Track. The first year and a half are common, with a one course difference so students do not need to make a track decision until the beginning of their third year.

In a few years of completing their undergraduate degree, graduates of the Bachelor of Science in Electrical Engineering:

- Will establish themselves in successful aerospace, aviation, and engineering careers and/or will be pursuing advanced degrees;
- Will be serving society and their professions as involved and responsible citizens, leaders, and role models by demonstrating strong values, high ethical standards, and integrity;
- Will have reputations as practical problem solvers, systems thinkers, innovators, and as those who are curious and have a continued interest in learning


Degree Requirements

The Bachelor of Science in Electrical Engineering requires the successful completion of a minimum of 129 credit hours. A minimum cumulative grade point average of 2.0 is needed for all required CEC, CS, EE, SE and EGR courses that fulfill any degree requirement.

Accelerated MSECE Option

Exceptional students in undergraduate engineering programs, including the Bachelor of Science in Electrical Engineering program, are invited to apply to the Accelerated Master of Science Option in Electrical and Computer Engineering. This program enables students to pursue a MSECE degree with only one additional year of studies beyond the BS degree. For additional details, see the Accelerated MSECE section of the catalog.

Aerospace Systems Track

The modern aircraft is an assembly of a wide spectrum of components, all operating together in a large and complex system. The aircraft then operates in the National Airspace System where it must operate in harmony with other aircraft, air traffic management, navigation, and safety systems, all at a reasonable cost. This example shows the importance of systems engineering and the broad range of subjects covered.

Suggested Plan of Study

Students should be aware that several courses in each academic year may have prerequisites and/or corequisites (check the course descriptions before registering for classes to ensure requisite sequencing).

See the Common Year One outline in the Engineering Fundamentals Program Introduction. CS 223 is a required course for this degree program.

**Year One**

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<td>Speech</td>
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<td>CEC 220</td>
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<td>Digital Circuit Design</td>
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<tr>
<td>and</td>
<td></td>
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<td>CEC 222</td>
<td>1</td>
<td>Digital Circuit Design Laboratory</td>
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<td>CEC 320</td>
<td>3</td>
<td>Microprocessor Systems</td>
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<td>CEC 322</td>
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<td>Microprocessor Systems Laboratory</td>
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<td>Physics for Engineers III</td>
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<td>PS 253</td>
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<td>Physics Laboratory for Engineers</td>
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**Year Two**

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<th>Course</th>
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<tr>
<td>CEC 315</td>
<td>Signals and Systems</td>
<td>3</td>
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<tr>
<td>CEC 330</td>
<td>Digital Systems Design with Aerospace Applications</td>
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<tr>
<td>EC 225</td>
<td>Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>EE 300</td>
<td>Linear Circuits Analysis II</td>
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<tr>
<td>EE 302</td>
<td>Electronic Devices and Circuits</td>
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<tr>
<td>EE 304</td>
<td>Electronic Circuits Laboratory</td>
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<tr>
<td>SYS 303</td>
<td>Optimization in Systems Engineering</td>
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<tr>
<td>SYS 304</td>
<td>Trade Studies, Risk and Decision Analysis</td>
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<tr>
<td>MA 412</td>
<td>Probability and Statistics</td>
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<tr>
<td>MA 441</td>
<td>Mathematical Methods for Engineering and Physics I</td>
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### Year Four

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<tr>
<td>CEC 460</td>
<td>Telecommunications Systems</td>
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<td>EE 308</td>
<td>Introduction to Electrical Communications</td>
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<tr>
<td>EE 401</td>
<td>Control Systems Analysis and Design</td>
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<tr>
<td>EE 402</td>
<td>Control Systems Laboratory</td>
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<tr>
<td>SYS 415</td>
<td>Systems Engineering Practices: Specialty Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 417</td>
<td>Systems Engineering Capstone Project I</td>
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<tr>
<td>SYS 418</td>
<td>Systems Engineering Capstone Project II</td>
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<td>Specified Electives *</td>
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* Note: Specified electives are courses to be selected, with the approval of the program coordinator, to support acquiring a minor, an identified concentration of domain knowledge (for example, but not restricted to aerospace, aviation, business, communications, human factors, mathematics, etc.) or further depth in systems engineering, electrical engineering, or related discipline.

### Avionics Track

The Avionics track of the Electrical Engineering program provides preparation for students interested in the field of avionics. Fields of study include wired and wireless systems, digital communications, electromagnetics, high-frequency RF systems, and aeronautical navigation and communications systems. Students choosing the Non-Track option may replace **EE 307** and **EE 310** with approved CEC/EE/MA/PS/SE 300/400 upper-level electives, and **EE 420/EE 421** with an approved senior design sequence.

### Year One

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
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### Year Two

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<tr>
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<tr>
<td>COM 219</td>
<td>Speech</td>
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<td>or</td>
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<td>CEC 220</td>
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<tr>
<td>and</td>
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<td>CEC 222</td>
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<tr>
<td>CEC 315</td>
<td>Signals and Systems</td>
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<tr>
<td>CS 225</td>
<td>Computer Science II</td>
<td>4</td>
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<tr>
<td>EE 223</td>
<td>Linear Circuits Analysis I</td>
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<tr>
<td>EE 224</td>
<td>Electrical Engineering Laboratory I</td>
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<tr>
<td>MA 243</td>
<td>Calculus and Analytical Geometry III</td>
<td>4</td>
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<td>MA 345</td>
<td>Differential Equations and Matrix Methods</td>
<td>4</td>
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<tr>
<td>PS 250</td>
<td>Physics for Engineers III</td>
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<td>PS 253</td>
<td>Physics Laboratory for Engineers</td>
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<td>SYS 301</td>
<td>Introduction to Systems Engineering</td>
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</tbody>
</table>

* Note: Specified electives are courses to be selected, with the approval of the program coordinator, to support acquiring a minor, an identified concentration of domain knowledge (for example, but not restricted to aerospace, aviation, business, communications, human factors, mathematics, etc.) or further depth in systems engineering, electrical engineering, or related discipline.
Non-Track Option
The non-track option of the Electrical Engineering program gives students the opportunity to pursue topics in their own areas of interest. Many fields of study are common with the Avionics track, including wired and wireless systems, digital communications, electromagnetics, and high-frequency RF systems.

Year Three

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CEC 320</td>
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<td>Microprocessor Systems Laboratory</td>
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<tr>
<td>COM 221</td>
<td>Technical Report Writing</td>
<td>3</td>
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<tr>
<td>EC 225</td>
<td>Engineering Economics</td>
<td>3</td>
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<tr>
<td>EE 300</td>
<td>Linear Circuits Analysis II</td>
<td>3</td>
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<td>EE 302</td>
<td>Electronic Devices and Circuits</td>
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<tr>
<td>EE 304</td>
<td>Electronic Circuits Laboratory</td>
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<tr>
<td>EE 307</td>
<td>Avionics I</td>
<td>3</td>
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<tr>
<td>EE 308</td>
<td>Introduction to Electrical</td>
<td>3</td>
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<tr>
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<td>Communications</td>
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<tr>
<td>EE 340</td>
<td>Electric and Magnetic Fields</td>
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<tr>
<td>MA 412</td>
<td>Probability and Statistics</td>
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<td>MA 441</td>
<td>Mathematical Methods for</td>
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<td></td>
<td>Engineering and Physics I</td>
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Credits Subtotal: 32.0

Year Four

<table>
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<th>Course Title</th>
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<tbody>
<tr>
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<td>Digital Signal Processing Laboratory</td>
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<tr>
<td>CEC 460</td>
<td>Telecommunications Systems</td>
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<tr>
<td>EE 310</td>
<td>Avionics II</td>
<td>3</td>
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<tr>
<td>EE 401</td>
<td>Control Systems Analysis and</td>
<td>3</td>
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<tr>
<td></td>
<td>Design</td>
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<td>EE 417</td>
<td>Digital Communications</td>
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<tr>
<td>EE 420</td>
<td>Avionics Preliminary Design</td>
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<tr>
<td>EE 421</td>
<td>Avionics Detail Design</td>
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<tr>
<td>EE 430</td>
<td>Introduction to Radio Frequency</td>
<td>3</td>
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<td>Circuits</td>
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<td>EE 430L</td>
<td>Radio Frequency Circuits</td>
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Credits Subtotal: 32.0

Credits Total: 129
### MA 441
Mathematical Methods for Engineering and Physics I 3

 Credits Subtotal 32.0

#### Year Four

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CEC 410</td>
<td>Digital Signal Processing</td>
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<td>CEC 411</td>
<td>Digital Signal Processing Laboratory</td>
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<td>EE 401</td>
<td>Control Systems Analysis and Design</td>
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<td>EE 420</td>
<td>Avionics Preliminary Design</td>
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<td>Avionics Detail Design</td>
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<td>EE 430</td>
<td>Introduction to Radio Frequency Circuits</td>
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<td>Radio Frequency Circuits Laboratory</td>
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<td>Telecommunications Systems</td>
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<td>EE/CEC/MA/PS Upper-Level Technical Elective</td>
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<tr>
<td>Open Elective</td>
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</table>

 Credits Subtotal 32.0

Credits Total: 129

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### B.S. in Mechanical Engineering

Mechanical Engineering is a well-established engineering discipline that involves state-of-the-art engineering analysis, design, and research. Mechanical engineers have been in demand for literally hundreds of years and remain one of the more sought-after degree holders.

The common freshman engineering year one is the first year of the Mechanical Engineering program. The second year is the same as Aerospace Engineering, which gives the student great flexibility when deciding on a major field of study.

The Mechanical Engineering program offers four areas of emphasis, or tracks: Biomedical Systems, Energy Systems, High Performance Vehicles, and Robotic Systems (with an emphasis in Unmanned and Autonomous Vehicle Systems), which add to the breadth of topics in Mechanical Engineering, such as machine design, heat transfer, and vibrations. The Robotic Systems track prepares students for the rapidly expanding robotics field, including applications to the aerospace industry. Attention is paid to the systems nature of robotics to include the integration of mechanics and electronics. The High Performance Vehicles track prepares students for employment in vehicle design and manufacturing, from competition vehicles to fuel-efficient and environmentally friendly vehicles. Subjects include aerodynamics, structures, and safety. The Energy Systems track prepares students to design, develop and evaluate energy-related projects to reduce cost and improve energy efficiency. The Biomedical Systems track prepares students to become knowledgeable and skilled mechanical engineers with an understanding of the fundamental principles that lead to scientific discovery and technology innovation in the bioengineering and biomedical fields.

The Program Educational Objectives of the Mechanical Engineering program as offered at the Daytona Beach campus are that, in a few years of graduation, our graduates:

1. Are established as engineers in the aerospace, aviation, automotive, biomedical, energy, robotics, or related fields or engaged in advanced studies
2. Have demonstrated their ability to work effectively and responsibly as practical problem solvers, innovators and as members of diverse professional teams

The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET, [http://www.abet.org](http://www.abet.org).

The curriculum is designed to accomplish these objectives with a base of engineering, math, and sciences that includes probability and statistics or numerical methods; engineering economics; advanced mathematics; electrical engineering; and engineering design. The culmination of the program is a two-semester design project that prepares the students for working in a team environment on projects involving mechanical engineering.

### Degree Requirements

The Bachelor of Science in Mechanical Engineering requires the successful completion of a minimum of 129 credit hours. A minimum cumulative grade point average of 2.0 is needed for all required ME, EE, EGR, and ES courses, including technical electives.
Suggested Plan of Study

Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Please check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

See the Common Year One outline in the Engineering Fundamentals Program Introduction.

<table>
<thead>
<tr>
<th>Year One</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>See the Common Year One outline in the College of Engineering introduction.</td>
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<tr>
<td>Year Two</td>
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<tr>
<td>COM 221 Technical Report Writing</td>
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<tr>
<td>COM 219 Speech</td>
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<td>or EGR 120 Graphical Communications</td>
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<tr>
<td>ES 201 Statics</td>
<td>3</td>
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<tr>
<td>ES 202 Solid Mechanics</td>
<td>3</td>
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<tr>
<td>ES 204 Dynamics</td>
<td>3</td>
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<tr>
<td>ME 208 Manufacturing Laboratory</td>
<td>1</td>
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<td>MA 243 Calculus and Analytical Geometry III</td>
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<td>MA 345 Differential Equations and Matrix Methods</td>
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<tr>
<td>CHM 110 General Chemistry I</td>
<td>3</td>
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<td>CHM 110L General Chemistry I Laboratory</td>
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<td>PS 250 Physics for Engineers III</td>
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<tr>
<td>EE 327 Electrical Engineering Fundamentals</td>
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<tr>
<td>ES 305 Thermodynamics</td>
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<tr>
<td>ES 309 Fluid Dynamics</td>
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<td>ES 320 Engineering Materials Science</td>
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<td>ES 403 Heat Transfer</td>
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<td>MA 348 Numerical Analysis I</td>
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<td>or MA 412 Probability and Statistics</td>
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<td>or MA 441 Mathematical Methods for Engineering and Physics I</td>
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<td>or ME 501 Modeling Methods in Mechanical Engineering</td>
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<tr>
<td>ME 304 Introduction to Machine Design</td>
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<tr>
<td>ME 313 Instrumentation and Data Acquisition</td>
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<td>ME 314 Instrumentation and Data Acquisition Laboratory</td>
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<td>ME 400 Vibration and Acoustics</td>
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<td>Professional Development Elective</td>
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<td>Track Course</td>
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<td>ME 436 Advanced Machine Design</td>
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<td>ME 438 Model-Based Control System Design</td>
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<td>ME 438L Model-Based Control System Design Laboratory</td>
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<td>Technical Elective AE/CEC/CIV/CS/EE/EGR/EP/ME/SE/SYS or Track specific electives</td>
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<td>Track Course</td>
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<td>Preliminary Design Course (ME 413 or ME 407 or ME 414 or ME 448)</td>
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<td>Senior Design Course (ME 433 or ME 437 or ME 434 or ME 458)</td>
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** CEME 396 or AF 402/MSL 402/NSC 402 or ME 540 will satisfy this requirement.

*** AF/NSC/MSL UL may fulfill 3 credits of technical electives.

Biomedical Systems Track Courses*

| ME 442 Biofluid Mechanics | 3 |
| ME 444 Biomechanics | 3 |
| ME 460 Biosolid Mechanics | 3 |
| ME 448 Preliminary Design for Bio-Mechanical Systems with Laboratory | 4 |
ME 458  Senior Design for Bio-Mechanical Systems with Laboratory  4

Total Credits  17

* Students may also select from the following courses as upper level technical electives: CHM 310/CHM 310L, HF 312, HF 326, HF 440, BIO 305/BIO 305L, BIO 306/BIO 306L, BIO 340, BIO 405/405L, or BIO 440

Energy Systems Track Courses
ME 316  Thermodynamics II  3
ME 443  Heating, Ventilation, and Air-Conditioning  3
ME 445  Sustainable Design  3
ME 414  Preliminary Design for Energy Systems  4
ME 434  Senior Design for Energy Systems  4

Total Credits  17

High Performance Vehicles Track Courses
ME 303  Vehicle Dynamics  3
ME 405  Vehicle Power Systems  3
ME 409  Vehicle Aerodynamics  3
ME 413  Preliminary Design for High Performance Vehicles with Laboratory  4
ME 433  Senior Design for High Performance Vehicles with Laboratory  4

Total Credits  17

Robotic Systems Track Courses
ME 311  Robotics Technologies for Unmanned Systems  3
ME 402  Robotic Arms  3
ME 404  Mechatronics  3
ME 407  Preliminary Design for Robotic Systems with Laboratory  4
ME 437  Senior Design for Robotic Systems with Laboratory  4

Total Credits  17

B.S. in Software Engineering

The Bachelor of Science degree in Software Engineering is designed to prepare students for an entry-level software engineering position in industry that supports the design and implementation of software systems with the focus on real-time, embedded, and safety-critical applications. Such systems are critical in aviation, space, medicine, and other disciplines that rely on high-quality, dependable software.

In a few years of completing their undergraduate degree, graduates of the Bachelor of Science in Software Engineering:

- Have established themselves in successful engineering careers in aviation, aerospace, and related fields and/or are pursuing advanced degrees.
- Are serving society and their professions as involved and responsible citizens, leaders, and role models.
- Are problem solvers, systems thinkers, and innovators.

The curriculum is designed to facilitate accomplishment of these objectives by program graduates. It provides a broad education, including fundamental knowledge about computer software and hardware. It also allows graduates to work in a team environment and to recognize the value of collaborative effort. The program lays a foundation for lifelong learning, professional growth, and ethical and responsible behavior in society. The Software Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Degree Requirements

The Bachelor of Science degree can be earned in eight semesters assuming appropriate background and full-time enrollment. Successful completion of a minimum of 127 credit hours is required. A minimum cumulative grade point average of 2.0 is needed for all required CEC, CS, EE, SE and EGR courses that fulfill any degree requirement.

Students entering this program should have demonstrated a competence in mathematics and science (preferably physics). They should be prepared to enter Calculus I, having demonstrated proficiency in algebra and trigonometry. Students
can prepare for the program by taking MA 143 before taking MA 241. For those students who have not taken physics in high school, it is recommended that PS 103 be taken prior to PS 150.

The Software Engineering program is designed to prepare students to work as part of a team on the development of software systems. Software engineering concepts, methods, and techniques are integrated through the curriculum. The curriculum includes courses in general education, math and science, and computing. The latter is divided into computing fundamentals, advanced concepts, applied computing, and software engineering. In addition, a student can acquire a minor or a concentration in a domain area of interest. Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

Suggested Plan of Study

Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Please check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

See the Common Year One outline in the Engineering Fundamentals Program Introduction. CS 223 is a required course for this degree program.

Year One

<table>
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<tr>
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<th>Course Title</th>
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<td>Principles of Aeronautical Science</td>
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<td>Digital Circuit Design</td>
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<td>Digital Circuit Design Laboratory</td>
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<td>Microprocessor Systems</td>
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<td>Microprocessor Systems Laboratory</td>
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<td>Technical Report Writing</td>
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<td>CS 221</td>
<td>Introduction to Discrete Structures</td>
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<tr>
<td>CS 225</td>
<td>Computer Science II (3 credits lecture, 1 credit laboratory)</td>
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Credits Subtotal 32.0-33.0

Year Two

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<thead>
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<th>Course Title</th>
<th>Credits</th>
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<td>CEC 470</td>
<td>Computer Architecture</td>
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<td>CS 317</td>
<td>Files and Database Systems</td>
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</tr>
<tr>
<td>CS 332</td>
<td>Organization of Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>CS 420</td>
<td>Operating Systems</td>
<td>3</td>
</tr>
<tr>
<td>EC 225</td>
<td>Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>MA 412</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>SE 310</td>
<td>Analysis and Design of Software Systems</td>
<td>3</td>
</tr>
<tr>
<td>SE 320</td>
<td>Software Construction</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Three

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 225</td>
<td>Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>MA 412</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>SE 310</td>
<td>Analysis and Design of Software Systems</td>
<td>3</td>
</tr>
<tr>
<td>SE 320</td>
<td>Software Construction</td>
<td>3</td>
</tr>
<tr>
<td>Humanities or Social Sciences Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA Upper-Level Elective **</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Credits Subtotal 31.0-32.0

Year Four

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 410</td>
<td>Software Modeling</td>
<td>3</td>
</tr>
<tr>
<td>SE 420</td>
<td>Software Quality Assurance</td>
<td>3</td>
</tr>
<tr>
<td>SE 450</td>
<td>Software Team Project I (2 credits lecture, 1 credit lab)</td>
<td>3</td>
</tr>
<tr>
<td>SE 451</td>
<td>Software Team Project II (1 credit lecture, 2 credits lab)</td>
<td>3</td>
</tr>
<tr>
<td>CEC/CS/SE Upper-Level Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Humanities or Social Sciences</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Upper Level Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Open Elective ***</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Specified Electives</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Credits Subtotal 33.0

Credits Total: 127

* Students in the Software Engineering program are encouraged to take CS 225 during the first year, postponing COM 219 until the second year.
Math elective to be selected from an approved list of courses maintained by the program coordinator.

Courses to be selected, with the approval of the program coordinator, to support acquiring a minor, an identified concentration of domain knowledge (aerospace, aviation, business, communications, human factors, mathematics, etc.), or further depth in software engineering or related disciplines.

**Accelerated Engineering Options**

Accelerated programs offer well-qualified students the opportunity to start a Master's degree while still completing their Bachelor's degree, and allow for the crossing of disciplines. Students earn B.S. once all requirements for that degree are met, while still working to complete their M.S.

- M.S. in Aerospace Engineering (p. 257)
- M.S. in Civil Engineering (p. 258)
- M.S. in Cybersecurity Engineering (p. 258)
- M.S. in Electrical and Computer Engineering (p. 259)
- M.S. in Mechanical Engineering (p. 259)
- M.S. in Software Engineering (p. 260)
- M.S. in Systems Engineering (p. 261)
- M.S. in Unmanned and Autonomous Systems Engineering (p. 261)

**Accelerated Aerospace Engineering Option**

Accelerated Master of Science in Aerospace Engineering

For exceptional students enrolled in the Bachelor of Science in Aerospace Engineering program, the Department offers the opportunity for students to pursue a Master's degree, either Thesis Option or Non-Thesis Option. Refer to the M.S. in Aerospace Engineering page for more information: https://catalog.erau.edu/daytona-beach/engineering/masters/aerospace-engineering/. The goal of the program is to produce graduates who are prepared for further academic study at the doctoral level and for leadership positions within the Aerospace industry. This program augments the student's undergraduate technical electives with graduate-level courses and/or thesis work to focus on future research.

In the Accelerated Aerospace Engineering option, six credits of graduate coursework may be taken to fulfill the undergraduate technical electives requirements. These credits will count toward both the BS and MS degree requirements provided the student maintains enrollment in the accelerated program and receives a "B" or better in the courses. For these graduate level courses taken for undergraduate technical elective credit, it is recommended that one course be selected from the student's chosen MSAE Area of Concentration's core courses and the other a graduate level Mathematics course. These six credits will appear on the undergraduate transcript. These six credits will not be part of the master's transcript until the time of graduation.

Students enrolled in the Bachelor of Science in Aerospace Engineering program may apply for admission into the accelerated program after they have completed their third year of AE courses (90 credit hours). The application for the Accelerated Bachelor/Master program must be submitted to the Undergraduate Program Coordinator to verify the minimum requirement (CGPA of 3.0 or higher and a minimum CGPA of 3.2 in all AE/ES courses). Once approved, the application is then forwarded to the Graduate Program Coordinator. Once accepted into the accelerated program, a CGPA of 3.0 or higher must be maintained, a CGPA of 3.2 or higher in undergraduate AE/ES courses must be maintained and a CGPA of 3.0 or higher in graduate courses must be maintained for continued enrollment. Students will be dropped from the program if their CGPA falls below 3.0 or if they have not completed the MSAE degree requirements within three (3) years of finishing their undergraduate degree.

Students are future admitted to the MSAE program as a non-degree student and are limited to 9 graduate credits. The Bachelor of Science in Aerospace Engineering will be conferred upon completion of all bachelor's degree requirements listed in this catalog. The student is then formally admitted to the MSAE program. The Master's degree will be conferred upon completion of all Master's degree requirements listed in this Catalog.

For approved Area of Concentration core courses and recommended graduate Mathematics courses,
Accelerated Civil Engineering Option

Accelerated Master of Science in Civil Engineering

For exceptional students enrolled in an engineering Bachelor of Science degree program, the Civil Engineering Department offers the opportunity to pursue a combined Master of Science degree program. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate civil/technical elective requirements. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MS option and receives a B or better in the course.

Students enrolled in the B.S. Civil Engineering program may apply for admission into the five-year B.S./M.S. program after they have completed at least 90 hours of coursework, including at least four CIV courses. Students should have a minimum CGPA of 3.2 (out of a possible 4.0) in CIV/ES courses for admission. For continued enrollment, a CGPA of 3.2 in undergraduate CIV/ES courses and 3.0 in graduate courses must be maintained. The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements listed in this catalog; the Master of Science degree will be conferred upon completion of all master’s degree requirements listed in this catalog.

Approved Courses for the Accelerated Option

Students enrolled in the accelerated option are encouraged to consult with their academic advisor and the MSCIV program coordinator to determine appropriate course selection and mode of substitution.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 502</td>
<td>Wind Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIV 504</td>
<td>Bridge Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CIV 506 Transportation Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CIV 508 Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CIV 510 Design and Analysis of Airfield and Highway Pavement</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Accelerated Cybersecurity Engineering Option

Accelerated Master of Science in Cybersecurity Engineering

Exceptional students enrolled in a Bachelor of Science degree program at the Daytona Beach College of Engineering can pursue the Master of Science in Cybersecurity Engineering (MSCybE) in an accelerated format. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate technical elective requirements and specified courses. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MSCybE option and receives a “B” or better in the course. Students must complete a minimum of 120 undergraduate course credits for their Bachelor of Science degree.

Undergraduate students may apply to the accelerated MS option by submitting an application to the MSCybE Program Coordinator. Students must have completed 88 credit hours toward the BS degree and must have a 3.2 minimum GPA to be admitted to the program. Students will be dropped from the program if their GPA falls below 3.0. The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements; the Master of Science degree will be conferred upon completion of all master’s degree requirements.

Below is a list of approved graduate courses that satisfy this program’s requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 527</td>
<td>System Exploitation and Penetration Testing</td>
<td>3</td>
</tr>
<tr>
<td>CS 529</td>
<td>Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>CS 532</td>
<td>Software Security Assessment</td>
<td>3</td>
</tr>
<tr>
<td>CS 538</td>
<td>Applied Cryptography</td>
<td>3</td>
</tr>
<tr>
<td>SE 500</td>
<td>Software Engineering Discipline</td>
<td>3</td>
</tr>
<tr>
<td>SE 510</td>
<td>Software Project Management</td>
<td>3</td>
</tr>
</tbody>
</table>
Accelerated Electrical and Computer Engineering Option

Accelerated Master of Science in Electrical and Computer Engineering

Exceptional students enrolled in an Engineering Bachelor of Science degree program are invited to pursue an Accelerated Master of Science in Electrical and Computer Engineering degree program. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate technical elective requirements and specified courses. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MS option and receives a "B" or better in the course. Students in this accelerated program must have a minimum of 120 hours of undergraduate credits in addition to any graduate credits to complete their undergraduate degree. Graduate courses taken in satisfaction of this program must be selected from the list of approved courses, targeted substitutions, or by arrangement with the MSECE program coordinator.

Undergraduate students may apply to the accelerated MS option by submitting an application to the MSECE program coordinator. Students must have completed 88 credit hours toward the BS degree and must have a 3.2 minimum GPA to be admitted to the program. Students will be dropped from the program if their GPA falls below a 3.0.

The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements: the Master of Science degree will be conferred upon completion of all master’s degree requirements.

Students enrolled in the Accelerated Option should take courses from the core concentration for their focus (Electrical Engineering or Computer Engineering). Where relevant to a field of study, courses from the list of electives may also be used. In all cases, students are encouraged to consult with their academic advisor and the MSECE program coordinator to determine appropriate course selection and mode of substitution. Below is a list of suggested courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
<tr>
<td>CEC 500</td>
<td>Engineering Project Management</td>
<td>3</td>
</tr>
<tr>
<td>CEC 530</td>
<td>Image Processing and Machine Vision</td>
<td>3</td>
</tr>
<tr>
<td>EE 510</td>
<td>Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 515</td>
<td>Random Signals</td>
<td>3</td>
</tr>
<tr>
<td>EE 525</td>
<td>Avionics and Radio Navigation</td>
<td>3</td>
</tr>
<tr>
<td>EE 620</td>
<td>Digital Communications</td>
<td>3</td>
</tr>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Students declaring the accelerated MS option are required to choose electives from the above list, or targeted substitutions, to replace up to nine hours of electives and required courses. All substitutions for non-elective courses must be approved by the MSECE program coordinator.

Accelerated Mechanical Engineering Option

Accelerated Master of Science in Mechanical Engineering

For exceptional students enrolled in an engineering Bachelor of Science degree program, the Mechanical Engineering Department offers the opportunity to pursue a combined Master of Science degree program. In this option, up to nine (9) credit hours of graduate coursework may be taken to fulfill undergraduate technical elective requirements, advanced math elective or Professional development. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MS option and receives a B or better in the course. Graduate courses taken for technical elective credit must be selected from any of the track elective lists specified under the MSME degree program requirements.

Undergraduate students may apply to the accelerated MS option by submitting an application to the Mechanical Engineering Graduate Program Coordinator. Students must have completed 88 credit hours toward an engineering BS degree and must have a 3.0 minimum GPA to be admitted to the program. Students will be dropped from the
program if their GPA falls below 3.0 or if they have not completed the MSME degree requirements within two years of finishing their undergraduate degree. BSME students in the accelerated MSME option can opt to replace the undergraduate requirement of CEME 396 (Coop Ed Mechanical Eng.) with ME 540 (Engineering Practicum).

The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements; the Master of Science degree will be conferred upon completion of all master’s degree requirements.

Technical electives must be chosen from any of the lists of track electives specified in the MSME program description (p. 274).

**Accelerated Software Engineering Option**

**Accelerated Master of Science in Software Engineering**

Exceptional students are invited to pursue an Accelerated Master of Science in Software Engineering (MSSE) degree program. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate technical elective requirements and specified courses that are in excess of 120 hours required for their undergraduate degree. These hours will count toward both the BS and MSSE degree requirements provided that the student is enrolled in the accelerated MSSE option and receives a "B" or better in the course. Graduate courses taken in satisfaction of this program must be selected from the list of approved courses, targeted substitutions, or by arrangement with the Accelerated MSSE program coordinator.

Undergraduate students may apply to the Accelerated MSSE option by submitting an application to the Accelerated MSSE program coordinator. Students are eligible to apply if they are enrolled in an undergraduate program in Software Engineering, Computer Engineering or Computer Science, or have enrolled in the Computer Science Minor course of study. Undergraduate students may also be accepted for the Accelerated MSSE option if they can demonstrate adequate knowledge and preparation equivalent to completing a Computer Science Minor. Students applying must have completed 88 credit hours toward their BS degree and must have a 3.2 minimum GPA to be admitted to the program. Students will be dropped from the program if their GPA falls below a 3.0. Students enrolled in this accelerated option on the basis of completing a Computer Science Minor will be dropped from the program if that Minor is not completed.

The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements. The Master of Science in Software Engineering degree will be conferred upon completion of all master’s degree requirements.

**Approved Courses for the Accelerated Option**

Students enrolled in the Accelerated Option should take courses from the core requirements for the MSSE degree. Where relevant, courses from the list of MSSE electives may also be used. In all cases, students are required to consult with their academic advisor and the Accelerated MSSE program coordinator to determine appropriate course selection and mode of substitution.

Students declaring the Accelerated MSSE option are required to choose courses from the following list, or approved substitutions, to replace up to 9 hours of electives and required courses. All substitutions for non-elective undergraduate courses must be approved by the Accelerated MSSE program coordinator.
Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 500</td>
<td>Software Engineering Discipline</td>
<td>3</td>
</tr>
<tr>
<td>SE 510</td>
<td>Software Project Management</td>
<td>3</td>
</tr>
<tr>
<td>SE 530</td>
<td>Software Requirements Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SE 555</td>
<td>Object-Oriented Software Construction</td>
<td>3</td>
</tr>
</tbody>
</table>

Technical Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 505</td>
<td>Model-Based Verification of Software</td>
<td></td>
</tr>
<tr>
<td>SE 520</td>
<td>Formal Methods for Software Engineering</td>
<td></td>
</tr>
<tr>
<td>SE 535</td>
<td>User Interface Design and Evaluation</td>
<td></td>
</tr>
<tr>
<td>SE 545</td>
<td>Specification and Design of Real-Time Systems</td>
<td></td>
</tr>
<tr>
<td>SE 550</td>
<td>Current Trends in Software Engineering</td>
<td></td>
</tr>
<tr>
<td>SE 565</td>
<td>Concurrent and Distributed Systems</td>
<td></td>
</tr>
<tr>
<td>SE 580</td>
<td>Software Process Definition and Modeling</td>
<td></td>
</tr>
<tr>
<td>SE 585</td>
<td>Metrics and Statistical Methods for Software Engineering</td>
<td></td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 18

Accelerated Systems Engineering Option

Accelerated Master of Science in Systems Engineering

Exceptional students enrolled in a Bachelor of Science degree program at DB College of Engineering have the opportunity to pursue the Master of Science in Systems Engineering in an accelerated degree program format. The M.S. in Systems Engineering degree requirements for the accelerated option are the same as those for the regular M.S. in Systems Engineering program. In the accelerated option, undergraduate students may take up to nine hours of graduate coursework to fulfill undergraduate technical elective requirements and specified courses. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated M.S. in Systems Engineering option and receives a grade of "B" or better in the course. Graduate courses taken in satisfaction of this program must be selected from the list of approved courses.

Undergraduate students may apply to the combined MS option by submitting an application to the M.S. in Systems Engineering program coordinator. Students must have completed at least 60 credit hours toward the BS degree and must have a 3.2 minimum GPA to be admitted to the program. Students will be dropped from the program if their GPA falls below a 3.0. The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements applicable to the student’s specific major; the Master of Science degree will be conferred upon completion of all master’s degree requirements for the M.S. in Systems Engineering program.

Approved Courses for the Accelerated Option:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 530</td>
<td>System Requirements Analysis and Modeling</td>
<td>3</td>
</tr>
<tr>
<td>SYS 625</td>
<td>System Quality Assurance</td>
<td>3</td>
</tr>
</tbody>
</table>

Accelerated Unmanned and Autonomous Systems Engineering Option

For exceptional students enrolled in an engineering Bachelor of Science degree program, the Master of Science in Unmanned and Autonomous Systems Engineering (MSUASE) program offers the opportunity to pursue a combined Master of Science degree program. In this option, up to nine hours of graduate coursework may be taken to fulfill undergraduate technical elective requirements. These hours will count toward both the BS and MS degree requirements provided that the student is enrolled in the accelerated MS option and receives a B or better in the course. Graduate courses taken for technical elective credit must be selected from the list of MSUASE Core courses listed below.

Undergraduate students may apply to the accelerated MS option by submitting an application to the MSUASE Program Coordinator. Students must have completed 88 credit hours toward the BS degree and must have a 3.2 minimum GPA to be admitted to the program. Students will be dropped from the program if their GPA falls below 3.0 or
if they have not completed the MSUASE degree requirements within two years of finishing their undergraduate degree. The Bachelor of Science degree will be conferred upon completion of all bachelor’s degree requirements; the Master of Science degree will be conferred upon completion of all master’s degree requirements.

Technical electives must be chosen from the list of MSUASE core courses as well as courses supporting the UAS area of concentration, listed below.

**Approved Courses for the Accelerated Option**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 527</td>
<td>Modern Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>or EE 527</td>
<td>Modern Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>or ME 527</td>
<td>Modern Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>AE 506</td>
<td>Airplane Dynamic Stability</td>
<td>3</td>
</tr>
<tr>
<td>AE 623</td>
<td>Atmospheric Navigation, Guidance and Control</td>
<td>3</td>
</tr>
<tr>
<td>AE 626</td>
<td>Aircraft Fault Tolerance and Advanced Control Theory</td>
<td>3</td>
</tr>
<tr>
<td>EE 510</td>
<td>Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 528</td>
<td>Sensors and Data Links</td>
<td>3</td>
</tr>
<tr>
<td>ME 503</td>
<td>Unmanned and Autonomous Vehicle Systems</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>

**Combined Engineering Options**

Combined programs offer well-qualified students the opportunity to start a Master’s degree while still completing their Bachelor’s degree, and allow for the crossing of disciplines. Students earn B.S. once all requirements for that degree are met, while still working to complete their M.S.

**Admission Requirements**

Students interested in pursuing one these programs must:

- Maintain at least a 3.2 cumulative GPA throughout the undergraduate course of study.
- Maintain at least a 3.0 cumulative GPA throughout the graduate course of study.
- Take the Graduate Management Admission Test (GMAT)* during their junior year, earning a score at least at the 50th percentile, and apply for admission to the program through the Office of Graduate Admissions.
- Complete a minimum of 100 credit hours, including the required Business Administration minor courses, prior to enrollment in Business graduate transition courses.

Students should review the undergraduate degree program sections for the recommended course of study and program requirements.

*The GMAT requirement may be waived by the Graduate Program Coordinator for exceptional students.

**Aerospace Engineering/MBA**

This program does not require any Business Administration courses to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Three or Four**

- Technical Elective
  - BA 511 Operations Research 3

**Year Four**

- Technical Electives
  - BA 523 Advanced Aviation Economics 3

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

- ACC 517 Accounting for Decision Making 3
- BA 514 Strategic Marketing Management in Aviation 3
- BA 518 Managerial Finance 3
- BA 520 Organizational Behavior, Theory, and Applications in Aviation 3
Aerospace Engineering/MSHF

In the Accelerated BSAE/MSHF, students may take up to 12 credits of graduate course work during their BSAE senior year. Two graduate courses (six credits) may fulfill the undergraduate technical elective requirements. These six credits will count towards both the BS and MS degree requirements provided the student maintains enrollment in the accelerated program and receives a "B" or better in the courses. For these graduate level courses taken for undergraduate technical elective credit, it is recommended that students take HFS 510 Research Design and Analysis I and HFS 610 Research Design and Analysis II during the fall and spring semesters of their undergraduate senior year respectively. These courses are part of a three course series. If they are not completed during those semesters, completing the program may be delayed. These six credits will appear on the undergraduate transcript. These six credits will not be part of the Master's transcript until the time of graduation. In addition, students are encouraged to take up to two additional graduate courses as undergraduates to reduce the overall duration of the program. These additional courses should be core courses approved by the BSAE and MSHF program coordinators.

Students enrolled in the Bachelor of Science in Aerospace Engineering program may apply for admission into this accelerated program after they have completed their third year of BSAE courses (approximately 90 credit hours). The application for the Accelerated BSAE/MSHF program must be submitted to the BSAE Undergraduate Program Coordinator to verify the minimum requirement (CGPA of 3.0 or higher). Once approved, the application will be forwarded to the MSHF Graduate Program Coordinator along with the student's unofficial transcript, a personal statement and resume.

Once accepted into the accelerated program, a CGPA of 3.0 or higher in undergraduate courses and a CGPA of 3.0 or higher in graduate courses must be maintained for continued enrollment. Students will be dropped from the program if their CGPA in either falls below 3.0. Students are future-admitted to the MSHF program as non-degree students and are limited to 12 graduate credits prior to completing their BSAE requirements. The Bachelor of Science in Aerospace Engineering will be conferred upon completion of all bachelor's degree requirements listed in this catalog. The student is then formally admitted to the MSHF program. The Master's degree will be conferred upon completion of all Master's degree requirements listed in this Catalog. Degree Credits BSAE: 129 (6 credits from MSHF courses) Degree Credits MSHF: 36 (6 credits taken for BSAE level credit) Total Degree Credits: 159. If the student chooses to leave the program before completion of the MSHF program and has acquired the minimal hours required for graduation with the BSAE, any MSHF transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

BSAE Technical Electives

One upper level Technical Elective must be an AE course. All non-duplicating AE upper-level undergraduate and graduate courses are acceptable. The remaining upper-level Technical Elective needs to be selected from the BSAE Approved Technical Electives list, in the areas of Engineering and Science, maintained by the AE Department.

Accepted students may complete these requirements as identified in the accelerated program. The objective of this combined accelerated program is to produce graduates who are prepared for leadership positions within the Aerospace Industry and/or further academic study at the doctoral level. This program augments the student's undergraduate technical electives with graduate-level courses and/or thesis work to focus on future research.

**MSHF Core Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFS 510</td>
<td>Research Design and Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>HFS 515</td>
<td>Ergonomics</td>
<td>3</td>
</tr>
<tr>
<td>HFS 600</td>
<td>Human Factors in Systems</td>
<td>3</td>
</tr>
<tr>
<td>HFS 610</td>
<td>Research Design and Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>HFS 612</td>
<td>Human Factors Methods</td>
<td>3</td>
</tr>
<tr>
<td>HFS 615</td>
<td>Sensation and Perception</td>
<td>3</td>
</tr>
<tr>
<td>HFS 635</td>
<td>Human-Computer Interaction</td>
<td>3</td>
</tr>
<tr>
<td>HFS 620</td>
<td>Memory and Cognition</td>
<td>3</td>
</tr>
</tbody>
</table>
HFS 675 Multivariate Statistics: Factor Analysis and Data Reduction 3

Total Credits 27

Electives Non-Thesis = 9 credits, Thesis = 3 credits

HFS 500 Systems Concepts, Theory, and Tools 3
HFS 520 Team Performance 3
HFS 521 Modeling Humans in Complex Systems 3
HFS 526 Aerospace Physiology 3
HFS 527 Psychopharmacology 3
HFS 590 Graduate Seminar 3
HFS 614 Human Factors in Medicine 3
HFS 616 Human Factors of Transportation 3
HFS 618 HF in Aging: Behavioral and Biological Foundations 3
HFS 622 Human Factors in Entertainment Systems 3
HFS 624 User Experience 3
HFS 625 Applied Testing and Selection 3
HFS 626 Human Factors Principles of Visual Communication 3
HFS 630 Applied Cognitive Science 3
HFS 640 Aviation/Aerospace Psychology 3
HFS 650 Human Factors of Aviation/ Aerospace Applications 3
HFS 680 Graduate Seminar: Current Applications in Human Factors 3
HFS 690 Graduate Student Capstone 3
HFS 696 Graduate Internship in Human Factors and Systems 1-3
HFS 699 Special Topics in Human Factors and Systems 1-6

*For Students participating in Internships, a maximum of two (2) WW online courses (MSHF) may be taken that would be applicable towards the student's DB MSHF degree. Prior approval from the HF Graduate Program Coordinator is required for each course option.

MSHF 606 for HFS 620, MSHF 624 for HFS 515, MSHF 612 or MSHF 618 for electives. WW waiver may be required.

These options are being provided to ERAU BSAE/MSHF students interested in interning with Industry, especially during the Summer months. It is envisioned that students interning non-for-credit (HFS 690), interning for credit (HFS 696), or interning not-for-credit while researching/working on their Thesis (HFS 700) can potentially take a WW course to maximize their opportunity to complete the MSHF degree within a two (2) year timeframe.

Civil Engineering/MBA

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student's junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

Business Administration Transition

Year Four

Technical Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>or BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
</tbody>
</table>

Year Five

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 517</td>
<td>Accounting for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives 12

Total Degree Credits 155

Computer Engineering/MBA

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by
the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

<table>
<thead>
<tr>
<th>Specified Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 Operations Research 3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics 3 or BA 520 Organizational Behavior, Theory, and Applications in Aviation</td>
</tr>
</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

| ACC 517 Accounting for Decision Making 3 |
| BA 511 Operations Research 3 |
| BA 514 Strategic Marketing Management in Aviation 3 |
| BA 518 Managerial Finance 3 |
| BA 520 Organizational Behavior, Theory, and Applications in Aviation 3 |
| BA 523 Advanced Aviation Economics 3 |
| BA 635 Business Policy and Decision Making 3 |

Specified Electives 12

**Total Degree Credits** 154

**Computer Science/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

<table>
<thead>
<tr>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 Operations Research 3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics 3</td>
</tr>
</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

| ACC 517 Accounting for Decision Making 3 |
| BA 511 Operations Research 3 |
| BA 514 Strategic Marketing Management in Aviation 3 |

**Electrical Engineering/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

<table>
<thead>
<tr>
<th>Specified Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 Operations Research 3</td>
</tr>
<tr>
<td>BA 523 Advanced Aviation Economics 3 or BA 520 Organizational Behavior, Theory, and Applications in Aviation</td>
</tr>
</tbody>
</table>

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

<p>| ACC 517 Accounting for Decision Making 3 |
| BA 511 Operations Research 3 |
| BA 514 Strategic Marketing Management in Aviation 3 |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 518</td>
<td>Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 520</td>
<td>Organizational Behavior, Theory, and Applications in Aviation</td>
<td>3</td>
</tr>
<tr>
<td>BA 523</td>
<td>Advanced Aviation Economics</td>
<td>3</td>
</tr>
<tr>
<td>BA 635</td>
<td>Business Policy and Decision Making</td>
<td>3</td>
</tr>
</tbody>
</table>

Specified Electives  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

Total Degree Credits  

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>156</td>
</tr>
</tbody>
</table>

**Mechanical Engineering/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

Technical Electives

- BA 511 Operations Research 3
- BA 523 Advanced Aviation Economics 3

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

- ACC 517 Accounting for Decision Making 3
- BA 511 Operations Research 3
- BA 514 Strategic Marketing Management in Aviation 3
- BA 518 Managerial Finance 3
- BA 520 Organizational Behavior, Theory, and Applications in Aviation 3
- BA 523 Advanced Aviation Economics 3
- BA 635 Business Policy and Decision Making 3

Specified Electives  

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

Total Degree Credits  

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>154</td>
</tr>
</tbody>
</table>

**Software Engineering/MBA**

This program does not require any courses in Business Administration to be completed prior to application. Entry in this program will be approved by the College of Business late in the student’s junior year after the GMAT and other required admission processes are complete. The student will then take the MBA transition courses in place of the third/fourth year technical electives listed in the program.

**Business Administration Transition**

**Year Four**

Specified Electives

- BA 511 Operations Research 3
- BA 523 Advanced Aviation Economics 3
  or BA 520 Organizational Behavior, Theory, and Applications in Aviation

**Year Five**

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

- ACC 517 Accounting for Decision Making 3
- BA 511 Operations Research 3
- BA 514 Strategic Marketing Management in Aviation 3
- BA 518 Managerial Finance 3
- BA 520 Organizational Behavior, Theory, and Applications in Aviation 3
- BA 523 Advanced Aviation Economics 3
- BA 635 Business Policy and Decision Making 3

Specified Electives  

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

Total Degree Credits  

<table>
<thead>
<tr>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>154</td>
</tr>
</tbody>
</table>

**M.S. in Aerospace Engineering**

**Introduction**

The Master of Science in Aerospace Engineering (MSAE) provides formal advanced study, preparing students for careers in the aerospace industry and in research and development. Students can select the thesis option or the non-thesis option. The degree program is planned to augment the individual student’s engineering and science background with adequate depth in areas of computational fluid dynamics, aeroacoustic modeling, rotorcraft aerodynamics, flow control, Propulsion design and analysis, heat transfer, air-breathing hypersonic and rocket propulsion, autonomous unmanned air and ground vehicles, aircraft and spacecraft guidance,
navigation and control, aeroelasticity, composites, nanomaterials, smart materials, structural health monitoring, computational structural mechanics, and design optimization, as well as other topics in aerospace engineering. Candidates for the program can select courses that prepare them for the aerospace engineering profession or that prepare them to continue on to doctoral studies.

The degree program requires a minimum of 30 credit hours of graduate-level work.

### Degree Requirements

#### Non-Thesis Option

<table>
<thead>
<tr>
<th>AE Core courses</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Mathematics course *</td>
<td>3</td>
</tr>
<tr>
<td>Graduate Electives (at most six hours of non-AE courses in EP, other Engineering, Math, or BA 511, with Advisor and Program Coordinator approval)</td>
<td>21</td>
</tr>
</tbody>
</table>

| Total Credits | 30 |

#### Thesis Option

<table>
<thead>
<tr>
<th>AE Core courses</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Mathematics course *</td>
<td>3</td>
</tr>
<tr>
<td>Graduate Electives (at most six hours of non-AE courses in EP, other Engineering, Math, or BA 511, with Advisor and Program Coordinator approval)</td>
<td>12</td>
</tr>
</tbody>
</table>

| Thesis (AE 700) **                                         | 9 |

To remain on track for Thesis work: upon completion of the first 3 credit hours of Thesis, the student is required to submit a Topic Statement. Upon completion of the second 3 credit hours of Thesis, the student is required to conduct a pre-defense. Consult with the graduate program coordinator for additional information.

| Total Credits | 30 |

* Recommended Graduate Mathematics Courses:
MA 502 or EP 501 for both the Aerodynamics and Propulsion and the Structures and Materials Concentrations, and MA 502 or MA 510 for the Dynamics and Controls Concentration. Students are encouraged to consult an advisor within their respective areas.

** AE 700 Advisors must be AE Department faculty.

---

### Areas of Concentration

#### Aerodynamics and Propulsion

This area includes Aerodynamics, Propulsion, Computational Aero and Fluid Dynamics, Transition and Turbulence, Aeroacoustics, Heat Transfer, and Combustion.

**Core Courses for Aerodynamic and Propulsion Concentration**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 504</td>
<td>Advanced Compressible Flow</td>
<td>3</td>
</tr>
<tr>
<td>AE 521</td>
<td>Viscous Flow</td>
<td>3</td>
</tr>
<tr>
<td>AE 528</td>
<td>Advanced Incompressible Aerodynamics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives for Aerodynamics and Propulsion Concentration**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 507</td>
<td>Design, Build and Test</td>
<td>3</td>
</tr>
<tr>
<td>AE 508</td>
<td>Intermediate Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>AE 512</td>
<td>Combustion I</td>
<td>3</td>
</tr>
<tr>
<td>AE 516</td>
<td>Computational Aeronautical Fluid Dynamics</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 524</td>
<td>Rocket Engine Propulsion Systems</td>
<td>3</td>
</tr>
<tr>
<td>AE 536</td>
<td>Rotorcraft Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 550</td>
<td>Thermodynamics: Classic and Modern Perspectives</td>
<td>3</td>
</tr>
<tr>
<td>AE 596</td>
<td>Graduate Internship in Aerospace Engineering</td>
<td>1-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 610</td>
<td>Advanced Computational Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 625</td>
<td>Hypersonic Aerospace Propulsive Flows</td>
<td>3</td>
</tr>
<tr>
<td>AE 631</td>
<td>Aeroacoustics</td>
<td>3</td>
</tr>
<tr>
<td>AE 635</td>
<td>Flow Stability and Control</td>
<td>3</td>
</tr>
<tr>
<td>AE 640</td>
<td>Turbine Engine Propulsion Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 652</td>
<td>Turbulent Flows</td>
<td>3</td>
</tr>
<tr>
<td>AE 699</td>
<td>Special Topics in Aerospace Engineering</td>
<td>1-3</td>
</tr>
</tbody>
</table>

### Dynamics and Control

This area includes the six degrees of freedom rigid body dynamics of aerospace vehicles, linear and nonlinear modeling and simulation of the dynamics, state and parameter estimation and the control of aerospace vehicles.

**Core Courses for Dynamics and Control Concentration**

---

College of Engineering
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 523</td>
<td>Modeling and Simulation of Linear Dynamic Systems</td>
<td>3</td>
</tr>
<tr>
<td>AE 527</td>
<td>Modern Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>AE 544</td>
<td>Analytical Dynamics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives for Dynamics and Control**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 505</td>
<td>Spacecraft Dynamics and Control</td>
<td>3</td>
</tr>
<tr>
<td>AE 506</td>
<td>Airplane Dynamic Stability</td>
<td>3</td>
</tr>
<tr>
<td>AE 526</td>
<td>Engineering Optimization</td>
<td>3</td>
</tr>
<tr>
<td>AE 546</td>
<td>Nonlinear Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>AE 596</td>
<td>Graduate Internship in Aerospace Engineering</td>
<td>1-3</td>
</tr>
<tr>
<td>AE 623</td>
<td>Atmospheric Navigation, Guidance and Control</td>
<td>3</td>
</tr>
<tr>
<td>AE 626</td>
<td>Aircraft Fault Tolerance and Advanced Control Theory</td>
<td>3</td>
</tr>
<tr>
<td>AE 627</td>
<td>Adaptive Control of Aerospace Structures</td>
<td>3</td>
</tr>
<tr>
<td>AE 629</td>
<td>Robust Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>AE 633</td>
<td>Optimal Control</td>
<td>3</td>
</tr>
<tr>
<td>AE 646</td>
<td>Nonlinear Dynamical Systems and Chaos</td>
<td>3</td>
</tr>
<tr>
<td>AE 699</td>
<td>Special Topics in Aerospace Engineering</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**Structures and Materials**

This area includes Structural Analysis, Vibration, Nondestructive Testing, Composite Materials, Elasticity, and Design Optimization.

**Core Courses for the MSAE Program in the Structures and Materials Concentration**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 502</td>
<td>Strength and Fatigue of Materials</td>
<td>3</td>
</tr>
<tr>
<td>AE 510</td>
<td>Aircraft Structural Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 522</td>
<td>Analysis of Aircraft Composite Materials</td>
<td>3</td>
</tr>
</tbody>
</table>

**Core Courses for the PhD Program in the Structures and Materials Concentration**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 514</td>
<td>Introduction to the Finite Element Method</td>
<td>3</td>
</tr>
<tr>
<td>AE 522</td>
<td>Analysis of Aircraft Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>AE 548</td>
<td>Introduction to Continuum Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives for Structures Concentration**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 511</td>
<td>Engineering Materials Selection</td>
<td>3</td>
</tr>
<tr>
<td>AE 514</td>
<td>Introduction to the Finite Element Method</td>
<td>3</td>
</tr>
<tr>
<td>AE 520</td>
<td>Perturbation Methods in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>AE 525</td>
<td>Structural Design Optimization</td>
<td>3</td>
</tr>
<tr>
<td>AE 532</td>
<td>Failure Analysis of Materials</td>
<td>3</td>
</tr>
<tr>
<td>AE 534</td>
<td>Smart Materials in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>AE 538</td>
<td>Theory of Elasticity</td>
<td>3</td>
</tr>
<tr>
<td>AE 540</td>
<td>Structural Health Monitoring</td>
<td>3</td>
</tr>
<tr>
<td>AE 542</td>
<td>Mechanics of Structures: Variational and Computational Methods</td>
<td>3</td>
</tr>
<tr>
<td>AE 596</td>
<td>Graduate Internship in Aerospace Engineering</td>
<td>1-3</td>
</tr>
<tr>
<td>AE 606</td>
<td>Finite Element Aerospace Applications</td>
<td>3</td>
</tr>
<tr>
<td>AE 612</td>
<td>Analysis of Aircraft Plate and Shell Structures</td>
<td>3</td>
</tr>
<tr>
<td>AE 616</td>
<td>Advanced Aircraft Structural Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 618</td>
<td>Aeroelasticity</td>
<td>3</td>
</tr>
<tr>
<td>AE 648</td>
<td>Thermal Stresses in Aerospace Engineering</td>
<td>3</td>
</tr>
<tr>
<td>AE 699</td>
<td>Special Topics in Aerospace Engineering</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**M.S. in Civil Engineering**

The Masters degree program in Civil Engineering offers tracks in Structural Engineering, Transportation Engineering and a general Master of Science in Civil Engineering. Each Masters degree track has both thesis or non-thesis option. The thesis option will consist of 12 credits of core courses, 6 credits of elective courses, and 9 thesis credits. The program of study is intended to be completed over three semesters plus the summer semester for
research. The non-thesis option will consist of the 15 credit core course curriculum plus 15 elective credits in an advisor-approved program of study. Each degree option may be pursued either as a five-year accelerated BS/MS program for Embry-Riddle Civil Engineering students, or as a three semester program for those with a BS from another institution or Embry-Riddle engineering discipline.

Degree program requires a minimum of 30 credit hours of graduate-level work.

Admission Requirements

Applicants to the Master of Science in Civil Engineering program must:

- Have completed a B.S. degree in an ABET-accredited engineering program (or international equivalent) or a closely related engineering discipline;
- Applicants to the five-year BS/MS program are eligible to apply with 90 earned credits towards the B.S. degree with a minimum 3.20 cumulative grade point average (CGPA) in CIV/ES courses
- Have a CGPA of 3.0
- Complete the Graduate Record Examination (GRE)
- Submit a complete application package before the deadline specified in the University catalog.

International applicants whose primary language is not English must also achieve the minimum score requirement of TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Test System) as required by the University.

Degree Requirements

The Master of Science in Civil Engineering is granted to students who complete the course work described below. Students may choose Non-Thesis or Thesis Option.

Non-Thesis Option

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV Required Courses</td>
<td>12</td>
</tr>
<tr>
<td>Electives</td>
<td>18</td>
</tr>
<tr>
<td>Total Credits</td>
<td>30</td>
</tr>
</tbody>
</table>

Thesis Option

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering Required Courses</td>
<td>12</td>
</tr>
<tr>
<td>Electives</td>
<td>9</td>
</tr>
<tr>
<td>Thesis Research (3 cr of CIV 700A plus 6 cr of Thesis Research)</td>
<td>9</td>
</tr>
<tr>
<td>Total Credits</td>
<td>30</td>
</tr>
</tbody>
</table>

Transportation Engineering Track

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required courses</td>
<td>12</td>
</tr>
<tr>
<td>CIV 506</td>
<td>Transportation Systems Engineering</td>
</tr>
<tr>
<td>CIV 522</td>
<td>Advanced Geometric Design of Highways and Streets</td>
</tr>
<tr>
<td>CIV 532</td>
<td>Transportation Planning</td>
</tr>
<tr>
<td>CIV 602</td>
<td>Transportation Safety</td>
</tr>
<tr>
<td>Transportation Electives</td>
<td>18</td>
</tr>
<tr>
<td>Max 12 credits outside CIV</td>
<td></td>
</tr>
<tr>
<td>BA 511</td>
<td>Operations Research</td>
</tr>
<tr>
<td>BA 514</td>
<td>Strategic Marketing Management in Aviation</td>
</tr>
<tr>
<td>BA 604</td>
<td>International Management and Aviation Policy</td>
</tr>
<tr>
<td>BA 645</td>
<td>Airport Operations and Management</td>
</tr>
<tr>
<td>BA 650</td>
<td>Airline/Airport Relations</td>
</tr>
<tr>
<td>BA 651</td>
<td>Strategic Airport Planning</td>
</tr>
<tr>
<td>CIV 510</td>
<td>Design and Analysis of Airfield and Highway Pavement</td>
</tr>
<tr>
<td>CIV 512</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>CIV 520</td>
<td>Railroad Engineering and High Speed Rail</td>
</tr>
<tr>
<td>CIV 524</td>
<td>Access Management</td>
</tr>
<tr>
<td>CIV 534</td>
<td>Transportation Simulation and Modeling</td>
</tr>
<tr>
<td>CIV 604</td>
<td>Advanced Signal Control and Design</td>
</tr>
<tr>
<td>HFS 600</td>
<td>Human Factors in Systems</td>
</tr>
<tr>
<td>HFS 616</td>
<td>Human Factors of Transportation</td>
</tr>
<tr>
<td>MA 505</td>
<td>Statistics I</td>
</tr>
<tr>
<td>MA 506</td>
<td>Probability and Statistical Inference</td>
</tr>
<tr>
<td>MA 540</td>
<td>Data Mining</td>
</tr>
<tr>
<td>MSA 508</td>
<td>Advanced Airport Modeling</td>
</tr>
<tr>
<td>MSA 511</td>
<td>Earth Observation and Remote Sensing</td>
</tr>
</tbody>
</table>
MSA 602  The Air Transportation System
MSA 662  Statistical Analysis for Aviation/Aerospace
MSA 674  Project Management in Aviation Aerospace

Total Credits  30

Structural Engineering Track

Required Courses  12

AE 514  Introduction to the Finite Element Method
CIV 514  Advanced Concrete Analysis and Design
CIV 516  Advanced Steel Analysis and Design
CIV 526  Advanced Geotechnical and Foundation Design

Structures Electives  18

Max 9 credits outside CIV

AE 502  Strength and Fatigue of Materials
AE 510  Aircraft Structural Dynamics
AE 523  Modeling and Simulation of Linear Dynamic Systems
AE 532  Failure Analysis of Materials
CIV 502  Wind Engineering
CIV 504  Bridge Engineering
CIV 510  Design and Analysis of Airfield and Highway Pavement
CIV 518  Structural Reliability
CIV 528  Structural Health Monitoring in Civil Infrastructure
ME 525  Structural Design Optimization

Total Credits  30

General Civil Engineering Track

Required Courses  12

CIV 506  Transportation Systems Engineering
  or CIV 532  Transportation Planning
CIV 514  Advanced Concrete Analysis and Design
  or CIV 5 Advanced Steel Analysis and Design
CIV 510  Design and Analysis of Airfield and Highway Pavement
  or CIV 526  Advanced Geotechnical and Foundation Design

Civil Electives  18

Non-Thesis Option:
CIV Graduate Electives (Advisor approved (6-18 credits)
Non-CIV Graduate Electives (Advisor approved) (0-12 credits)

Total Credits  30

M.S. in Cybersecurity Engineering

Introduction

Computers and the services provided by them are ubiquitously available. The number of services provided by networked computers is ever increasing along with increasing penetration of computers into a wide spectrum of products, from microwaves to satellites. The growing use of computers and their networking and information sharing also bring forth cybersecurity challenges. These issues are of growing importance both nationally and internationally. As the news of a breach can result in severe damage to an organization, cybersecurity considerations take place from design and implementation of systems all the way to the decommissioning of systems. The Master of Science in Cybersecurity Engineering program prepares graduates to address challenges in development of secure systems and maintaining secure operations as well as decommissioning of these systems. Cybersecurity professionals are increasingly in demand in both public and private sectors.

The Master of Science in Cybersecurity Engineering provides its participants with exceptional learning opportunities and prepares them for careers after the degree. The program is designed such that the engineers and managers currently in the workforce can also enhance their skill set in this increasingly important field.

For applicants inclined toward research and later doctoral studies, the program offers a thesis track. For applicants more interested in entering or returning to the workplace, the program offers a non-thesis track. Based on their background and interests, students applying for the non-thesis option can choose to do a 3-hour graduate capstone project plus electives or take only elective classes and fulfill the 30-hour requirement for the degree program.
Admission Requirements

Applicants to the Master of Science in Cybersecurity Engineering program must

- Have completed an undergraduate degree in an engineering or computer science program or closely related discipline;
- Have superior academic records with a minimum cumulative grade point average (CGPA) of 3.0;
- Complete the Graduate Record Examination (GRE);
- Submit a complete application package before the deadline specified in the University catalog.

International applicants whose primary language is not English must also achieve the minimum score requirement of TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Test System) as required by the University.

Degree Requirements

The master degree in Master of Science in Cybersecurity Engineering is granted to students who complete the course work described below. The program consists of 18 credits of core courses and 12 credits of advisor-approved electives. The electives can be completed in one of three modes:

- All courses: 12 credits of advisory-approved electives;
- Courses plus a one-semester capstone: Nine credits of advisory-approved electives, plus the one-semester capstone project leading to a conference paper or technical report equivalent;
- Courses plus a six-credit thesis: Six credits of advisor-approved electives, plus a six-credit research thesis by publication based on a journal paper, multiple conference papers, or technical report equivalents.

Program Core Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 527</td>
<td>System Exploitation and Penetration Testing</td>
<td>3</td>
</tr>
<tr>
<td>CS 529</td>
<td>Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>CS 532</td>
<td>Software Security Assessment</td>
<td>3</td>
</tr>
<tr>
<td>CS 538</td>
<td>Applied Cryptography</td>
<td>3</td>
</tr>
<tr>
<td>SE 500</td>
<td>Software Engineering Discipline</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 18

Thesis Option

<table>
<thead>
<tr>
<th>Program Core</th>
<th>Open Electives</th>
<th>CS 700 Graduate Thesis</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>6</td>
<td>1-6</td>
<td>25-30</td>
</tr>
</tbody>
</table>

Non-Thesis: Capstone Project Option

<table>
<thead>
<tr>
<th>Program Core</th>
<th>Open Electives</th>
<th>CS 690 Cybersecurity Engineering Capstone Project</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>9</td>
<td>3</td>
<td>30</td>
</tr>
</tbody>
</table>

Non-Thesis: Course Only Option

<table>
<thead>
<tr>
<th>Program Core</th>
<th>Open Electives</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>12</td>
<td>30</td>
</tr>
</tbody>
</table>

M.S. in Electrical and Computer Engineering

Introduction

The Master of Science in Electrical and Computer Engineering prepares students for advanced careers in the aerospace industry. Like its undergraduate counterparts, it focuses on developing engineers who possess not only technical mastery but also the knowledge and ability to execute systems-level design, whether in avionics systems, spacecraft electronics, or more earthbound computer design.

The program allows the student to focus either on electrical engineering or computer engineering. For each area of concentration, the program begins with a foundation of courses in linear systems, random processes, and systems engineering. Then, each area has its own core: digital communications plus avionics & radio navigation comprise the electrical engineering core; project management and computer systems safety, the computer engineering core. The student can tailor each area of concentration toward either professional practice or further graduate study. For those inclined toward research and later doctoral studies, the program offers a thesis option. For
those more interested in entering or returning to the workplace, there is a non-thesis option.

Applicants must have an undergraduate degree in electrical and/or computer engineering, another engineering discipline, computer science, or the physical sciences. Any engineering degree earned in the United States must be from an ABET-accredited program. Students should possess a strong academic record, demonstrated by a 3.0 CGPA or better. Applicants may be admitted conditionally with the provision that they complete specific undergraduate courses prior to enrolling in graduate courses.

Each area of concentration consists of 15 credits of required courses, with 9 credits common to both areas. The thesis option requires 9 credits of thesis and allows 6 credits of restricted electives. The non-thesis option allows for 12 credits of restricted electives and requires completion of a 3-credit project. Restricted electives include core courses from the complementary area of concentration, advanced courses in both electrical engineering and computer engineering, and graduate subjects in software engineering, aerospace engineering, mechanical engineering, engineering physics, and mathematics.

### MSECE (Thesis option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core courses</td>
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</tr>
<tr>
<td>Electives</td>
<td>6</td>
</tr>
<tr>
<td>CEC 700 Graduate Thesis</td>
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</tr>
<tr>
<td>or EE 700 Graduate Thesis</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### MSECE (Nonthesis option)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core courses</td>
<td>15</td>
</tr>
<tr>
<td>Electives</td>
<td>12</td>
</tr>
<tr>
<td>CEC 690 Graduate Project</td>
<td>3</td>
</tr>
<tr>
<td>or EE 690 Graduate Project</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### Areas of Concentration

#### Electrical Engineering

This area includes avionics, communications, power electronics, electromagnetic systems, computing systems, control systems, and systems engineering.

### Core Courses for Electrical Engineering Concentration

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 510</td>
<td>Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 515</td>
<td>Random Signals</td>
<td>3</td>
</tr>
<tr>
<td>EE 525</td>
<td>Avionics and Radio Navigation</td>
<td>3</td>
</tr>
<tr>
<td>EE 620</td>
<td>Digital Communications</td>
<td>3</td>
</tr>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td></td>
</tr>
</tbody>
</table>

### Electives for Electrical Engineering Concentration

**Thesis Option, choose two; Non-thesis Option, choose four of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 514</td>
<td>Introduction to the Finite Element Method</td>
</tr>
<tr>
<td>AE 526</td>
<td>Engineering Optimization</td>
</tr>
<tr>
<td>AE 527</td>
<td>Modern Control Systems</td>
</tr>
<tr>
<td>CEC 500</td>
<td>Engineering Project Management</td>
</tr>
<tr>
<td>CEC 510</td>
<td>Digital Signal Processing</td>
</tr>
<tr>
<td>CEC 526</td>
<td>Sensor Data Fusion</td>
</tr>
<tr>
<td>CEC 530</td>
<td>Image Processing and Machine Vision</td>
</tr>
<tr>
<td>CEC 610</td>
<td>State and Parameter Estimation</td>
</tr>
<tr>
<td>EE 500</td>
<td>Digital Control Systems</td>
</tr>
<tr>
<td>EE 505</td>
<td>Advanced Mechatronics</td>
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<tr>
<td>EE 527</td>
<td>Modern Control Systems</td>
</tr>
<tr>
<td>EE 528</td>
<td>Sensors and Data Links</td>
</tr>
<tr>
<td>EE 529</td>
<td>Electro-Optical Systems</td>
</tr>
<tr>
<td>EE 625</td>
<td>Satellite-Based Communications and Navigation</td>
</tr>
<tr>
<td>EP 501</td>
<td>Numerical Methods for Engineers and Scientists</td>
</tr>
<tr>
<td>EP 505</td>
<td>Spacecraft Dynamics and Control</td>
</tr>
<tr>
<td>HFS 635</td>
<td>Human-Computer Interaction</td>
</tr>
<tr>
<td>MA 510</td>
<td>Fundamentals of Optimization</td>
</tr>
<tr>
<td>ME 503</td>
<td>Unmanned and Autonomous Vehicle Systems</td>
</tr>
<tr>
<td>ME 520</td>
<td>Sensor Processing with Applications</td>
</tr>
<tr>
<td>ME 527</td>
<td>Modern Control Systems</td>
</tr>
<tr>
<td>ME 613</td>
<td>Advanced Model-Based Control Design</td>
</tr>
<tr>
<td>ME 615</td>
<td>Pattern Recognition and Machine Learning</td>
</tr>
<tr>
<td>SE 500</td>
<td>Software Engineering Discipline</td>
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<tr>
<td>SE 505</td>
<td>Model-Based Verification of Software</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>SE 530</td>
<td>Software Requirements Engineering</td>
</tr>
<tr>
<td>SE 535</td>
<td>User Interface Design and Evaluation</td>
</tr>
<tr>
<td>SE 545</td>
<td>Specification and Design of Real-Time Systems</td>
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<tr>
<td>SE 600</td>
<td>User Interface Design for Unmanned Systems</td>
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<tr>
<td>SE 610</td>
<td>Software Systems Architecture and Design</td>
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<tr>
<td>SE 625</td>
<td>Software Quality Engineering and Assurance</td>
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<tr>
<td>SE 655</td>
<td>Performance Analysis of Real-Time Systems</td>
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<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
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<tr>
<td>SYS 530</td>
<td>System Requirements Analysis and Modeling</td>
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<td>SYS 560</td>
<td>Introduction to Systems Engineering Management</td>
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<tr>
<td>SYS 610</td>
<td>System Architecture Design and Modeling</td>
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<tr>
<td>SYS 625</td>
<td>System Quality Assurance</td>
</tr>
<tr>
<td>SYS 660</td>
<td>Organizational Systems Management</td>
</tr>
</tbody>
</table>

**Total Credits**: 21-27

* Other electives may be approved by the degree program coordinator

**Computer Engineering**

This area includes the analysis, design, development and deployment of computer systems, particularly real-time, safety-critical, and high-reliability systems.

**Core Courses for Computer Engineering Concentration**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEC 500</td>
<td>Engineering Project Management</td>
<td>3</td>
</tr>
<tr>
<td>EE 510</td>
<td>Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 515</td>
<td>Random Signals</td>
<td>3</td>
</tr>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives for Computer Engineering Concentration**

Thesis Option, choose two; Non-thesis Option, choose four of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 514</td>
<td>Introduction to the Finite Element Method</td>
<td></td>
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<td>Modern Control Systems</td>
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<td>CEC 510</td>
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<td>CEC 526</td>
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<td></td>
</tr>
<tr>
<td>SE 610</td>
<td>Software Systems Architecture and Design</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td>SE 625</td>
<td>Software Quality Engineering and Assurance</td>
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</tr>
<tr>
<td>SE 655</td>
<td>Performance Analysis of Real-Time Systems</td>
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</tr>
<tr>
<td>SYS 530</td>
<td>System Requirements Analysis and Modeling</td>
<td></td>
</tr>
<tr>
<td>SYS 560</td>
<td>Introduction to Systems Engineering Management</td>
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<td>System Architecture Design and Modeling</td>
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</tr>
<tr>
<td>SYS 625</td>
<td>System Quality Assurance</td>
<td></td>
</tr>
<tr>
<td>SYS 660</td>
<td>Organizational Systems Management</td>
<td></td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>21-27</td>
</tr>
</tbody>
</table>

* Other electives may be approved by the degree program coordinator.

### M.S. in Mechanical Engineering

The Master of Science degree in Mechanical Engineering (MSME) provides advanced study, preparing students for a wide range of careers including the following industries: aerospace, automotive, robotic and unmanned systems, energy systems, and biomedical systems. The program has three tracks: a broad track in Mechanical Systems designed to allow students to create a customized plan of study, a focused track in High Performance Vehicles, and a focused track in Robotic Systems. Students in the Mechanical Systems track may choose to participate in a thesis or non-thesis program. Students in the High Performance Vehicle track or the Robotic Systems track will complete a two semester group research project. Each option requires a total of 30 credit hours. Students are required to submit a plan of study during their first semester in the graduate program, and course selections and changes must be approved by the graduate program coordinator. Candidates in any track can continue on to doctoral studies.

#### Mechanical Systems Track Thesis Option

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 501</td>
<td>Modeling Methods in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 700A</td>
<td>Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>ME 700</td>
<td>Graduate Thesis</td>
<td>6</td>
</tr>
<tr>
<td>Mechanical Systems Electives</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

#### Mechanical Systems Track Non-Thesis Option

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 501</td>
<td>Modeling Methods in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME 700A</td>
<td>Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Systems Electives</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>General Electives</td>
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<td>9</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

#### Mechanical Systems Electives
Select five of the following:

- EE 500 Digital Control Systems
- EE 505 Advanced Mechatronics
- ME 500 Clean Energy Systems
- ME 503 Unmanned and Autonomous Vehicle Systems
- ME 506 Design for Manufacturing and Assembly
- ME 508 Hybrid and Electric Vehicles
- ME 510 Micro-Electrical Mechanical Systems
- ME 514 Introduction to the Finite Element Method
- ME 520 Sensor Processing with Applications
- ME 521 HVAC Systems
- ME 522 Mechanical System Design
- ME 523 Modeling and Simulation of Linear Dynamic Systems
- ME 525 Structural Design Optimization or AE 527 Modern Control Systems or EE 527 Modern Control Systems
- ME 527 Modern Control Systems
- ME 530 Advanced Kinematics and Mechanics
- ME 540 Mechanical Engineering Practicum
- ME 542 Biofluid Mechanics
- ME 544 Biomechanics
- ME 546 Structural Crashworthiness and Impact Safety
- ME 548 Introduction to Continuum Mechanics
- ME 560 Biosolid Mechanics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>
ME 601  Advanced Modeling Methods in Mechanical Engineering
ME 610  Automation and Additive Manufacturing
ME 611  Computational Heat Transfer and Fluid Flow
ME 612  Computer Integrated Manufacturing
ME 613  Advanced Model-Based Control Design
ME 614  Multidisciplinary Design Optimization
ME 615  Pattern Recognition and Machine Learning
ME 616  Design and Manufacturing of Biomedical Devices
ME 618  Vehicle Safety and Occupant Protection
ME 620  Advanced Vehicle Dynamics
ME 622  Path Planning and Navigation
SYS 500  Fundamentals of Systems Engineering
SYS 560  Introduction to Systems Engineering Management

Total Credits  15

High Performance Vehicles Track
ME 501  Modeling Methods in Mechanical Engineering  3
SYS 560  Introduction to Systems Engineering Management  3

High Performance Vehicle Electives  12
General Electives  6
ME 690  Graduate Research Project 1  3
ME 692  Graduate Research Project 2  3

Total Credits  30

Robotic Systems Track
ME 501  Modeling Methods in Mechanical Engineering  3
ME 700A  Research Methods  3
Robotic Systems Electives  12
General Electives  6
ME 690  Graduate Research Project 1  3
ME 692  Graduate Research Project 2  3

Total Credits  30

Robotic Systems Electives
Select four of the following  12
EE 505  Advanced Mechatronics
ME 503  Unmanned and Autonomous Vehicle Systems
ME 520  Sensor Processing with Applications
ME 527  Modern Control Systems
ME 530  Advanced Kinematics and Mechanics
ME 615  Pattern Recognition and Machine Learning
ME 622  Path Planning and Navigation

Total Credits  12

General Electives - All Tracks
General Electives can be courses chosen from the track electives above, and from appropriate graduate courses offered by the College of Engineering. Electives may also be chosen from the College of Arts and Sciences with program coordinator approval. Students may also obtain general elective credit for completing the graduate internship.

M.S. in Software Engineering
Introduction
The Master of Science in Software Engineering (MSSE) degree program is designed to give recent
college graduates, or college graduates who have had several years of professional life, an opportunity to enhance their careers and work on the leading-edge of modern software development. Software engineers who complete this program can rapidly assume positions of substantial responsibility in a software development organization.

The degree program achieves its purpose by providing students not only with the technical tools and techniques of the field but also with skills in communication, group interaction, management, and planning. The program emphasizes a process-centered quantitative approach to the engineering of software systems. The goal of the program is to give graduates an in-depth understanding of the tools, techniques, and appropriate processes for the management of software development, elicitation and analysis of requirements, architecture and design, implementation, and verification and validation of software systems. In addition, the program pays special attention to the issues related to communication and teamwork.

The program emphasizes real-time embedded software systems such as encountered in the FAA’s air traffic control computer systems, aircraft avionics, spacecraft electronics, and other safety-critical systems such as medical devices and automotive control. The MSSE curriculum incorporates key practices from the Software Engineering Institute’s Capability Maturity Model (CMM) throughout the program.

The curriculum for the program is structured into three groups of courses: core courses (15 credits), specified electives (6 to 12 credits) and a capstone experience (3 to 9 credits). The capstone experience is obtained by one of the two following options: a) the student must complete a 9 credit Graduate Thesis, SE 700 or b) the student must complete a 3 credit capstone experience which entails a major project that involves applications of the theory, practices, and technology studied in the other core courses. Students choosing the second option may take a project development practicum, SE 697, to satisfy the capstone experience or, in special cases, the capstone experience can be satisfied by completing a graduate research project (GRP), SE 690. If the GRP is chosen, prior to registering for SE 690 a faculty member must agree to be a GRP advisor and the student must obtain approval of a GRP research area.

Courses available as specified electives include metrics and statistical methods for software engineering, performance analysis of software systems, concurrent and distributed systems, software safety, and formal methods for software engineering.

An accelerated combined undergraduate and graduate program leading to a MSSE is available and is described elsewhere in this catalog.

Degree Requirements
Students must complete 15 credit hours of core courses.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 500</td>
<td>Software Engineering Discipline</td>
<td>3</td>
</tr>
<tr>
<td>SE 510</td>
<td>Software Project Management</td>
<td>3</td>
</tr>
<tr>
<td>SE 530</td>
<td>Software Requirements Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SE 555</td>
<td>Object-Oriented Software Construction</td>
<td>3</td>
</tr>
<tr>
<td>SE 610</td>
<td>Software Systems Architecture and Design</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
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</table>

Non-Thesis Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>SE 690</td>
<td>Graduate Research Project</td>
<td>3</td>
</tr>
<tr>
<td>or SE 697</td>
<td>Software Engineering Practicum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specified Software Engineering Electives</td>
<td>12</td>
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</table>

Thesis Option

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>SE 700</td>
<td>Graduate Thesis</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Specified Software Engineering Electives</td>
<td>6</td>
</tr>
</tbody>
</table>

Specified Software Engineering Electives:

Select from the following list of specified electives: 6-12

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 505</td>
<td>Model-Based Verification of Software</td>
</tr>
<tr>
<td>SE 520</td>
<td>Formal Methods for Software Engineering</td>
</tr>
<tr>
<td>SE 535</td>
<td>User Interface Design and Evaluation</td>
</tr>
<tr>
<td>SE 545</td>
<td>Specification and Design of Real-Time Systems</td>
</tr>
<tr>
<td>SE 550</td>
<td>Current Trends in Software Engineering</td>
</tr>
</tbody>
</table>
SE 565  Concurrent and Distributed Systems
SE 580  Software Process Definition and Modeling
SE 585  Metrics and Statistical Methods for Software Engineering
SE 590  Graduate Seminar
SE 625  Software Quality Engineering and Assurance
SE 655  Performance Analysis of Real-Time Systems
SE 660  Formal Methods for Concurrent and Real-Time Systems
SE 699  Special Topics in Software Engineering
SYS 505  System Safety and Certification

Note: Other electives may be authorized based on the student’s background, program of study, performance during the MSSE, and approval of the MSSE program coordinator.

M.S. in Systems Engineering

As complex engineering projects are at the heart of modern business, systems engineers are in high demand across multiple industries. In order to innovate, adapt, survive, and thrive, organizations must practice systems engineering to coordinate different teams, understand complex technology and tools, and integrate interdepartmental work processes. The Master of Science in Systems Engineering prepares graduates to be leaders who can manage such efforts by establishing a solid foundation in systems engineering fundamentals and practices.

For applicants inclined toward research and later doctoral studies, the program offers a thesis track. Students enrolled in the thesis track can select thesis advisors from the participating faculty in the College of Engineering and the College of Business, as appropriate to individual faculty’s research interests. For applicants more interested in entering or returning to the workplace, the program offers a non-thesis track. Based on their background and interests, students applying for the non-thesis option can select between the two different tracks available, allowing students to tailor their education to their career goals. The Technical track concentrates on system design, analysis, and implementation, while the Engineering Management track concentrates on organization, process, and management. The M.S. in Systems Engineering delivers exceptional learning and an esteemed credential for systems engineers entering the field, engineers wishing to broaden their perspective or advance to management positions, and managers seeking the knowledge and skills necessary for engineering products and services from a systems perspective.

Admission Requirements

In addition to the ERAU admission requirements, applicants must have an undergraduate degree in an engineering discipline, computer science, or the physical sciences. Any engineering degree earned in the United States must be from an ABET accredited program. Students should possess a strong academic record, demonstrated by a 3.0 CGPA or better. Applicants may be admitted conditionally with the provision that they complete specific undergraduate courses prior to enrolling in graduate courses.

Degree Requirements

Both thesis and non-thesis option require the completion of 30 credits with a common core of 12 credits program core.

Thesis Option

Core Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 530</td>
<td>System Requirements Analysis and Modeling</td>
<td>3</td>
</tr>
<tr>
<td>SYS 560</td>
<td>Introduction to Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 625</td>
<td>System Quality Assurance</td>
<td>3</td>
</tr>
<tr>
<td>SYS 700</td>
<td>Graduate Thesis</td>
<td>9</td>
</tr>
</tbody>
</table>

Program Electives

Electives will be chosen from existing Daytona Beach campus courses offered in the College of Engineering and/or the College of Business, and must be approved by the student’s advisor or program coordinator.

Total Credits 30
### Non-Thesis Option - Technical Track

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 530</td>
<td>System Requirements Analysis and Modeling</td>
<td>3</td>
</tr>
<tr>
<td>SYS 560</td>
<td>Introduction to Systems Engineering Management</td>
<td>3</td>
</tr>
<tr>
<td>SYS 610</td>
<td>System Architecture Design and Modeling</td>
<td>3</td>
</tr>
<tr>
<td>SYS 625</td>
<td>System Quality Assurance</td>
<td>3</td>
</tr>
<tr>
<td>SYS 690</td>
<td>Systems Engineering Project</td>
<td>3</td>
</tr>
</tbody>
</table>

**Technical Track Electives** 12

Electives will be chosen from existing Daytona Beach campus courses offered in the College of Engineering and/or the College of Business, and must be approved by the student’s advisor or program coordinator.

Total Credits 30

### Non-Thesis Option - Engineering Management Track

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS 500</td>
<td>Fundamentals of Systems Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SYS 530</td>
<td>System Requirements Analysis and Modeling</td>
<td>3</td>
</tr>
<tr>
<td>SYS 560</td>
<td>Introduction to Systems Engineering Management</td>
<td>3</td>
</tr>
<tr>
<td>SYS 625</td>
<td>System Quality Assurance</td>
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<tr>
<td>SYS 660</td>
<td>Organizational Systems Management</td>
<td>3</td>
</tr>
<tr>
<td>SYS 690</td>
<td>Systems Engineering Project</td>
<td>3</td>
</tr>
</tbody>
</table>

**Engineering Management Track Electives** 12

Electives will be chosen from existing Daytona Beach campus courses offered in the College of Engineering and/or the College of Business, and must be approved by the student’s advisor or program coordinator.

Total Credits 30

### M.S. in Unmanned and Autonomous Systems Engineering

The 30-credit program, built on rigorous coursework, allows students the option of developing and demonstrating knowledge attainment through project-based experiences. The program’s fifteen-credit core provides breadth across pertinent issues in unmanned and autonomous systems: unmanned platforms; planning and localization; sensors and data links; control systems; reliability, safety, and certification; and the requisite mathematical background. The program’s remaining fifteen credits consists of elective courses, determined in consultation with the student’s advisor to tailor a program of study. The electives provide the student three options: all coursework; coursework plus a two-semester capstone project performed either alone or, more likely, as a member of a small team, leading to publication of a conference paper (or preparation of a technical report of comparable publication quality); or a thesis option leading to publication of multiple conference papers or a journal article (or preparation of technical reports of comparable quality). In addition, the student can choose the Unmanned Aircraft Systems area of concentration, building a deep understanding of problems in the field through development of an operational aircraft and control station, or the Systems Engineering area of concentration to develop skills in systems engineering toward the requirements, design, implementation, validation, and certification of unmanned and autonomous systems.

### Areas of Concentration

**Technical Area of Concentration**

The Technical Area of Concentration supports the Thesis, Capstone, and Coursework only options.

#### Required Courses for Technical Concentration 15

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AE/EE/ME 527</td>
<td>Modern Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 510</td>
<td>Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 528</td>
<td>Sensors and Data Links</td>
<td>3</td>
</tr>
<tr>
<td>ME 503</td>
<td>Unmanned and Autonomous Vehicle Systems</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>

**Thesis Option**

Two (2) Electives Required 6

**Capstone Option**

Three (3) Electives Required 9

College of Engineering
Current Catalog Edition: 2019-20

Unmanned Aircraft Systems Area of Concentration
The UAS Area of Concentration only supports the Capstone Option

Required Courses UAS Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AE/EE/ME 527</td>
<td>Modern Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 510</td>
<td>Linear Systems</td>
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</tr>
<tr>
<td>EE 528</td>
<td>Sensors and Data Links</td>
<td>3</td>
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<tr>
<td>ME 503</td>
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<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>

Elective Courses for UAS Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 506</td>
<td>Airplane Dynamic Stability</td>
<td>3</td>
</tr>
<tr>
<td>AE 623</td>
<td>Atmospheric Navigation, Guidance and Control</td>
<td>3</td>
</tr>
<tr>
<td>AE 626</td>
<td>Aircraft Fault Tolerance and Advanced Control Theory</td>
<td>3</td>
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</tbody>
</table>

Capstone for UAS Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>UAS 691</td>
<td>Unmanned and Autonomous Systems Capstone Design Project I</td>
<td>3</td>
</tr>
<tr>
<td>UAS 692</td>
<td>Unmanned and Autonomous Systems Capstone Design Project II</td>
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</table>

Total Credits

30

Approved Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AE 502</td>
<td>Strength and Fatigue of Materials</td>
<td>3</td>
</tr>
<tr>
<td>AE 506</td>
<td>Airplane Dynamic Stability</td>
<td>3</td>
</tr>
<tr>
<td>AE 516</td>
<td>Computational Aeronautical Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 522</td>
<td>Analysis of Aircraft Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>AE 526</td>
<td>Engineering Optimization</td>
<td>3</td>
</tr>
<tr>
<td>AE 610</td>
<td>Advanced Computational Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>AE 631</td>
<td>Aeroacoustics</td>
<td>3</td>
</tr>
<tr>
<td>AE 640</td>
<td>Turbine Engine Propulsion Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEC 510</td>
<td>Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>CEC 526</td>
<td>Sensor Data Fusion</td>
<td>3</td>
</tr>
<tr>
<td>CEC 527</td>
<td>Mobile Sensor Networks</td>
<td>3</td>
</tr>
<tr>
<td>CEC 530</td>
<td>Image Processing and Machine Vision</td>
<td>3</td>
</tr>
<tr>
<td>CEC 610</td>
<td>State and Parameter Estimation</td>
<td>3</td>
</tr>
<tr>
<td>CS 528</td>
<td>Multi-Agent Systems</td>
<td>3</td>
</tr>
<tr>
<td>CS 529</td>
<td>Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>EE 500</td>
<td>Digital Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 505</td>
<td>Advanced Mechatronics</td>
<td>3</td>
</tr>
<tr>
<td>EE 525</td>
<td>Avionics and Radio Navigation</td>
<td>3</td>
</tr>
<tr>
<td>EE 529</td>
<td>Electro-Optical Systems</td>
<td>3</td>
</tr>
<tr>
<td>EE 625</td>
<td>Satellite-Based Communications and Navigation</td>
<td>3</td>
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</tbody>
</table>

Systems Engineering Area of Concentration
The Systems Engineering Area of Concentration only supports the Capstone Option.

Required Courses for Systems Engineering Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ME 503</td>
<td>Unmanned and Autonomous Vehicle Systems</td>
<td>3</td>
</tr>
<tr>
<td>SYS 505</td>
<td>System Safety and Certification</td>
<td>3</td>
</tr>
</tbody>
</table>
For exceptional students enrolled in an engineering Master of Science degree program, the College of Engineering and the David B. O'Maley College of Business offer the opportunity to simultaneously pursue a Master of Science in Engineering (Aerospace, Civil, Computer, Cybersecurity, Electrical and Computer, Mechanical, Software, Systems, Unmanned Autonomous Systems) and a Master of Business Administration.

With this option, the student will take a total of 30 credits to obtain a MS in Engineering and an additional 21 credits to obtain an MBA. Twelve (12) credits from the MS in Engineering will count towards the MBA's total requirement of 33 credits. One of those courses has to be BA 511 and the remaining 3 courses have to be approved by both the MBA program coordinator and the respective MS in Engineering program coordinator. See specific description below.

Graduate students may apply to the Dual MS in Engineering and MBA option by submitting an application to both, the respective engineering and business graduate program coordinator. Students must have completed 12 credit hours toward the respective MS in Engineering degree and must have a 3.0 minimum GPA to be admitted to the dual degree program. Students will be dropped from the program if their GPA falls below 3.0. In addition, students will also have to complete the MBA Prep-Series successfully before being admitted to the MBA program.

Dual Degree Program Description:

MS in Engineering Degree Requirements (for each discipline) (30 credits):

These courses include required and elective credits as specified by each graduate engineering program and as per respective graduate program coordinator approval.

BA 511 - Operations Research (3 credits), which can satisfy one of the electives or a math requirement for MS in engineering students.

MBA Degree Requirements (21 additional credits):

ACC 517  Accounting for Decision Making  3
BA 514  Strategic Marketing Management in Aviation  3
BA 518  Managerial Finance  3
Ph.D. in Aerospace Engineering

Ph.D. Program

Learn more about the Ph.D. in Aerospace Engineering (http://daytonabeach.erau.edu/coe/degrees/phd-program/aerospace-engineering) at the Daytona Beach College of Engineering website.

The Ph.D. in Aerospace Engineering is conferred in recognition of creative work and the ability to investigate scientific and engineering problems independently, as well as completion of the coursework necessary to build a solid foundation for research. In addition to its academic rigor, the degree emphasizes discovery of new knowledge and performance of research of importance to industry and to the aerospace engineering community. Admission to the program is reserved for candidates at the bachelors and masters levels, with high academic achievement and a desire to advance their career through scientific inquiry and knowledge discovery in areas related to aerospace engineering.

Overview

The objective of the Ph.D. in Aerospace Engineering is to provide an opportunity for highly motivated students with a strong science and engineering background to participate in a program of research and course work in the areas of Aerodynamics & Propulsion, Dynamics & Control, and Structures & Materials while earning their doctoral degree.

The degree is conferred primarily in recognition of original research and completion of a dissertation resulting in journal publications. In addition, a minimum number of advanced courses that help students build a solid foundation for Ph.D. level research is required.

Although the program is designed for delivery through traditional residential format, provisions are in place to allow highly qualified working individuals in industry or government to participate, when appropriate arrangements can be made.

Areas of Concentration

There are three areas of concentration in the Ph.D. in Aerospace Engineering:

- **Aerodynamics & Propulsion** focuses on aerodynamics, viscous flows, hypersonic flows, and jet engine and rocket aero-thermodynamics. Courses are offered in these subjects, as well as in specialized topics such as combustion, heat transfer, aeroacoustics, and rotorcraft aerodynamics. Computational Fluid Dynamics (CFD) is offered at an introductory level. Advanced level topics include CFD as well as turbine engine systems. Research topics within the Aero-Propulsion group include: Aeroacoustic modeling and noise mitigation; micro air vehicles and synthetic jets for mitigating icing and flow separation; heat transfer in turbine blades; rocket propulsion simulation; Unmanned Aerial Vehicles; hypersonic vehicles and hypersonic combustion; pulsed detonation engines; extending stall margins in fans and compressors; rotorcraft aerodynamics; turbulent boundary layer/shear layers and their control; two-phase boundary layers; fluid structure interaction; numerical simulation of plasma for flow control and plasma assisted combustion;
and LES of compressible turbulence and high speed combustion.

- **Dynamics & Control** focuses on the modeling of complex dynamical systems and the design, implementation and testing of guidance, navigation and active feedback control of these systems to meet rigorous requirements and high levels of performance. Particular research topics include autonomous unpiloted air and ground vehicles; evolving aerospace structures and formations; control of flexible aerospace structures; networked systems; aircraft guidance control and handling qualities; spacecraft guidance, navigation and control, with emphasis on rendezvous and proximity operations; aviation safety; artificial intelligence; wind energy systems; and control of quantum information systems.

- **Structures & Materials** focuses on the study of aeroelasticity, vibration, fracture mechanics, thermoelasticity, composite materials, nanomaterials, smart materials, structural health monitoring, reliability analysis, computational structural mechanics, and design optimization. Particular research topics include aircraft structural design; aeroelastic tailoring; design for additive manufacturing; optimization of composite structures; smart actuators and systems; guided-wave structural health monitoring; static and impact performance of lightweight materials; use of carbon nanotubes and graphene for strengthening and repair of composites; and molecular dynamic simulation.

**Advantages**
The Ph.D. in Aerospace Engineering program targets domestic and international students, as well as working professionals with a Masters degree in aerospace engineering (or closely related engineering disciplines), who have exemplary track records of academic achievement in their course work, and demonstrated keen interest and ability for engaging in research and independent inquiry.

**Requirements**
Applicants to the Ph.D. in Aerospace Engineering must:

1. have superior academic records with a minimum Masters cumulative grade point average (CGPA) of 3.5.
2. have taken the Graduate Record Examination (GRE), and have an acceptable score on both quantitative and verbal sections.
3. submit a complete application package before the deadline specified in the University catalog.
4. International applicants whose primary language is not English must also achieve the minimum score requirement of TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Test System) as required by the University. The minimum acceptable scores are 79 TOEFL or 6.0 IELTS.

While the typical time for completing the Ph.D. in Aerospace Engineering will be three (3) years for students with a Masters degree, it will be the policy of the College of Engineering that the total duration of the doctoral study should not exceed five (5) years beyond the Masters degree. Exceptions will be allowed when justified.

**Degree Requirements**
The Ph.D. in Aerospace Engineering will be conferred primarily in recognition of creative accomplishment and the ability to investigate scientific or engineering problems independently. The doctoral program also requires completion of advanced coursework that helps students build a solid foundation for Ph.D. level research.

A student in the Ph.D. program is expected to:

1. complete an approved plan of study during the first semester as a Ph.D. student
2. pass the qualifying examinations to achieve advancement to candidacy
3. pass the preliminary examination (present a dissertation proposal acceptable to the dissertation committee)
4. complete a program of significant original research
5. prepare and defend a dissertation concerning the research work
6. complete the credit hours requirement listed below

Candidates will have an Aerospace Engineering faculty member assigned as their research advisor.
and chair of their dissertation committee. The candidate and advisor will work collaboratively to define the research topic, to determine the courses of study and to select appropriate members of the dissertation committee. Working under the auspices and direction of the advisor, the candidate will be responsible for developing a research plan and the dissertation proposal.

**Credit Hours Requirement**
For students with a Master degree, the curriculum requires a minimum of 42 credit hours, including a minimum of 18 credit hours of coursework (including one advanced math course) and a minimum of 24 credit hours of dissertation research.

For students with a BS degree, the student needs to complete the requirements for a Master degree first in addition to the 42 credit hours mentioned above.

At least six hours of coursework must be at 600 level. At most six hours of non-AE courses in EP, other Engineering, or MA, with Advisor and Program Coordinator approval.

**Qualifying Examinations**
A Ph.D. student must take the qualifying examination in both mathematics and their area of concentration (i.e. Aerodynamics & Propulsion, Structures & Materials or Dynamics & Control).

The qualifying examinations are given once a year in early May. A student must pass the qualifying examination prior to presenting a dissertation proposal.

- See Ph.D. AE Qualifying Examination Procedure (p. 284) for details.

**Preliminary Examinations**
The purpose of the preliminary examination is to evaluate students’ readiness for conducting their proposed research, assess their ability to use their knowledge to carry out independent and creative research and confirm their potential for successful completion of the Ph.D. dissertation. A Ph.D. student must take the preliminary examination within one year after completing the qualifying examinations.

The preliminary examination consists of a written research proposal and an oral presentation, which is made to the examining committee. The preliminary examination is to evaluate student’s readiness for completing the proposed research.

**Dissertation Defense**
The dissertation defense is the candidate’s presentation of the work accomplished since the passing of the preliminary examination, and has been deemed sufficient and complete by the candidate’s advisor. The defense is administered by the student’s dissertation committee, in accordance with Department of Aerospace Engineering, College of Engineering and University guidelines. The purpose of the examination is to evaluate the student's research efforts and written dissertation, to determine if the candidate is qualified to receive a Ph.D. in Aerospace Engineering. The major areas of emphasis of this examination are the quality and originality of the candidate’s research, and his/her knowledge and understanding of the general areas of study related thereto.

**Advisor and Dissertation Committee**
Students must have an advisor from the faculty of the Aerospace Engineering department when he/she is admitted to the doctoral program in aerospace engineering.

A student must work with his/her major advisor to form a plan of study, a proposed calendar of events and a dissertation committee. The dissertation committee is composed of four faculty members of Embry-Riddle Aeronautical University’s Daytona Beach Campus, including at least three faculty members from the Aerospace Engineering Department. The fourth member should be a faculty from outside the Aerospace Engineering Department, i.e. faculty in another Engineering Department, or Physics, Mathematics. etc. In the event that a student is involved in collaborative research with an outside institution and/or company, one or more qualified members from these entities may serve on the dissertation committee, in addition to the four faculty members from the Daytona Beach Campus. The student’s advisor serves as the chair of the dissertation committee. The dissertation committee must be formed within two semesters of the student’s admission to the Ph.D. program.

**Annual Progress Review**
The dissertation committee will review the progress of the Ph.D. student/candidate once a year. The purpose of the review is to ensure that students
continue to make satisfactory progress toward their degree objective. All major recommendations from this annual review will be forwarded to the student, with an assessment of achievements and of areas where improvements are expected.

Application Deadlines
The following deadlines are used in the admission of Ph.D. AE students:
- The deadline for admission with financial aid for Fall semester: January 15
- The deadline for admission with financial aid for Spring semester: September 15

Guidelines on PhD AE Qualifying Exams

Purpose of Qualifying Exams
Prior to being formally admitted to candidacy for the PhD AE degree, the student must demonstrate knowledge of aerospace engineering fundamentals by passing qualifying exams (QE). The purposes of the qualifying exams are:

- To motivate students to review course work learned that lays foundations for PhD research
- To determine the student’s ability to understand fundamental concepts and potential to pursue doctoral research
- To identify areas that need to be strengthened for the student to be successful in PhD research

Subject Areas of Qualifying Exams
The qualifying exams cover core areas of aerospace engineering and fundamentals of mathematics. A student is required to take:

- Qualifying exam in mathematics
- Qualifying exam in a the chosen Area of Concentration

Specifically, the qualifying exams will be offered annually in Mathematics and all three areas of concentration: a.) Aerodynamics and Propulsion, b.) Structures & Materials, and c.) Dynamics & Control.

Qualifying subject exam in Mathematics
This exam is composed of required topics and elective topics.

Required Topics

1. Mathematics for engineers
2. Ordinary differential equations

Elective Topics (select two):

1. Partial differential equations
2. Numerical analysis
3. Optimization
4. Complex variables

Reference Courses for Qualifying Exam

<table>
<thead>
<tr>
<th>Preparation in Mathematics</th>
<th>Mathematics for engineers MA 441</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary differential equations</td>
<td>MA 345</td>
</tr>
<tr>
<td>Partial differential equations</td>
<td>MA 502</td>
</tr>
<tr>
<td>Optimization</td>
<td>AE 526 and MA 510</td>
</tr>
<tr>
<td>Numerical analysis</td>
<td>EP 501</td>
</tr>
<tr>
<td>Complex variables</td>
<td>MA 543</td>
</tr>
</tbody>
</table>

Qualifying subject exam in Aerodynamics & Propulsion
This exam is based on three graduate core courses in the concentration:

1. Advanced Compressible Flow (AE 504)
2. Advanced Incompressible Aerodynamics (AE 528)
3. Viscous flow (AE 521)

A student is required to select two out of the three topics.

Reference Courses for Qualifying Exam

<table>
<thead>
<tr>
<th>Preparation in Aerodynamics &amp; Propulsion</th>
<th>Compressible flow AE 504</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incompressible aerodynamics</td>
<td>AE 528</td>
</tr>
<tr>
<td>Viscous Flow</td>
<td>AE 521</td>
</tr>
</tbody>
</table>

Qualifying subject exam in Structures & Materials
This exam is based on three graduate core courses in the concentration:
1. Introduction to Continuum Mechanics (AE 548)
2. Introduction to the Finite Element Method (AE 514)
3. Analysis of Aircraft Composite Materials (AE 522)
A student is required to select two out of the three topics.

Reference Courses for Qualifying Exam
Preparation in Structures & Materials
<table>
<thead>
<tr>
<th>Structure</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 548</td>
<td></td>
</tr>
<tr>
<td>Finite element method</td>
<td>AE 514</td>
</tr>
<tr>
<td>Composite materials</td>
<td>AE 522</td>
</tr>
</tbody>
</table>

Qualifying subject exam in Dynamics & Control
This exam is based on three graduate core courses in the concentration:
1. Modeling and Simulations of Linear dynamic systems (AE 523)
2. Modern Control Systems (AE 527)
3. Analytical Dynamics (AE 544)
A student is required to select two out of the three topics.

Reference Courses for Qualifying Exam
Preparation in Dynamics & Control
<table>
<thead>
<tr>
<th>Dynamics &amp; Control</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear dynamic systems</td>
<td>AE 523</td>
</tr>
<tr>
<td>Modern control systems</td>
<td>AE 527</td>
</tr>
<tr>
<td>Analytical Dynamics</td>
<td>AE 544</td>
</tr>
</tbody>
</table>

Qualifying Exam Schedule
The qualifying exams are offered in May, usually the week right after the spring semester’s final exams period. The qualifying exams are offered in two consecutive days with concentration QE on day one and Math QE on day two.

A student must take both Math QE and concentration QE within one year of being admitted to PhD AE program, including those admitted to the program with BS degree.

A student who plans to take the qualifying exams must file a request form at least one month before the exams. If a student plans to take a Math QE, he/she must select two topics from the list of Math electives above. The request form must be signed by the student’s dissertation advisor.

Grading of Qualifying Exam
One of the following grades will be assigned to a student for each QE taken:
- Pass
- Pass with conditions
- Fail

If a student fails both the Math QE and the concentration QE, the student will be dismissed from the PhD AE program.

If a student fails either the Math QE or the concentration QE, the student must take and pass the make-up exam in the immediate following August, during the first week of the fall semester. Otherwise, the student will be dismissed from the PhD AE program. Oral exams may be given as part of the make-up exam.

If a student receives “Pass with Conditions” in an exam, the QE committee may decide to put conditions (e.g. taking an additional course) for a passing grade. After the conditions are satisfied, the grade becomes a “Pass”.

Ph.D. in Electrical Engineering and Computer Science
The PhD in Electrical Engineering and Computer Science (EE&CS) is a terminal degree program designed to demonstrate a student’s mastery in her/his field and ability to perform original research. The degree program is research-oriented and will prepare graduates for careers in research and development in the corporate, government, or academic arenas. Students will be expected to conduct guided independent research culminating in a dissertation that contributes to the body of knowledge in the discipline. Successful students will be self-motivated, have in-depth knowledge, and be creative and critical thinkers.

Admissions Requirements
The ECSSE department administers admission to the Ph.D. in EE&CS. The department Ph.D.
committee, comprised of five faculty members including its chair, the EE&CS Ph.D. Program Coordinator, reviews and evaluates applications. Minimum requirements for admission to the program are:

1. Have completed a BS or higher degree in Computer Engineering, Computer Science, Electrical Engineering, Software Engineering, Systems Engineering, or a closely related field from an ABET accredited program or international equivalent.

2. Have excellent academic credentials with a minimum CGPA of 3.2 on a 4.0 scale.

3. Have taken the GRE within 5 years of application, with scores having been reported to the university.

4. Have demonstrated an aptitude for high-level research through submission of resumes, publications, portfolios, and/or through on-site or electronically-mediated interviews.

5. Have submitted a written statement outlining their research interests and personal goals.

6. Have submitted 3 letters of recommendation attesting to their aptitude, character, and work ethic.

7. Have submitted a completed application packet to Graduate Admissions by the appropriate deadline.

8. Have met university requirements for demonstration of English proficiency (international students whose native language is not English).

Achievement of the minimum requirements alone will not guarantee admission. The committee will admit only students deemed to have a high probability of successfully completing the Ph.D.

Degree Requirements
The awarding of the Ph.D. degree signifies an individual's expertise in a field of study and their ability to conduct original research that adds to the state-of-the-art of knowledge in the field. The requirements for the Ph.D. in EE&CS are focused heavily towards enabling and requiring the student to establish, complete, and defend a program of original research.

To earn a PhD in Electrical Engineering and Computer Science a student is required to:

1. Define and complete a plan of study of coursework in the field.

2. Pass a qualifying examination to be admitted to degree candidacy.


4. Define and complete a program of original research.

5. Prepare and defend a dissertation concerning the research work.

Credit Hour Requirements
Students entering the program with a Master of Science degree shall complete a minimum of 42 credit hours of additional graduate work past the master’s to earn the doctorate. Of those 42 credit hours, at least 18 must be coursework and at least 24 must be dissertation. Students entering with a bachelor’s degree shall complete at least 72 credit hours of graduate work beyond their baccalaureate degree: at least 48 credit hours of coursework and at least 24 credit hours of dissertation research.

For coursework in the program, at least one course is required to be 500-, 600-, or 700-level mathematics and the remaining must be 500-, 600-, or 700-level courses in the COE or a field closely related to the individual student’s research. All students are required to complete a plan of study, approved by the student’s advisor and submitted to the Ph.D. Program Coordinator within the first year of enrollment in the program, outlining the courses to be taken in support of their individual research topics. All Ph.D. students are required to maintain a minimum GPA of 3.0 throughout their tenure in the program. Standard course load for a doctoral student is six credit hours per semester, although the student’s advisor may permit higher loads.

Students entering the program with a BS may choose to fulfill the requirements of one of the master’s programs in the ECSSE department, thesis or non-thesis option, with the master’s degree awarded upon completion of that program’s requirements, independent of completion of the doctorate. Those students will be expected to complete nine credit hours per semester during their
first year in the program in order to complete required course work and focus on research. Ph.D. program funding will not be available to students until after completion of 30 credits of academic coursework.

Qualifying Examination
All PhD students will be required to demonstrate their aptitude and mastery of the engineering fundamentals, including mathematics, by passing a qualifying examination. The exam will be administered not less than once per year. If a student fails the qualifying exam when first sitting for it, they shall take the exam again at its next offering. Students who fail to pass the qualifying exam within two attempts will be dismissed from the program at the end of the semester containing the second failed attempt. Students who pass the qualifying exam are eligible to schedule the preliminary examination.

The departmental Ph.D. committee will have the authority to administer the qualifying exam. Students will be required to demonstrate mastery of mathematics and EE&CS topical areas. The departmental committee will determine the precise form of the examination.

Dissertation Committee
All doctoral students are required to from a dissertation committee consisting of five members, including a dissertation advisor chosen from among the ECSSE faculty. The committee must include at least two other ECSSE faculty members besides the dissertation advisor; at least one committee member must come from outside the department. Qualified non-ERAU personnel and ex-officio members may be appointed to the committee in compliance with university doctoral policies. The dissertation advisor shall serve as chair of the dissertation committee. If the student desires to work with a research advisor from outside the department, that person and the dissertation advisor shall co-advice the student and co-chair the committee. The advisor shall be selected within one year of matriculation, and the committee shall be established within one year of the student’s passing the qualifying examination.

Preliminary Dissertation Examination
The core of the EE&CS Ph.D. is original research conducted by the student under the guidance of the dissertation committee. Within one year after completing the qualifying exam, each student is required to pass a preliminary dissertation examination. The student will prepare a written research proposal outlining the proposed topic of research, a review of literature, an outline of the proposed approach, an estimate of resources required, and a schedule of milestones and events. The student will then orally defend this proposal before the dissertation committee.

The preliminary exam is passed and the student admitted to Ph.D. candidacy when the dissertation committee accepts and approves the proposal. If the proposal fails to meet the committee’s expectations, the student will be given one chance to revise the proposal and retake the preliminary exam. The proposal revision and exam retake must occur within six months of the initial failed examination. Students who fail again to successfully complete the preliminary examination will be dismissed from the program at the end of the semester containing the second failed attempt.

Dissertation and Defense
Each Ph.D. student is required to complete a research program and individually prepare an original dissertation that significantly contributes to state-of-the-art of knowledge in the field. The dissertation shall be prepared according to ECSSE, COE, and university guidelines. It must contain an outline of the problem and its significance, a review of the relevant literature, a description of the methodology, a presentation of results, and a set of conclusions emphasizing the original contributions made by the work.

Students are required to defend the dissertation subject to ECSSE, COE, and university oral defense guidelines. A minimum of one semester must elapse between the preliminary exam and the dissertation defense. Students who pass their defense are eligible for degree conferral upon completion of all other program requirements. Students who fail the defense may be asked to revise their work and re-defend or may be dismissed from the program according to the committee’s judgment and recommendations. The dissertation preparation, oral examination, and archival submission must comply with all requirements of appropriate university doctoral policies.

Annual Progress Review
All doctoral students are subject to an annual progress review by the dissertation committee. The
committee will review the student’s academic and research progress to assess the achievements, provide guidance, and make recommendations for improvement. The advisor shall forward a status report regarding each student’s progress to the department Ph.D. committee. Students who demonstrate unsatisfactory progress towards a degree as judged by the dissertation committee, the department committee, or in accordance with policy APD-15 may be recommended to the department chair for dismissal from the program.

**Ph.D. in Mechanical Engineering**

The Ph.D. in Mechanical Engineering is a terminal degree program designed to demonstrate a student’s mastery in the field and ability to perform original research. The degree program is research-oriented and will prepare graduates for careers in research and development in the corporate, government, or academic arenas. Students will be expected to conduct guided independent research culminating in a dissertation that contributes to the body of knowledge in the discipline. Successful students will be self-motivated, have a high level of academic knowledge, and be excellent critical thinkers.

**Admissions Requirements**

Admission to the Ph.D. program will be administered through the Mechanical Engineering department. Applications will be reviewed and evaluated by a departmental Ph.D. committee chaired by the Mechanical Engineering Ph.D. Program Coordinator.

The minimum requirements for admission to the program are:

- Have completed a B.S. or higher degree in Mechanical Engineering or a closely related field from an accredited institution
- Have excellent academic credentials with a minimum CGPA of 3.5 on a 4.0 scale
- Have taken the GRE within 5 years of application and reported the scores to the university (this requirement may be waived for exceptional candidates)
- Have demonstrated an aptitude for high-level research through submission of resumes, publications, portfolios, and/or through on-site or phone interviews
- Have submitted a written statement outlining the student’s research interests and personal goals
- Have submitted 3 letters of recommendation attesting to the student’s aptitude, character, and work ethic
- Have submitted a completed application packet to Graduate Admissions by the appropriate deadline
- International students must meet university requirements for demonstration of English proficiency and verification of academic records

Admission to the Ph.D. program is highly selective: meeting the minimum requirements does not guarantee admission. It is expected that successful candidates will significantly exceed the minimum requirements in all areas and will be able to perform research in areas of interest to Mechanical Engineering faculty. Preference may be given to students holding MS degrees.

**Degree Requirements**

The awarding of the degree of Ph.D. is intended to signify recognition of an individual’s expertise in a field of study and their ability to conduct original research that adds to the state-of-the-art of knowledge in the field. Therefore, the requirements for the Ph.D. in Mechanical Engineering are focused heavily towards enabling and requiring the student to establish, complete, and defend a program of original research.

To earn a Ph.D. in Mechanical Engineering a student is required to:

- Define and complete a plan of study of coursework in the field
- Pass a qualifying examination to be admitted to degree candidacy
- Pass a preliminary examination that includes the presentation of a dissertation proposal
- Define and complete a program of original research
- Prepare and defend a dissertation that demonstrates mastery in the student’s area of research
- Present the research findings at a National or International conference and publish the results at the conference proceedings
- Submit the research work for publication at a peer-reviewed scientific journal
Credit Hour Requirements
All Ph.D. students will be required to complete a minimum of 72 credit hours of graduate work beyond their baccalaureate degree or a minimum of 42 credit hours beyond their master’s degree. Students entering the program with a B.S. must also fulfill the requirements of the Master of Science in Mechanical Engineering program. The Master of Science in Mechanical Engineering degree will be awarded upon completion of the M.S. requirements, independent of the Ph.D.

Beyond the requirements of the MS degree, Ph.D. students must complete a minimum of 18 credit hours of coursework and 24 credit hours of dissertation research. This work must be completed in compliance with transfer and residency requirements of academic policy APD-04. Of the 18 hours of coursework, at least one course is required to be 500, 600, or 700-level mathematics and the remaining must be 500, 600, or 700-level courses in the COE or a field closely related to the individual student’s research. All students will be required to complete an approved plan of study outlining the courses to be taken in support of their individual research topics. The plan of study must be approved by the student’s advisor and submitted to the Ph.D. Program Coordinator within the first year of enrollment in the program.

All Ph.D. students will be required to maintain a minimum GPA of 3.0 throughout their tenure in the program. Standard course load for a Ph.D. student is expected to be 6 credit hours per semester, although higher loads may be permitted with approval of the student’s advisor. Students entering the program with a B.S. degree will be expected to complete 9 credit hours of lecture coursework per semester during their first year in the program. Students will be limited to a maximum of 6 credit hours of dissertation research per semester and a total of 6 credit hours in the summer.

Qualifying Examination
All Ph.D. students will be required to pass a qualifying examination to demonstrate the student’s aptitude and mastery of the fundamentals of engineering and mathematics. The exam will be administered at least once per year. Students who fail to pass the qualifying exam within two attempts will be dismissed from the program at the end of the semester in which they fail a second time. Students who pass the qualifying exam are eligible to schedule a preliminary examination.

The qualifying exam is defined and administered by the Mechanical Engineering department Ph.D. committee. Due to the broad portfolio of subject areas within Mechanical Engineering, the qualifying exam will require students to demonstrate mastery within mathematics plus at least two other Mechanical Engineering topical areas.

Dissertation Committee
All Ph.D. students will be required to select an advisor from among the College of Engineering Ph.D. faculty and to form a dissertation committee consisting of not less than four additional Embry-Riddle Aeronautical University Ph.D. faculty. The committee must include at least two members from Mechanical Engineering, with the advisor serving as chair of the committee and the majority of the members must be from the College of Engineering. Qualified non-Embry-Riddle Aeronautical University personnel and ex-officio members may be appointed to the committee in compliance with university policies. The advisor must be selected within one year of matriculation and the committee must be established within one year of the student passing the qualifying examination.

Preliminary Examination
The core of the Mechanical Engineering Ph.D. will be original research conducted by the student under the guidance of the dissertation committee. Within one year after completion of the qualifying exam, each student will be required to pass a preliminary examination. The student will prepare a written research proposal outlining the proposed topic of research, a review of literature, an outline of the proposed approach, an estimate of resources required, and a schedule of milestones and events. The student will then orally defend this proposal to the dissertation committee.

If the proposal is accepted, the student will be passed and admitted to Ph.D. candidacy. If the proposal fails to meet the committee’s expectations, the student will be given one chance to revise and retake the preliminary examination. The retake must occur within 6 months of the failed examination. Students who fail to successfully complete the preliminary examination will be dismissed from the program.
program at the end of the semester in which the second failed attempt occurs.

Dissertation and Defense
Each Ph.D. student will be required to complete a research program and individually prepare an original dissertation that significantly contributes to the state-of-the-art of knowledge in Mechanical Engineering. The dissertation should be prepared according to Mechanical Engineering, College of Engineering and University guidelines and contain an outline of the problem and its significance, a review of the relevant literature, a description of the methodology, a presentation of results, and a set of conclusions emphasizing the original contributions made by the work. The dissertation must meet all requirements of university policy.

Students will be required to defend the dissertation subject to Mechanical Engineering, College of Engineering, and University oral defense guidelines. A minimum of 6 months must elapse between the preliminary and final examinations. The examination and submission of the dissertation will be administered in compliance with university policy. Students who pass their defense are eligible for degree conferral upon completion of all other program requirements. Students who fail the defense may be asked to revise their work and re-defend or may be dismissed from the program according to the committee’s judgment and recommendations.

Annual Progress Review
All Ph.D. students will be subject to an annual progress review by the dissertation committee. The committee will review the student’s academic and research progress to assess the achievements and make recommendations for improvement. If the committee fails to meet, the student’s advisor may perform the progress review on their behalf. Students who fail to demonstrate satisfactory progress towards a degree as judged by the committee or in accordance with university policy may be recommended to the department chair for dismissal from the program.
Undergraduate Courses

Courses numbered 1–99 are basic skills courses and do not apply toward degree requirements. Courses numbered 100–299 are lower-division courses and are generally taken in the freshman and sophomore years. Many lower-division courses serve as prerequisites for other coursework, so students are urged to plan ahead to meet necessary prerequisites. Courses numbered 300–499 are upper-division courses, reflecting advanced levels of technical skills and disciplinary knowledge. Upper-division work is generally taken in the junior and senior years. Only the dean of a college, or an appointed designee, may waive corequisite and prerequisite requirements. The University reserves the right to administratively drop a student from a course in which prerequisite requirements have not been met.

Course numbers ending in 96 or 97 identify special sequential courses. Those ending in 98 provide students with a unique, collective program of learning activities supervised by a professor. Courses ending in 99 denote individual study between professor and student.

Numbers in parentheses, immediately following course titles and numbers, indicate lecture and laboratory hours that a class meets each week. For example, (3,3) signifies that the course consists of three lecture hours and three laboratory hours weekly.

A limited number of courses are offered as hybrids, bearing the HYB course designator. In hybrid courses, students and professors meet face-to-face, but some class sessions take place online. HYB courses have the same learning outcomes as regular courses and have comparable grading standards and assignments. HYB courses can present challenges to some students, however. For example, students enrolling in HYB courses should have excellent time management skills. For more information and to gauge whether or not to enroll in an HYB course, students should contact the corresponding instructor and/or department.

The following courses are not necessarily offered every term, nor are they offered at all campus locations.

Accounting (ACC)

Courses

ACC 210 Financial Accounting 3 Credits (3,0)
An introduction to accounting information systems and financial reports, including accounting concepts and analysis and interpretation of financial reports with an emphasis on the operating activities of aviation-related businesses.

ACC 312 Managerial Accounting 3 Credits (3,0)
Emphasizes management's use of cost information in internal decision-making. Decision-making processes include cost analysis, control, allocation, and planning. A variety of accounting techniques applicable to aviation/aerospace companies are presented.

Prerequisites: ACC 210.

ACC 338 Intermediate Accounting I 3 Credits (3,0)
Intermediate Accounting I is the first of two intermediate financial accounting courses. The objective of this course is to contribute to the development of the student's ability to understand and analyze financial accounting topics and to learn how to prepare and read annual reports. The course enables the student to develop an understanding of the institutional framework surrounding the development of generally accepted accounting standards (GAAP), applying the theory of financial accounting and reporting, evaluating the methodology used to report an enterprise's financial position and results of operations, and applying GAAP to various business events. Topics include the conceptual framework of accounting, accounting information systems, financial statements, receivables, inventories, acquisition and disposition of property, plant and equipment, depreciation and intangible assets.

Prerequisites: ACC 210.
ACC 340 International Accounting 3 Credits (3,0)
This course introduces the student to accounting in the global environment. The student will learn about accounting systems and reporting practices around the world. Efforts toward accounting harmonization and the impact of international financial reporting standards will be discussed. Specific accounting topics such as accounting for currency exchange rate changes; financial reporting and disclosure issues in a global context; and using financial statements across borders and in emerging capital markets, will be covered. Managerial issues in an international context will also be discussed.
Prerequisites: ACC 210.

ACC 348 Intermediate Accounting II 3 Credits (3,0)
Intermediate Accounting II is the second of two intermediate financial accounting courses. The objective of this course is to continue the development of the student's ability to understand and analyze financial accounting topics and to learn in greater depth and detail how to prepare and read annual reports. The course enables the student to develop a more detailed understanding of the institutional framework surrounding the development of generally accepted accounting standards (GAAP), applying the theory of financial accounting and reporting, evaluating the methodology used to report an enterprise's financial position and results of operations, and applying GAAP to various more technical business transactions. Topics include current and non-current liabilities, leases, deferred taxes, retirement benefits, stockholders' equity, earning per share, accounting changes and errors, statement of cash flows, and full disclosure in financial reporting.
Prerequisites: ACC 210 and ACC 338.

ACC 351 Auditing Principles and Procedures 3 Credits (3,0)
This course introduces students with the basic concepts of auditing and the role the auditor plays in a business environment. The course examines the nature of auditing by focusing on both auditing principles and practice including statutory requirements; auditing standards; guidelines; and other professional pronouncements. The course also addresses the auditing ethical and legal environment, objectives and procedures, materiality, risk management, sampling, and auditing in a computer environment.
Prerequisites: ACC 210.

ACC 439 Federal Taxation 3 Credits (3,0)
This course focuses on the fundamentals of federal income taxation. The materials covered will include the tax concepts and applications in corporate taxation, individual taxation, partnership taxation, transactions in property, and gift and estate taxation.

Aeronautical Science (AS)
Courses
AS 120 Principles of Aeronautical Science 3 Credits (3,0)
An introductory course in Aeronautical Science designed to provide the student with a broad-based aviation orientation in flight-related areas appropriate to all non-Aeronautical Science degree programs. Subjects include historical developments in aviation and the airline industry; theory of flight; airport operations; aircraft systems and performance; elements of air navigation; basic meteorology theory; air traffic principles; flight physiology; and aviation regulations and safety. Not available to Aeronautical Science students, students with FAA pilot certificates, or students who have credit for AS 121.
AS 121  Private Pilot Operations  5 Credits (5,0)
This course develops the aeronautical knowledge required for certification as a Private Pilot with an Airplane Single Engine Land rating. Topics include: regulations, safety, pre-solo operations, cross-country planning, airspace, chart use, communications, weather, performance, weight and balance, aerodynamics, and decision-making. Students must register for the same section of AS 121 and ASC 101. A grade of C or better is required in any program, minor or area of concentration requiring AS 121.
Corequisites: ASC 101.

AS 199  Special Topics in Aeronautical Science  1-6 Credit
Individual independent or directed studies of selected topics in general aviation.

AS 220  Unmanned Aircraft Systems  3 Credits (3,0)
This course is a survey of unmanned aircraft systems (UAS), emphasizing the military and commercial history, growth, and application of UASs. The course will include basic acquisition, use, and operation of UASs with an emphasis on operations.
Prerequisites: Proof of US Citizenship
Corequisites: UA 101.

AS 221  Instrument Pilot Operations  3 Credits (3,0)
This course develops aeronautical knowledge required for addition of an Instrument Airplane rating to a Private Pilot certificate. Topics include instrument flying regulations, safety, operations, navigation systems, chart use, weather, flight planning, decision-making, and crew resource management. A grade of C or better is required in any program, minor or area of concentration requiring AS 221.
Prerequisites: AS 121.

AS 222  Unmanned Aircraft Systems Security  3 Credits (3,0)
Unmanned Aircraft System Security is a sophomore level seminar course focused on the concepts of UAS security and protection. Through a combination of instructor lead discussion, assigned readings, and projects students will examine the concepts of security engineering, vulnerability, and malicious attack. Students will formulate opinions and strategies for protecting systems and assets from danger while understanding the implications of ignoring security concerns.
Prerequisites: AS 220 and UA 101 and proof of US citizenship.

AS 235  Unmanned Aircraft Systems Operation and Cross-Country Data Entry  3 Credits (3,0)
This course provides an understanding of the core technologies of unmanned aircraft systems. It will include examinations of the design concepts, powerplants, control systems, and communication technologies utilized in current unmanned aircraft systems and/or likely to be used in the next few years. Particular attention will be given to the technical capabilities, best applications, and operational best practices of cross-country flight planning for today’s UASs. Proof of US citizenship is required for DB students.
Prerequisites: AS 121 and AS 220 UA 101 and proof of US citizenship.

AS 235L  UAS Mission Planning  1 Credit (0,1)
This laboratory is dedicated to Unmanned Aircraft System (UAS) flight planning techniques, procedures, and methods for UAS operations. Students will apply vehicle specific knowledge to create detailed flight plans and adhere to procedures. This lab is designed to complement AS 235.
Prerequisites: AS 220L Corequisites: AS 235.

AS 237  UAS Applications in Aerial Photography  3 Credits (3,0)
This course will familiarize the student with guidelines, regulatory standards, and practical operational considerations for aerial photography and videography techniques specific to the use of Unmanned Aircraft Systems (UAS). Current procedures and relevant practical application methods will provide a basis for commercial applications that leverage future UAS technologies.
AS 254 Aviation Legislation 3 Credits (3,0)
This course examines the evolution of federal civil aviation regulations in the United States. Students will examine the past and present problems prompting regulation of the industry, the resultant safety legislation, airport development, funding, legislation, and international aviation legislation.

AS 299 Special Topics in Aeronautical Science 1-6 Credit
Individual independent or directed studies of selected topics in general aviation.

AS 309 Aerodynamics 3 Credits (4,0)
Students are provided with an opportunity to explore incompressible flow airfoil theory, wing theory. Topics center on calculation of stall speed, drag, basic performance criteria, configuration changes, high and low speed conditions, special flight conditions, and an introduction to compressible flow.

Prerequisites: PS 113 or PS 160 and MA 112 or MA 241.

AS 310 Aircraft Performance 3 Credits (3,0)
Aerodynamic performance of aircraft powered by reciprocating, turboprop, or jet turbine engines. Additional topics address stability and control, weight and balance, and operating data.

Prerequisites: AS 309.

AS 311 Aircraft Engines - Turbine 3 Credits (3,0)
A comprehensive study of aircraft gas turbine engine fundamentals and theory at the technical level. Areas of study include background, types, variations, and applications; engine theory; construction and design; systems and accessories and representative engines.

Prerequisites: PS 113 or PS 150 and MA 112 or MA 241.

AS 312 Ethics in Aviation Environment 3 Credits (3,0)
This course will introduce the student to decision making and sound business practice based on legal, ethical, moral, and statutory fundamentals. Students will be introduced to legal restraints and model professional rules pertaining to confidentiality and conflict of interest, as well as ethical and cultural issues such as competence and truthfulness as related to legal and aviation related professions. Emphasis will be on restraints placed on the decision-making process required of aviation and business professionals. Prerequisite is junior standing.

Prerequisites: Junior standing.

AS 315 Unmanned Aircraft Systems Robotics 3 Credits (3,0)
This course prepares students to integrate robotic technology into the hardware and software regimes of unmanned aviation. It will include examinations of control and system programming in the context of specific missions through guided discussions, simulation, and the operation of actual unmanned aircraft robotic systems.

Prerequisites: AS 220 and junior standing and proof of US citizenship.

AS 318 Safety Systems for UAS Operations in Public Safety 3 Credits (3,0)
This course explores the safe use of unmanned aircraft systems to support public safety operations. Students will examine the concepts of developing standard operating procedures (SOPs), conducting proper risk assessment and applying mitigation solutions, integrating safety management systems, and creating operational emergency response procedures. Students will formulate opinions and strategies to create safety systems and integrate safety concepts in to public safety operations for successful UAS operations.

Prerequisites: AS 220 and AS 222 and UA 101 and proof of US citizenship.
AS 319 UAS Law 3 Credits (3,0)
This course will introduce students to the evolving area of UAS law. Students will become familiar with how the various levels of government, federal (Constitution, statutes and regulations), state, and local, regulate UAS activity. The course will expose students to the following areas of law: constitutional, consumer protection, criminal, product liability and tort law. Participants in the course will also learn about the FAA rulemaking and enforcement process. Research skills will be applied to examine the impact of privacy doctrines on UAS operations. Throughout the course, students will have the opportunity to examine the legal issues that different types of UAS users (e.g., law enforcement, media, and agriculture) must contend with in operating UAS.
Prerequisites: Junior Standing.

AS 321 Commercial Pilot Operations 3 Credits (3,0)
This course develops aeronautical knowledge required for certification as a Commercial Pilot with Single and Multi-Engine Land ratings. Topics include multi-engine flying in VFR and IFR environments, including high altitude, night, winter, and mountain. Topics also include regulations, safety, weather, aerodynamics, weight and balance, performance, aircraft systems, navigation facilities, chart use, and decision-making. A grade of C or better is required in any program, minor or area of concentration requiring AS 321.
Prerequisites: AS 221 and FA 121.

AS 322 Operational and Industrial Aspects of UAS 3 Credits (3,0)
The design, development and operational fielding of Unmanned Aircraft Systems (UAS) for commercial application. Strategies to increase viability through the use of practical assessment techniques: Federal Aviation Regulation (FAR) interpretation; the descriptive analysis of outcomes that may improve longevity and profitability of commercial UAS applications.
Prerequisites: AS 220 and UA 101 and COM 221 and proof of US citizenship.

AS 323 Crew Resource Management for UAS 3 Credits (3,0)
Principles of organizational behavior, interpersonal relationship skills, and critical behavioral dynamics used by Unmanned Aircraft Systems (UAS) crews. Information processing, Human Error, Communications Processes, Problem Solving, Workload Management, and Situational Awareness with particular attention given to dealing with teleoperation and automation in UAS application.
Prerequisites: AS 220 and UA 101 and proof of US citizenship.

AS 332 Dispatch Aircraft Performance 3 Credits (3,0)
This course explores the aerodynamic performance of jet turbine powered aircraft with a focus on air crew Tier Dispatch Release development and interpretation. Topics include aerodynamics, turbine engine operation, performance curves, performance parameters, performance theory, weight and balance, and operational efficiency. This course may not substitute for AS 310 in the Aeronautical Science degree.
Prerequisites: AS 221 and MA 111.

AS 340 Instructional Design in Aviation 3 Credits (3,0)
The application of the method of scientific inquiry to the process of instruction in aviation is presented. This means the systematic design of instruction, based on knowledge of the learning process, taking into account as many factors about the particular situation as possible. Special emphasis will be placed on examining instructional problems and needs in aviation, setting a procedure for solving them, and then evaluating the results.
AS 350  Domestic and International Navigation  3
Credits (3,0)
This course will study FAR Part 121 domestic and flag regulations and evaluate their impact on long-range domestic and international flights. The student will be able to use ICAO, JAA, and FAA operational requirements and typical air carrier Ops SPECS to plan domestic and transoceanic flights. CBT simulation programs may be utilized as necessary to demonstrate actual flight scenarios. High-altitude airspace, navigation, and approach procedure chart interpretation will be examined in detail. Students will study and use the concepts of MNPS and RVSM airspace, dispatch procedures, ETOPS, ETP, driftdown, track messages, LRN accuracy checks, Oceanic Air Traffic Control clearances, international METARs and TAFs and emergencies and contingencies while on oceanic tracks. Communication systems requirements and methodology will be examined to include satellite, digital, and analog devices.
Prerequisites: AS 221
Corequisites: AS 310.

AS 356  Aircraft Systems and Components  3
Credits (3,0)
A comprehensive study of aircraft systems and components at the technical level. Areas of study include aircraft electrical, hydraulic, fuel, propeller, and auxiliary systems, including theory of operation, calculations, and related Federal Aviation Regulations. This course is not available for students who have received credit for the AMS systems course.
Prerequisites: PS 113 or PS 150 and MA 112 or MA 241.

AS 357  Flight Physiology  3 Credits (3,0)
This course explores aero- medical information. Topics include causes, symptoms, prevention, and treatment of flight environment disorders. Altitude effects, spatial disorientation, body heat imbalance, visual anomalies, and psychological factors are included as they relate to pilot performance and survival effectiveness.
Prerequisites: Sophomore standing.

AS 365  UAS Electronic Flight Management  3
Credits (3,0)
This course addresses the theory and principles governing flight guidance and control utilized in unmanned aircraft autopilots and flight management systems. Students will apply theory and principles by demonstrating good decision-making and procedural processes in the programming and control of unmanned aircraft system simulators.
Prerequisites: AS 235 and proof of US citizenship.

AS 368  UAS Sensing Systems  3 Credits (3,0)
This course is aimed at building a foundation of remote sensing principles and developing a fundamental understanding of the operation and design of equipment used to gather data from unmanned and autonomous platforms. Through guided discussion and team effort, students will address complex mission requirements by selecting and/or designing appropriate unmanned and autonomous systems appropriate for a given mission set. Students will explore sensor acquisition and procurement, limitations of the installation, and data interpretation. Proof of US citizenship is required for DB students.
Prerequisites: AS 235 and proof of US citizenship.

AS 380  Pilot Career Planning and Interviewing Techniques  1 Credit (1,0)
A course in which students will discuss and develop short-term and long-term job and career goals, conduct career research using various University and Industry resources, prepare a personal job search portfolio, prepare resumes and letters of application, and gain insights and proficiency in interviewing skills so they are better prepared to enter the job market upon graduation. Students will participate in simulated interview scenarios, will be expected to correspond with at least one company, and will be involved in the evaluation of letters, resumes, and interviews. This course will be graded Pass/Fail. Pre-Requisite: Junior standing
Prerequisites: Junior standing.
AS 384 European Aviation Appreciation 3 Credits (3.0)
An experiential, highly participatory course based around research at the great aviation museums of Europe. Students can expect to spend approximately three to four weeks (total) in London, Paris, and Munich studying European contributions to past and present aviation and aerospace achievements. If scheduling permits, visits to the Paris Air Show or the Farnborough Air Show are included. Integral to the course is understanding how the historical development of aviation was influenced by the unique culture of each country. AS 384 is offered in conjunction with the ERAU Study Abroad program.

AS 387 Crew Resource Management 3 Credits (3.0)
A course designed to develop a detailed understanding of the organizational behavior, interpersonal relationships skills, and other critical behavioral dynamics of professional flight crews. The history of CRM, CRM concepts of communication processes, problem solving, group dynamics, workload management, and situational awareness will be investigated. Aircraft incidents and accidents related to the evolution of CRM training programs and FAA regulations will be analyzed. Intrapersonal and psychomotor skills will be addressed as they relate to safe, legal, and efficient flight operations. This course is a capstone course for the AMS degree, flight AOC.
Prerequisites: AS 350 and PSY 101 and COM 221.

AS 390 Application of UAS Technology 3 Credits (3.0)
This course, through a combination of lectures and instructional laboratory, trains aspiring UAS operators to apply UAS technology to meet contemporary commercial objectives. The course includes education in geographic information systems, extracting payload data, imagery processing and synthesizing captured data to develop commercial products.
Prerequisites: AS 368 and proof of US citizenship.

AS 395L UAS Disaster Relief Study Away Program 3 Credits (3.0)
Student will use the senseFly eBee and DJI Inspire 1 UAS to collect still and full motion imagery. During this cooperative education opportunity, students will gain a deeper understanding of the operational and coordination requirements associated with UAS in support of disaster relief operations. Student will have hands on experience employing unmanned aircraft systems to accomplish mission specific tasks. Through a combination of student centered learning, classroom lecture, simulation, and actual flight operations, students will learn how UAS can support local communities in need of disaster response from hazardous weather such as tornadoes. Students will also be exposed to hazardous weather forecasting as a result of teaming with the Weather/ Storm Chaser Study Away Program led by the Department of Applied Aviation Sciences.

AS 399 Special Topics in Aeronautical Science 1-6 Credit
Individual independent or directed studies of selected topics in general aviation.

AS 402 Airline Operations 3 Credits (3.0)
A study of the scope and function of a major air carrier’s organizational structure and the specific relationships of the operations department with those of marketing, maintenance, and safety are discussed. A study of corporate issues including the industry in general, market structure, certification, FAR Part 121 regulations, economic issues, mergers, corporate culture, and international topics will be included. From an operational perspective, topics include flight operations employment policies, domiciles, operating specifications, types of services provided, training, passenger considerations, decision making, communications, and pertinent FARs.
Prerequisites: Junior standing or instructor consent.
AS 403 Unmanned Sensing Systems  3 Credits (3,0)
This is the capstone course of the Unmanned Aviation minor, aimed at giving students direct experience with the planning and effective conduct of complex missions involving the proper use of the complex sensing systems on unmanned aircraft. Through guided discussion and team effort, students will address complex mission assignments by determining the proper sensing system to use, assessing alternate courses of action, selecting and/or designing appropriate unmanned aircraft equipped with the sensing system appropriate to the mission, and by performing other tasks as required to achieve mission success.
Prerequisites: AS 220 and AS 235 and PS 104 or PS 160 and proof of US citizenship

Corequisites: AS 403L.

AS 403L UAS Payload Application  1 Credit
This laboratory addresses advanced Unmanned Aircraft System (UAS) application techniques and procedures. Students will work as a crew to complete operations focused of payload employment. This lab is designed to complement AS 403.
Prerequisites: AS 235L Corequisites: AS 403.

AS 405 Aviation Law  3 Credits (3,0)
This course will introduce the advanced student to the U.S. Constitution as well as to federal, state, and local statutes. The student will become familiar with case law and common law and develop an understanding of the chronological development of these laws and their application to aviation. The student will be introduced to civil law, including tort, product liability, contract, sales, secured credit, property, environmental, and labor laws. Criminal statutory law and government, airman, and operator rights and liabilities will also be studied, as well as international laws and conferences.
Prerequisites: COM 221 and Junior standing.

AS 408 Flight Safety  3 Credits (3,0)
This course is designed to assist the student in developing an attitude and philosophy for accident prevention and an awareness of major flight security issues. The course includes ideal and practical personal and organizational safety and security procedures and goals; safety philosophies; aircraft accident reports; human factors; principles of accident investigation, accident prevention programs, and accident statistics; current events; NTSB special studies; and the nature of accident/error chains.
Prerequisites: Aeronautical Science senior standing.

AS 410 Airline Dispatch Operations  3 Credits (3,0)
This capstone course includes a review of pertinent Federal Aviation Regulations, navigation systems and procedures, manual flight planning, emergency and abnormal procedures, the general operating manual, aircraft systems and performance development, human factors, and practical dispatching applications.
Prerequisites: AS 310 and AS 321 or AS 350
Corequisites: WX 301 and AT 202.

AS 411 Jet Transport Systems  3 Credits (3,0)
This course will provide the student with detailed knowledge of complete turbojet systems. The student will be exposed to complex air carrier aircraft systems and will conduct a detailed examination of a jet transport aircraft. Air carrier procedures are examined from a crew member's operational perspective.
Prerequisites: AS 356 or permission of instructor.

AS 412 Corporate and Business Aviation  3 Credits (3,0)
This course is designed to provide the student with an understanding of the operation of a corporate flight department, value of management mobility, aircraft and equipment evaluation, maintenance, flight operations, administration, and fiscal considerations.
Prerequisites: Junior standing.
AS 414  Aviation and the Administrative Law Process  3 Credits (3,0)
This course will introduce the student to administrative law and the role of the Federal Aviation Administration in the rule-making process. Additionally, the student will learn and understand the adjudication and judicial review functions the court exercises over administrative agencies and the process by which they exercise such control.

**Prerequisites:** AS 254.

AS 416  UAS Field Service and Sustainment  3 Credits (2,1)
This course is designed to provide students with the requisite knowledge and an in-depth understanding of the requirements for the maintenance, inspection, troubleshooting, and repair of unmanned aircraft systems (UAS) and subsystems. This culminating experience of lecture and practical laboratory application integrates aspects associated with both routine and non-routine maintenance (i.e., preventative and corrective) activities related to UAS systems and subsystems, airframe, power-plants, and components. Topics for discussion include, but are not limited to basic electrical components, avionics principles, radio frequency propagation and transmission methods, composite materials, electric and gas generated power plant, ground control stations (GCS), software diagnostics and system checks, launch and recovery, and human factors in maintenance. Through practical tasks in a laboratory environment students will engage in the fundamentals of fault diagnosis, preventative and corrective maintenance, inspection, replacement and repairs.

**Prerequisites:** AS 318 and proof of US citizenship.

AS 420  Flight Technique Analysis  3 Credits (3,0)
Application of aerodynamic principles to the development of optimal pilot techniques and procedures. Uniform procedures applicable to all airplanes and special procedures for large, high-performance, and transport aircraft are analyzed, including principles of flight deck resource management.

**Prerequisites:** AS 310 and AS 435.

AS 432  Deploying UAS in Public Safety Flight Operations  3 Credits (3,0)
Deploying UAS in Public Safety Operations is a senior level seminar course focused on the concepts of UAS Public Safety Operations. Through a combination of instructor lead discussion, assigned readings, hands-on projects, and utilizing UAS for live flight operations students will conduct basic flight mission encountered by Public Safety entities during daily operations. Students will formulate and demonstrate safe operational preparation and deployment strategies for launching and recovering UAS while understanding the consequences of ignoring safety concerns. This course explores the safe use of unmanned aircraft systems to support public safety operations. Students will examine the concepts of developing standard operating procedures (SOPs), conducting proper risk assessment and applying mitigation solutions, integrating safety management systems, and creating operational emergency response procedures. Students will formulate opinions and strategies to create safety systems and integrate safety concepts into public safety operations for successful UAS operations.

**Prerequisites:** AS 318 and proof of US citizenship.

AS 434  Airline Operations Command and Control  3 Credits
Students will learn and practice the functions of a typical airline operational command and control center. This multifaceted course will utilize knowledge and skills from several disciplines including: meteorology, dispatch, aircraft performance, safety, air traffic control, and crew resource management. Students will research and apply regulations from FAR part 61, 91, 117, 119, 121, and 135 to real world problems while identifying and solving conflicting priorities within an airline’s operational environment utilizing collaborative decision-making strategies and techniques.

**Prerequisites:** AS 402 or AS 410 or WX 410.

AS 435  Electronic Flight Management Systems  3 Credits (3,0)
This course teaches the theory and principles governing flight with autopilot and flight management systems. Students will apply theory and principles by demonstrating good decisions and thought processes in autopilot and FMS/PC simulators.

**Prerequisites:** AS 310 and AS 350.
AS 472  Operational Applications in Aeronautical Science  3 Credits (3,0)
This capstone course is designed to be a culminating experience for students in the Aeronautical Science degree program. This course focuses on the professional aspects of a career pilot, industry expectations of those entering the profession, and insights into the real-world application of aeronautical decision-making, crew resource management, threat and error management, and airline operations. Lifelong learning skills are promoted through the use of team exercises that require students to explore the regulatory and ethical requirements of professional pilots. Must be taken during last two semesters before graduation
Prerequisites: AS 350 and AS 387.

AS 473  UAS Flight Simulation  3 Credits (3,0)
This course will include instruction, through lectures and instructional laboratory, of Unmanned Aircraft Systems ground control stations, pilot stations, and sensor operator stations. The course will include the organization of a typical unmanned aircraft ground control station. Using an unmanned aircraft simulator, the instructional lab will include education in the proper use of flight controls, sensor controls, and the human factors interface between personnel, and man/machine.
Prerequisites: AS 368 and UA 301 and proof of US citizenship.

AS 474  Operational Applications in Aeronautics  3 Credits (3,0)
Designed to be a culminating experience for students in the Aeronautics degree program. Allows students to explore how their chosen career field fits into the broader aviation industry while examining more deeply issues related to their minor field of study. Provides a macro-level review of the aviation industry and how to prepare to meet industry expectations for those entering the profession. Special emphasis will be on insights into contemporary issues and emerging trends within the industry. Classroom assignments will challenge student critical thinking, collaborative problem solving, written and oral communications, and lifelong learning skills. Prerequisites are COM 221 and students must be a senior in their last or next-to-last semester.
Prerequisites: COM 221 and Senior standing.

AS 499  Special Topics in Aeronautical Science  1-6 Credit
Individual independent or directed studies of selected topics in general aviation.

Aerospace and Occupational Safety (SF)

Aerospace and Occupational Safety Courses
SF 201  Introduction to Health, Occupational, and Transportation Safety  3 Credits (3,0)
This course introduces the student to the field of safety and covers basic health, safety, and regulatory issues that apply to aviation and non-aviation business in the United States. Included is a comprehensive health and safety overview of legislative development and enactment of appropriate statutes, regulations, and laws. This course also provides an introduction to hazard recognition, reporting, analysis, and control used in risk management and accident prevention. Additional topics include accident investigation; safety data statistics; ergonomics; security and emergency preparedness; safety culture; aircraft systems; air traffic control; and workers’ compensation. This course reviews theories, applications, and practices of the field of safety.

SF 205  Principles of Accident Investigation  3 Credits (3,0)
This course is an introduction to the process required for the investigation of accidents. Topics will include different methods of accident investigation, such as root cause analysis and Management Oversight Risk Tree (MORT), among others. Further topics will include filing appropriate accident reports and applications of corrective actions.
Prerequisites: SF 201 or SF 210.

SF 210  Introduction to Aerospace Safety  3 Credits (3,0)
This course provides an introduction and overview of the theories, concepts, applications, and practices of the field of aerospace safety. This course is designed for the beginning aviation safety student and covers topics such as human factors, mechanical factors, accident investigation, safety programs, and safety statistics.

SF 299  Special Topics in Safety  1-6 Credit
Individual independent or directed studies of selected topics in aviation or non-aviation safety topics.
SF 309 Aerodynamics and Performance for Air Safety Investigators  3 Credits (3,0)
Every air safety investigator will eventually be faced with trying to determine the aerodynamic and performance characteristics of an aircraft in the moments before an accident. This course will examine aerodynamics forces, performance characteristics, and their impact on accidents.
Prerequisites: SF 201 or SF 210.

SF 315 Environmental Compliance and Safety  3 Credits (3,0)
This course examines matters associated with health and safety relating to the environment including air, water quality and sanitation. Areas of concentration include hazardous materials, their storage, handling, and transportation. Additional study includes waste management and cleanup as well as a detailed study of environmental laws, regulations, and protection of workers involved in activities associated with hazardous material activities.
Prerequisites: SF 201 or SF 210.

SF 316 Workers Compensation, Insurance, and Risk Management  3 Credits (3,0)
Loss control activities related to workers’ compensation and injury prevention practiced by major insurance companies are studied. Concepts of measuring, evaluating, and ensuring safety and health hazard risks are addressed. Basics of workers’ compensation are covered together with evaluating, quantifying, and managing risk due to safety and health hazards.
Prerequisites: SF 201 or SF 210.

SF 320 Human Factors in Aviation Safety  3 Credits (3,0)
This course focuses on the major human causative agent in aircraft accidents: the human being. Emphasis is placed on the psychological and physiological factors that enhance the accident probability. Included is a detailed analysis of ergonomics (human engineering) and its influence in aviation design.
Prerequisites: SF 201 or SF 210.

SF 325 Human Factors and Ergonomics I  3 Credits (3,0)
This course is an introduction to cognitive and physical ergonomics. Topics will include musculoskeletal anatomy and physiology, anatomy and physiology of the perceptual system, and basic introduction to perception, experimental psychology, and cognitive psychology. Applications will include design of both the physical and cognitive interfaces with the work environment.

SF 330 Aircraft Accident Investigation  3 Credits (3,0)
A detailed evaluation of the methods and procedures involved in aircraft accident investigation. The organization, duties, and procedures of the Aircraft Accident Board are analyzed. The student explores procedures for determining accident causes through analysis for such elements as the function and techniques employed by the trained accident investigator and the role of the specialized laboratory. Analyses are also made of reporting procedures and the all important follow-up work designed to avoid similar or related aircraft accidents.
Prerequisites: SF 201 or SF 210.

SF 335 Mechanical and Structural Factors in Aviation Safety  3 Credits (3,0)
This course examines the influence that design, manufacturing, metallurgy, and maintenance have on aircraft accidents. A detailed analysis of the failure process will be conducted. Additional topics include stress and design loading, fatigue, corrosion, and the envelope of operation.
Prerequisites: SF 330.

SF 341 Safety and Security of Airport Ground Operations  3 Credits (3,0)
This innovative course discusses general aviation airport ground operations, particularly from the pilot and ramp worker perspectives. Focus will be on increasing awareness of airport operations and improving airport safety by creating an enhanced awareness of rules, policies, procedures, and potential hazards that affect the safety and security of aircraft, crew, passengers, and others within the airport ground operations environment. Specific topics include aircraft marshaling procedures, airfield security issues, ground vehicle operations, and accident/incident response and reporting.
SF 342 Investigation of Aircraft Systems and Components 3 Credits (3,0)
This course presents information about new avionics technologies and some of the new investigative techniques available in determining the cause of aircraft accidents. Among the systems covered are hydraulics, pneumatics, emergency systems, flight control, and digital avionics subsystem examination. **Prerequisites:** SF 330 and PS 104.

SF 345 Safety Program Management 3 Credits (3,0)
A study of the principles of the development and management of an effective safety program. The philosophy and historical development of major concepts are examined with particular emphasis on areas of special concern in organizational accident prevention. Students analyze the influence of morale, education, and training, the role of the supervisor, and other substantial program elements of value to the safety manager. **Prerequisites:** SF 201 or SF 210.

SF 350 Aircraft Crash and Emergency Management 3 Credits (3,0)
Theory, practices, and techniques utilized in the response phase of aircraft crashes and emergencies are examined. This course is designed as a "real world" introduction to the field of emergency response at the CFR agency level, the airport response and administration levels, and the related and associated entities involved in aircraft mishaps. **Prerequisites:** SF 201 or SF 210.

SF 355 Industrial Hygiene and Toxicology 3 Credits (3,0)
This course examines principles associated with industrial hygiene. Topics include recognition, evaluation, and control of hazards related to noise; vibration; ionizing and non-ionizing radiation; thermal conditions; chemicals; airborne contaminants; cumulative trauma; and biological substances. These subjects will be discussed in relation to all regulatory requirements using engineering and non-engineering controls for reducing or eliminating health hazards in the workplace. **Prerequisites:** SF 201.

SF 357 Language as a Factor in Aviation Safety 3 Credits (3,0)
This course will develop students? awareness and understanding of the role of language as a critical factor in aviation safety. Students will gain an understanding of basic linguistic principles that relate to aviation operational safety in order to identify, discover, analyze, and address a range of language-in-aviation issues.

SF 365 Fire Protection 3 Credits (3,0)
This course introduces the basics of fire and fire protection. Students will study the physics, chemistry, characteristics, and behavior of fire, fire hazards of material, fire suppression systems, extinguishing agents, and detection and alarm systems. Primary emphasis will be on transportation-related fire hazards and the regulatory requirements associated with air, rail, marine, and highway modes of transportation. **Prerequisites:** SF 201 or SF 210.

SF 375 Propulsion Plant Investigation 3 Credits (3,0)
A technical course in aircraft reciprocating and turbine engine fundamentals and relevant accident investigative procedures. Areas of study include basic construction and design with emphasis on major sections, components, and their mechanical relationships. Powerplant systems and system mishap investigation is also covered and includes fuel, lubrication, ignition, and start systems. A study of propeller basics and investigative techniques is also included. On-site field investigation as well as engine teardown/disassembly procedures are presented. **Prerequisites:** SF 330.

SF 380 Internship I 3 Credits (3,0)
This internship is designed to give students hands-on experience in the field of safety, health, and the environment. Students apply concepts and theories learned in the program to real-world industrial settings. Students develop inspection and auditing procedures, conduct on-site measurements and evaluations of hazards, and formulate comprehensive reports detailing findings and recommendations. In addition to the prerequisite, students must complete 12 credit hours of SF courses. **Prerequisites:** SF 201 or SF 210.
SF 399  Special Topics in Safety  1-6 Credit
Individual independent or directed studies of selected topics in aviation safety.

SF 405  Applications in Industrial Hygiene  3 Credits (3,0)
This course advances and expands on the concepts discussed in SF 355 and emphasizes the measurement and evaluation of workplace health hazards. Design and regulatory compliance of environments in office settings and manufacturing environments are addressed. Students develop and/or evaluate industrial hygiene programs for selected industries.
Prerequisites: SF 355.

SF 410  Design of Engineering Hazard Controls  3 Credits (3,0)
This course addresses the application of scientific and engineering principles and methods to achieve optimum safety and health through the analysis and design of processes, equipment, products, facilities, operations, and environments. Subjects will include product design, plant layout, construction maintenance, pressure vessels, and transportation vehicles and systems. These subjects will be discussed in relation to all regulatory requirements.
Prerequisites: SF 201 or SF 210.

SF 420  Analysis of Observational Data  3 Credits (3,0)
Methods for the analysis of observational data are primarily drawn from the discipline of epidemiology. This will include a set of heuristics and quantitative methods used to analyze the distributions of events (diseases, crashes, fatalities, etc.) in populations to infer the causes of those events. This course is a survey of these quantitative methods with an emphasis on occupational applications. Topics will include rates, standardized mortality ratios, methods of assessing agreement, case-control studies, cohort studies, recognizing and assessing causes of error, and advanced techniques in observational data analysis.
Prerequisites: MA 222 and SF 201 and SF 210.

SF 425  Human Factors and Ergonomics II  3 Credits (3,0)
This course is an extension of Human Factors and Ergonomics I and will provide greater depth in such topics as biomechanics, work physiology, ergonomics field methods, psychophysical methods, signal detection theory, information theory and human error/reliability.
Prerequisites: SF 325.

SF 435  Aircraft Crash Survival Analysis and Design  3 Credits (3,0)
An in-depth analysis of the accident environment with particular emphasis on the protection of occupants. The injury mechanisms and causes will be analyzed, as will the physics and kinematics of the impact sequence. The intent of the course is to familiarize the student with what can be done to minimize the effects of an accident.
Prerequisites: SF 201 or SF 210 and SF 330.

SF 440  Design of Engineering Hazard Controls II  3 Credits (3,0)
This course covers all relevant standards and regulations related to construction together with the development and implementation of construction safety programs. OSHA Standards 29 CFR 1926 and work methods design will serve as a basis for this course.
Prerequisites: SF 201.

SF 445  System Safety in Aviation  3 Credits (3,0)
This course entails the specialized integration of skills and resources in all phases of the life cycle of a given system in furtherance of accident prevention. Its heritage is systems engineering and management theory but it is amplified to include modern safety practices derived from numerous disciplines. Accordingly, this course reviews the development and implementation of system safety technology in aviation, both civil and military. Students will acquire an understanding of how accident prevention is designed into an aircraft under development, evaluated and enhanced during flight test, and ensured or otherwise controlled during operational use. This learning is juxtaposed with other elements of the total aviation system.
Prerequisites: SF 201 or SF 210.
SF 450 Internship II  3 Credits (3,0)
This internship is designed to give students hands-on experience in the field of safety, health, and the environment. Students apply concepts and theories learned in the program to real-world industrial settings. Students develop inspection and auditing procedures, conduct on-site measurements and evaluations of hazards, and formulate comprehensive reports detailing findings and recommendations.
Prerequisites: SF 380.

SF 455 Digital Safety Data Analysis  3 Credits (3,0)
This course examines techniques for analyzing various types of digital data, such as FOQA, in furtherance of accident prevention. Safety management systems are amplified to include modern safety programs and their use of digital and other forms of recorded and live data. Accordingly, this course reviews the development of digital data technology in aviation and other industries, its historical use for accident investigation, the proactive use of digital data to identify and address operational risks before they can lead to incidents/accidents, and the potential use for predictive safety. Students will acquire an understanding of potential digital data sources and how it is retrieved, analyzed. They will develop recommendations for interventions based on their analyses of the data.
Prerequisites: SF 210.

SF 462 Health, Safety, and Aviation Law  3 Credits (3,0)
This course introduces the student to the legal issues and concerns confronting the health and safety industry. Included is an overview of the historical legal precedence established for the aviation industry, as well as a comprehensive examination of laws, regulations, and legislation that govern the actions and authority of the health and safety professional. This course also provides an introduction to the governing bodies and associations that are tasked with setting the legal standards by which the industry must operate, including the scope and level of their authority.
Prerequisites: SF 201 or SF 210.

SF 470 Applications of Safety Management Capstone  3 Credits (3,0)
This course offers students a capstone experience by examining various approaches utilized to manage the safety and health function within an organization. This course will have students explore various methods necessary to effectively manage the safety and health process within an organizational setting.
Prerequisites: SF 345 and SF 462.

SF 475 Senior Project  3 Credits (3,0)
This course requires senior-level students to conduct research in a safety-related topic of his or her choosing under the direction of a faculty member.

SF 499 Special Topics in Safety  1-6 Credit
Individual independent or directed studies of selected topics in aviation or non-aviation safety topics.

Aerospace Engineering (AE)

Courses

AE 199 Spec Topics in Aerospace Eng  1-6 Credit
Individual independent or directed studies of selected topics in aerospace engineering. See program coordinator for approval.

AE 201 Aerospace Flight Vehicles  3 Credits (3,0)
History of atmospheric and exo-atmospheric flight, aircraft and spacecraft anatomy, fundamental aerodynamic properties, hydrostatics, properties of the atmosphere, fluid conservation equations, concepts of internal and external fluid flows, dimensional analysis, airfoil shapes, aerodynamic forces and moments, experimental results of airfoil and wing behavior, vehicle propulsion including reciprocating engines and gas turbines, airplane and rocket vehicle performance, introduction to viscous flows, supersonic and hypersonic flight, introduction to rockets and spacecraft.
Prerequisites: EGR 115 and ES 201.

AE 299 Special Topic in Aerospace Engineering  1-6 Credit
Individual independent or directed studies of selected topics in aerospace engineering. See program coordinator for approval.
AE 302 Aerodynamics II 3 Credits (3,0)
Prerequisites: AE 301 and ES 305.

AE 307 Incompressible Aerodynamics 3 Credits (3,0)
Conservation equations and fundamental fluid dynamic principles, elementary solutions of inviscid incompressible flows, method of predicting flows around airfoils and wings including thin airfoil theory, panel methods, lifting line and lifting surface theories, viscous flows and turbulence, Navier-Stokes equations, laminar and turbulent boundary layers.
Prerequisites: AE 201 and ES 204 and MA 345
Corequisites: MA 441.

AE 308 Compressible Aerodynamics 3 Credits (3,0)
Review of thermodynamics, compressibility, governing equations for compressible flow, normal shock waves, one-dimensional flow with heat addition and friction. Raleigh Fanno curves, oblique shock waves and expansion waves, compressible flow through nozzles, diffusers and wind tunnels, subsonic and supersonic flow around airfoils, including linear theories, elements of hypersonic flow.
Prerequisites: AE 201 and ES 305.

AE 313 Space Mechanics 3 Credits (3,0)
This course presents a vector-based solution of the two-body problem and the solution for the position and time problem (Kepler's equations). These are used to analyze orbits, satellite launch, ground tracks, orbit transfer, interplanetary trajectories, and interception and rendezvous. Using threedimensional vector dynamics, the motion and stability of rigid and semi-rigid spacecraft are studied as are the means for controlling spacecraft orientation.
Prerequisites: EGR 115 and ES 204 and MA 345.

AE 314 Experimental Aerodynamics 1 Credit (1,0)
This course supports the Experimental Aerodynamics lab by providing lectures based on practice and theory. Topics include wind tunnel design, instrumentation, scaling effects, data acquisition, and data reduction as well as good experimental practices. The Experimental Aerodynamics Lab AE 315 must be taken during the same semester as AE 314.
Prerequisites: COM 221 and AE 307 and AE 308
Corequisites: AE 315.

AE 315 Experimental Aerodynamics Laboratory 1 Credit (0,1)
This laboratory consists of a sequence of experiments that demonstrate basic aerodynamic theory while developing skills in the use of classic and modern experimental apparatus, the practice of good experimental technique and the writing of experimental reports along with the requirements of designing an experiment. Specific experiments depend on the apparatus availability and instructor preference. The Experimental Aerodynamics Lab, AE 315, must be taken during the same semester as AE 314.
Prerequisites: COM 221 and AE 307 and AE 308
Corequisites: AE 314.

AE 316 Aerospace Engineering Materials 3 Credits (3,0)
Prerequisites: ES 202 and CHM 110 and CHM 110L.

AE 318 Aerospace Structures I 3 Credits (3,0)
Prerequisites: ES 202.
AE 350  Project Engineering  3 Credits (3,0)
Role of the engineer in project management with emphasis on systematic evaluation of the benefits and costs of projects involving engineering design and analysis. Proposal preparation and presentation, engineering contracts, negotiation techniques. Value engineering. Pre-Requisite: Junior standing
Prerequisites: Junior standing.

AE 399  Special Topic in Aerospace Engineering  1-6 Credit
Individual independent or directed studies of selected topics in aerospace engineering. See program coordinator for approval.

AE 403  Jet Propulsion  3 Credits (3,0)
An introduction to airbreathing propulsion and the gas turbine engine. Topics include control volumes; the conservation equations; combustion processes; efficiencies; fuel consumption; ideal and real ramjets; gas turbine engine cycles; diffuser and nozzle flows and preliminary component analysis.
Prerequisites: AE 307 and AE 308.

AE 409  Aircraft Composite Structures  3 Credits (3,1.5)
Introduction to reinforced plastic composite structural materials and their use in modern aircraft. Discussion of basic material properties, testing procedures, design and analysis using classical lamination theory, and fabrication techniques, including some hands-on demonstrations.
Prerequisites: AE 316.

AE 411  Advanced Experimental Aerodynamics  3 Credits (2,3)
This course is a technical elective and consists of a series of advanced experiments using the wind tunnel. Model design and construction, testing procedure, control surface testing, propeller testing, use of wind tunnel data, scale effects, complete model testing. Includes introduction to supersonic testing.
Prerequisites: AE 314 and AE 315.

AE 413  Airplane Stability & Control  3 Credits (3,0)
Prerequisites: AE 307.

AE 414  Space Propulsion  3 Credits (3,0)
This course provides the student with an introduction to the basic principles of liquid and solid propulsion systems. Flight performance parameters are presented for single and multistage vehicles. The thermo-chemistry of the combustion process will also be discussed. Performance enhancements of nuclear rockets and electric propulsion will be covered.
Prerequisites: AE 307 and AE 308.

AE 415  In-Flight Laboratory  3 Credits (2,3)
Development of longitudinal and lateral-directional, static and dynamic stability and excess power, rate of climb, turn rate, and load factor performance theory, with laboratory concept validation.
Prerequisites: AE 413.

AE 416  Aerospace Structures and Instrumentation  1 Credit (1,0)
Lecture-based course to support the Structures and Instrumentation Laboratory. Course emphasizes aerospace vehicle testing through instrumentation, data acquisition, and data reduction. Test plans and designs are utilized.
Prerequisites: COM 221 and AE 316 and EE 327 and EE 328 Corequisites: AE 417.

AE 417  Aerospace Structures and Instrumentation Laboratory  1 Credit (0,3)
Principles of modern aerospace vehicles testing and instrumentation. Basic electrical measurements and devices such as strain gages, piezoelectric sensors, and thermocouples. Topics could include measurement of fluid pressure and flow, temperature, thermal and transport properties, strain, motion, vibration, force and torque. Experimental static and dynamic analysis of structures. Processing and analyzing experimental data, report writing and data presentation.
Prerequisites: COM 221 and AE 316 and EE 327 and EE 328 Corequisites: AE 416.

AE 418  Aerospace Structures II  3 Credits (3,0)
Methods of computer-aided deflection and stress analysis of redundant lightweight structural systems by means of virtual work principles and their energy counterparts. Introduction to finite element theory. Buckling considerations. Applications include space structures and semimonocoque structures.
Prerequisites: AE 318.
AE 420  Aircraft Preliminary Design  4 Credits (3,3)
Airplane conceptual design principles are developed to meet modern aerodynamic, propulsion, structural and performance specifications. A complete airplane is designed, resulting in a design package consisting of specifications, aerodynamic calculations, inboard profile drawing, weight and balance, general arrangement drawing, aerodynamic drag analysis and complete performance report.
Prerequisites: COM 219 and AE 314 and AE 315 and AE 403 and AE 413.

AE 421  Aircraft Detail Design  4 Credits (3,3)
Principles of aircraft detail and component part design, manufacture, and production are covered along with projects to give actual experience in the design of aircraft components. The design of an aircraft is carried from the general layout to the design of its detail parts and the design of necessary tools.
Prerequisites: AE 418 and AE 420 and AE 316.

AE 425  Aircraft Acoustics and Noise Control  3 Credits (3,0)
Prerequisites: AE 307.

AE 426  Spacecraft Attitude Dynamics  3 Credits (3,0)
Prerequisites: AE 313.

AE 427  Spacecraft Preliminary Design  4 Credits (3,3)
Spacecraft preliminary design principles are developed to meet mission objectives. A complete spacecraft is designed, resulting in a design package consisting of specifications, calculations, CAD drawings, weight and various subsystem budgets, and a series of trade studies, reviews, and design reports.
Prerequisites: AE 314 and AE 315 and AE 414 and COM 219 Corequisites: AE 426.

AE 432  Flight Dynamics and Control  3 Credits (3,0)
Prerequisites: AE 413.

AE 433  Aerodynamics of the Helicopter  3 Credits (3,0)
Prerequisites: AE 307 and MA 441.

AE 434  Spacecraft Control  3 Credits (3,0)
A review of spacecraft equations of motion and state variable representation of the equations of motion. Automatic control theory, the classical approach as well as the modern control approach. Attitude control with thrusters, attitude control with reaction wheels, and attitude stabilization with spin. Attitude control during thrust maneuvers. Control of translational motion.
Corequisites: AE 426.
AE 435  Air-Breathing Propulsion Preliminary Design  4 Credits (3,3)
This course is concerned with the preliminary design, subject to specifications, of an air-breathing engine for aircraft propulsion. A complete engine is designed and presented with proposed engine layout, cycle calculations, installed performance, and engine sizing information. Calculations demonstrating that the proposed engine satisfies requirements are also presented.
Prerequisites: AE 314 and AE 315 and COM 219 and AE 403.

AE 436  Introduction to Optimization  3 Credits (3,0)
This course will cover mathematical optimization methods, problem formulation, and optimality criteria, linear programming methods for optimality problems, numerical methods for unconstrained and constrained problems, sequential linear programming, genetic algorithms, and hybrid optimal control.
Prerequisites: EGR 115 and MA 345.

AE 437  Advanced Space Propulsion  3 Credits (3,0)
Advanced Space Propulsion covers the exotic propulsion concepts beyond the typical existing liquid, hybrid, solid and electric propulsion systems. The course emphasizes the advanced concepts to orbit and also emphasizes deep space travel including interstellar and propulsion at relativistic speeds. Topics include fusion propulsion, Bussard ramjets, matter-antimatter propulsion, antigravity, space drives, warp drives and faster-than-light travel.
Prerequisites: AE/ME students must have C or better in AE 408 or AE 414 or ME 309.

AE 440  Air-Breathing Propulsion Detail Design  4 Credits (3,3)
This course is concerned with the design of the various components of an air-breathing engine, starting with the general layout. The students are grouped into teams and each team is charged with the design of a major component (inlet, fan, compressor, combustor, turbine, nozzle, support systems). The components are then integrated to verify that they function together.
Prerequisites: AE 435.

AE 442  Experimental Dynamics and Control  1 Credit (1,0)
Linear Control. Open loop and close loop system feedback analysis. Modeling, linearization and parameter system identification and validation of dynamical systems. State space system representation, system block diagrams, feedback and transfer functions. Control design based on transient and steady state specifications. Concepts of stability and controllability. Stability criteria. Control design and analysis of dynamical systems in time and frequency domains.
Prerequisites: COM 221 and AE 432 or AE 434 Corequisites: AE 443.

AE 443  Experimental Dynamics and Control Laboratory  1 Credit (0,3)
Laboratory for the dynamics and control of systems. Course emphasizes dynamical systems testing through instrumentation, amplifiers, analog-to-digital converters, boolean algebra, logic gates and microprocessors, data acquisition and data analysis. This lab includes modeling of dynamics for flexible link systems, rotational systems including electrical servos and transformers; experimental determination of the system natural frequency. Control design and implementation based on time domain transient and steady state requirements; pole placement and state feedback control design and implementation. Full-state-feedback vs. partial-state-feedback analysis. Finding first and second order system parameters. System response analysis to various input types. Sensor bias removal techniques and actuator saturation. Processing and analysis of experimental and simulated data; report writing and data presentation.
Prerequisites: COM 221 and AE 432 or AE 434 Corequisites: AE 442.

AE 445  Spacecraft Detail Design  4 Credits (3,3)
Principles of spacecraft detail and subsystem design, analysis, modeling, manufacture, and test are covered and incorporated into projects to give actual experience in detail design and integration of spacecraft subsystems and systems. Integration of multiple subsystems into a single functional model is a key component to the course.
Prerequisites: AE 318 and AE 427 and AE 434.
AE 499 Special Topic in Aerospace Engineering  1-6 Credit
Individual independent or directed studies of selected topics in aerospace engineering. See program coordinator for approval.

Air Force Aerospace Studies (AF)

Courses

AF 101 U.S. Military Forces GMC  1 Credit (1,2)
A survey course designed to introduce students to the U.S. Air Force and Air Force Reserve Officer Training Corps. Featured topics include mission and organization of the Air Force, officership and professionalism, military customs and courtesies, and Air Force officer career opportunities. Leadership Laboratory is mandatory for Air Force ROTC cadets and complements this course by providing cadets with followership experiences.
Corequisites: AF 101L.

AF 101L Leadership Laboratory  0 Credits (0,2)
Consists of Air Force customs, courtesies, leadership, teamwork, field training orientation, drill, and ceremonies. Includes a mandatory physical fitness program. These courses are graded Pass/ Fail.
Corequisites: AF 101.

AF 102 U.S. Military Forces GMC  1 Credit (1,2)
Continuation of AF 101. Topics include Air Force core values, leadership principles, group leadership dynamics, and an introduction to communication skills. A weekly Leadership Laboratory is mandatory.
Corequisites: AF 102L.

AF 102L Leadership Laboratory  0 Credits (0,2)
Consists of Air Force customs, courtesies, leadership, teamwork, field training orientation, drill, and ceremonies. Includes a mandatory physical fitness program. These courses are graded Pass/ Fail.
Corequisites: AF 102.

AF 199 Special Topics in AFROTC  1-6 Credit
Individual independent or directed studies of selected topics in Air Force aerospace studies.

AF 201 The Evolution of USAF Air and Space Power (General Military Course)  1 Credit (1,2)
The AF 201 course is designed to examine the aspects of air and space power through a historical perspective. Using this perspective, the course covers a time period from the first balloons and dirigibles to the air and space applications employed at the beginning of the Cold War. Historical examples are studied to extrapolate the fundamentals of air power, including the tenets of air and space power, principles of war, and Air Force competencies, functions, and doctrine. In addition, the students will continue to discuss the importance of the Air Force core values through the use of operational examples and historical Air Force leaders, and will continue to develop their communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.
Corequisites: AF 201L.

AF 201L Leadership Laboratory  0 Credits (0,2)
Consists of Air Force customs, courtesies, leadership, teamwork, drill, ceremonies, and field training orientation. Includes a mandatory physical fitness program. These courses are graded Pass/ Fail.
Corequisites: AF 201.

AF 202 The Evolution of USAF Air and Space Power (General Military Course)  1 Credit (1,2)
Continuation of AF 201. This course continues to explore Air Force history, beginning with the Vietnam era and culminating with the modern air and space applications employed during Operations Iraqi and Enduring Freedom. A weekly Leadership Laboratory is mandatory.
Corequisites: AF 202.

AF 202L Leadership Laboratory  0 Credits (0,2)
Consists of Air Force customs, courtesies, leadership, teamwork, drill, ceremonies, and field training orientation. Includes a mandatory physical fitness program. These courses are graded Pass/ Fail.
Corequisites: AF 202.

AF 299 Special Topics in AFROTC  1-6 Credit
Individual independent or directed studies of selected topics in Air Force aerospace studies.
AF 301 Air Force Leadership Studies
(Professional Officer Course) 3 Credits (1,2)
A study of leadership, management fundamentals, professional knowledge, Air Force personnel evaluation systems, leadership ethics, and the communication skills required of an Air Force junior officer. Case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical applications of the concepts being studied. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.
Corequisites: AF 301L.

AF 301L Leadership Laboratory 0 Credits (0,2)
Provides advanced leadership experience in officer-type activities, giving students the opportunity to apply leadership and management principles. Includes a mandatory physical fitness program. These courses are graded Pass/Fail.
Corequisites: AF 301.

AF 302 Air Force Leadership Studies
(Professional Officer Course) 3 Credits (1,2)
Continuation of AF 301. A weekly Leadership Laboratory is mandatory.
Corequisites: AF 302L.

AF 302L Leadership Laboratory 0 Credits (0,2)
Provides advanced leadership experience in officer-type activities, giving students the opportunity to apply leadership and management principles. Includes a mandatory physical fitness program. These courses are graded Pass/Fail.
Corequisites: AF 302.

AF 399 Special Topics in AFROTC 1-6 Credit
Individual independent or directed studies of selected topics in Air Force aerospace studies.

AF 401 Preparation for Active Duty (Professional Officer Course) 3 Credits (1,2)
Examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. Special topics of interest focus on the military as a profession, officership, military justice, civilian control of the military, preparation for active duty, and current issues affecting military professionalism. Continued emphasis is given to the refinement of communication skills. An additional Leadership Laboratory complements this course by providing advanced leadership management principles.
Corequisites: AF 401L.

AF 401L Leadership Laboratory 0 Credits (0,2)
Provides advanced leadership experiences in officer-type activities, giving students the opportunity to apply leadership and management principles. Includes a mandatory physical fitness program. These courses are graded Pass/Fail.
Corequisites: AF 401.

AF 402 Preparation for Active Duty (Professional Officer Course) 3 Credits (1,2)
Continuation of AF 401. A weekly Leadership Laboratory is mandatory.
Corequisites: AF 402L.

AF 402L Leadership Laboratory 0 Credits
Provides advanced leadership experiences in officer-type activities, giving students the opportunity to apply leadership and management principles. Includes a mandatory physical fitness program. These courses are graded Pass/Fail.
Corequisites: AF 402.

AF 403L Leadership Laboratory 0 Credits (3,0)
Mandatory. Provides advanced leadership experiences in officer-type activities. Includes a mandatory physical fitness program.

AF 404L Leadership Lab 0 Credits (3,0)
Mandatory. Provides advanced leadership experiences in officer-type activities. Includes a mandatory physical fitness program.

AF 499 Special Topics in AFROTC 1-6 Credit
Individual independent or directed studies of selected topics in Air Force aerospace studies.
Air Traffic Management (AT)

Courses

AT 199 Special Topics in Air Traffic Control  1-6 Credit
Individual independent or directed studies of selected topics in air traffic management.

AT 202 Introduction to Air Traffic Management  3 Credits (3,0)
Introduction to Air Traffic Management provides students with knowledge in the following areas: the Federal Aviation Administration, its mission, organization and operation; the air traffic control career; federal aviation regulations, FAA publications, manuals, maps, charts, and regulations used by pilots and air traffic controllers in the National Airspace System (NAS). ATC procedures, control tower operations and future air traffic control systems are also discussed. This course provides students with a fundamental knowledge of the US air traffic control system, and develops content knowledge in the following areas: Principles of Flight; VFR/IFR charts and Standard Instrument Departures, Standard ATC Arrival Routes (STARS), Instrument Approach Procedures; Pilot’s Environment; Aircraft/Ground Emergencies; Search and Rescue; PIREPS; Airman’s Meteorological Information (AIRMET); Significant Meteorological Information (SIGMET); Convective SIGMET (WST); Center Weather Advisory (CWA); METAR; SPECI; Basic ATC Communications; Strip Marking; ATC Clearances/Approaches; Aircraft Characteristics/Recognition.

AT 299 Special Topics in Air Traffic Control  1-6 Credit
Individual independent or directed studies of selected topics in air traffic management.

AT 305 Introduction to Terminal Radar Operations  3 Credits (3,0)
This course covers the basic air traffic control (ATC) procedures for instrument flight rules (IFR) in terminal ATC facilities in the National Airspace System (NAS). Knowledge and skill requirements for air traffic control specialists (ATC) in the current ATC system are studied in the classroom and practiced in a realistic, performance-based laboratory environment. Duties and responsibilities of the TRACON air traffic controller are integrated into an understanding of how the total ATC system works. Classroom delivery is augmented by practical laboratory problems using an air traffic control simulation of terminal radar operations.

Prerequisites: AT 202.

AT 306 Safety in Air Traffic Management  3 Credits (3,0)
This course introduces the Air Traffic Management (ATM) student to the safety environment associated with air traffic control. The student will be introduced to ATM Safety in five areas: FAA safety policies, International ATM safety policies and procedures, ATM safety associated with weather, ATM safety as it relates to modernization such as NexGen and SESAR, and impacts of cyber security in ATM. ALL ERAU ATM students will have the option of completing this course on main campus in a face-to-face setting or by completing course in the ATM Study Abroad.

Prerequisites: AT 202 and SF 210.

AT 307 Global Harmonization in Air Traffic Management  3 Credits (3,0)
The Global Harmonization of Air Traffic Management course relates directly to the job of an air traffic controller and staff positions within the FAA and international ATM (Air Traffic Management) organizations. This course will provide a solid learning experience into international ATM harmonization and integration. Students will become familiar with many of the global Air Navigation Service Providers (ANSPs), FAA, EuroControl, DFS, DSNA and more), modernization programs such as (SESAR, NextGen, ICAO ASBU, and more), and organizations such as (EASA, NTSB, NATCA, IFATCA, CANSO, ATCA, IATA, GAMA and others) that are continuously working to harmonize and integrate ATM procedures.

Prerequisites: AT 202 and AT 305 and AT 401.
AT 310  Air Traffic Control Tower for Non ATC  3 Credits (3.0)
Air Traffic Control Tower (ATCT) class for non Air Traffic Management (ATM) degree majors or minors. This course provides students with a fundamental knowledge of VFR Tower terminal operations within the US air traffic control system and develops content knowledge in the following areas: (a) control tower equipment and operating positions; (b) the airport traffic area; (c) controller/pilot phraseology; (d) aircraft taxi instructions; (e) federal aviation regulations; (f) notification and handling of emergency aircraft; (g) flight progress strip marking; (h) wake turbulence and its effects on arriving/departing aircraft; (i) IFR ATC procedures; (j) runway incursions; and (k) and criteria for runway selection. The course also provides essential information that is useful for pilots and other aviation professionals.

Prerequisites: AT 202.

AT 315  Introduction to Air Traffic Control Tower  3 Credits (1,2)
AT 315 is the air traffic control VFR Tower segment in the Air Traffic Management (ATM) degree sequence. This course provides students with a fundamental knowledge of VFR Tower terminal operations in the U.S. air traffic control system and develops content knowledge in the following areas: control tower equipment and operating positions; the airport traffic area; navigation aids; airspace; VFR traffic patterns; controller/pilot phraseology; aircraft taxi instructions; control of vehicle movement; interagency communications and intra-facility coordination; federal aviation regulations; notification and handling of emergency aircraft; flight progress strip marking; aircraft recognition and characteristics; limited weather observations; airport lighting systems; wake turbulence and its effects on arriving/departing aircraft; VFR and IFR ATC procedures; runway incursions; using ATIS; reporting RVR/RCR; determining prevailing visibility using visual reference; NOTAMs; and criteria for runway selection. The course also provides essential information that is useful for pilots and other aviation professionals.

Prerequisites: AT 202.

AT 399  Special Topics in Air Traffic Control  1-6 Credit
Individual independent or directed studies of selected topics in air traffic management.

AT 401  Advanced Terminal Radar Operations  3 Credits (3.0)
This course integrates the knowledge of air traffic control gained in previous air traffic control courses with an opportunity to actually "work" air traffic control operating positions. Using a realistic air traffic control simulation, students issue instructions to aircraft, make hand-offs, coordinate with other controllers, solve aircraft confliction problems, and do other controller tasks. The ability to make real-time decisions, determine strategies for controlling aircraft, and work with a dynamic scenario are features unique to this learning experience. This course combines classroom discussion and group and team coordination with various forms of evaluation for course credit. Student competency in the performance phase of the course is determined by computer scoring.

Prerequisites: AT 202 and AT 305.

AT 405  En route Radar Operations  3 Credits (2,3)
This course introduces students to the en route radar procedures and minima prescribed in FAAH 7110.65 and builds upon knowledge gained in previous courses, all in a simulated environment. Training includes the vertical, lateral, and longitudinal separation of aircraft in the departure, en route, and arrival phases of flight. Phraseology, strip marking, instrument and visual approaches and the coordination procedures necessary to complete these functions are included in simulated ATC scenarios, along with the associated keyboard commands in an en route environment.

Prerequisites: AT 202 and AT 305 and AT 401.
AT 406 En route Non-Radar Operations  3 Credits (3,0)
This course introduces students to the non-radar procedures and minima prescribed in FAAH 7110.65 and builds on knowledge gained in prerequisite courses. Training includes the vertical, lateral, and longitudinal separation of aircraft in the departure, en route, and arrival phases of flight. Phraseology, strip marking, instrument/visual approaches, and the coordination procedures necessary to operate in an en route non-radar environment will be covered. Students will work a number of air traffic control scenarios and demonstrate higher-level performance and decision-making skills required for entry-level qualification as an air traffic control specialist.
Prerequisites: AT 202 and AT 305 and AT 401 and AT 405.

AT 415 Advanced Air Traffic Control Tower  3 Credits
This course is designed to give students the advanced skills necessary to perform air traffic functions in a moderate to busy air traffic control tower. Emphasis is placed on understanding complex airport operations and the air traffic procedures, rules, and coordination methods necessary to accomplish a safe, orderly and expeditious movement of air traffic.
Prerequisites: AT 202 and AT 305 and AT 315.

AT 425 Collaborative Air Traffic Management  3 Credits (3,0)
The course introduces the student to traffic flow management definitions, concepts, technologies (current and planned for NextGen), and applications required to perform system analysis of the constraints and their impact on efficiency of traffic flows within the National Airspace System (NAS).
Prerequisites: AT 202 and AT 315 and AT 401 and AT 405.

AT 499 Special Topics in Air Traffic Control  1-6 Credit
Individual independent or directed studies of selected topics in air traffic management.

Arabic (LAR)
Courses
LAR 101 Arabic I 3 Credits (3,0)
Elementary oral-aural introduction to Arabic, including such topics as courtesy phrases, basic vocabulary, and patterns for questions and answers. Not open to students with two or more years of high-school instruction or the equivalent, or native speakers of the language.
Prerequisites: LAR 101.

LAR 199 Special Topics in Arabic Language  1-3 Credit
Individual independent or directed studies of selected topics in the Arabic Language.

LAR 201 Arabic III 3 Credits (3,0)
A continuation of LAR 102.
Prerequisites: LAR 102.

LAR 202 Arabic IV 3 Credits (3,0)
A continuation of LAR 201.
Prerequisites: LAR 201.

LAR 499 Special Topics in Arabic Language  1-6 Credit
Individual independent or directed studies of selected topics in the Arabic language.

Aviation Maintenance Science (AMS)
Courses
AMS 115 Aviation Mathematics and Physics  2 Credits (5.5,0)
This course covers the fundamentals of mathematics and physical sciences appropriate to the training of the aviation maintenance technician. The math topics include fractions, decimals, ratio, geometry, formulae, and proportions. The aviation physics topics include atmospheric properties, thermodynamics, fluid power, heat, power, work, basic machines, and sound.
AMS 116 Fundamentals of Electricity 4 Credits (6.75,3)
This course covers direct and alternating current electricity, electrical circuit design, measuring devices, transformers, solid state, and logic devices. Emphasis is placed on voltage, current, resistance, and impedance relationships. The classroom theory is reinforced with laboratory projects.

AMS 117 Tools, Materials and Processes 4 Credits (4.5,4)
This course introduces the student to common and precision measurement tools, aviation hardware, and materials used in aircraft manufacturing, maintenance and repair. Various methods of nondestructive testing are also studied and performed. The course studies the principles of corrosion control and allows the student to apply its theory. Aircraft drawings, blueprints, charts, and graphs are also introduced and applied.

AMS 118 Aircraft Familiarization and Regulations 2 Credits (5,1.75)
This course is a familiarization course in terminology, basic aerodynamics, and human factors. The course also offers a comprehensive summary of the privileges and limitations of the Federal Aviation Administration’s (FAA) Federal Aviation Regulations (FAR, Title 14 Code of Federal Regulations) parts 43, 65, 91 as well as other regulations pertinent to aircraft maintenance. The course identifies the associated documents, publications, and records applicable to the maintenance technician. AMS 118 also identifies the standards for aircraft ground operation, movement, and associated safety procedures in addition to the concepts and computation of aircraft weight and balance.

AMS 261 Aircraft Metallic Structures 3 Credits (6.75,5.25)
A study of aircraft structural characteristics and methods of fabrication with an emphasis on aluminum sheet metal applications. Explains metalworking processes and develops the techniques necessary for airworthy manufacturing as well as acceptable methods of repair employed in the industry. The course also covers the theory and practice of aircraft welding relevant to several approved industry standards.

AMS 262 Aircraft Composite Structures 3 Credits (4,3.5)
This is a course of study encompassing the structural and nonstructural use of composite, plastic, wood, and fabric materials on aircraft. Fabrication, repairs, finishing, and safety practices relating to these materials will be discussed and practiced. Included will be the application of adhesive and plastic resins, composite machining, and vacuum bagging of composite parts.

AMS 263 General Aviation Aircraft Systems 3 Credits (5.5,1.5)
This course covers the operating principles and basic troubleshooting techniques for aircraft systems found in general aviation aircraft. Theory of operation, inspection, and troubleshooting will be emphasized for all systems covered in the course. These systems include hydraulic systems, air conditioning and heating systems, oxygen systems, landing gear systems, brake systems, ice and rain detection/protection systems, fire detection/extinguishing systems, fuel systems, and flight controls.

AMS 264 General Aviation Aircraft Electrical and Instrument Systems 3 Credits (6.75,3.75)
The theory/application of aircraft wiring, basic electrical troubleshooting of airframe systems, DC alternator power systems, and instruments/avionics for general aviation aircraft are developed through the use of laboratory projects and classroom material.

AMS 271 Aircraft Reciprocating Powerplant and Systems 3 Credits (6.75,5.25)
AMS 271 is a study of various types of aircraft engines in use in the aviation industry. Reciprocating engine disassembly, inspection, and reassembly procedures are practiced. A study of the inspection, repair, and operation of powerplant fuel metering units and superchargers as well as induction, cooling, and exhaust systems.

AMS 115 and AMS 117 and AMS 118.
AMS 272  Powerplant Electrical and Instrument Systems  3 Credits (5.5,2)  
A study of various electrical and instrumentation systems use in support of aircraft powerplants. Included in the course are the overhaul and testing procedures for reciprocating and turbine engine electrical system components, including auxiliary power units.  
**Prerequisites:** AMS 116 and AMS 117 and AMS 118.

AMS 273  Propeller Systems  2 Credits (3,2.5)  
Maintenance, repair, and trouble-shooting theory and practices for propellers and propeller system components are covered as they pertain to reciprocating and turboprop engines found in modern aircraft.  
**Prerequisites:** AMS 115 and AMS 116 and AMS 117 and AMS 118.

AMS 274  Aircraft Turbines Powerplants and Systems  4 Credits (6.75,6.75)  
A study of the construction and design of modern gas turbine engines used on the current generation of aircraft. Turbine engine systems will be studied, including lubrication, fuel scheduling, starting, and ignition. Emphasis is placed on proper inspection, troubleshooting, and maintenance techniques.  
**Prerequisites:** AMS 116 and AMS 117 and AMS 118.

AMS 365  Transport Category Aircraft Systems  3 Credits (4.5,3.5)  
This course covers the operating principles and basic troubleshooting techniques for systems found in today's transport category aircraft. The theory of operation, troubleshooting, maintenance, and inspection will be emphasized for all systems covered in the course. These systems include hydraulic and pneumatic systems as well as environmental control systems; oxygen systems; landing gear systems; brake and anti-skid systems; ice and rain detection/ protection systems; fire detection/extinguishing systems; fuel; and flight control systems. This course incorporates practical lab situations for learning reinforcement.  
**Prerequisites:** AMS 116 and AMS 118 and AMS 263 and AMS 264.

AMS 366  Transport Category Aircraft Electrical and Instrument Systems  3 Credits (6.75,4.5)  
The theory/application of transport category aircraft power systems including AC power on large aircraft, and DC generator systems on multiengine turbine powered aircraft are developed. Electrical troubleshooting is addressed in depth, and large aircraft avionics/instrument systems are presented in general.  
**Prerequisites:** AMS 116 and AMS 264.

AMS 375  Repair Station Operations  3 Credits (3.5,4.5)  
This course contains a detailed study supported by the actual overhaul of operational reciprocating engines in a certificated engine repair station environment. Included is a study of the procedures and acceptable techniques used in engine disassembly, inspection, repair, and reassembly. Advanced techniques of nondestructive testing are included in this course.  
**Prerequisites:** AMS 271 and AMS 272.

AMS 376  Powerplant Line Maintenance  3 Credits (4,4.5)  
A course of study that details the correct procedures and methods of installation, inspection, and operational checks of reciprocating and turbine engines. Includes adjustment and troubleshooting of fuel, oil, electrical, and propeller systems on operational aircraft engines.  
**Prerequisites:** AMS 271 and AMS 272.

AMS 380  Radio Communication Theory & Application  2 Credits (2,0)  
Study of advanced radio communication and electronics preparing students for the FCC General Radio Telephone License (GROL) Examination (Elements 1 & 3) and The National Center for Aerospace and Transportation Technologies (NCATT) Aviation Electronic Technician (AET) certifications.  
**Prerequisites:** AMS 116 and AMS 264 and AMS 366.
AMS 384 General Aviation Avionics Systems Integration 4 Credits (0,0)
Study of aviation electronic equipment; installation; system testing. Wiring and integration of a General aviation avionics package and GPS. Operation, testing, and troubleshooting of general aviation avionics systems and wiring concepts.
**Prerequisites:** AMS 116 and AMS 264 and AMS 366.

AMS 388 Air Transport Avionics Systems Line Maintenance 6 Credits (0,0)
Advanced principles in aircraft wiring and air transport avionics systems with hands-on wiring and ramp testing with a concentration in corporate and airline maintenance and troubleshooting.
**Corequisites:** AMS 384.

**Aviation Maintenance Science (AMSA)**

**Courses**
AMS A 490 Aviation Technical Operations 3 Credits
This capstone course is applicable to all students enrolled in the Bachelor of Science in Aviation Maintenance Science (BSAMS) in all Areas of Concentration (AOC). The course is intended to provide a holistic view of an aviation technical operations with an emphasis on Continuing Analysis and Surveillance Systems (CASS), Operations Specifications (OpSpecs), Electronic Recordkeeping, Repair Stations, Safety Management Systems (SMS), Human Factors (MxHF), and International Standard for Business Aircraft Operations (IS-BAO). The Capstone Project associated with this course simulates the student becoming the newly hired VP of Tech Ops of a fictitious airline with a dysfunctional maintenance operation. The student will identify the discrepancies within the organization and implement changes to ensure compliance with current regulations. Pre-Req: Senior Standing and Airframe and Powerplant coursework or certification completed.
**Prerequisites:** Senior standing and all coursework for A and P.

**Biology (BIO)**

**Courses**
BIO 110 Research Methods I 1 Credit (1,0)
Introduction to hypothesis-driven science. Review of scientific literature. Practice in conducting focal literature reviews and critiquing peer-reviewed articles. Familiarization with search engines and reference management software.

BIO 111 Research Symposium 1 Credit (1,0)
Introduction to research study design. Identification of a mentor and potential research project. Submission of formal proposal to be developed as research capstone experience. Exposure to research presentations by peer undergraduates and graduate students.
**Prerequisites:** BIO 110.

BIO 120 Foundations of Biology I 3 Credits
A biological science course introducing the fundamentals of biology and essential structures, components, and processes of life. Emphasis placed on biochemistry; cell structure, function, organization, and division; sources and uses of biological energy; as well as genetics and inheritance.
**Corequisites:** BIO 120L.

BIO 121 Foundations of Biology II 3 Credits
An introduction to organismal diversity, using the phylogenetic tree of life as an organizing theme. Emphasizes methods of phylogenetic reconstruction, current knowledge of the tree of life, and the evolution of life’s most important and interesting innovations.
**Prerequisites:** BIO 104 or BIO 120 **Corequisites:** BIO 121L.
BIO 121L Foundations of Biology II Lab 1 Credit
An introduction to organismal diversity, using the phylogenetic tree of life as an organizing theme. Laboratories cover methods of phylogenetic reconstruction, current knowledge of the tree of life, and the evolution of life's most important and interesting innovations.
Corequisites: BIO 121.

BIO 142 Introduction to Environmental Science 3 Credits (3,0)
An introductory course that stresses the interrelations of all aspects of the living and the nonliving world. Introduces the student to key concepts and principles that govern how nature works and the application of these concepts and principles to possible solutions to environmental and resource problems.

BIO 210 Research 1 Credit (1,0)
Cluster of courses constituting a capstone experience. Engagement in research in conjunction with a faculty mentor or an approved mentor from collaborating institution, agency or firm. Hypothesis formation, bench work, data collection/analysis with written report of progress and/or findings each term. Course substitution offered for study abroad, study away or other experiential learning opportunities.
Prerequisites: BIO 111.

BIO 216 Microbiology 3 Credits
A comprehensive course covering the involvement of microorganisms in disease processes. Course topics include the relationship between host and pathogen, opportunism, the basic functions of the immune system, molecular mechanisms of pathogenesis, and a significant section on the biology of viruses, bacteria, and fungi.

BIO 216L Microbiology Laboratory 1 Credit
Emphasizes the identification, life history, evolutionary history microbes including viruses, bacteria and fungi
Prerequisites: (BIO 120L or BIO 120L) and (BIO 105L or BIO 121L) and (CHM 106L or CHM 111L)
Corequisites: BIO 216.

BIO 245 Natural History of the Region 3 Credits
Focuses on the geology, paleohistory, flora, fauna, and ecosystems of the region, including such topics as the relationship between slope, elevation, topography, and plan communities.

BIO 245L Natural History of the Region Laboratory 1 Credit
Focuses on the practical applications and identification of geomorphology, paleohistory, flora, fauna, and ecosystem structure of the region. Explores the relationship between slope, elevation, topography, and plant communities.

BIO 305 Human Anatomy and Physiology I 3 Credits
It is an intensive lecture course emphasizing the basic concepts and principles of human anatomy and physiology.
Prerequisites: BIO 120 and BIO 121 Corequisites: BIO 305L.

BIO 305L Human Anatomy & Physiology Laboratory 1 Credit
It is an intensive laboratory course emphasizing the basic concepts and principles of human anatomy and physiology.
Corequisites: BIO 305.

BIO 306 Human Anatomy and Physiology II 3 Credits
A continuation of BIO 305. Intensive lecture emphasizing concepts and principles of human anatomy and physiology.
BIO 306L Human Anatomy and Physiology II Laboratory 1 Credit
A continuation of BIO 305L. Intensive laboratory course emphasizing concepts and principles of human anatomy and physiology.

BIO 310 Research 1 Credit (1,0)
Cluster of courses constituting a capstone experience. Engagement in research in conjunction with a faculty mentor or an approved mentor from collaborating institution, agency or firm. Hypothesis formation, bench work, data collection/analysis with written report of progress and/or findings each term. Course substitution offered for study abroad, study away or other experiential learning opportunities. Prerequisites: BIO 211.

BIO 311 Research 1 Credit (1,0)
Cluster of courses constituting a capstone experience. Engagement in research in conjunction with a faculty mentor or an approved mentor from collaborating institution, agency or firm. Hypothesis formation, bench work, data collection/analysis with written report of progress and/or findings each term. Course substitution offered for study abroad, study away or other experiential learning opportunities. Prerequisites: BIO 310.

BIO 321 Behavioral Neuroscience I 3 Credits (3,0)
Fundamental information about the human nervous system, from neuron to complex central nervous system, and how it impacts behavior. Emphasis on molecular biology of the neuron, synaptic transmission, and the neural basis of cognition and perception; including touch, nociception, vision, audition, and vestibular physiology. Prerequisites: BIO 120 and BIO 121.

BIO 322 Behavioral Neuroscience II 3 Credits (3,0)
A continuation of Behavioral Neuroscience I. Emphasis on neural components of movement, sleep, and aging. Special emphasis on disorders of the nervous system and potential interventions. Prerequisites: BIO 321.

BIO 340 Survey of Clinical Instrumentation 3 Credits (1,6)
Practicum at Florida Hospital. Lecture, discussion, and practical applications of instrumentation in a hospital setting. One (1) lecture hour and five (5) hours of practicum at Florida Hospital each week.

BIO 405 Molecular and Cell Biology 3 Credits
A study of basic and essential processes of cells with emphasis on the correlation of structure and function at the organelle and cellular levels. Basic study of the principles of molecular biology including recombinant DNA technology and other approaches and methodologies used in investigating bacterial, archaeal, and eukaryotic cellular structure, development, chromosome organization, gene expression, and gene regulation. Corequisites: BIO 405L.

BIO 405L Molecular and Cell Biology Laboratory 1 Credit
A study of basic and essential processes of cells with emphasis on the correlation of structure and function at the organelle and cellular levels. Basic study of the principles of molecular biology including recombinant DNA technology and other approaches and methodologies used in investigating bacterial, archaeal, and eukaryotic cellular structure, development, chromosome organization, gene expression, and gene regulation. Corequisites: BIO 405.

BIO 406 Forensic DNA Analysis 3 Credits
Examining the theories and current practices used in criminal investigations and legal proceedings to collect, analyze, and interpret biological evidence using molecular biology with emphasis on forensic DNA analysis. Prerequisites: BIO 405 or BIO 400 Corequisites: BIO 406L.

BIO 406L Forensic DNA Analysis Laboratory 1 Credit
Examining the theories and current practices used in criminal investigations and legal proceedings to collect, analyze, and interpret biological evidence using molecular biology with emphasis on forensic DNA analysis. Prerequisites: BIO 400 or BIO 405 Corequisites: BIO 406.
BIO 410 Research 1 Credit (1.0)
Cluster of courses constituting a capstone experience. Engagement in research in conjunction with a faculty mentor or an approved mentor from collaborating institution, agency or firm. Hypothesis formation, bench work, data collection/analysis with written report of progress and/or findings each term. Course substitution offered for study abroad, study away or other experiential learning opportunities.
Prerequisites: BIO 311.

BIO 411 Research Symposium II 1 Credit (1.0)
Culminating course in series of required research seminars. Presentation and discussion of research project, including related literature review and hypothesis, research premises, methodologies, findings, and recommendations in a colloquium format directed at peers and incoming freshman.

BIO 440 Clinical Rotation 3 Credits (1.6)
Advanced practicum, completed at Florida Hospital. Rotation through major medical disciplines. Lecture with case study review, presentation, and discussion. One (1) lecture hour and five (5) hours of practicum at Florida Hospital each week.

Business Administration (BA)
Courses
BA 101 Introduction to Business Programs and Careers 1 Credit (1.0)
The student will assess and develop the personal and interpersonal dynamics and intellectual and social demands necessary to succeed in college. Time management, study skills, goal clarification, career concerns, and college resources are included in the course. Different aspects of careers in business will be discussed in depth. This course is available to freshmen only.

BA 120 Introduction to Computer Based Systems 3 Credits (3.0)
An overview of computing in the business environment, and an introduction to the tools, techniques, and strategies of computer-based information system development. The emphasis is on developing computer literacy through the use of computers in the design and presentation of business communications such as plans, proposals, spreadsheets, graphs, and charts.

BA 201 Principles of Management 3 Credits (3.0)
Provides an overview of relevant management principles and practices as applied in contemporary formal and informal organizations. Focuses on management theories, philosophies, and functions.

BA 205 Foundations of Business 3 Credits (3.0)
Basic topics in business, such as: management, organizational environments, ethics and social responsibility, planning, organizational strategy, global management, and managing teams are discussed. Basic marketing principles such as: marketing mix, marketing research, new product development, marketing channels, promotion, and personal selling. Customer relationship management and the role of social media in marketing are also discussed. Basic topics in accounting for students without prior knowledge of accounting will emphasize how managers, investors, and business stakeholders use accounting in small business startups are also covered in this course. This course is not available to Business Majors.

BA 215 Transportation Principles 3 Credits (3.0)
This course will introduce the basic principles of several modes of transportation, including air, sea, rail, automobile, transit, and pipeline. The operating characteristics of each mode is discussed, as are issues associated with intermodal competition, compatibility, and interconnectivity, the importance of each in the economy, environmental issues, and future developmental prospects.

BA 220 Marketing 3 Credits (3.0)
Marketing theory; marketing management, sales management; market research. Public and customer relations, advertising, distribution.

BA 225 Business Law 3 Credits (3.0)
This course is an overview of the law as it pertains to business relations and business transactions. Areas covered include procedure; torts; criminal law and procedure; constitutional law; administrative law; contracts; agency; real property; personal property; wills; trusts and estates; insurance law; employment law; commercial transactions; secured transactions; creditor/debtor law; and negotiable instruments. Areas of the law applicable to the aviation industry will also be covered.
BA 230  Advanced Computer Based Systems  3 Credits (3.0)
This course is a continuation of BA 120. It covers advanced concepts of spreadsheet use, database management systems, presentation graphics and Internet usage that will assist in problem analysis, worksheet management and exchanging spreadsheet data with other programs. It introduces the student to project planning, project scheduling and project tracking using computer software. In addition, the course provides experience in the basics of retrieving graphical and text-based information and also explores webpage design and development to support management activities.
Prerequisites: BA 120 or CS 120.

BA 299  Special Topics in Management  1-6 Credit
Individual independent or directed studies of selected topics in management.

BA 308  Public Administration  3 Credits (3.0)
Characteristics of organization and management in government; impact of political processes and public pressures on administration action; role of regulatory agencies; governmental personnel and budgetary procedures; unique qualifications of the public administrator.
Prerequisites: BA 201.

BA 310  Airport Management  3 Credits (3.0)
Students will be introduced to the history of airports in the United States, including major federal legislation affecting their development. Students will be introduced to the rules and regulations governing airport operations; the air traffic control, airfield, terminal, and ground access facility infrastructure of airports; airport security policies; and the economic, political, and social role of civil-use airports.
Prerequisites: BA 201 or AS 120 or AS 121.

BA 314  Human Resource Management  3 Credits (3.0)
This course will examine the functions to be accomplished in effectively managing human resources. An in-depth study of the interrelationship of managers, organizational staff, and/or specialists will assist the student in understanding and applying management theories to real-world human resource planning. Areas of concentration include human resource planning; recruitment and selection; training and development; compensation and benefits; safety and health; and employee and labor relations.
Prerequisites: BA 201.

BA 315  Airline Management  3 Credits (3.0)
An introduction to the administrative aspects of airline operation and management. Topics include demand modeling and forecasting, analyzing market competition, schedule planning, fleet assignment, crew scheduling, maintenance routing, irregular operations management, revenue management, the theory of pricing, and marketing and sales initiatives.
Prerequisites: BA 201.

BA 317  Organizational Behavior  3 Credits (3.0)
This course introduces students to the fundamental concepts of organizational behavior with an emphasis on research, theory, and practice.
Prerequisites: BA 201.

BA 318  Entrepreneurship I  3 Credits (3.0)
An analysis of the theoretical and practical knowledge necessary to be successful in conceiving, initiating, organizing, and operating a small business is the main focus. Special focus will be placed on developing a business plan, business in aviation, and entrepreneurship.
Prerequisites: BA 201.

BA 320  Business Information Systems  3 Credits (3.0)
A management approach to understanding business information systems. The general characteristics, potential, and limitations of business systems are covered. The major emphasis is on understanding the inputs, processing, and outputs of a variety of business systems; the ways in which business systems are interrelated and the inherent management problems involved in the implementation and control of such systems.
Prerequisites: BA 230.
BA 321 Aviation/Aerospace Systems Analysis Methods 3 Credits (3,0)
Overview of the system development life cycle. Emphasis on current system documentation through the use of both classical and structured tools/techniques for describing process flows, data flows, data structures, file designs, input and output designs, and program specifications.
Prerequisites: BA 320.

BA 322 Aviation Insurance 3 Credits (3,0)
An introduction to the basic principles of insurance and risk with its special application to the aviation industry. An in-depth review of the aviation insurance industry in the United States including the market and types of aviation insurers. Pre-Requisite: Sophomore Standing.
Prerequisites: BA 201 and Sophomore standing.

BA 324 Aviation Labor Relations 3 Credits (3,0)
An investigation of labor-management relations with specific reference to the aviation industry. Examined are the history of unionism, structure of unions, legal environment and the Railway Labor Act, collective bargaining, public sector relationships, grievance procedures, conflict resolution, and contemporary trends affecting union membership.
Prerequisites: BA 201.

BA 325 Social Responsibility and Ethics in Management 3 Credits (3,0)
A comprehensive inquiry into the major components of social responsibility including economic, legal, political, ethical, and societal issues involving the interaction of business, government, and society.
Prerequisites: BA 201 and COM 219 and COM 221.

BA 326 Marketing Management 3 Credits (3,0)
Marketing management in today's global marketplace must focus on developing strategic options and business plans by managers possessing an integrative functional perspective and understanding marketing's role in the firm. Emphasis will be given to corporate and marketing strategy formulation; market analysis and target market selection; strategic marketing programming; and control of the marketing tactics selected.
Prerequisites: BA 220.

BA 327 Airline-Airport Operations 3 Credits (3,0)
Airline-Airport Operations is a comprehensive overview of the symbiotic and dynamic relationship between airline and airport operations. This course focuses on the day-to-day issues that airline and airport management must address in order to effectively operate. The student will develop an understanding of current issues impacting the relationship between airlines and airports. A historical overview, current airport and airline operational characteristics, regulatory perspectives, current political and financial environment, air service development, and future issues are studied.
Prerequisites: BA 201.

BA 330 Professional Selling 3 Credits (3,0)
This course focuses on the study of the professional selling (business-to-business) process, including the demonstration of self-confidence building exercises in listening skills, interpersonal communications, non-verbal communication skills, and demonstrated competency in key selling skills.
Prerequisites: BA 220.

BA 332 Corporate Finance I 3 Credits (3,0)
The finance function as used by management, including financial analysis and control financial planning; and short, intermediate, and long-term financing, using the theory of cost of capital and leverage in planning financial strategies. Aviation-related businesses are emphasized.
Prerequisites: BA 210 and Junior standing.

BA 333 Personal Financial Planning 3 Credits (3,0)
A study of the personal financial planning process. Includes taxes, investments, purchase of housing/auto, insurance needs and analysis, use of credit, and retirement and estate planning. Student will develop a personal financial plan and will invest in a $500,000 portfolio of securities.

BA 333HYB Personal Financial Planning 3 Credits
Please Note: The HYB designator indicates that this course will be taught in a hybrid delivery format. In the hybrid format, some face-to-face class sessions are replaced with online activities. Hybrid courses are best suited for students who are technically competent, self disciplined and highly motivated.
BA 334 Investment Analysis 3 Credits (3,0)
This course is an introduction to the field of investments. The course is designed as a guide for people studying the capital markets for the first time. The course provides a survey of investments including security markets, investment vehicles, and investment analysis and portfolio management. Specific topics include the concept of risk and return; types of financial instruments; study of how they are bought and sold; an introduction to how they are valued in the marketplace; the survey of investment companies; asset allocation; concept of efficient markets; equity and bond portfolio management; portfolio performance evaluation; fiduciary responsibility and ethical conduct in investment profession; and corporate governance. The course is taught from the viewpoint of an individual rather than institutional investor. The course utilizes current economic and capital market information to make practical application of the course materials.
Prerequisites: BA 332 or EC 225.

BA 335 International Business 3 Credits (3,0)
An analysis of economic development and international trade in modern times, with an examination of current U.S. relations with other nations. Attention will be focused on the impact of foreign trade on the aviation industry and the industry's contribution to economic development.
Prerequisites: BA 201.

BA 336 Electronic Commerce 3 Credits (3,0)
This course seeks to develop knowledgeable users and effective managers in electronic commerce (e-commerce) with a focus on aviation and aerospace management applications. Fundamental business concepts will be applied to the e-commerce environment. A combination of technical and managerial material is presented in order to achieve an understanding of the operational and strategic uses of electronic commerce in the aviation industry. Emphasis is placed on today's electronic marketplace and the use of computers as a selling, marketing, and communications tool.
Prerequisites: BA 220 and BA 230.

BA 342 International Finance 3 Credits (3,0)
The purpose of this course is to provide the analytical framework required for understanding how changes in international financial conditions influence decisions faced by modern business leaders in a global setting. The focus will be on interactions between cross-border trade and capital flows; inflation; interest rates; exchange rates; monetary and fiscal policy; and economic growth. Exchange rate regimes; exchange rate risk and hedging; global capital budgeting; short-term and long-term financing of multinational enterprise; and managing multinational operations will also be explored. The course is tailored to students seeking careers in global banking and investment or with finance and strategy departments of aviation operating enterprise in global markets.

BA 343 Fraud Detection 3 Credits (3,0)
This course provides the student with an understanding of the various forms of fraud. It will cover the principles of fraud detection and examination. It will also include topics such as skimming; cash larceny; billing schemes; check tampering; payroll schemes; register disbursement schemes; non-cash misappropriations; corruption; accounting principles and fraud; fraudulent financial statements; interviewing witnesses; conducting investigations; occupational fraud; and commercial online services.
Prerequisites: BA 210.

BA 345 Business Law II 3 Credits (3,0)
This course will introduce the student to the substantive international and domestic law that applies to the aviation industry from a management perspective. Included is a study of the U.S. legal system; administrative law and the federal regulatory process; international law; domestic and international regulation of aviation; common law contracts and the Uniform Commercial Code; labor law; and antitrust law.
BA 352  Business Quantitative Methods  3 Credits (3,0)
Development, implementation, and utilization of business models for managerial decision making. Various techniques for modeling, such as statistical analyses techniques, data analysis, regression and correlation analysis, forecasting, simulation, and optimization models are covered. Developing models needed in decision support systems using Microsoft Excel.
Prerequisites: BA 230 and MA 222.

BA 355  Marketing Research  3 Credits (3,0)
Fundamentals of marketing research designed to solve marketing and business problems. Research processes used to develop marketing information for managerial decision making. Problem definition, research design, questionnaire construction, sampling determination, data analysis, evaluation, and presentation of results.

BA 363  Supply Chain Management  3 Credits (3,0)
An introduction to supply chain management (SCM) course that discusses the key concepts of SCM and its role in efficiency and competitiveness of companies. Particular attention is given to applications of SCM in aviation and aerospace industries.

BA 399  Special Topics in Management  1-6 Credit
Individual independent or directed studies of selected topics in management.

BA 405  General Aviation Marketing  3 Credits (3,0)
Marketing and management concepts applicable to FBOs and other general aviation enterprises. Travel analysis is performed to determine the need for a business aircraft.
Prerequisites: BA 201.

BA 410  Management of Air Cargo  3 Credits (3,0)
Intensive study of the practices and problems of management with respect to air cargo. Importance of air cargo service to the economy, rate and tariff problems, terminal facilities, competition, and future prospects.
Prerequisites: BA 215.

BA 411  Logistics Management for Aviation/Aerospace  3 Credits (3,0)
This course examines ways to optimize the physical flow of goods and materials in a firm from acquisition through production, and movement through channels of distribution. It focuses on applying logistics theory to aviation management problems in materials handling, managing inventory, planning capacities, and locating distribution centers. It includes case studies with aviation/aerospace applications using computer models.
Prerequisites: BA 201 and MA 222.

BA 412  Airport Planning and Design  3 Credits (3,0)
The principles of airport master planning and system planning are studied. This course covers essential elements of current U.S. and international airport planning and design trends, including airport master planning and layout plans; geometric design and layout of the airfield and terminal facilities; obstruction analysis; signage and lighting; forecasting; airside and landside interface; and capacity and delay effects. The course also focuses on environmental planning, such as hazardous wildlife attractants, airport noise, and compatible land use.
Prerequisites: BA 310 and MA 222.

BA 418  Airport Administration and Finance  3 Credits (3,0)
An advanced study of the organizational, political, and financial administration of public and private civil use airports. Areas of emphasis include public relations management; safety and security issues; employee organizational structures; financial and accounting strategies; revenue and expense sources; economic impacts of airport operations; airport performance measurement standards; and current trends and issues of direct concern to airport administrators.
Prerequisites: BA 310 and BA 332.
BA 419 Aviation Maintenance Management 3 Credits (3,0)
This course provides a comprehensive examination of organizational maintenance policies; programs and procedures with an emphasis on maintenance planning; forecasting and cost control; reliability; safety and flight schedule performance. Note: This is a capstone course for the AOC in Maintenance Management for the Aviation Maintenance Science (AMS) degree.
Prerequisites: BA 201 and MA 222.

BA 420 Management of Production and Operations 3 Credits (3,0)
An intensive study of management in all organizations: service oriented and product oriented. Scheduling, inventory control procurement, quality control, and safety are investigated. Particular attention is given to applications of aviation-oriented activities.
Prerequisites: MA 222.

BA 422 Life Cycle Analysis for Systems and Programs in Aviation/Aerospace 3 Credits (3,0)
This course is a study of system theory and its relationship to aviation/aerospace systems management. It covers a brief history of system theory and system life cycle and presents the major activities in each phase of a system's life cycle. Also covered are specific topics related to system design and support, including reliability, maintainability, availability, testing, quality control, customer support, product improvement program analysis, and the role of data collection and analysis in the operational phase. Related topics covered are cost-effectiveness analysis and project management. The course examines applications and case studies specific to aviation/aerospace, including military applications and computer simulation models.
Prerequisites: BA 201 and MA 222.

BA 424 Project Management in Aviation Operations 3 Credits (3,0)
This course introduces the student to the concept of project management in aviation operations. It addresses the three-dimensional goals of every project: the accomplishment of work in accordance with budget, schedule, and performance requirements. The procedures for planning, managing, and developing projects in an aeronautical environment are covered as well as the aspects of controlling project configuration from inception to completion. Automated tools used to determine cost, schedule, staffing, and resource allocation are covered, as well as the process of determining the effectiveness and technical validity of aviation-related projects.
Prerequisites: MA 222.

BA 425 Trends and Current Problems in Air Transportation 3 Credits (3,0)
This course assists students in building skills that allow them to identify trends and current problems in air transportation. These trends are related to market growth, airline network structure, competition, schedule change, aircraft size change, pricing, delays and on-time performance, and financial conditions. Students will use available databases to extract data, perform descriptive and statistical analysis, and derive conclusions.
Prerequisites: BA 201.

BA 426 International Aviation Management 3 Credits (3,0)
An investigation of international aviation management and its three elements: the nature of international aviation business, working in a foreign environment, and managing in an international environment.
Prerequisites: BA 335.

BA 427 Management of Multicultural Workforce 3 Credits (3,0)
An investigation into the multicultural workforce. The elements of cultural anthropology and international business, communicating across cultures, contrasting cultural values, and managing and maintaining organizational culture are addressed in the context of international aviation management.
Prerequisites: BA 201 and COM 219 and COM 221.
BA 430  International Trade and Regulations  3 Credits (3,0)
Economic analysis of international trade, capital flows, and labor migration with particular emphasis on the laws governing these factors. Aviation applications include code-sharing and other international airline agreements and the impact of trade subsidies and open skies treaties.
Prerequisites: EC 200 or EC 210 or EC 211.

BA 434  Corporate Finance II  3 Credits (3,0)
The objective of this course is to study the major decision-making areas of managerial finance and some selected topics in financial theory. The course reviews the theory and empirical evidence related to the investment and financing policies of the firm and attempts to develop decision-making ability in these areas. This course serves as a complement and supplement to Corporate Finance I. Topics include leasing, dividend policy, mergers and acquisitions, corporate reorganizations, financial planning, working capital management, and international finance. Aviation and aerospace related businesses are emphasized.
Prerequisites: BA 332 and Junior Standing.

BA 437  Strategic Management and Consulting  3 Credits (3,0)
This business program capstone course blends strategic management principles with actual consulting applications. Coursework includes strategy formulation, implementation, evaluation, and organization analysis. A case analysis employing aviation and global strategic management principles is used to examine organizational problems. Students also work in teams to undertake a mandatory field consulting project. As faculty-led student consultants, students must rely on influence, professional experience and knowledge sharing - rather than managerial control - to assess and impact a client and/or organization. Prerequisite: Graduating Seniors in Business Majors Only.

BA 438  Entrepreneurship II  3 Credits (3,0)
The foundation concepts of effective new venture startups, such as management, marketing, finance, and growth are presented along with other considerations in entrepreneurial venture creation and the tools necessary to successfully grow technology ventures.
Prerequisites: BA 318.

BA 450  Airline/Airport Marketing  3 Credits (3,0)
An investigation of the role of marketing in the aviation/airport industries. Topics to be covered include consumer segmentation, database management, integrated marketing communications, public relations, vendor relations, and retailing.
Prerequisites: BA 220.

BA 490  Strategic Management  3 Credits (3,0)
A business capstone course, strategic management principles involving strategy, formulation, implementation, evaluation, and organization analysis are studied. Case analysis, employing strategic management principles, is used to solve and examine organizational problems. Total Quality Management concepts are studied for improvement of organizational effectiveness. Prerequisite: Graduating Senior Standing.

BA 499  Special Topics in Management  1-6 Credit
Individual independent or directed studies of selected topics in management.

Chemistry (CHM)

Courses

CHM 101  Basic Chemistry  3 Credits
This course is a study of elementary chemical theory. It covers basic atomic theory, elements, compounds, and mixtures, calculation of weight and weight volume relationships, basic descriptive chemistry and one 1.5 hour lab session per week. Cannot be used for credit in chemistry toward degrees in Aerospace or Electrical Engineering. Passing grade required for Lab. NOTE: Students must register for lab section CHM 101L.
Corequisites: MA 140 and CHM 101L.

CHM 101L  Basic Chemistry Laboratory  0 Credits
One 1.5 hour laboratory session per week, with experiments related to the material of CHM 101.
Corequisites: CHM 101.

CHM 110  General Chemistry I  3 Credits
Fundamental principles of chemistry. Nomenclature, stoichiometry, atomic structure, periodic relationships, chemical bonding, geometry of molecules, properties of gases, chemical thermodynamics, and solutions.
Corequisites: CHM 110L.
CHM 110L  General Chemistry I Laboratory 1 Credit
Experiments paralleling the material in CHM 110. Topics include chemical stoichiometry; states of matter; solutions; thermodynamics.
Corequisites: CHM 110.

CHM 111  General Chemistry II 3 Credits
Chemical principles that include thermodynamics, acids and bases, rates of reaction, electrochemistry, organic chemistry, synthetic materials.
Prerequisites: CHM 110 Corequisites: CHM 111L.

CHM 111L  General Chemistry II Laboratory 1 Credit
Laboratory with experiments paralleling material in CHM 111. Topics include Colligative Properties; Kinetics; Equilibrium and Le Chatelier's Principle; Acids and bases Ka, pKa, % composition of a weak acid, Buffers; Solubility product constant Ksp; Thermodynamics; Electrochemistry; Nuclear Chemistry; Introduction to Organic Synthesis
Prerequisites: CHM 110L Corequisites: CHM 111.

CHM 140  Chemistry for Engineers 4 Credits (4,0)
Chemical stoichiometry, states of matter, solutions, thermodynamics, rate of reaction, equilibrium, oxidation-reduction, corrosion, organic compounds, and polymers.
Prerequisites: CHM 101 and MA 111 or MA 120 or MA 140 Corequisites: CHM 140L or CHM 110L.

CHM 140L  Chemistry for Engineers Laboratory 1 Credit
One three hour laboratory session per week, with experiments parallelizing the material in CHM 140. Topics include chemical stoichiometry; states of matter; solutions; thermodynamics; rate of reaction; equilibrium; oxidation-reduction; corrosion; organic compounds and polymers.
Corequisites: CHM 140 or CHM 110.

CHM 210  Organic Chemistry I 3 Credits
A study of the fundamental chemistry of organic compounds, including nomenclature, functional groups, chemical and physical properties, structure determination, syntheses of the major classes of organic compounds, and reaction mechanisms.
Prerequisites: CHM 111 Corequisites: CHM 210L.

CHM 210L  Organic Chemistry I Laboratory 1 Credit
Laboratory with experiments paralleling the material in CHM 210. Topics include chemical stoichiometry; states of matter; solutions; thermodynamics
Prerequisites: CHM 111 and CHM 111L Corequisites: CHM 210.

CHM 211  Organic Chemistry II 3 Credits
A continuation of CHM 210. Covers the remaining important types of organic compounds, biological molecules, and the methods of organic synthesis.
Prerequisites: CHM 210 Corequisites: CHM 211L.

CHM 211L  Organic Chemistry II Laboratory 1 Credit
Experiments paralleling the material in CHM 211. Topics include chemical stoichiometry; states of matter; solutions; thermodynamics
Prerequisites: (CHM 200 or CHM 210) and (CHM 200L or CHM 210L) Corequisites: CHM 211.

CHM 310  Biochemistry 3 Credits
A comprehensive survey of the fundamentals of biological chemistry, including the structure and function of biological macromolecules, metabolic pathways in living cells, and the molecular basis of genetics and gene expression
Prerequisites: CHM 211 Corequisites: CHM 310L.

CHM 310L  Biochemistry Laboratory 1 Credit
An experiential laboratory of the fundamentals of biological chemistry, that focuses on the structure and function of biological macromolecules, metabolic pathways in living cells, and the molecular basis of genetics and gene expression
Prerequisites: CHM 211L Corequisites: CHM 310.

Chinese (LCH)

Courses

LCH 101  Mandarin Chinese I 3 Credits (3,0)
Introduction to Mandarin Chinese language, including the pronunciation system (pin yin), basic grammar, traditional character writing and reading, speaking simple sentences, as well as cultural contexts inseparable from the language. Open only to those without prior knowledge of Mandarin Chinese or with consent of the instructor.

LCH 102  Mandarin Chinese II 3 Credits (3,0)
A continuation of Mandarin Chinese I.
Prerequisites: LCH 101.
**LCH 103 Chinese I and II** 6 Credits (6,0)
Introduction to the Mandarin Chinese language, including the pronunciation system (pin yin); basic grammar; simplified or traditional character writing and reading; speaking from single sentences to sentence strings; as well as cultural contexts inseparable from language use. Open only to those without prior knowledge of Mandarin Chinese or with consent of the instructor.

**LCH 199 Special Topics in Lower-Level Chinese** 1-6 Credit
Study Abroad course or directed studies of selected topics in the Chinese language.

**LCH 201 Mandarin Chinese III** 3 Credits (3,0)
A continuation of LCH 102 with emphasis on communicative abilities in listening, speaking, reading, and writing.
**Prerequisites:** LCH 102.

**LCH 202 Mandarin Chinese IV** 3 Credits (3,0)
A continuation of LCH 201.
**Prerequisites:** LCH 201.

**LCH 299 Special Topics in Lower Level Chinese** 1-6 Credit
Study Abroad course or directed studies of selected topics in the Chinese language.

**LCH 306 Asian Literature** 3 Credits (3,0)
A continuation of the study of communication and Asian literature in translation. Representative readings are chosen from ancient times to the present, from poetry to prose, from female writers to male writers, from South Asia to East Asia. Synthesis of major literary themes and development, as well as the cultural contexts for literature, is an important part of the course. The course uses both books and films as study material. A regional and/or thematic focus may be created depending on the instructor expertise. For example, an instructor may focus on East Asia rather than South Asia, on prose rather than drama. Pre-Requisite: Sophomore standing.
**Prerequisites:** Sophomore Standing.

**LCH 307 Personality and Profiling** 3 Credits (3,0)
This course provides a rigorous and comprehensive foundation for explaining, understanding, predicting, and influencing people. This foundation will be applied to stopping people from violating trust, namely, committing espionage and to identifying and controlling them as quickly as possible after they have violated trust. The course will largely focus on personality theory and research based on scientific methodologies. The course also will explore other approaches to human knowledge and meaning including the philosophy of epistemology, literary criticism, and the interpretation of cultural products such as film, music, dance, and painting. By course’s end, students will have profiled a U.S. citizen convicted of spying against his country.
**Prerequisites:** LCH 400.

**LCH 399 Special Topics in Chinese Language** 1-6 Credit
Upper-level study abroad course or directed studies of selected topics in Chinese language.

**LCH 400 Eastern and Western Civilization** 3 Credits (3,0)
Cultural achievements of Eastern and Western civilization from ancient times to the present. Comparisons will be made among different civilizations of the world, and how these civilizations relate to each other. Course may include supplementary reading and writing assignments in English.
**Prerequisites:** LCH 306.

**LCH 499 Special Topics in Chinese Language** 1-6 Credit
Upper-level study abroad course or directed studies of selected topics in Chinese language.

**Civil Engineering (CIV)**

**Courses**

**CIV 140 Engineering Measurements** 1 Credit
Introduction to data collection and analysis. Principles of surveying and mapping, with emphasis on modern methods. Laboratory methods.
**Corequisites:** CIV 140L.
CIV 140L Engineering Measurements
Laboratory 1 Credit
Field practice in surveying and mapping. Use of modern measurement instrumentation. Development of teamwork and surveying project management skills.
Corequisites: CIV 140.

CIV 199 Special Topics in Civil Engineering 1-6 Credit
Directed studies of special topics in Civil Engineering. Offered by arrangement only.

CIV 222 Introduction to Environmental Engineering 3 Credits (3,0)
This introductory course treats general environmental engineering issues but will focus on the varied environmental considerations inherent in the operation of aviation- and aerospace-related facilities, and their associated manufacturing plants. Typically encountered hazardous materials will be covered, as well as how their proper handling can impact the environment. Environmental laws, regulations, and professional ethics will be discussed. Upon taking this course, the student will be able to identify potential environmental hazards normally encountered at aerospace-related facilities, and will be able to understand the impacts of releases to the surrounding environment.
Prerequisites: CHM 110.

CIV 304 Structural Analysis 3 Credits (3,0)
Analysis of statically determinate and indeterminate structures using statics, kinematics, virtual work, strain energy, force, and displacement methods. Structural laboratory testing
Prerequisites: ES 201.

CIV 307 Civil Engineering Materials I 3 Credits
Prerequisites: ES 202 and COM 221 Corequisites: CIV 307L.

CIV 307L Civil Engineering Materials I Laboratory 1 Credit
Use of modern testing methods for determining the engineering properties of steel, concrete, asphalt, polymers, and composites. Laboratory report development.

CIV 311 Introduction to Transportation Engineering 3 Credits (3,0)
Fundamentals of transportation engineering, including planning, design, construction, maintenance, operation, economics, and the role of transportation facilities in society. Concepts, underlying theory, and design issues are detailed.
Prerequisites: PS 150.

CIV 316 Hydraulics 3 Credits (3,0)
Open channel and pipe flows. Hydraulic structures. Groundwater hydrology and storm water management.
Prerequisites: ES 201.

CIV 320 Soil Mechanics 3 Credits
Study of the engineering behavior of soil: origin, classification, identification, and structure. Permeability, seepage, consolidation, settlement, slope stability, lateral pressures, bearing capacity. Soil sampling and testing. Laboratory methods.
Prerequisites: ES 202 and COM 221 Corequisites: CIV 320L.

CIV 320L Soil Mechanics Laboratory 1 Credit
Modern soil testing and analysis methods. Preparation of samples. Testing of soils for engineering behavioral properties, including permeability, settlement, bearing capacity, and lateral pressures.
Corequisites: CIV 320.

CIV 330 Computer Applications in Transportation 2 Credits (1,3)
Application of computer software for planning and design of transportation systems. Emphasis is placed on finding solutions to current problems associated with existing airport and intermodal transportation systems.

CIV 340 Construction Engineering 3 Credits (3,0)
Delivery of construction projects. Introduction to construction equipment, production rates, construction methods for concrete, asphalt, steel, wood, and masonry, planning and scheduling, safety, and construction economics.

CIV 362 Engineering and Construction Operations in Space 3 Credits (3,0)
CIV 370  Computational Methods in Civil Engineering  3 Credits (3,0)
Prerequisites: EGR 115.

CIV 399  Special Topics in Civil Engineering  1-6 Credit
Directed studies of special topics in Civil Engineering. Offered by arrangement only.

CIV 415  Sustainable Food Production and Aquaponics  3 Credits (3,0)
Principles of sustainable engineering. Dynamic stability of biological systems, mass and energy balances, nutrient cycling in natural and artificial environments. Chemical and biological requirements and controls, system modeling and analysis. Renewable energy, technology, and economics of sustainable fish and vegetable production in aquaponic systems. System concepts of sustainable food supplies on extended space exploration missions.

CIV 417  Air Pollution  3 Credits (3,0)
Types and sources of outdoor and indoor air pollutants from stationary and mobile sources. Properties of gases and particulate pollutants; measurement and monitoring of pollutants; air quality modeling. Engineering technologies for air pollution control for nitrogen and sulfur oxides, ozone, VOCs, odors, and CO2.

CIV 421  Geotechnical and Foundation Engineering  3 Credits (3,0)
Prediction of settlement, analysis of the stability of slopes, prediction of the bearing capacity of shallow and deep foundations, and determination of earth pressures acting on retaining structures.
Prerequisites: CIV 320.

CIV 422  Design of Pavement Structures  3 Credits (3,0)
Theory and practice in pavement design for highways and airfields, pavement performance, structural design of pavement layers, types of materials used in pavement layers, characterization of pavement layer materials, and introduction to pavement management concepts.
Prerequisites: CIV 320.

CIV 424  Rehabilitation of Pavement Structures  3 Credits (3,0)
Pavement distresses and their causes. Pavement evaluation, roughness, friction, drainage survey and evaluation, structural evaluation, material characterization, traffic loading evaluation, design of pavement rehabilitation alternatives, economic analysis, and selection of preferred alternatives.
Prerequisites: CIV 320.

CIV 431  Reinforced Concrete Design  3 Credits (3,0)
Prerequisites: CIV 304 and ES 202.

CIV 432  Structural Steel Design  3 Credits (3,0)
Steel and its properties. Design of tension members, column members, torsional members, and plate girders. Welded and bolted connections. Steel design specifications and building codes. Current philosophies in steel design.
Prerequisites: CIV 304 and ES 202.

CIV 437  Water Resources and Hydrology  3 Credits (3,0)
Discussion of broad perspectives on control and utilization of water, quantitative hydrology, groundwater, probability concept, economic study, hydraulic structures, multi-purpose water resources projects
Prerequisites: ES 309.

CIV 441  Civil Engineering Materials II  3 Credits
Physical and mechanical properties of construction materials, portland cement concrete, proportioning of concrete mixtures including admixtures. Fiber reinforced concrete design and evaluation. Origin, production, specifications, and tests of bituminous materials and paving mixtures used in construction and maintenance of roads and pavements, pavement surface properties, pavement distress, and correction alternatives.
Prerequisites: CIV 307 Corequisites: CIV 441L.

CIV 441L  Civil Engineering Materials II Laboratory  1 Credit
Advanced testing methodology for concrete, concrete mixtures, bituminous materials, and pavements.
Corequisites: CIV 441.
CIV 443 Traffic Data Collection Method and Computer Application in Traffic Engineering  3 Credits (3,0)
Basic methods in collecting and analyzing traffic data used in traffic engineering. Application of computer analysis tools for planning, design, and evaluation of transportation systems. Emphasis on analyzing the operation and safety performance of the transportation networks including freeways, highway corridors, and intersections.
Prerequisites: CIV 311.

CIV 447 Airport Design I  3 Credits (3,0)
Fundamental principles of airport layout and preliminary design. Airport site selection, runway length and orientation, air traffic control, capacity, and delay.
Prerequisites: CIV 311.

CIV 457 Airport Design II  3 Credits (3,0)
Airport terminal passenger and vehicle processing systems. Lighting and signing systems, pavement marking, baggage handling, communication systems, and security systems.
Prerequisites: CIV 447.

CIV 470 Senior Project Preliminary Design  1 Credit
Preliminary design activities will be discussed, primarily in response to a Request for Bid Document or a request for Proposals issuance. Students will form teams with corporate structures, will develop a bid capture plan, and will author a Bid Proposal document in response to client requests. When possible, the proposal process will be accomplished in a competitive atmosphere with other student teams providing competing bids. Formal bid presentations will complete the bidding process at the end of the semester. Bid Proposal customs, laws and common practices will be discussed. Professionalism, including ethical behavior, will be reviewed and incorporated into the bid process.
Pre or Co-requisites: Senior standing or consent of instructor. Pre-Requisite: Senior Standing.
Prerequisites: Senior standing.

CIV 471 Senior Design Preliminary Design  3 Credits (3,0)
This course will serve as the pre-requisite and planning phase for CIV 481 - Senior Design. Students will work in small groups and complete essential steps in the engineering design process that will be needed to construct their projects in CIV 481. These steps include (but are not limited to): conceptual design, engineering analysis, testing and validation of concepts and construction methods, development of detail plans/drawings, and cost estimation.
Prerequisites: Senior standing and department approval.

CIV 480 Senior Project Final Design  2 Credits
This course will develop the skills needed to fully develop a preliminary design to the point of project completion and presentation to the client. Activities will include creation of design drawings, construction schedules, cost estimates, and final reports to the client. Construction and demonstration of the design project normally is part of the course. Progress in the design process will be reviewed at formal 30%, 60%, and 90% Critical Design Reviews. These reviews will be conducted in a formal and professional manner with the instructor and other interested faculty serving as the client. Professionalism and ethical conduct will be discussed and incorporated into the class content. Note: It is recommended that CIV 370 precede CIV 480, but it is not a requirement.
Prerequisite: Senior Standing
Prerequisites: Senior standing and department approval.

CIV 481 Senior Design Final Design  4 Credits (3,0)
This course is a continuation of CIV 471 (Preliminary Senior Design). Students will work in small groups and complete the engineering design process. These steps include (but are not limited to): conceptual design, engineering analysis, testing and validation of concepts and construction methods, development of detail plans/drawings and cost estimation.
Prerequisites: Senior standing and department approval.

CIV 490 The Civil Engineering Profession  1 Credit (1,0)
Current problems in engineering, professional duties and responsibilities, opportunities for professional development, ethics, and professionalism. Pre-Requisite: Graduating Senior standing
Prerequisites: Graduating Senior standing.
CIV 499 Directed Design Project 1-6 Credit
Directed design project. Individual investigation of current design problem. Offered by special arrangement only.

Commercial Space Operations (CSO)

Courses
CSO 101 Space Programs Seminar 1 Credit
A continuation of the college success course introduces students to the degree structure and the resources available to reach their learning goals and career aspirations. Seminar topics and speakers explore the private, commercial, and agency space programs underway and in the planning stages.

CSO 199 Special Topic in Commercial Space Operations 1-6 Credit
Individual independent or directed studies of selected topics in commercial space operations.

CSO 230 Space Policy and Law - History 3 Credits (3,0)
How and why underlying factors in Cold War weapons buildup directed the first space efforts in the two Superpowers following WW-II. Continuing evolution of space policy linked through scientific exploration, national interests, and national security; specific legislative processes and landmarks; contemporary policy issues.

CSO 299 Special Topic in Commercial Space Operations 1-6 Credit
Individual independent or directed studies of selected topics in commercial space operations.

CSO 310 International Space Policy and Law 3 Credits (3,0)
Examination of U.S. and international space policy and law which continually evolve due to revised goals and objectives in space operations and partnerships. Influence includes budget and defense issues, and shifting space programs. Current space policy and law issues reviewed, along with needs and accommodations for international law and treaty obligations.
Prerequisites: CSO 230.

CSO 330 Spaceflight and Operations Training 3 Credits (3,0)
Introduction of astronaut and cosmonaut selection and training showing strong parallels with military pilot selection and training, including the rapid evolution of manned space flight training. Current selection techniques, and Spaceflight and Operations Training programs examined, along with the training center facilities and shared training techniques used for International Space Station crews. Examination of commercial training programs already in place and planned.
Prerequisites: HF 330.

CSO 351 Fundamentals of Space Policy and Regulation 3 Credits (3,0)
Regulation and certification of the expanding commercial space programs are characterized within the responsibilities of the FAA and NASA. Preliminary space project and flight operations; training, program evaluation, facilities, medical requirements, and safety practices reviewed.

CSO 390 Payloads and Integration 3 Credits (3,0)
Evaluate overall impact of integration and design concepts on various spacecraft and payload component subsystems. Determine how to align myriad requirements with available system and subsystem performance. Define a final integrated system arrangement and work through validation and testing procedures.

CSO 399 Special Topics in Commercial Space Operations 1-6 Credit
Individual independent or directed studies of selected topics in commercial space operations.

CSO 410 Space Operations Planning and Analysis 3 Credits (3,0)
Safety assurance and risk analysis are emphasized in mission planning, and in launch and flight operations for each phase of commercial space flight. Included are pad and range safety considerations in launch preparations and launch operations; contingency planning for flight operations including reentry.
CSO 460  Applied Spaceflight Policy and Regulation  3 Credits (3,0)
Development and operational regulation and certification for commercial launchers and flight vehicles examined for both cargo and crew ratings. Private and commercial programs compared to NASA projects, with safety and security concerns emphasized. Space launch, flight, and reentry planning and contingency elements reviewed, in addition to coordination of planned and emergency commercial and private space operations with Federal airspace and aviation operations.
Prerequisites: CSO 351.

CSO 490  Senior Space Operations Project  3 Credits (3,0)
Required senior-level capstone project entails interdisciplinary coordination of a simulated flight, launch or training program comparable to commercial or private space operations at established companies.
Prerequisites: CSO 330 and CSO 351 and CSO 410.

CSO 499  Special Topic in Commercial Space Operations  1-6 Credit
Individual independent or directed studies of selected topics in commercial space operations.

Communication (COM)
Courses

COM 8  Developmental Writing for Non-Native Speakers of English  3 Credits (4,0)
A developmental course designed to help intermediate-level non-native speakers of English develop their English language proficiency. The emphasis is on writing and reading in academic settings. Students cannot withdraw from the course. The course must be passed with a grade of C or better. (Credit not applicable to any degree.)

COM 18  Fundamentals of Communication for Non-Native Speakers of English  3 Credits (4,0)
Improves writing and critical thinking skills of students for whom English is not a first language to prepare them for English Composition for Non-Native Speakers of English (COM 122NNS). Emphasizes construction of sentences, paragraphs, and essays that do not involve the integration of secondary sources. (A grade of C or above required to pass this course. Course cannot be dropped. Course credit not applicable to any degree).
Prerequisites: COM 8.

COM 20  Fundamentals of Communication  3 Credits (0,0)
Improves students' writing and critical thinking skills to prepare them for English Composition (COM 122). Emphasizes construction of sentences, paragraphs, and essays that do not involve the integration of secondary sources. (A grade of C or above required to pass this course. Course cannot be dropped. Course credit not applicable to any degree).

COM 122  English Composition  3 Credits (3,0)
This course focuses on the principles of using writing for thinking, as well as a tool for expressing ideas. It addresses the composing process, research and documentation, and rhetorical strategies for various audiences and purposes. Students develop their communicative, evaluative, critical thinking, and research writing abilities. Daytona Beach students need C or better is required.
Prerequisites: COM 20.

COM 199  Special Topics in Communication  1-6 Credit
Individual independent or directed studies of selected topics in communications.

COM 219  Speech  3Credits (3,0)
A continuation of the study of communication and communication theory with emphasis on overcoming communication apprehension, developing listening skills, mastering oral performance, and writing about communication. Individual sections may focus on public speaking, group discussion, oral interpretation, or interpersonal communication. Section emphasis varies by instructor and is listed in the Schedule of Courses.
Prerequisites: COM 122.
COM 221  Technical Report Writing  3 Credits  (3,0)
This course introduces students to the preparation of formal and informal technical reports, abstracts, proposals, instructions, professional correspondence and other forms of technical communication. Major emphasis is placed on the long technical report and the acquisition of advanced writing skills.
Prerequisites: Any 100 or 200 level HU course.

COM 222  Business Communication  3 Credits  (3,0)
An introduction to effective business communication. Topics in oral, written, nonverbal, and intercultural communication are covered. Research methods, effective speaking, and the preparation of letters, memoranda, and reports are emphasized.
Prerequisites: HU 140 or HU 141 or HU 142 or HU 143 or HU 144 or HU 145 or HU 146.

COM 225  Science and Technology Communication  3 Credits  (3,0)
Introduces the practices of communicating news and issues in science and technology to a variety of publics through feature-style writing and public speaking. Includes readings from successful science and technology communicators, illustrating various solutions to writing about complex subjects. Practice in identifying science and technological stories, evaluating sources and information, and communication findings clearly, comprehensibly and accurately for publication and speaking engagements.
Prerequisites: COM 221 or COM 222.

COM 230  Digital Photography  3 Credits  (3,0)
This course introduces fundamental photographic skills through digital technologies. Emphasis is placed on the tools, techniques, and aesthetics of a range of photographic applications pertaining to graphic design and interactive media. Pre-Requisite: Sophomore Standing
Prerequisites: Sophomore Standing.

COM 265  Introduction to News Writing  3 Credits  (3,0)
COM 265 offers Communication majors theory and practice in the fundamentals of various journalistic genres: news reporting, features, interviews, spot news, page layout, interpretive journalism, and more. This course introduces students to use of the AP Stylebook, libel law, and ethical issues in journalism.
Prerequisites: COM 122.

COM 268  Sports Writing  3 Credits  (3,0)
Training in interviewing, research, and writing skills and strategies employed by print sports journalists. This course involves rigorous practice in a variety of sports articles, including game stories, features, advanced-depth writing, opinion, and hard news sports stories using Associated Press style.
Prerequisites: COM 122.

COM 267  Communication Research Theory and Methods  3 Credits  (3,0)
This course offers strategies for discovering and interpreting communication research. Students explore various qualitative, quantitative, and critical research theory and methods. They develop criteria for evaluating each methodological and theoretical approach to communication studies.

COM 269  Special Topics in Communication  1-6 Credit
Individual independent or directed studies of selected topics in communications.

COM 319  Advanced Speech  3 Credits  (3,0)
This course continues the study of oral communication with emphasis on effective public speaking. It includes the analysis and practice of modern and traditional methods of persuasion within and beyond the classroom.
Prerequisites: COM 219.

COM 320  Mass Communication Law and Ethics  3 Credits  (3,0)
The legal and ethical concepts underpinning mass media practices in the United States. Judicial processes; First Amendment freedoms; speech-related torts; professional practices and privileges of journalists and other media professionals; ethical models for decision-making.
Prerequisites: COM 221 or COM 222.
COM 322  Aviation and Aerospace Communication  3 Credits (3,0)
Practices of communicating news and issues in aviation and aerospace to a variety of publics through journalistic writing. Recognize news value of contemporary aviation issues, gain understanding of issues through research and interviews, and write about the issues. Students will identify publishing opportunities, with the ultimate goal to have one of more of their works published.
Prerequisites: COM 265 and COM 221 or COM 222.

COM 325  Mass Media and Current Events  3 Credits (3,0)
The study of mass media and society through inspection of media coverage of a major news event or issue. Course will examine the symbiotic relationship between mass media and advocates/players within a major news story as seen through real-time developments.
Prerequisites: HU1 14X.

COM 326  Social Media Communication  3 Credits (3,0)
Practice in managing effective social media content for specific target audiences in a professional capacity. Explore the relationship between audience, purpose, and content using social media formats. Develop criteria for evaluating each form of content, find examples, assess effectiveness, and practice professional social media skills.
Prerequisites: COM 221 or COM 222.

COM 350  Environmental Communication  3 Credits (3,0)
An examination of a specific national and/or regional environmental issue, including such topics as climate change, pollution, conservation, policy-making and policy change. Students’ individual interests determine their research focus.
Prerequisites: COM 221 or COM 222 or COM 225.

COM 360  Media Relations I  3 Credits (3,0)
The course focuses on different theories of persuasive communication and the construction of persuasive messages. Individual instructors may explore persuasive communication in public service and political campaigns, interpersonal communication, social movements, persuasive writing, or advertising. Students are evaluated on their ability to recognize, apply, and evaluate the communication theories used to design persuasive messages.
Prerequisites: COM 219 and COM 265.

COM 362  Communication and Organizational Culture  3 Credits (3,0)
Analysis of organizational culture, a study of theory, as well as survey and application of research methods in communication. Allows students to assess particular organizations and to increase their ability to initiate organizational change. Entails a variety of research methods, including reviews of house publications, internal communication, speeches and interview communication.
Prerequisites: COM 219 and COM 221 and COM 270.

COM 364  Visual Design  3 Credits (3,0)
Principles of visual design with an emphasis on understanding effective organization and presentation of information in print and digital mediums. Special topics include audience awareness, data presentation, visual aids, photo editing, document design, typography, color theory, and composition. Students analyze existing graphical artifacts and create projects focused on communicating ideas related to science and technology.
Prerequisites: COM 221 or COM 222.

COM 399  Special Topics in Communication  1-6 Credit
Individual independent or directed studies of selected topics in communications.
COM 410  Advanced Professional Writing  3 Credits (3,0)
A sophisticated process approach to strategies for effective communication in the workplace. Balancing theory and practice in professional communication, students will work singly and in collaborative teams to integrate visuals, layout and design, editing and review systems, online documentation, and electronic publishing. All assignments carry written components with equal emphasis placed on oral execution.
Prerequisites: COM 219 and COM 221 or COM 222 and COM 265.

COM 411  Web Design Workshop  3 Credits (3,0)
In addition to highlighting theories of communication related to design and content, this course serves as a practical workshop in Web site development, with an emphasis on communicating science and technology in a professional context. In close consultation with the professor, students design and produce Web sites for University programs, departments, non-profit organizations, and businesses. Experience with Web development software is recommended.
Prerequisites: COM 219 and COM 221 or COM 222.

COM 412  Advanced Technical Writing  3 Credits (3,0)
Communication specific to the technical communication profession is studied, and students prepare at least one formal project suitable for inclusion in a career portfolio. The projects may include, but are not limited to, the following: technical manual, grant or business proposal, product development and documentation, multimedia training or product presentation, training modules, and corporate reports. Projects may be in paper, electronic, or combination of multimedia formats, depending on trends in the profession and use of technology. Professional technical communicators may serve as mentors or speakers.
Prerequisites: COM 221 or COM 222.

COM 415  Nonverbal Communication  3 Credits (3,0)
This course entails the study of communication behaviors and processes not involving the expression of written or spoken words, which contribute information to a message. Special attention is directed to the study of voice qualities; facial expression and body language; space, personal distance, and touch; the use of time and objects; and personal appearance. Study also involves non-verbal communication in applied settings, as well as research strategies for observing, measuring, and understanding non-verbal phenomena. Also offered as HU 415. Students receive either Communications or Humanities credit, but not both.
Prerequisites: COM 219 and COM 270 and (COM 221 or COM 222)

COM 460  Media Relations II  3 Credits (3,0)
Mastery of writing and speaking genres in media relations with an emphasis on crisis communication.
Prerequisites: COM 221 or COM 222.

COM 475  Video Production  3 Credits (1,2)
Production of weather and news segments for multi-platform broadcast. Exposure to industry standard equipment; performing the various jobs of a professional newsroom or production studio (writer, editor, producer, director and on-air talent); field production work.

COM 499  Special Topics in Communication  1-6 Credit
Individual independent or directed studies of selected topics in communications.

Computer Engineering (CEC)

Courses

CEC 220  Digital Circuit Design  3 Credits (3,0)
This course provides a knowledge and facility in logic design, interfacing digital circuits, Boolean algebra, combinatorial logic circuits, circuit minimization techniques, flip-flop storage elements, shift registers, counting devices, sequential logic circuits, state machines and computer structure.
Corequisites: CEC 222.
CEC 222 Digital Circuit Design Laboratory 1 Credit (0,3)
Laboratory experiments in the measurement and verification of digital circuits. Discrete and integrated logic circuit design analysis and measurements. **Corequisites:** CEC 220.

CEC 299 Special Topics in Computer Engineering 1-6 Credit
Directed studies of selected topics in computer engineering.

CEC 300 Computing in Aerospace and Aviation 3 Credits (3,0)
This course explores the computer engineering aspects of systems ranging from embedded sensor and actuator controllers to high-performance computing systems used in air traffic control and weather forecasting. The critical factors that impact the engineering decisions involved, including technological, economic, social, and professional issues are discussed. Key engineering techniques and practices, including database, human-computer interaction, and networks of systems are explored through case studies and representative examples from the aerospace and aviation domains. Pre-Requisite: Junior Standing **Prerequisites:** EGR 115 or CS 223.

CEC 315 Signals and Systems 3 Credits (3,0)
Introduction to signal processing systems for both digital and analog systems. Mathematics of signal representation and signal processing, including functional descriptions of signals and systems. Implications of linearity and time-invariance, and input-output behavior of linear, time-invariant systems. Causality and stability. Zero-input and zero-state responses. Z and Laplace Transforms. Fourier Series and Fourier Transforms for discrete and continuous systems. Extensive use of MATLAB and Simulink. **Prerequisites:** EGR 115 or CS 223 **Corequisites:** MA 345.

CEC 320 Microprocessor Systems 3 Credits (3,0)
Study of digital computer organizations. Introduction to microcomputer systems using a current microprocessor. Assembly language programming techniques for microcomputers will be used to study digital computer operation. Input and output techniques, memory devices, RS 232, and other interfacing techniques will be studied. Hardware and software relationships will also be discussed. **Prerequisites:** CEC 220 **Corequisites:** CEC 322.

CEC 322 Microprocessor Systems Laboratory 1 Credit (0,2)
Hands-on experience with a microprocessor is provided through weekly experiments involving hardware and software techniques. **Prerequisites:** CEC 220 **Corequisites:** CEC 322.

CEC 330 Digital Systems Design with Aerospace Applications 4 Credits (3,2)
This is the continuation of Introduction to Digital Circuit Design (CEC 220). Students in this class use tools such as FPGA (field programmable gate array) to design and implement digital circuit components and subsystems that are responsible for the control and operation of an aerospace system. In addition, students will be introduced to high-level design languages, such as VHDL (VHSIC hardware description language), RTL (register transfer language), and their application to the design and development of digital circuits. **Prerequisites:** CEC 220 and CEC 222.

CEC 399 Special Topics in Computer Engineering 1-6 Credit
Directed studies of selected topics in computer engineering.
CEC 410  Digital Signal Processing  3 Credits (3,0)
Specification, design, and implementation of offline signal processing systems on general-purpose computers and real-time signal processing systems on special-purpose digital signal processing microprocessors (DSPs). Review of sampling theory and discrete time filtering. Filter design tools. Digital-to-analog and analog-to-digital conversion hardware. DSP core architectures and hardware interrupts. Aspects of system-on-a-chip DSPs for data transfer, cache management, external memory reference, and co-processor interface. Real-time operating systems for DSPs. Applications to modern communication and control systems.
Prerequisites: CEC 315  Corequisites: CEC 411.

CEC 411  Digital Signal Processing Laboratory  1 Credit (0,3)
Laboratory companion course to CEC 410 featuring development of signal generation, processing, and analysis systems using digital signal processing microprocessors (DSPs). DSP software development and debugging environments. Chip- and board-support libraries. Use of algorithm libraries for rapid system development. System development tools, including automatic code generation with Simulink. Culminates in development of stand-alone board-based DSP system.
Prerequisites: CEC 315  Corequisites: CEC 410.

CEC 420  Computer Systems Design I  3 Credits (2,3)
This is the first course in the senior project sequence (CEC 420 and CEC 421). This course introduces students to discussing issues of management, planning, task assignment, resource allocation, requirement collection, and system specification and design. The team working in a distributed environment will develop a base for implementation of a computer-centered system with elements of both hardware and software. The artifacts developed during this course will be used as the foundation for further development during the second course (CEC 421) in the sequence. Pre-Requisite: Computer Engineering Major and Senior status
Prerequisites: Computer Engineering majors and Senior standing.

CEC 421  Computer Systems Design II  3 Credits (1,6)
This is the second course in the senior project sequence (CEC 420 and CEC 421). This is the continuation of CEC 420. This course continues with project development, focusing on issues of detailed design, modularization, component selection, coding, assembling, and testing. The team working in a distributed environment will implement and test a computer-centered system with elements of both hardware and software.
Prerequisites: CEC 420.

CEC 440  Autonomous Vehicle Design  3 Credits (3,0)
This course introduces students to the issues involved in the development of autonomous vehicles as applied in aerospace and aviation. This multidisciplinary course is designed to give students a variety of basic concepts and hands-on experience in robotics and automation. Topics include control, sensing, vision, intelligence, and mechanics. To gain hands-on experience, students will participate in a project in which they will design and build an autonomous vehicle that will participate in an international robotics competition.
Prerequisites: CEC 320.

CEC 450  Real-Time Systems  3 Credits (3,0)
The course introduces the concepts of real-time systems from the user and designer viewpoint. The requirements, design, implementation, and basic properties of real-time application software are described with an overview of system software. Related topics such as interrupts, concurrent task synchronization, sharing resources, and software reliability are discussed. A team project on a real-time prototype application may be incorporated in the course.
Prerequisites: CS 225 and CEC 320.

CEC 460  Telecommunications Systems  3 Credits (3,0)
Techniques and applications in telecommunications. Types of data communication versus line discipline methodology. Hardware requirements and constraints. Speed versus quality. Security and encoding algorithms.
Prerequisites: CEC 320.
CEC 470  Computer Architecture  3 Credits (3,0)
This course describes in detail the Von Neuman computer architecture, which includes processors, memory, input/ output, and transfer of information; examples of machine language, assembly language, microprogramming, and operating systems will be discussed. Additional topics in advanced computer architecture and computer systems will be covered.
Prerequisites: CEC 320.

CEC 499  Special Topics in Computer Engineering  1-6 Credit
Directed studies of selected topics in computer engineering.

Computer Science (CS)

Courses
CS 118  Fundamentals of Computer Programming  3 Credits (3,0)
Introduction to basic concepts of structured programming with applications in business, technology, and engineering. This course is intended for the student with little or no experience in programming.

CS 120  Introduction to Computing in Aviation  3 Credits (3,0)
This course provides an introduction to computer organization and applications, with an emphasis towards issues relating to aeronautical science and the aviation industry. Computational models are presented and related to real world architectures. Data representation and file organization are introduced. Basic network structure and behavior is presented. These topics form the building blocks of more specialized course segments focusing on the use of computers in the aviation field. Aviation specific course components include computer simulation, instrumentation, and avionics systems. Additional material discusses the impact of computers on society and business practices.

CS 125  Computer Science I  4 Credits (4,0)
Introduction to problem-solving methods, algorithm development, and software engineering; software development process, program design, coding, review, testing, and documentation; and programming using a modern programming language that supports modular development. The course has a closed laboratory that includes activities dealing with the computing environment, the software development process, and programming exercises.
Prerequisites: CS 125L.

CS 125L  Computer Science I Laboratory  0 Credits
Computer Science I Laboratory
Corequisites: CS 125.

CS 199  Special Topics in Computer Science  1-6 Credit
Individual independent or directed studies of selected topics in computer science.

CS 222  Introduction to Discrete Structures  3 Credits (3,0)
An introduction to the fundamental algebraic, logical, and combinatorial concepts of mathematics that provide a foundation for the study of computer science. Pre-requisite: Experience in programming in a high-level language, pre-Calculus mathematics.

CS 223  Scientific Programming in C  3 Credits (3,0)
This is a course in C programming for scientists and engineers. Using a problem-solving approach for developing algorithms, the algorithms are implemented in C and include the following topics: data types and related operations, input/output, control structures, functions, arrays, files, and strings.

CS 225  Computer Science II  4 Credits (3,3)
This course emphasizes program design, style, data abstraction, information hiding, and testing; advanced programming features; and introduction to object-oriented concepts, basics of algorithm analysis, exception handling, string processing, recursion, pointers, and simple data structures. The course has a closed laboratory that includes activities dealing with the computing environment, the software development process, and programming exercises.
Prerequisites: CS 223 or EGR 115 Corequisites: CS 225L.
CS 299 Special Topics in Computer Science 1-6
Credit
Individual independent or directed studies of selected topics in computer science.

CS 303 Network Security 3 Credits (3,0)
This course introduces the principles and algorithms of modern encryption and some major issues and problems of computer security. Topics covered include the notion of block ciphers and implementations such as DES and Blowfish. Modern public key encryption techniques such as the RSA algorithm. Statistical attacks on encryption including traffic monitoring. Hash functions. Digital signatures and authentication methods. An introduction to some attacks and defenses such as viruses, worms, and firewalls. This course is intended to be a required course in an Cyber Security Engineering minor or a technical elective for students majoring in Computer Science or Computer Engineering.
Prerequisites: CS 225.

CS 315 Data Structures and Analysis of Algorithms 3 Credits (3,0)
This course emphasizes the design, implementation, and analysis of algorithms dealing with searching, sorting, graphs, trees, and disk files.
Prerequisites: CS 222 and CS 225.

CS 317 Files and Database Systems 3 Credits (3,0)
Introduction to file and database systems. The course will cover the theory of database systems, various database models, and the design of a database system. Course homework will reflect real-life problems requiring cooperation, problem formulation, and problem-solving skills. A team/group term project may be assigned.
Prerequisites: CS 225 and CS 222.

CS 332 Organization of Programming Languages 3 Credits (3,0)
A comparative study of different programming paradigms. Students program in several languages chosen to illustrate the essential features of the paradigms studied. Formal language concepts are also introduced.
Prerequisites: CS 222 and CS 225.

CS 335 Introduction to Computer Graphics 3 Credits (3,0)
Introduction to computer graphics, algorithms, graphics programming, graphics design, use of graphic packages, and applications of computer graphics to aviation, business, and scientific problems. A term project involving a graphics programming application may be assigned.
Prerequisites: MA 241.

CS 344 C Programming and UNIX 3 Credits (3,0)
This course is an advanced course in the C programming language and the UNIX programming environment and provides basic information about the general principles of operating systems. It begins with an introduction to the UNIX operating system, followed by an in-depth study of the C programming concepts and techniques in the UNIX environment. In addition, topics such as the function and structure of operating systems, process management, memory management, concurrency, UNIX system programming, and UNIX programming tools will be covered.
Prerequisites: CS 225.

CS 350 Computer Modeling and Simulation 3 Credits (3,0)
Introduction to the basic aspects of modeling and simulation. Topics include statistical models, queuing theory, random variate generation, simulation languages, object-oriented programming, graphic output with animation, design and analysis of experiments, and verification and validation of simulation models. A term project involving the simulation of an element of aviation or aerospace may be assigned. Junior standing.
Prerequisites: MA 412 or MA 222.

CS 399 Special Topics In Computer Science 1-6
Credit
Individual independent or directed studies of selected topics in computer science.

CS 420 Operating Systems 3 Credits (3,0)
Development, structure, and functions of operating systems; demand service models; development of concurrent models. Pre-Requisite: Junior standing
Prerequisites: CS 225.
CS 426  Digital Forensics  3 Credits (3,0)
Locating evidence and recovering data using low-level techniques and tools. Preservation, identification extraction, documentation, and interpretation of computer data following clear, well-defined methodologies and procedures; details of various PC and server-based partitions as well as file systems such as FAT, NTFS, HFS, Ext*, and UFS*. File system and partition data structures.

CS 427  System Exploitation and Penetration Testing  3 Credits (3,0)
Common vulnerabilities and their exploitation for disrupting a system’s integrity; common attack techniques for penetration testing; avoiding common exploits incorporated into systems during design and implementation phases.
Prerequisites: CS 303.

CS 428  Applied Cryptography  3 Credits (3,0)
Fundamental concepts of cryptography for enhancing security properties of systems. Common cryptanalysis techniques and tools.
Prerequisites: CS 225 or CS 222 and MA 222 or MA 412.

CS 429  Current Topics in Cybersecurity  3 Credits (3,0)
Examination of the most recent, often still developing issues, in the field of cybersecurity; the course content depends on current trends at the time of offering.

CS 432  Information and Computer Security  3 Credits (3,0)
The course will start with an overview of the larger context of information security, including the "softer" aspects of personnel and operational security, and then delve into the technical basis and practical difficulties of COMPUSEC itself. This course is intended to be a required course in an Cyber Security Engineering minor or a technical elective for students majoring in Computer Science or Computer Engineering.
Prerequisites: CS 420.

CS 455  Artificial Intelligence  3 Credits (3,0)
Introduces introductory topics of artificial intelligence and its application to real-world problems. Addresses tools and techniques including agent-based systems, problem solving algorithms, expert systems, fuzzy logic, feed forward back propagating artificial neural networks, and ethical issues of intelligent systems. Students are exposed to both algorithms and tools (commercial and/or open source).
Prerequisites: CS 225.

CS 490  Computer Science Capstone Design I  3 Credits (3,0)
This course is the continuation of SE 300 (Software Engineering Practices), where the students are given an opportunity to work on a term-long interdisciplinary (computer science, software engineering, and the student’s area of concentration) project culminating the knowledge and expertise they have gained throughout their program of study.
Prerequisites: SE 300.

CS 491  Computer Science Capstone Design II  3 Credits (3,0)
The capstone sequence allows students an opportunity to perform in depth work that builds on the computer science foundations learned in previous courses. Students are expected to demonstrate a capability to perform the management, analysis, design, implementation, and testing tasks necessary to create a complex computational system. Project work is assessed using industrial software standards and review techniques. The senior project sequence is considered the capstone course for undergraduate students in computer science.
Prerequisites: CS 490.

CS 499  Special Topics in Computer Science  1-6 Credit
Individual independent or directed studies of selected topics in computer science.
Cybersecurity (CYB)

Courses

CYB 155 Foundations of Information Security 3 Credits
Survey of the broad field of cyber-security and information assurance. Definition of information security; the need for this field of study; ethical and legal issues; risk management and planning; and information security technology; role of the U.S. Department of Homeland Security (DHS) in securing the cyberspace and the nation's information-related infrastructures.

CYB 235 Computer and Network Technologies 3 Credits (3,0)
Introduction to the technology that underlies computers and communication networks, Understanding of how computers operate; how users interact with computers; how computers store data; how computers communicate with other computers; the building blocks of communications networks; the Internet, and TCP/IP communications protocols and applications.

CYB 335 Information Security Tools and Techniques 3 Credits
Introduction to the tools and techniques used to secure computers; data networks; and digital information. How attackers view and identify vulnerabilities; weaknesses. Methods to attack and secure operating systems; communications infrastructures; and data networks including TCP/IP and the Internet; including attacker applications. Demonstration and hands-on exercises.

Prerequisites: CYB 235.

CYB 365 Introduction to Digital Forensics 3 Credits
Introduction to the field of digital forensics; its use in gathering evidence; information interpretation for criminal and civil courts; use for intelligence gathering; in research; and incident response. Legal aspects governing search and seizure; the role of file systems and operating systems and how they interrelate; basic tools for computer, network, and mobile forensics acquisition, analysis, and reporting. Demonstration and hands-on exercises.

Prerequisites: CYB 235.

CYB 465 Cybercrime and Cyberlaw 3 Credits
Types of criminal behavior in cyberspace, such as identify theft, white collar crimes, fraud, child sexual exploitation, intellectual property theft, and online scams. Laws governing cyberspace, defining criminal activity and guiding law enforcement investigations; U.S. decisional law guiding search and seizure of digital devices and information; international laws related to computer crime and privacy.

Prerequisites: CYB 235.

CYB 474 Issues in Aviation Cybersecurity 3 Credits (3,0)
Employs a multi-pronged approach to the study of problems related to aviation cybersecurity. Will discuss the cyber threat landscape, and apply the lessons of cyber defense to many actors within the aviation and aeronautics industry, including airlines, airplanes, manufacturers, airports, cargo and other vendors, unmanned systems, and more. Topics include cyber threats to all aspects of the industry, including communications, navigation, supply chain, and airports. Examination of frameworks being devised to protect assets from the cyber attack vector, as well as vulnerabilities, protection, and countermeasures. Will explore the current research literature concerning cybersecurity and information assurance as it impacts aviation.

Prerequisites: CYB 335 or CYB 365 or CYB 465.

CYB 485 War, Terrorism and Diplomacy in Cyberspace 3 Credits
Cyberdiplomacy; cyberwar; cyberterrorism, definitions and examples and uses in illegal, violent actions against people for purposes of furthering ideological, economic, or political objectives. Impact of cyberspace on modern views of warfare, terrorism, and diplomacy.

Prerequisites: CYB 335 or CYB 365 or CYB 465.

CYB 499 Special Topics in Cybersecurity 1-6 Credit
This is a variable credit independent study course. Students wishing to pursue an independent study in Cybersecurity will need to coordinate and establish the number of credits (for example, 1-3), topics, etc. with a Cybersecurity faculty member willing to work with him/her.
Economics (EC)

Courses
EC 200 An Economic Survey 3 Credits (3,0)
An introduction to macro and microeconomic principles, problems, and policies with a view to current economic problems.

EC 210 Microeconomics 3 Credits (3,0)
An introduction to the economic principles of free enterprise supply and demand, private and social implications of profit maximization, market structure, and resource markets. Current microeconomic issues in aviation (such as liability reform, evolution of airline competition, etc.) are discussed.

EC 211 Macroeconomics 3 Credits (3,0)
An introductory analysis of employment, inflation, recession, GDP economic growth, and international trade with an emphasis on practical policy alternatives. Macroeconomic aviation applications such as the counter-cyclical growth of start-up airlines and consideration of ATC privatization are incorporated.

EC 225 Engineering Economics 3 Credits (3,0)
An introduction to microeconomic principles, problems, and policies as well as basic financial principles such as time value of money, capital budgeting, and cost of capital. The course will provide the engineering graduate with the tools needed for success in the workplace.

EC 299 Special Topics in Economics 1-6 Credit
Individual independent or directed studies of combinations of selected topics in economics.

EC 315 Managerial Economics 3 Credits (3,0)
This course presents an analytical approach to the manager’s role in understanding pricing, costing, production and forecasting. This course emphasizes the quantitative and qualitative applications of economic principles to business analysis and concentrates on simple quantitative models to explain the firm’s position in the market and how the manager can react to and control information. Aviation related topics commonly discussed include airport privatization, employee ownership of airlines, forecasting passenger demand, airline production and cost analysis, optimal pricing and production decisions, sensitivity analysis, and capital budgeting.
Prerequisites: EC 210.

EC 399 Special Topics in Economics 1-6 Credit
Individual independent or directed studies of combinations of selected topics in economics.

EC 420 Economics of Air Transportation 3 Credits (3,0)
A study of the economic aspects of airline service with consideration given to the impact of federal aid and regulation, types of aircraft, airport problems, consumer interests, and competitive practices.
Prerequisites: EC 200 or EC 210.

EC 499 Special Topics in Economics 1-6 Credit
Individual independent or directed studies of combinations of selected topics in economics.

Electrical Engineering (EE)

Courses
EE 199 Special Topics in Electrical Engineering 1-6 Credit
Individual independent or directed studies of selected topics in electrical engineering.

EE 223 Linear Circuits Analysis I 3 Credits (3,0)
Corequisites: MA 345 and PS 250.
EE 224 Electrical Engineering Laboratory I 1 Credit (0,3)  
Problem sessions, electrical instrumentation and measurement, verification of theory presented in EE 223, working knowledge of electronic test equipment.  
**Corequisites:** EE 223.

EE 299 Special Topics in Electrical Engineering 1-6 Credit  
Directed studies of selected topics in electrical engineering.

EE 300 Linear Circuits Analysis II 3 Credits (3,0)  
**Prerequisites:** EE 223  
**Corequisites:** MA 441.

EE 302 Electronic Devices and Circuits 3 Credits (3,0)  
Introduction to basic semiconductor theory and semiconductor device characteristics. Diode and transistor models used in the analysis and design of electronic circuits. Basic amplifier circuits. Single and multi-stage amplifier analysis, design, and frequency response. Integrated circuit implementation of differential stages and operational amplifier circuits.  
**Prerequisites:** EE 223  
**Corequisites:** EE 304.

EE 304 Electronic Circuits Laboratory 1 Credit (0,3)  
Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits.  
**Corequisites:** EE 302.

EE 307 Avionics I 3 Credits (3,3)  
Provides the first part of a comprehensive and rigorous study of avionics systems. The course covers avionics systems from the basic physics of avionics to the latest technology.  
**Prerequisites:** EE 223.

EE 308 Introduction to Electrical Communications 3 Credits (3,0)  
This is an introductory course in communications and includes channels, networks, Shannon's law, random processes, modulation, and multiplexing. Transmitters and receivers are covered as an application of the theory introduced in this course. The Fourier transform is the major mathematical tool used in this course. The subjects are the basic foundation of both analog and digital communications, both wired and wireless.  
**Prerequisites:** CEC 315.

EE 310 Avionics II 3 Credits (3,0)  
Provides the second part of a comprehensive and rigorous study of avionics systems. This course includes practical laboratory examples. The course covers avionics systems from the basic physics of avionics to the latest technology. This course is a continuation of EE 307.  
**Prerequisites:** EE 307.

EE 311 Robotics Technologies for Unmanned Systems 3 Credits (3,0)  
An introduction to robotics with emphasis on sensors, actuators and computer control. Topics include the terminology used to describe unmanned systems, such as fly-by-wire control, teleoperation and autonomy. Technologies studied include range finding systems (e.g., sonar, radar, ladar), position determination systems (e.g., GPS and landmark-based systems), optical sensors (infrared and visible light imaging), inertial guidance systems, servomotors and safety systems. The course includes a microprocessor-based robotics project.  
**Prerequisites:** EGR 115 or CS 223.

EE 327 Electrical Engineering Fundamentals 3 Credits (3,0)  
EE 328 Electrical Engineering Fundamentals Laboratory 1 Credit (0.3)
Laboratory experiments and techniques in electrical engineering. The Electrical Engineering Fundamentals Lab EE 328 must be taken during the same semester as EE 327 (Electrical Engineering Fundamentals).
**Prerequisites:** PS 253  
**Corequisites:** EE 327.

EE 340 Electric and Magnetic Fields 3 Credits (3,0)
This course introduces the study of time-varying electromagnetic fields and the relevant analysis in electrical engineering, electrostatics and magnetostatics. Topics discussed include the study of magnetic and dielectric material properties; Maxwell's equations; energy and radiation of plane waves; introduction of electromagnetic waves, transmission lines, the Smith chart, and radiation from antennas.
**Prerequisites:** EE 223 and MA 441.

EE 399 Special Topics in Electrical Engineering 1-6 Credit
Directed studies of selected topics in electrical engineering.

EE 401 Control Systems Analysis and Design 3 Credits (3,0)
Modeling, analysis, and design of analog and digital linear control systems using time and frequency domain techniques. Topics include feedback control system characteristics performance analysis and stability, Z-transforms, and controller design.
**Prerequisites:** MA 345.

EE 402 Control Systems Laboratory 1 Credit (0.3)
Laboratory experiments involving the principles of operation and design of linear control systems. Experiments to support theory introduced in EE 401.
**Corequisites:** EE 401.

EE 410 Communication Systems 3 Credits (3,1)
Theory and application of electronic communication systems; spectral analysis; modulation and demodulation techniques; transmitting and receiving systems. Behavior of receivers and transmitters in the presence of noise. Study of avionic radio systems currently in use, such as NAV, COMM, DME, ATCRBS, ILS, and others.
**Prerequisites:** EE 340.

EE 412 Communication Systems Laboratory 1 Credit (0.3)
Laboratory experiments involving design and analysis of electronic communication; circuitry and measuring performance characteristics; and limitations of various communication components and systems.
**Corequisites:** EE 410.

EE 417 Digital Communications 3 Credits (3,0)
This course covers digital codes, including the understanding of the generation of common codes and the advantages and disadvantages of the various types of codes. Bandwidth considerations are introduced. Common distortion and interference phenomena are studied in terms of inter-symbol interference, bit error rates, and the tools for analyzing these impairments, such as eye diagrams and constellation diagrams. Techniques for improving digital communications, including matched filters, error detection, error correction, and data compression, are discussed.
**Prerequisites:** EE 308.

EE 420 Avionics Preliminary Design 3 Credits (3,0)
Study of FAA requirements governing design of airborne electronic equipment. Study of component and subsystem specification and design practices. Application of the above in the preparation of a proposal/design plan for an airborne electrical/electronic subsystem. Integrate the knowledge gained throughout the curriculum with practical aspects of the practice of engineering to enable the student to comprehend engineering as a pivotal aspect of the business cycle and to responsibly participate in society by the practice of his/her profession. The course will introduce the combination of hardware and software requirements and preliminary design, preparation of project, and testing plans following established industry standards. 
**Pre-Requisite:** Senior Standing
**Prerequisites:** Senior standing.

EE 421 Avionics Detail Design 3 Credits (3,0)
Continuation of EE 420 or EE 428. Senior-level project. Students will work as members of a team in the execution of winning proposals from EE 420/428. The course incorporates the combination of hardware and software detailed design, implementation, and testing following established industry standards.
**Prerequisites:** EE 420.
EE 430  Introduction to Radio Frequency Circuits  3 Credits
This course introduces the fundamentals of radio frequency (RF) theory and circuits. The main topics in the RF theory part include RF behavior of common devices, transmission lines, Smith chart, impedance matching, and S parameters. The main topics in the RF circuit part include filters, amplifiers, oscillators, and mixers.
Prerequisites: EE 302 and EE 340  Corequisites: EE 430L.

EE 430L  Radio Frequency Circuits Laboratory  1 Credit (0,3)
This lab accompanies radio frequency (RF) circuits. The main topics of this lab include operating the RF measurement equipment; demonstrating the RF behavior of common devices; measuring the parameters of transmission lines; measuring the S-parameters of transistors and integrated circuits; matching the impedances of networks; and designing/testing filters, amplifiers, and oscillators, as well as mixers.
Corequisites: EE 430.

EE 499  Special Topics in Electrical Engineering  1-6 Credit
Directed studies of selected topics in electrical engineering.

Engineering (EGR)

Courses
EGR 101  Introduction to Engineering  2 Credits (1,2)
This course is an introduction to the interdisciplinary aspects of the engineering of aerospace systems. It is a project-based course, demonstrating how the engineering profession is a multi-disciplinary field. Students are involved in an array of conceptual exercises, simple design activities, and projects dealing with engineering in aerospace-related areas.

EGR 111  Engineering Drawing  2 Credits
Freehand pencil sketching for graphical communication of engineering designs. Standard forms for design graphic and view layout, orthographic projection, section and auxiliary views, dimensioning, tolerancing, and introduction to shop processes. This course is not equivalent to EGR 120.

EGR 115  Introduction to Computing for Engineers  3 Credits (3,0)
This is an introductory course in programming and computing for scientists and engineers. The course introduces students to the following aspects of software engineering: specification, requirements, design, code, and test. This course uses a problem-solving approach for developing algorithms. The following topics will be included: data types and related operations, looping, decision, input/output, functions, arrays, files, and plotting.
Corequisites: MA 112 or MA 241.

EGR 120  Graphical Communications  3 Credits (2,2)
Freehand pencil sketching and CAD as tools for graphical communication of engineering designs. Standard forms for design graphics and view layout, orthographic projection, section and auxiliary views, dimensioning, tolerancing, introduction to shop processes.

EGR 195B  Introductory Problems for Engineering Applications  4 Credits (4,0)
This course will provide an overview of the math topics most heavily used in the core sophomore-level engineering courses. All math topics will be presented within the context of an engineering application, and reinforced through extensive examples of their use in the core engineering courses. This course will also provide an introduction to the engineering analysis software MATLAB.
Prerequisites: Math Placement of MA 143
Corequisites: EGR 195BL.

EGR 199  Special Topics in Engineering  1-6 Credit
Individual independent or directed studies of selected topics in engineering.

EGR 299  Special Topics in Engineering  1-6 Credit
Individual independent or directed studies of selected topics in engineering.
EGR 305 3D-CADD and Engineering Documentation 3 Credits (3.0)
Application and use of high-end computer-assisted drafting, design, and analysis tool (CATIA) to engineering challenges. Applications of CATIA workbenches: the product specification tree, knowledge-ware, parametric design, part and assembly design, modification, document release and control, final drawings, and changes.
Prerequisites: EGR 120 and ES 201 and ES 204.

EGR 399 Special Topics in Engineering 1-6 Credit
Individual independent or directed studies of selected topics in engineering.

EGR 499 Special Topics in Engineering 1-6 Credit
Individual independent or directed studies of selected topics in engineering.

Engineering Physics (EP)
Courses
EP 101 Current Topics in Space Science 1 Credit (1.0)
A survey seminar intended to explore contemporary topics encountered in the exploration of the upper atmosphere and near space environment.

EP 199 Special Topics in Engineering Physics 1-6 Credit
Individual, independent, or directed study of topics in the fields of applied physics, space systems, and allied engineering disciplines. Student design projects involve significant engineering design such as microgravity experiments and moon-buggy design. May be considered as an engineering elective with approval of the program coordinator.

EP 299 Special Topics in Engineering Physics 1-6 Credit
Individual, independent, or directed study of topics in the fields of applied physics, space systems, and allied engineering disciplines. Student design projects involve significant engineering design such as microgravity experiments and moon-buggy design. May be considered as an engineering elective with approval of the program coordinator.

EP 320 Electro-Optical Engineering 3 Credits
Prerequisites: EGR 115 or CS 223 and PS 303
Corequisites: MA 345 & PS 305.

EP 335 Nanomaterials and Nanoscience 3 Credits
Nanomaterials are substances that have dimensions on the order of 1 nm to 100 nm. This is an introductory course designed to acquaint upper-level science and engineering students with the new and rapidly changing field of nanotechnology. Topics include the synthesis and characteristics of nanodots, nanowires, and nanotubes; characterization methods such as atomic force microscopy, scanning electron microscopy, and x-ray diffraction; and the large number of applications that employ nanomaterials; and nanotoxicology.
Prerequisites: PS 139 or PS 140 & PS 228 or PS 250 & MA 242.

EP 340 Introduction to Space Systems Design 2 Credits (2,1.5)
This course is an introduction to space mission analysis and design process, mission characterization, evaluation and requirements definition. It includes an introduction to numerical modeling and simulation of engineering systems, the finite element method and the finite difference method.
Prerequisites: CS 223 or EGR 115.

EP 345 Space Science Seminar 1 Credit
Seminar-style course, with lectures, readings, and writing on topics of current interest in Space Science.
Prerequisites: Junior Standing.
EP 391 Microcomputers and Electronic Instrumentation 3 Credits (3,0)
This course will provide students with a background in electronics as it applies to the design of circuits of measuring instruments and to interface sensors and computers. The program of study will concentrate on following the form of the electrical signal from light, pressure, temperature and other sensors as it proceeds through signal conditioning circuits and into the microcomputer for further processing.
Prerequisites: PS 228 or PS 250 & PS 228L & EGR 115 or CS 223 Corequisites: MA 345.

EP 391L Microcomputer and Electronic Instrumentation Laboratory 1 Credit (0,3)
Two 90 minute laboratory sessions per week, with experiments complementing the lectures of EP 391 on a weekly basis. The labs will introduce the students to software modeling of circuits; cover analog devices such as diodes, transistors, op-amps, motors; digital devices such as a microcontroller, multiplexers, communication radios; and also practice device level C-programming concepts.

EP 393 Spaceflight Dynamics 3 Credits (3,0)
This course is a study of the basic topics in analytical dynamics, two body orbits and the initial value problem, the two body orbital boundary value problem, Earth coverage and space mission geometry, non-Keplerian effects, orbital maneuvers and rendezvous, interplanetary transfer.
Prerequisites: MA 345 and CS 223 or EGR 115.

EP 394 Space Systems Engineering 3 Credits (3,0)
Development of the fundamental principles used in the engineering and design of space systems. Several major subsystems including power, telemetry and command, communications, thermal control and guidance, navigation, and control subsystems are covered. Topics on space environmental control and life support systems, space system integration and testing, and space system operations are also discussed.
Prerequisites: AE 313 or EP 393.

EP 399 Special Topics in Engineering Physics 1-6 Credit
Individual, independent, or directed study of topics in the fields of applied physics, space systems, and allied engineering disciplines. Student design projects involve significant engineering design such as microgravity experiments and moon-buggy design. May be considered as an engineering elective with approval of the program coordinator.

EP 400 Thermodynamics and Statistical Mechanics 3 Credits
Prerequisites: PS 303.

EP 410 Space Physics 3 Credits (3,0)
This course is a study of the origin, evolution, and structure of the neutral and ionized terrestrial atmosphere, the effect of sun’s electromagnetic radiation on Earth’s ozone shield, photo-ionization and thermal structure of the neutral atmosphere as well as on the ionosphere and magnetosphere, solar disturbances and their effects on satellite orbit decay and on long distance communication. It also includes studies of composition, thermodynamics, physical processes of the near-Earth space environment, rocket and satellite monitoring, remote sensing, numerical and instrument design considerations.
Prerequisites: PS 320 Corequisites: EP 440.

EP 411 Space Physics II 3 Credits (3,0)
EP 420  Planetary Science  3 Credits (3,0)  
This course is a study of the planetary system: origin, evolution, composition, present configuration, dynamics, interiors, surfaces, atmospheres, and magnetospheres of the planets, satellites, asteroids, and comets. Experiments and spacecraft missions to aid in determination of the origin and evolution of the solar system are stressed.  
**Prerequisites:** PS 303.

EP 425  Observational Astronomy  3 Credits (2,3)  
Basic design and use of an optical telescope, fundamentals of astronomical optics including refracting and reflecting systems, principles and applications of optical filters and adaptive optics. Design optimization and trade-offs in an observing system. Telescope system calibration and techniques for enhancing tracking accuracy. Visual observation and analysis of images of the sun, moon, planets, stars, nebulae, and galaxies. Electronic imaging including quantification of radiant energy, spectroscopy, and techniques for reducing the effects of noise sources. Optical and detector design trade-offs for measurement optimization.  
**Prerequisites:** PS 303 and PS 305 and PS 224 and PS 224L or PS 316 and PS 318.

EP 430  Spacecraft Instrumentation  3 Credits  
This is a required course in the Engineering Physics degree program with a Spacecraft Instrumentation AOC. The course will undertake the study of space environment and models used for engineering analysis. Topics include considerations for instrument design in space environment, such as plasma interactions, chemical reactions, optical and other radiation effects, and thermal issues. These will include theory, engineering, and data reduction techniques for in situ spacecraft instrumentation and for spacecraft command and telemetry systems.  
**Prerequisites:** CEC 320 & CEC 315  
**Corequisites:** EP 394 & EP 391.

EP 440  Engineering Electricity and Magnetism  3 Credits (3,0)  
This course is a study of the Solutions of electrostatics problems using Poisson's Equation and Laplace's Equation, electrostatic energy, electric current, magnetic field, electromagnetic induction, Maxwell's equations (reflection, refraction, waveguides, antenna radiation).  
**Prerequisites:** PS 303 and PS 305 and PS 320 and EGR 115 or CS 223  
**Corequisites:** MA 442.

EP 455  Quantum Mechanics  3 Credits  
**Prerequisites:** EP 440.

EP 492  Senior Project  3 Credits (3,0)  
This is an optional capstone course for senior Space Physics or Astronomy & Astrophysics students. Students will carry out their senior research project in an area of interest that overlaps the interest of the supervising faculty. Pre-Requisite: Must be a senior with grades of a B or better in all-300-level EP and PS courses required in the student's degree program.  
**Prerequisites:** Senior with grades of a B or better in all-300-level EP and PS courses required in the student's degree program.

EP 496  Space Systems Design I  3 Credits (1,3)  
A program of undergraduate research, supervised by physics or engineering faculty, leading to the writing of a technical design report in an area of current interest in engineering physics.  
**Prerequisites:** EP 340 and EP 394.

EP 497  Space Systems Design II  3 Credits (2,4)  
This course is a continuation of EP 496 and is the second of the two-semester sequence and completes senior design project requirements.  
**Prerequisites:** EP 496.

EP 499  Special Topics in Engineering Physics  1-6 Credit  
Individual, independent, or directed study of topics in the fields of applied physics, space systems, and allied engineering disciplines. Student design projects involve significant engineering design such as microgravity experiments and moon-buggy design. May be considered as an engineering elective with approval of the program coordinator.
Engineering Science (ES)

Courses

ES 199 Special Topics in Engineering Science 1-6 Credit
Individual independent or directed studies of selected topics in engineering science.

ES 201 Statics 3 Credits (3,0)
This course explores a vector treatment of the concepts and characteristics of forces and couples. Topics discussed include distributed forces; center of mass; centroid; equilibrium of particles and rigid bodies; trusses and frames; internal forces; shear and moment distribution in beams; and area moments of inertia.
Prerequisites: PS 150 or PS 226 and EGR 120 or EGR 111 Corequisites: MA 243.

ES 202 Solid Mechanics 3 Credits (3,0)
The concepts of stress and strain and their tensor properties. Elastic stress-strain relations. Analysis of stress and deformation in members subject to axial, torsional, bending, and combined loading. Column stability.
Prerequisites: ES 201.

ES 204 Dynamics 3 Credits (3,0)
A vector treatment of the kinematics and kinetics of particles and rigid bodies. Acceleration, work, energy, power, impulse, and momentum.
Prerequisites: ES 201.

ES 299 Special Topics in Engineering Science 1-6 Credit
Individual independent or directed studies of selected topics in engineering science.

ES 305 Thermodynamics 3 Credits (3,0)
Prerequisites: PS 160.

ES 309 Fluid Dynamics 3 Credits (3,0)
This course explores the physical characteristics of the fluid state, fluid statistics, kinematics of fluid motion, flow of an incompressible ideal fluid, the impulse-momentum principles, similitude and dimensional analysis and fluid measurements
Prerequisites: ES 204 and MA 345.

ES 315 Space Environment and Effects 3 Credits (3,0)
This course studies the effects of the space environment on spacecraft and spacecraft design. The vacuum, neutral, plasma, radiation, and space debris environments and their effect on space missions are examined. Special emphasis is placed on investigating the effects of radiation on electrical spacecraft subsystems and the space debris environment.
Prerequisites: AE/ME students need C grade in MA 241 MA 242 PS 150 PS 160 and ES 201 and PS 250.

ES 320 Engineering Materials Science 2 Credits (2,0)
Prerequisites: COM 221 and ES 202 and CHM 110 or CHM 140 Corequisites: ES 321.

ES 321 Engineering Materials Science Laboratory 1 Credit (0,3)
Students will complete laboratory experiments and study techniques in materials science, composites and solids mechanics. The Engineering Material Science Lab must be taken during the same semester as ES 320.
Corequisites: ES 320.

ES 399 Special Topics in Engineering Science 1-6 Credit
Individual independent or directed studies of selected topics in engineering science.

ES 403 Heat Transfer 3 Credits (3,0)
One- and two-dimensional steady and unsteady state conduction heat transfer including an introduction to finite-difference and finite-element methods of analysis. Free and forced convection heat transfer. Radiation heat transfer.
Prerequisites: ES 309 or AE 407.

ES 499 Special Topics in Engineering Science 1-6 Credit
Individual independent or directed studies of selected topics in engineering science.
Flight Airplane (FA)

Courses

FA 121 Private Single Flight 1 Credit (1,0)
During this course the student obtains the foundation for all future aviation training. The student will receive training in the maneuvers and procedures necessary for him/her to meet the standards contained in the FAA Private Pilot Practical Test Standards. Additionally, the student will receive training in safety awareness, crew resource management, and aeronautical decision-making. At the successful completion of this course the student will have gained the aeronautical experience necessary to attain a Private Pilot Certificate with an Airplane Single Engine Land Rating. ATSA clearance or Proof of US citizenship is required. Also students must see flight training manager to register for flight courses.
Corequisites: AS 121.

FA 199 Special Topics in Flight 1-6 Credit
Flight training in selected areas for the purpose of gaining proficiency in required pilot operations for various certificates and ratings. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: ATSA clearance.

FA 215 Upset Training 1 Credit (1,0)
This flight course is designed to give certified pilots the experience and knowledge to immediately recognize aircraft upset situations and the skills to safely and precisely recover from such occurrences. This course will include flight recoveries from nose-high, nose-low, and inverted attitudes; spin entries and recoveries; and basic aerobatic maneuvers. ATSA clearance or Proof of US citizenship is required. Also students Must see flight training manager to register for flight courses.
Prerequisites: FA 121.

FA 217 Tailwheel Transition 1 Credit
Training in the maneuvers and procedures necessary to meet FAA requirements for a tailwheel endorsement. Practice in performing a variety of maneuvers in a tailwheel airplane including ground handling, normal and crosswind takeoffs and landings, wheel landings, and go-arounds.
Prerequisite: FAA Private Pilot Certificate with Airplane category, Single-Engine Land class rating
Corequisites: FA 217L.

FA 217L Tailwheel Transition Laboratory 0 Credits
Foundational knowledge of the flight performance characteristics and operational procedures necessary to meet FAA requirements for a tailwheel endorsement will be attained in this course.
Corequisites: FA 217.

FA 221 Instrument Single Flight 1 Credit (1,0)
The student will receive training in the maneuvers and procedures necessary to meet the standards contained in the FAA Instrument Rating Practical Test Standards. Additionally, the student will receive training in safety awareness, crew resource management, and aeronautical decision-making. At the successful completion of this course the student will have gained the aeronautical experience necessary to attain the addition of an Instrument Rating for the Private Pilot Certificate. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: FA 121 Corequisites: AS 221.

FA 299 Special Topics in Flight 1-6 Credit
Flight training in selected areas for the purpose of gaining proficiency in required pilot operations for various certificates and ratings. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: ATSA clearance.

FA 321 Commercial Single Flight 1 Credit (1,0)
The student will receive training in the maneuvers and procedures necessary to meet the standards contained in the FAA Commercial Pilot Practical Test Standards. Additionally, the student will receive training in safety awareness, crew resource management, and aeronautical decision-making. At the successful completion of this course the student will have gained the aeronautical experience necessary to attain a Commercial Pilot Certificate with an Airplane Single-Engine Land Rating. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: FA 221 Corequisites: AS 321.
FA 323  Commercial Multi Add On  1 Credit (1,0)
The student will receive training in the maneuvers and procedures necessary to meet the standards contained in the FAA Multi-Engine Commercial Pilot Practical Test Standards. Additionally, the student will receive training in safety awareness, crew resource management, and aeronautical decision-making. At the successful completion of this course the student will have gained the aeronautical experience necessary to attain the addition of a Multi-Engine Rating for the Commercial Pilot Certificate. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: FA 321.

FA 324  Commercial Multi Instrument Flight  1 Credit (1,0)
The student will receive training in the maneuvers and procedures necessary to meet the standards contained in the FAA Multi-Engine Commercial Pilot Practical Test Standards. Additionally, the student will receive training in safety awareness, crew resource management, and aeronautical decision making. At the successful completion of this course the student will have gained the aeronautical experience necessary to attain a commercial Pilot Certificate with Airplane Multi-Engine Land, Instrument Ratings. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: FA 221
Corequisites: AS 321.

FA 326  Commercial Single Add On Flight  1 Credit (1,0)
The student will receive training in the maneuvers and procedures necessary to meet the standards contained in the FAA Commercial Pilot Practical Test Standards. Additionally, the student will receive training in safety awareness, crew resource management, and aeronautical decision-making. At the successful completion of this course the student will have gained the aeronautical experience necessary to attain the addition of a Single-Engine Rating for his/her Commercial Pilot Certificate. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: FA 324.

FA 399  Special Topics in Flight  1-6 Credit
Flight training in selected areas for the purpose of gaining proficiency in required pilot operations for various certificates and ratings. The total number of hours, solo, dual, simulator and oral hours is dependent upon the student’s previous flight experience and therefore will vary greatly from one student to the next in order to meet FAA requirements. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: ATSA clearance.

FA 417  Flight Instructor Rating  3 Credits (3,0)
The student will receive training in the maneuvers and procedures necessary for him/her to meet the standards contained in the Flight Instructor practical test standards and Single-Engine Land with Instrument Airplane rating. Additionally, the student will receive training in cockpit resource management and safe flying practices. Associated ground instruction will include completion of the Fundamentals of Instruction, the Flight Instructor Airplane, and the Flight Instructor Instrument written test.
Prerequisites: FA 321 or FA 326.

FA 418  Airline Transport Pilot Proficiency Development  1 Credit
Certified Commercial and Instrument rated multiengine pilots are provided extensive detailed instrument-oriented training to airline transport pilot proficiency standards. Emphasis is placed on precision attitude flying techniques including configuration change procedures, attitude and thrust setting determination, and velocity transitions; precise instrument approach and departure procedures; and integration of applicable emergency procedures during all phases of instrument flight. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: ATSA clearance.
FA 420  Airline Flight Crew Techniques and Procedures  2 Credits (2,2)
Instruction in airline flight crew operations with emphasis on the transition of the professionally qualified pilot into a highly skilled member of an air carrier flight management team. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: AS 387 and AS 435 Corequisites: AS 420.

FA 460 Multi-Engine Flight Instructor Rating  2 Credits (1,0)
The student will receive training in the maneuvers and procedures necessary for him/her to meet the FAA standards required to add the Multi-Engine Flight Instructor Rating to his/her CFI/I Rating. Additional instruction will be provided in advanced multi-engine flight crew training techniques including cockpit resource management and safe flying practices. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: FA 417.

FA 499 Special Topics in Flight  1-6 Credit
Flight training in selected areas for the purpose of gaining proficiency in required pilot operations for various certificates and ratings. ATSA clearance or Proof of US citizenship is required. Also, students must see flight training manager to register for flight courses.
Prerequisites: ATSA clearance.

Geoscience (GEO)

Geoscience Courses

GEO 210 Introduction to Geographic Information Systems  3 Credits (2,1)
Geographic Information Systems (GIS) encompass all aspects of spatial data analysis from data acquisition and manipulation through problem solving to the graphic presentation of results. This course surveys GIS theory and applications as students learn to store, retrieve, manipulate, analyze, and display spatial data according to a variety of user-defined specifications. Lectures will emphasize fundamental principles of GIS while computer-based exercises will emphasize training.

GEO 215 Introduction to Geoscience  3 Credits (3,0)

GEO 310 Advanced Geographic Information Systems  3 Credits (1,2)
Advanced GIS is designed to further develop the concepts and principles learned in GEO 210, Introduction to GIS. Lectures will focus on current theories and technology trends in geographic information sciences integrating theoretical knowledge with hands-on technical training in the computer classroom. Weekly discussion of the latest developments in GIS will reinforce these experiences while fostering an appreciation of GIS as an effective analytical tool for understanding complex processes. The course culminates in a class project involving scholarly research by teams of students based on GIS applications.
Prerequisites: GEO 210.

GEO 402 Geographic Information System Applications  3 Credits (3,0)
Geospatial data acquisition, management, and visualization in 2-D and 3-D. Various geospatial analysis methods including location analysis; change over time; value comparisons; geographic distribution; pattern analysis; and cluster identification.
Prerequisites: GEO 310.
Global Conflict Studies (GCS)

Courses

GCS 201  Introduction to Global Conflict Studies  3 Credits (3,0)
This course introduces students to the issues and concepts related to the study of peace and conflict and provides a survey of the historical and contemporary examples of how individuals, groups and nation-state have waged conflict and sought to make and keep peace.
Prerequisites: SS 110 or SS 115.

GCS 300  International Conflict Resolution  3 Credits (3,0)
The course will expose students to different kinds of organized, violent conflicts that exist in today’s world, will examine different theories seeking to explain why and how they have occurred, and will discuss and cleanly military, economic, diplomatic, legal, and nation-building conflict resolution. Prerequisite is any lower level SS or GCS course.
Prerequisites: SS 110 or SS 115 or SS 120.

GCS 302  Gender Security  3 Credits (3,0)
Theories, concepts, and issues in gender security. Considers different analytical approaches to gender as applied to security issues. Topics include gender inequality and international conflict; gender and power mechanisms such as ideology, economics, military, and politics; the gendered character of terrorism, war and political violence; and UN efforts to combat sexual exploitation in multilateral peace operations. This is a discussion-led course, based heavily on weekly readings on topics ranging from theory to practice. Incorporates political science, history, philosophy, international relations, and political theory to provide students with a strong understanding in why nations are in conflict.
Prerequisite is any lower level SS or GCS course.
Prerequisites: SS 110 or SS 115 or SS 120.

GCS 304  Political Violence  3 Credits (3,0)
This course examines various forms of political violence and introduces theories explaining why actors carry out these different types of violent behaviors. It explores violence such as insurgency, civil war, revolution, terrorism, slavery, torture, and genocide. Through examining historical case studies and contemporary events from comparative and international perspectives, the course investigates the interests and motives of state and non-state actors in committing acts of violence. Prerequisite is any lower level SS or GCS course.
Prerequisites: SS 110 or SS 115 or SS 120.

GCS 306  Theories of Nations and Nationalism  3 Credits (3,0)
This course will present and discuss vexing security challenges facing an increasingly globalized world through the lens of nationalism. This course analyzes the role of ideology, identity, demos, and elite actors in nation building. We will discuss theories of nationalism, the creation of the nation, nationalism and culture, patriotism, and genocide. This is a discussion-led course, based heavily on weekly readings on topics ranging from theory to practice.
Prerequisites: SS 110 or SS 115 or SS 120.

GCS 308  Transnational Crime  3 Credits (3,0)
An examination of historical, political, economic, social, and cultural aspects of transnational crime with an emphasis on key aspects of narcotics use, abuse, and control within and across national borders.
Prerequisites: SS 110 or SS 115 or SS 120.

GCS 400  Topics in Global Conflict Studies  3 Credits (3,0)
The study of global conflict including political, economic, environmental, religious and social causes as well as its impact on the individual, cultures, ethnic groups and nations, and the historical and contemporary theories and methodologies used to prevent, mitigate or resolve such conflicts. Course topics vary according to instructor and are subject to approval by the department chair. May be repeated for credit when topics change.
GCS 475  Senior Thesis in Global Conflict Studies  3 Credits (3,0)
Students will write a thesis involving original research on a topic related to Global Conflict Studies in order to illustrate their research and analytical abilities as well as synthesize their knowledge of related theories, concepts, and issues.

Prerequisites: GCS 490.

GCS 490  Capstone in Global Conflict Studies  3 Credits (3,0)
A comprehensive introduction to research proposal writing, research methodologies, and foundational research theories and protocols specific to Global Conflict Studies.

Prerequisites: GCS 201 and COM 221 or COM 222.

GCS 499  Special Topics in Global Conflict Studies  1-6 Credit
Individual independent or directed studies of selected topics in Global Conflict Studies.

Homeland Security (HS)

Courses

HS 110  Introduction to Homeland Security  3 Credits
The primary focus of this course is on issues dealing with the security of the citizens and industries of the United States, with emphasis on the transportation system and critical infrastructure protection roles of states, cities, and municipalities. Specific subjects introduced include the mission; the functions and responsibilities; and the legislative and regulatory framework governing the various agencies of the Department of Homeland Security; criminal acts against transportation; emergency management within the United States; the intelligence community and its role in homeland security; and issues pertaining to air; airtime; surface; and cargo security.

HS 199  Special Topics in Homeland Security  1-6 Credit
This is a variable credit independent study course. Students wishing to pursue an independent study in Homeland Security will need to coordinate and establish the number of credits (for example, 1-3), topics, etc. with a Homeland Security faculty member willing to work with him/her.

HS 215  Introduction to Industrial Security  3 Credits
This course will review the fundamentals of security and emergency planning and management. The nature, scope, history, and essential elements of security in the workplace are discussed with emphasis on personal protection and to a limited extent property protection. The workplace will include selected aviation and industrial settings. Operational aspects of security that include strategies for identifying and controlling security exposures and applicable legal issues are also discussed. Students develop and/or evaluate security programs for selected industries.

Prerequisites: HS 110.

HS 220  National Security Enterprise  3 Credits
This course will cover the broad components of the national and homeland security enterprise as well as the inter-agency process. The primary focus of this course is on understanding the role of national and homeland security in the increasingly complex governmental process. Students will examine the agencies and actors which take part in shaping America’s security policies such as the executive, legislative and judicial branches, as well as the military, state department, media, intelligence and law enforcement. Elements of the organizational and institutional cultures driving the process will be discussed and analyzed. Factors relating to success and failure of strategy implementation will be explored.

Prerequisites: HS 110.

HS 280  Professional Skills in Homeland Security  3 Credits
Prepare students to seek and win internships. Personality evaluations, cover letter and resume preparation, interviewing skills. Ethics and professionalism in homeland security. Prerequisite is sophomore standing.

Prerequisites: Sophomore standing.
HS 290 Introduction to Environmental Security 3 Credits
Students will learn how environmental issues may give rise to socio-political instability around the world. This course will explore how the development and execution of U.S. domestic and foreign policy, and ultimately U.S. national security, can be impacted by emerging threats to nations from environmental health issues, infrastructure vulnerabilities, and natural resource shortages caused by rapid industrialization, population growth, and urbanization in less developed countries. It will also examine transnational threats from ozone depletion, deforestation, and climate change. In a seminar format, students and faculty will cover a variety of readings and discuss their conclusions. Students will have the opportunity to lead class discussions on assigned readings.
Prerequisites: HS 110.

HS 299 Special Topics in Homeland Security 1-6 Credit
This is a variable credit independent study course. Students wishing to pursue an independent study in Homeland Security will need to coordinate and establish the number of credits (for example, 1-3), topics, etc. with a Homeland Security faculty member willing to work with him/her.

HS 310 Fundamentals of Emergency Management 3 Credits
This course includes thorough coverage of the historical background of emergency management (EM) in the United States as well as many of the most significant laws and policies that have defined and shaped the field, including HSPD 5, HSPD 8, the National Flood Insurance Act, and the Stafford Act. Topics include detailed coverage of FEMA’s all hazards approach, all phases of the EM cycle, including mitigation, preparation, response, and recovery; integrated emergency management systems, the incident command system, the National Incident Management System, emergency support functions, and risk communications. The course culminates with each student writing and formally presenting an integrated emergency management plan.
Prerequisites: HS 110 and HS 215 and HS 290.

HS 315 Critical Infrastructure Security, Resilience, and Risk Analysis 3 Credits
Critical infrastructure security, resilience, and risk analysis. History and evolution of critical infrastructure on both public and private levels. Federal definitions, sector identification, composition and characteristics of critical infrastructure, as expressed in formal documents (Stafford Act, PDD-63; HSPD-7, PPD-21) and within the private sector. The public-private partnership approach between infrastructure sectors, and sector-specific plans, critical infrastructure in a global context. Definition and role of resilience in critical infrastructure planning and disaster mitigation, response, and recovery. Complete a project involving an in-depth review and presentation of a critical infrastructure sector. Additionally, the concept of risk analysis as a means by which resources and assets are allocated to critical infrastructure(s).
Complete a group project utilizing a qualitative risk assessment methodology. Risk fundamentals, network theory, continuity of business planning, and cost-benefit analysis. A formal risk analysis report will be completed at the conclusion of the project and an oral presentation will be delivered. Role of risk in the overall mission of the Department of Homeland Security, to include the National Infrastructure Protection Plan (NIPP). Successful completion of a FEMA on-line certification on the NIPP.
Prerequisites: HS 110 and HS 215.
HS 320  Homeland Security Law and Policy  3 Credits
This course is an overview of key legal, policy, and ethical issues in the context of Homeland Security policy and practice. Students examine legal concepts regarding constitutional rights of individuals, legal process, access to courts, the law of war, and national security principles as they relate to homeland security legislation and policy initiatives. Legal principles of due process, habeas corpus, search and seizure, compulsory process, and international agreements are explored in greater depth. The law of war will be examined in the context of preemptive war and the 2006 National Security Strategy, as well as issues involving the status of combatants and detention. Elements of national security law, including intelligence collection and sharing, the Patriot Act, and military-civilian relations will also be discussed. Recent Supreme Court decisions relating to some of the above concepts and legal principles will be examined and discussed. **Prerequisites:** HS 110 and HS 215.

HS 321  Introduction to Fraud Investigation  3 Credits
The study of contemporary forms of white collar crime and its explanations, theories, and laws; along with the investigation and adjudication, of criminal and regulatory cases. Strategies and policies of law enforcement agencies with jurisdiction responsibilities in white collar crime matters. The utilization of business, public, and accounting records and tools to investigate fraud. Discussion and exposure to Forensic Accounting as an investigative tool against white collar crime. **Prerequisites:** HS 110.

HS 325  Terrorism: Origin, Ideologies, and Goals  3 Credits
This course will conduct an overview of the ideologies, concepts, and goals of terrorism. Definitions of terrorism will be explored and discussed. The history and background of terrorism will be examined. Types of terrorism - domestic, state-supported, transnational - will be identified and discussed. Terrorist groups, domestic and worldwide, will be examined in the context of doctrine and goals. Counter-terrorist measures, domestic and worldwide, will be examined. Our national strategies will be covered in light of past and present progress in what the Bush Administration called “The War on Terror.” **Prerequisites:** HS 110.

HS 340  Aviation Transportation Security  3 Credits (3,0)
This course will introduce the student to the fundamentals of Aviation Security. Students should recognize aviation as an advanced industry sector for the application of sophisticated security systems. This includes knowledge about: History and Threat Matrix of Aviation Security Rules and Regulations for Aviation Security Homeland and International Organizations dedicated to Aviation Security Security Systems and Processes at Airlines Specific areas include: Management of security risk and quality assurance in international flight operations Role of security in aviation crisis management Challenges from cyber security in the aviation industry **Prerequisites:** HS 110 and HS 215 or permission of instructor.

HS 342  Maritime Security  3 Credits (3,0)
The primary focus of this course is on the broad aspects of maritime security, including seaports, maritime transportation, regulations, piracy, drug trafficking, terrorism, and threat mitigation strategies. The course will also examine maritime security in various “hot” spots and commercial straits and chokepoints around the world, including the South China Sea, the Caribbean, the Persian Gulf, and the Black and Baltic Seas. The goal of this course is to introduce the student to ocean and port vulnerabilities and how to counter these potential threats in the larger homeland security context. **Prerequisites:** HS 110 or permission of instructor.

HS 350  Intelligence Systems and Structures in Homeland Security  3 Credits
Intelligence is a systematic process of collection, analysis, and dissemination of information in support of national, state, and/or local policy or strategy. This course will explore the varied expressions of the intelligence community as it exists in the U.S. In addition, students will explore the history and development of the IC in the U.S., as well as major legislative acts that led to the development of intelligence as a major function of US national security strategy. **Prerequisites:** HS 110 and HS 325.
HS 360 Strategic Planning and Decision Making in Homeland Security 3 Credits
Strategic planning is the process of defining an organization's strategy (a long term plan of action designed to achieve a particular goal or objective) or direction and making decisions on allocating its resources to pursue this strategy, including its capital, its technology and its human resources. This course will investigate the nature of strategic planning as it relates to homeland security and national security in the U.S. In addition, students will explore how strategic planning relates to decision making in more stable environments as well as decision making under uncertainty. Relevant legislation and past decisions (such as the Bay of Pigs and the Cuban Missile Crisis) will be explored. In addition, the basic concepts of and techniques for strategic communication will be explored and developed and related to decision making.
Prerequisites: HS 110 and HS 215 and HS 290.

HS 370 Emergency Management Strategy and Policy 3 Credits
This course will entail a detailed investigation into homeland security and emergency management policy and strategy at the local, states and national levels. Legal motivations and structures that support the emergency management function, FEMA as an organizations and the cross-over to homeland security tactics will be explored. Public education and risk communication efforts and strategies as well as the role of the Emergency Operations Center in the community will also be explored.
Prerequisites: HS 310 or HS 315.

HS 375 Studies in Transportation Sector Infrastructure and Protection 3 Credits
The exploration of the critical infrastructure in the multimodal sectors of transportation and using an all-hazards risk analysis methodology will assess the adversaries, threats, economic consequences, and controls regarding protection of these key assets. Topics covered will include government oversight of transportation security a thorough review of current federal documents, legislation, and regulations; the human factor in transportation security logistics; crisis, disaster, and risk management; technology of transportation security; smuggling, cargo theft, and contraband; weapons of mass destruction and transportation security; and finally, selected case studies in transportation security.
Prerequisites: HS 310 or HS 315.

HS 399 Special Topics in Homeland Security 1-6 Credit
This is a variable credit independent study course. Students wishing to pursue an independent study in Homeland Security will need to coordinate and establish the number of credits (for example, 1-3), topics, etc. with a Homeland Security faculty member willing to work with him/her.

HS 405 Emergent Topics in Homeland Security 3 Credits (3,0)
This course will present multiple learning opportunities for students in either the terrorism or the emergency management area of concentration. In a seminar format, this course will be facilitated by the instructor as an advanced reading class wherein current or emerging topics specific to a given area of concentration will be explored. The instructor will present a series of articles, case studies, and talking points that each student will read and be prepared to discuss in class. In addition, the concept of business continuity planning will be described and illustrated. In the second half of the semester, each student will lead at least one class in the scholarly discussion of a topic assigned to him/her. Domestic and foreign policy implications will be considered. It is possible that this course could springboard the student into a research topic that will be completed in HS 490. Prerequisite: Junior Standing
Prerequisites: HS 110 and HS 310 and HS 325.

HS 410 Exercise Design and Evaluation in Homeland Security 3 Credits
This course studies the nature and structure of exercise design as it is applied in the homeland security professions in general, and in the field of emergency management in particular. Students will be introduced to the nature and characteristics of both discussion-based and operations-based exercises as well as the Homeland Security Exercise Evaluation Program (HSEEP) inside the Department of Homeland Security. A brief history of the origins of emergency management and its legislative background (e.g., HSPD 5 and HSPD 8) will be presented. A final student project and presentation that demonstrates the student's understanding of how exercises are designed, scripted, implemented, and evaluated is required.
Prerequisites: HS 310 and HS 315.
HS 411 Terrorism, Insurgency and Irregular Warfare 3 Credits
This course will focus on the phenomena of terrorism and insurgency in the context of irregular warfare. Varying views of terrorism and insurgency will be examined and discussed. The efficacy of current counter-terrorism and counter-insurgency operations for U.S. forces throughout the world will be investigated. The strategic necessity of distinguishing between these two forces for mission success will be examined. Current COIN concepts will be examined in the context of current and prior U.S. attempts to conduct operations in non-traditional operational environments. The importance of strong civil-military partnerships as a necessary prerequisite for mission success will be discussed. Finally, the overarching importance of strategy as a template for COIN operations will be examined.
Prerequisites: HS 325.

HS 435 International Crime and Criminal Justice Structure 3 Credits
It has been said that not all criminals are terrorists, but that all terrorists are criminals. This course will expose the student to the current status and predicted trends in global crime, criminology, and the international criminal justice system. Explanations related to all aspects of criminology and the theories related to criminal behavior will be given, along with current examples. Concepts and theories will be applied in discussions on how to best combat organized crime, terrorism, human trafficking, international white collar crime and terrorism/insurgency.
Prerequisites: HS 110 and HS 325 and HS 350.

HS 450 Advanced Topics in Terrorism 3 Credits
Strategies and policies of the United States and its international partners and allies to utilize counterterrorism measures to mitigate or defeat the effects of terror-violence and other challenges to national security. History of terrorism in the United States from the Revolutionary War to present day and the development of counterterror (CT methods used to respond to attacks perpetrated by terrorists. Government agencies and organizations charged to ensure that CT policies and strategies are acted upon and adhered to including: the intelligence community and federal law enforcement agencies tasked to combat terrorism. Asymmetry as a tool of terrorism including the indiscriminate use of violence, weapons of mass destruction, and cyber-attacks to information systems and critical infrastructure.
Prerequisites: HS 320 and HS 325.

HS 490 Senior Capstone in Homeland Security 3 Credits
This course is designed to allow the student to explore more deeply issues specific to aspects of homeland security as they affect businesses. Students are expected to work collaboratively in groups to identify a real client, on or off campus, for whom the student group will attempt to solve a homeland security or emergency management related challenge. Each student group will research the origins of their client’s challenge, and attempt to identify best practices in the field in order to adapt and apply them to their client’s challenge. All projects will contain an introduction, literature review, problem statement, risk/hazard analysis, risk mitigation plan, and policy recommendations that are sensitive to economic realities facing their client. Students will culminate their final projects with presentations to their classmates and to their clients at the end of the term. The expectation of this class is to develop a professional example of the student’s thinking and writing. Must be Senior standing.
Prerequisites: HS 310 and HS 315 Corequisites: HS 410.
HS 491  Thesis in Homeland Security  3 Credits
HS 491 is a pass/fail advanced thesis in homeland security. Since students may use HS 491 to substitute for the internship requirement (i.e., for those students who academically do not qualify for internship), the expectation is that the research project must be equivalent to the 300 hours interns are obligated to work. Students will function fairly independently, but still in regular contact with the course instructor, to investigate current issues or challenges to US national security. The thesis project will be a professional paper that may use either primary or secondary data collection methods. Pre-requisite: Junior Standing
Prerequisites: HS 310 and HS 315 and HS 350 and HS 360.

HS 499  Special Topics in Homeland Security  1-6 Credit
This is a variable credit independent study course. Students wishing to pursue an independent study in Homeland Security will need to coordinate and establish the number of credits (for example, 1-3), topics, etc. with a Homeland Security faculty member willing to work with him/her.

Honors (HON)

Courses

HON 150  Honors Seminar I  3 Credits (3,0)
This course is open only to freshmen enrolled in the Honors program, and will satisfy the lower-level Humanities requirement in general education. An interdisciplinary Humanities course, it focuses on aesthetic, philosophical, and historical aspects of a subject, making use of text materials from several disciplines and varied media. The course also emphasizes student participation in a seminar discussion format and requires that students develop their research, critical thinking, and oral and written communication abilities. Requirements will include (but will not be limited to) text and Web-based original research, written essays, oral presentations, and participation in group discussion. Topics may vary according to instructor.

HON 399  Honors in Special Topics  1-6 Credit
Individual independent or directed studies of selected topics in honors.

HON 499  Honors in Special Topics  1-6 Credit
Individual independent or directed studies of selected topics in honors.
Human Factors (HF)

Human Factors Courses

HF 299 Special Topics in Human Factors 1-6 Credit
An area of study under the direct supervision of a faculty member. The course requirements and area of study are negotiated between the faculty member and the student with the approval of the department chair.

HF 300 Human Factors I: Principles and Fundamentals 3 Credits (3,0)
This course is intended to provide the student with an understanding of the basic principles of Human Factors Psychology. We will study the research, principles, and methods that are beneficial (and essential) in optimizing the interaction between people and machine elements of a system, while taking the environment into account.
Prerequisites: PSY 101.

HF 302 Human Factors II: Analytic Methods and Techniques 4 Credits (4,0)
This course explores a variety of engineering and behavioral analytic methods and techniques critical to the study of work performance. The course provides the theoretical concepts and required tools needed to accomplish workload analysis as a requisite to system design or redesign of an existing system. Specific methodologies and tools are addressed within the course. A lecture/discussion format will be used which means that you are encouraged to participate in class discussions. Classes will consist of lectures and group discussions/problem solving.
Prerequisites: HF 300.

HF 306 Human Factors III: Performance Processes 4 Credits
Intermediate and advanced processes and knowledge within the domain of human factors. Human and system performance measurement; design evaluation practices. Contributes to core course series providing a set of knowledge, skills, and abilities endemic to a human factors practitioner.

HF 310 Human-Computer Interaction 3 Credits (3,0)
The application of cognitive principles, ergonomics, and human factors guidelines and principles to the design and evaluation of human-computer systems. Topics include display technologies, human visual capacities, design of display parameters, and image quality metrics.
Prerequisites: HF 300.

HF 312 Ergonomics and Bioengineering 3 Credits (3,0)
Advanced applications from a variety of bioengineering subfields are identified and defined with respect to their importance in the practice of human factors. Quantitative methods for the analysis of human movement. Topics include anthropometry, kinematics, kinetics, work and power, muscle mechanics, and electromyography. Introduces students to the application of ergonomic principles to the industrial environment. Includes subject matter on ergonomic planning and implementation, the work environment, NIOSHA work factors, and workstation equipment and design.
Prerequisites: HF 201 or HF 210 or HF 300.

HF 315 Automation and Systems Issues in Aviation 3 Credits (3,0)
This course will involve analyzing and discussing the most current issues relevant to the new generation of aviation systems. Assumptions on which current systems are based will be identified and alternatives examined.
Prerequisites: HF 300.

HF 321 Psychopharmacology 3 Credits (3,0)
This course is meant to be an introductory class in pharmacology, particularly drugs that affect brain function and drugs that are relevant to aerospace environments. The history of drug use and abuse is discussed as well as the underlying politics that have guided FDA drug policy in the U.S. Current FAA and NASA drug considerations are described. The mechanisms and sites of action for medically relevant drugs and drugs of abuse will be described to explain the causes of their effects.
Prerequisites: PSY 101.
HF 325 Human Factors and System Safety 3 Credits (3,0)
This course emphasizes the integration of human factors in all phases of a system's life-cycle. Accident prevention, beginning with systems engineering together with sound management, are combined in this course to enable the student to fully comprehend the human's vital role in preventing accidents. The total program, from basic design concepts through testing, maintenance/systems management, and operational employment, is fully examined and evaluated.
Prerequisites: HF 300.

HF 326 Human Performance in Extreme Environments 3 Credits (3,0)
This course will focus on the physiological, behavioral, and human factors issues of performance in extreme environments, particularly the human-technology-environment relationship common to many of these settings. With this focus, students will survey different occupations and environments and learn how research findings from one setting, such as submarines, have relevance to similar settings like long-duration spaceflight. Students will also learn how to apply human factors principles to enhance performance, safety, and health in extreme environments.
Prerequisites: HF 300.

HF 330 Human Factors in Space 3 Credits (3,0)
This course is intended to provide the student with an understanding of the basic principles and knowledge of aerospace human factors. Emphasis will be on the human factors issues with living and working in space. In this course the student will study the research, principles, and methods that are beneficial (and essential) in optimizing the interaction between people and machine elements of aerospace systems.
Prerequisites: HF 300.

HF 335 Human Factors in Air Traffic Control 3 Credits (3,0)
A comprehensive examination of the application of human factors to air traffic control systems. The course covers the full range of applications of human factors.
Prerequisites: HF 300.

HF 352 Human Factors in Entertainment Systems 3 Credits
This class will expose students to the psychological and human factors considerations in the design, creation, and analysis of entertainment systems. A wide variety of topic domains will be reviewed including electronic games, movies and television programs, comic books and sports. A focus on psychological issues in individual activity and social dynamics will be examined in entertainment use while design considerations are investigated through analysis of entertainment system development. A consideration of human-computer interaction principles, gaming theory, and flow as applied to entertainment systems are included as central concepts. The impact of entertainment system advances in other domains will also be explored.
Prerequisites: HF 300.

HF 399 Special Topics in Human Factors 1-6 Credit
An area of study under the direct supervision of a faculty member. The course requirements and area of study are negotiated between the faculty member and the student with the approval of the department chair.

HF 400 Human Factors IV: System Design 4 Credits (4,0)
This course provides an introduction to the concept and nature of engineered systems, systems engineering, and the role of human factors and human factors engineering in the life cycle of such systems, in light of human roles within and interacting with systems. Human Factors methods, particularly the simulation technique, will be surveyed, and related to system development. Each student will participate in a human engineering program project for a modern urban system.
Prerequisites: HF 302 and HF 305 or HF 306.

HF 410 Human Factors Engineering: Crew Station Design 3 Credits (3,0)
In-depth treatment of human factors principles applicable to the design of crew command centers for aerodynamic aviation/aerospace systems.
Prerequisites: HF 300.
HF 412  Simulating Humans in Complex Systems 3 Credits (3,0)
This course involves understanding the theory and applications for modeling human behavior in the operation of complex systems. The student will learn to program basic problems such as a traffic flow problem, a hospital transportation problem, and a bank teller efficiency problem. Several software architectures will be presented and the student will gain a working knowledge of these. Examples may include Micro Saint Sharp, ACT-R, and MIDAS. The use of human performance modifiers to discrete event simulations such as fatigue and thermal shock will be discussed as they impact task management plans. The goals of the class are to acquaint the student with how human behavior in complex systems can be simulated, studied, and assessed with the goal of applying the results.

**Prerequisites:** HF 300.

HF 415  Human Factors in Simulation Systems 3 Credits (3,0)
This course provides a comprehensive examination of the human factors aspects of simulation in modern aviation/aerospace. Topics will include history, state-of-the-art simulation systems, and current research and development. Discussion focuses on the extent and impact of human factors in simulator training. Topics from flight crew training, evaluation, effectiveness, and simulator sickness are examined in detail.

**Prerequisites:** HF 300.

HF 422  Applied Ergonomic Design, Analysis, and Evaluation 3 Credits (3,0)
This course will provide students with comprehensive exposure to the application of ergonomics analysis in the design of human/machine systems and products. Students will examine, verify, and correct the design of differently configured systems with CATIAs human modeling and ergonomics workbench. Students will learn how to create a mannequin with unique characteristics of a specified population. Core parameters to be examined are comfort, reach, clearance, core of vision, posture analysis, range of motion, lift/lower, and push/pull analysis. Students will learn how to create a mannequin with unique characteristics of a specified population. Additionally, students will be exposed to the relevant methods of statistical analysis required to verify the output of the computer modeling simulations. Finally, students are introduced to the statistical tools used in the corroboration of ergonomic design and verification.

HF 440  Aerospace Physiology 3 Credits (3,0)
This course is intended to convey the adaptability of human physiological systems to unique aerospace environments. The student will learn the structure and function of the major relevant systems such as the central and peripheral nervous systems; cardiac and pulmonary systems; muscular and sensory neuroscience; and the immune and endocrine systems.

**Prerequisites:** BIO 120.

HF 490  Practicum in Human Factors Psychology 3 Credits (3,0)
Supervised applied practicum experience. This requirement may be fulfilled in several ways, including co-ops, internships, or working on an on-campus research team. Practica provide opportunities to gain practical experience in real-world settings. The student completes a specific project under the supervision of an organizational sponsor and/or a faculty member.

HF 499  Special Topics in Human Factors 1-6 Credit
An area of study under the direct supervision of a faculty member. The course requirements and area of study are negotiated between the faculty member and the student with the approval of the department chair.
Humanities (HU)

Courses

HU 140 Western Humanities I: Antiquity and the Middle Ages  3 Credits
A continuation of COM 122 with an interdisciplinary emphasis. Traces the evolution of the Western humanistic tradition from antiquity to the Middle Ages using examples from art, architecture, music, philosophy, and literature. Emphasizes writing, reading, and appreciation skills.
Prerequisites: COM 122.

HU 141 Western Humanities II: Renaissance to Postmodern  3 Credits
A continuation of COM 122 with interdisciplinary emphasis. Traces the evolution of the Western humanistic tradition from the Renaissance to the Post-modern using examples from art, architecture, music, philosophy, and literature. Emphasizes writing, reading, and appreciation skills.
Prerequisites: COM 122.

HU 142 Studies in Literature  3 Credits (3,0)
A continuation of COM 122 with emphasis on a survey of literature. Reading materials include selected novels, poems, and plays. Emphasizes writing, reading, and appreciation skills.
Prerequisites: COM 122.

HU 143 Introduction to Rhetoric  3 Credits (3,0)
A continuation of COM 122, HU 143 offers a broad survey of rhetorical theory and practice. Whether noble or base, rhetoric primarily uses language to achieve a desired end, usually persuasion. This course employs primary and secondary readings as a means to examine how rhetorical principles manifest themselves in a variety of cultural texts and to understand the powers of persuasion. Although instructors may choose various approaches to teaching this course, students should expect some exposure to classical rhetoricians.
Prerequisites: COM 122.

HU 144 Studies in Art  3 Credits (3,0)
A continuation of COM 122 with an emphasis on art. Provides a foundation in the basic vocabulary, concept, processes, and history of art. Works of art, sculpture, architecture, and film from various cultures are analyzed. Emphasizes writing, reading, and appreciation skills.
Prerequisites: COM 122.

HU 145 Themes in the Humanities  3 Credits (3,0)
A continuation of COM 122 with interdisciplinary emphasis. Through close reading of primary texts and analysis of visual and performing arts, Themes in the Humanities explores ideas central to the evolution of culture. The course is not restricted by period and is open to the full range of humanistic studies. Themes vary by instructor and are listed in the Schedule of Courses. Emphasizes writing, reading, and appreciation skills.
Prerequisites: COM 122.

HU 146 Music Appreciation and Criticism  3 Credits (3,0)
A continuation of COM 122 with an emphasis on listening to and writing about music. Elements of music (rhythm, meter, tempo, pitch, and pitch relationships), instruments of music, and musical forms. The course emphasizes Western classical music.
Prerequisites: COM 122.

HU 199 Special Topics in Humanities  1-6 Credit
Individual independent or directed studies of selected topics in humanities.
Prerequisites: COM 122.

HU 299 Special Topics in Humanities  1-6 Credit
Individual independent or directed studies of selected topics in the humanities.

HU 300 World Literature  3 Credits (3,0)
Major works and literary trends in world literature. Course content varies by instructor and is listed in the Schedule of Courses.
Prerequisites: Any 100 or 200 level HU course.

HU 302 Contemporary Issues in Science  3 Credits (3,0)
An examination of contemporary issues in science. Topics may include but are not limited to stem cell use, DNA engineering, reproductive medicine, obesity, the spread of disease, and responses to climate change. Course focuses on bridging science and humanities, examining how different disciplines approach problems of common interest. The course will include guest experts on selected topics. Focus varies by instructor.
Prerequisites: COM 221 or COM 222.

HU 305 Modern Literature  3 Credits (3,0)
The mainstreams of literature of this century. Course content varies by instructor and is listed in the Schedule of Courses.
Prerequisites: Any 100 or 200 level HU course.
HU 310  American Literature  3 Credits (3,0)
A survey of intellectual backgrounds, major works, and literary trends in American literature. Course content varies by instructor and is listed in the Schedule of Courses.
Prerequisites: Any 100 or 200 level HU course.

HU 315  Studies in Dramatic Literature and Theater Arts  3 Credits (3,0)
Explores dramatic literature and theater arts. Examines themes, structures, characters, staging, and performance of plays. Analyzes the relationship between drama and the cultures that produce it. Course content varies by instructor and is listed in the Schedule of Courses.

HU 316  Studies in Music  3 Credits (3,0)
Studies various musical works, instruments, and styles. Examines music through listening, reading scholarship, and experiencing performances. Explores the relationship between music and the cultures that produce it. Course content varies by instructor and is listed in the Schedule of Courses.
Prerequisites: Any 100 or 200 level HU course.

HU 321  Mythology  3 Credits (3,0)
This course introduces the study of the myths of humankind, both ancient and modern, using perspectives and methods from archeology, anthropology, psychology, literature, and film. It explores what myths reveal about the human psyche and about historical and modern cultures. It builds facility in symbolic thinking and critical understanding of how this thinking influences contemporary literature, art, film, communication, and politics.
Prerequisites: Any 100 or 200 level HU course.

HU 325  Exploring Film  3 Credits (3,0)
A survey of the art of film. History of the cinema. Basic elements, photography, continuity and rhythm, movement, imaging, music and sound, script writing, directing, editing, acting, great film artists/directors, cinematographers, actors, etc.
Prerequisites: Any 100 or 200 level HU course.

HU 330  Values and Ethics  3 Credits (3,0)
This course focuses on the process of practical ethics as a way of resolving moral conflict and of understanding professional responsibility in a multiculturally diverse society without devaluing specific viewpoints of ethical or metaphysical theory, ideology, or religion. Students will use proposals, value judgments, observation statements, assumptions, and alternate-world assumptions in arguing contemporary issues of moral importance. With this basic moral logic, students will resolve issues in terms of rights, responsibilities, and the community of rational beings in terms of consequences and contingencies and in terms of habituated virtues and character. Free and unrestricted discourse will be encouraged to let students find common ground in diversity.
Prerequisites: Any 100 or 200 level HU course.

HU 335  Technology and Modern Civilization  3 Credits (3,0)
A humanistic analysis of technology, with special attention to its influence on modern American culture in a global context. Topics include the history and development of technology, the influence of technology on certain philosophies such as determinism and utilitarianism, the influence of technology on the ecosphere, and the depiction of technology in imaginative literature.
Prerequisites: Any 100 or 200 level HU course.

HU 336  Travel Communication  3 Credits (3,0)
Focuses on the theory and practice of travel communication in traditional and digital media formats. Students work alone and in groups to research and review a variety of modalities for travel communication and compose a diverse mix of written and digital works connected to travel.
Prerequisites: HU 14X.

HU 338  Traversing the Borders: Interdisciplinary Explorations  3 Credits
This course entails the study of different approaches to gathering, analyzing, and interpreting information. Special attention is directed to recognizing connections between the boundaries of traditional disciplines. Study also involves in-depth research into a single reality-altering event. Investigation focuses on how people trained in different ways of thinking participate in and contribute to their society and the world by shaping new cultural meanings.
Pre-Requisite: Junior standing
Prerequisites: Any 100 or 200 level HU course.
HU 341 World Philosophy 3 Credits (3,0)
This course focuses on an investigation of some of the central problems of philosophical inquiry such as what we can know and what we cannot know, how we reason, who we are, why we are here, and what we can hope for. Freedom, beauty, knowledge and logical thinking, mind, morality, god or gods, religion, truth, death, and existence might be explored using a variety of sources, including but not limited to contemporary thinkers of the European and the Anglo-American traditions. This course is designed to challenge assumptions and to help students deal with contemporary philosophical issues.
Prerequisites: Any 100 or 200 level HU course.

HU 345 Comparative Religions 3 Credits (3,0)
A survey of the major religions of the world, beginning with a brief examination of the nature of religion and its study, as a vital aspect of human experience in history. This is followed by a survey of the eastern religions of Hinduism, Buddhism, Jainism, Taoism, Confucianism, and Shinto, and finally a survey of the monotheistic religions: Judaism, Christianity, Islam, and Sikhism.
Prerequisites: Any 100 or 200 level HU course.

HU 355 Creative Writing 3 Credits (3,0)
The course culminates the interpretive and expressive elements of communications classes. The study, practice, and use of a personal style of creative composition and examples of contemporary literature and submittal of publications are included in this course.
Prerequisites: Any 100 or 200 level HU course.

HU 363 Communication and Society 3 Credits (3,0)
An examination of human communication in a variety of cultural settings. Analysis of verbal discourses, non-verbal communication, symbolic imagery and media as means of constructing identity and social norms. Themes vary by instructor and are listed in the schedule of courses.
Prerequisites: COM 219 and Junior Standing.

HU 375 The Nature of Language 3 Credits (3,0)
This course provides a practical investigation into how people use language functions as a system of meaning. The diversity, complexity, and intrinsic fascination of this most human of behaviors is studied largely with reference to the English language. Topics include popular ideas about language, language and identity, language structure and system, language media, language acquisition and learning, language and the brain, and world languages.
Prerequisites: COM 221 or COM 222.

HU 399 Special Topics in Humanities 1-6 Credit
Individual independent or directed studies of selected topics in the humanities.
Prerequisites: HU 14X or HU 199.

HU 415 Nonverbal Communication 3 Credits (3,0)
This course entails the study of communication behaviors and processes, not involving the expression of written or spoken words, contribute information to a message. Special attention is directed to the study of voice qualities; facial expression and body language; space, personal distance, and touch; the use of time and objects; and personal appearance. Study also involves nonverbal communication in applied settings, as well as research strategies for observing, measuring, and understanding non-verbal phenomena. Also offered as COM 415. Students receive either Communication or Humanities credit, but not both.
Prerequisites: COM 219 and COM 221 or COM 222.

HU 420 Applied Cross-Cultural Communication 3 Credits (3,0)
An examination of the challenges to communicating across the variety of sub-cultures present in work environments. Ethnicity, nationality, gender, physical impairment, and sexuality are among the areas of difference often present in business and professional environments that may influence the establishment of cooperative working relationships. Means for analyzing and developing strategies to transcend and make positive use of sub-cultural differences will be considered.
Prerequisites: COM 219.
HU 475  Senior Thesis  3 Credits (3,0)
The culmination of the student's experience in Interdisciplinary Studies major, requiring the student to complete documented original research that is demonstrably tied to at least two of the student's minor fields of study. Open to other students not enrolled in the Interdisciplinary Studies major who may take the course but must tie their original research to a topic appropriate for their major or minor area(s) of study. Expectations for original research (e.g., experiments, scientific observations, or interviews with subject matter experts) and integration of research into the thesis. Additional requirements to write project-management documents (e.g., a proposal, research plan, literature survey, progress report) and to defend research. This course will not fulfill the Upper Level (300-400) Humanities General Education requirement.
Prerequisites: COM 219 and COM 221.

HU 499  Special Topics in Humanities  1-6 Credit
Individual independent or directed studies of selected topics in the humanities.

Mathematics (MA)

Courses

MA 4  Introductory and Intermediate Algebra  4 Credits
Introductory and intermediate level algebra. Topics include but are not limited to: operations and properties of real numbers; solving linear, inequality, and quadratic equations; formulas with applications; functions and graphing linear equations; operations with polynomials; factoring; rational expressions and equations; radical expressions and equations; and systems of equations. Credit is not applicable to any degree. A grade of "C" or higher is required to pass this course. Credit is not applicable to any degree.

MA 6  Intermediate Algebra  3 Credits
This is an intermediate algebra course. Topics include fundamental concepts of algebra; linear equations and inequalities; polynomials; rational expressions; exponents and radicals quadratic equations; functions and graphing; and systems of linear equations and inequalities. Credit not applicable to any degree. A grade of "C" or higher is required to pass this course.
Prerequisites: Math Placement.

MA 111  College Mathematics for Aviation I  3 Credits (3,0)
A pre-calculus course designed for the student of aviation. Review of the fundamentals of algebra; linear equations and inequalities; quadratic equations; variation; polynomial, rational, exponential, logarithmic, and trigonometric functions; radian measure; right triangle solutions, vectors, and the laws of sines and cosines.
Prerequisites: MA 6 or MA 4.

MA 112  College Mathematics for Aviation II  3 Credits (3,0)
This course presents basic calculus, designed for the student of aviation. Topics include differentiation and integration of algebraic functions; applications to velocity, acceleration, area curve sketching and computation of extreme values.
Prerequisites: MA 111.

MA 120  Quantitative Methods I  3 Credits (3,0)
An algebra methods course with applications to business and economics. Operations, relations, functions, modeling, and problem solving; systems of linear equations and inequalities.
Prerequisites: MA 6 or MA 4.

MA 140  College Algebra  3 Credits (3,0)
This course focuses on fundamentals of exponents, radicals, linear and quadratic equations, inequalities, functions, graphing techniques, and complex numbers. It includes an introduction to function; curve sketching; elementary theory of equations; sequences and series; matrix algebra and systems of equations; linear; polynomial; logarithmic; exponential; inverse and composite functions; variation; and systems of equations.
Prerequisites: MA 6 or MA 4.

MA 142  Trigonometry  3 Credits (3,0)
Trigonometric functions and their graphs; identities; radian measure with applications; compound, half, and double angle identities; solving elementary trigonometric equations, right and oblique triangles; law of sines and cosines; inverse trigonometric functions; vectors and trigonometric form of a complex number.
Prerequisites: MA 6 or MA 4.
MA 143 Precalculus Essentials  3 Credits
An introduction to the calculus sequence with an emphasis on functions and their graphs, including polynomial, rational, exponential, logarithmic and trigonometric; radian measure; trigonometric identities and equations.
Prerequisites: MA 6 or MA 4.

MA 145 College Algebra and Trigonometry  5 Credits (5,0)
Fundamentals of exponents, radicals, linear and quadratic equations, inequalities, elementary theory of equations, sequences and series, functions, exponential, logarithmic, and trigonometric functions, radian measure, trigonometric identities and equations, vectors, laws of sines, cosines, solutions of right triangles, and complex numbers.
Prerequisites: MA 6 or MA 4.

MA 199 Special Topic in Mathematics  1-6 Credit
Individual independent or directed studies of selected topics in mathematics.

MA 220 Quantitative Methods II  3 Credits (3,0)
This course is an introductory calculus course with applications to business and economics; limits; differentiation and integration of algebraic, exponential, and logarithmic functions; applications of differentiation to maximizing and minimizing; curve sketching; and marginal values.
Prerequisites: MA 111 or MA 120 or MA 140.

MA 222 Business Statistics  3 Credits (3,0)
This course is a study of basic descriptive and inferential statistics. Topics include types of data, sampling techniques, measures of central tendency and dispersion, elementary probability, discrete and continuous probability distributions, sampling distributions, hypothesis testing, confidence intervals, and simple linear regression.
Prerequisites: MA 111 or MA 120 or MA 140 or MA 145.

MA 241 Calculus and Analytical Geometry I  4 Credits (4,0)
Limits and continuity; differentiation and integration of algebraic and elementary transcendental functions; applications of first and second derivatives.
Prerequisites: MA 143.

MA 242 Calculus and Analytical Geometry II  4 Credits (4,0)
Differentiation and integration of transcendental functions; special integration techniques; applications of the definite integral; numerical methods; infinite series.
Prerequisites: MA 241.

MA 243 Calculus and Analytical Geometry III  4 Credits (4,0)
Solid analytic geometry; vector functions in three dimensions; partial differentiation; directional derivative and gradient; line integrals; multiple integrals
Prerequisites: MA 242.

MA 245 Applied Differential Equations  3 Credits
Applied treatment of ordinary differential equations; Laplace transforms; matrix algebra and applications; computer techniques; numerical methods; least squares fit; normal distribution and applications.
Prerequisites: MA 242.

MA 270 Computational Mathematics Seminar  1 Credit
Introduction to computational models drawn from a variety of scientific application areas. Models will be taught using guided inquiry, open-ended inquiry, cooperative learning, writing, and oral presentations. Each module used will be guided by a five-step process: problem statement; model of problem; methods chosen to solve; implementation; assessment of the model. Models will be implemented using computer algebra systems.
Corequisites: MA 241.

MA 299 Special Topics in Mathematics  1-6 Credit
Individual independent or directed studies of selected topics in mathematics.

MA 305 Introduction to Scientific Computing  3 Credits
This course is an introduction to the Unix operating system, programming in a high level language (e.g., C or Fortran), and the use of mathematical libraries. Applications may include root-finding algorithms, quadrature, least squares, linear systems, and first order differential equations.
Prerequisites: MA 242 and EGR 115 or CS 223.
MA 320  Decision Mathematics 3 Credits (3,0)
The mathematical concepts and applications in
mathematical model building and problem solving.
Included are mathematical areas that are basic to
decision theory
Prerequisites: MA 222.

MA 341  Introduction to Mathematical Analysis 3
Credits (3,0)
Careful treatment of the theoretical aspects of
the calculus of functions of a real variable. Topics
include the real number system, limits, continuity,
derivatives, the Riemann integral, elementary notions
of topology, and metric spaces.
Prerequisites: MA 243.

MA 345  Differential Equations and Matrix
Methods 4 Credits (4,0)
Treatment of ordinary differential equations to
include principal types of first and second order
equations; methods of substitution on simple higher
order equations; linear equations and systems
of linear equations with constant coefficients;
methods of undetermined coefficients and variation
of parameters; Laplace transforms; series solutions;
linear algebra and matrix methods of solutions; and
applications to physics and engineering.
Prerequisites: MA 243.

MA 348  Numerical Analysis I 3 Credits (3,0)
Floating point arithmetic, error analysis, algorithms
in interpolation, integration, differentiation, matrix
algebra, approximation and solution of equations,
use of numerical software packages.
Prerequisites: MA 345 and EGR 115.

MA 350  Introduction to Partial Differential
Equations 3 Credits (3,0)
Introduction to first order linear, quasi-linear, and
nonlinear partial differential equations, with an
introduction to numerical solutions; existence and
uniqueness of solutions to second order equations,
with emphasis on the heat, wave, and Laplace’s
equation. Uniform convergence with application
to Fourier series and integrals. Green’s functions,
introduction to integro-differential equations.
Difference equations.
Prerequisites: MA 345.

MA 360  Mathematical Modeling & Simulation I 3
Credits
A blended cyber-learning course in computational
mathematics. Topics include matrix operations,
linear and nonlinear optimization and interdisciplinary
problems whose solutions heavily depend on
mathematical modeling and simulation. Students
meet teachers twice per week in virtual classes
in problem help sessions and gain hands-on
experience on how to use software tools such as
MATLAB, Stella, Agentsheets, etc. to model and
simulate team projects.

MA 399  Special Topics in Mathematics 1-6
Credit
Individual independent or directed studies of selected
topics in mathematics.

MA 404  Statistics and Research Methods 3
Credits (3,0)
Elements of probability theory including finite
probability spaces, conditional probabilities,
independence, correlation, Bayes Theorem, and
Gaussian random variables. Statistical methods
including contingency tables, regression, hypothesis
testing. Experimental design. Ethical considerations
in experimentation. Nonquantitative research
methodologies. Numerical methods including the
introduction of at least one computer-based statistics
package.
Prerequisites: MA 112 or MA 241.

MA 410  Linear Optimization 3 Credits
An introduction to techniques for the solution and
analysis of deterministic optimization models. Topics
include the geometry of linear programming, the
simplex method, duality theory, sensitivity analysis,
and network flow models. Integer programming
models and methods are introduced. The course
emphasizes effective modeling of linear optimization
problems and introduces the use of optimization
packages and commercial solvers.
Prerequisites: MA 345.

MA 412  Probability and Statistics 3 Credits (3,0)
Finite sample spaces; conditional probability and
Bayes Theorem, discrete and continuous random
variables and their functions; expected value,
variance, and standard deviation; systematic study
of the major discrete and continuous distributions;
moment generating functions; hypothesis testing and
estimation.
Prerequisites: MA 242.
MA 413  Statistics  3 Credits
An introduction to statistical techniques for analysis of data. Topics include sampling distributions and central limit theorem, estimation: maximum likelihood estimation, sufficient statistics, Bayes estimation, hypothesis testing, likelihood ratio test, Neyman-Pearson lemma, simple linear regression, ANOVA, multiple regression, data exploration and nonparametric methods. The course introduces the use of statistical packages.
Prerequisites: MA 243.

MA 420  Nonlinear Optimization  3 Credits
Modeling and analysis of nonlinear optimization problems. Topics include convex analysis, unconstrained and constrained optimization, duality theory, Lagrangian relaxation, Karush-Kuhn-Tucker conditions, and methods for solving nonlinear programs, including descent methods, Newton methods, conjugate gradient methods, subgradient optimization, and penalty and barrier methods.
Prerequisites: MA 243.

MA 432  Linear Algebra  3 Credits (3,0)
Review of vector and matrix operations including matrix inverses, eigenvectors, and eigenvalues. Equations of lines and planes, vector spaces including basis and dimensions, linear transformations, change of basis, diagonalization of matrices, inner products and orthonormal bases, applications.
Prerequisites: MA 345.

MA 440  Data Mining  3 Credits (3,0)
Data Mining is to gather, assimilate, and make sense of large amounts of data. The course includes techniques, algorithms, and open-source software to automatically classify data, to discover novel and useful patterns, and to help predict future outcomes.
Prerequisites: MA 243 and EGR 115 or MA 305.

MA 441  Mathematical Methods for Engineering and Physics I  3 Credits (3,0)
Line and surface integrals; vector fields with the study of Green, Gauss, and Stokes Theorems; applications of vector field theory; Fourier series.
Prerequisites: MA 243.

MA 442  Mathematical Methods for Engineering and Physics II  3 Credits (3,0)
The solution of linear differential equations with variable coefficients; study of the derivation, characteristics, and solutions of partial differential equations; Fourier series, Fourier transform, Laplace transform, and Green's function; applications in science and engineering.
Prerequisites: MA 441.

MA 443  Complex Variables  3 Credits (3,0)
Algebra of complex numbers; complex functions, analytic functions; mapping by elementary functions; conformal mappings and their applications; additional topics may include complex integration, power series expansion.
Prerequisites: MA 441.

MA 444  Scientific Visualization  3 Credits
Scientific visualization is the representation of data graphically as a means of gaining understanding and insight into the data. This course will introduce different aspects of scientific visualization: computer graphics and related mathematics concepts, application packages for interactive display and analysis of data.
Prerequisites: MA 243 and EGR 115.

MA 448  Numerical Solution of Differential Equations  3 Credits
This course is an introduction to numerical techniques for solving differential equations. Topics covered will include numerical solution of ordinary and partial differential equations (both initial value and boundary value problems). Runge-Kutta and multistep methods are examined for initial value problems, as well as finite difference methods for elliptic, parabolic, and hyperbolic partial differential equations. Emphasis is placed on efficient computational procedures including the use of library and student-written procedures using high-level software such as MATLAB.
Prerequisites: MA 243.
MA 453  High Performance Scientific Computing  3 Credits
This course is an introduction to high performance computing in computational mathematics and sciences with practical applications. The course provides an overview of parallel computing and study of program efficiency on high performance computers. It concentrates on the two major parallelization paradigms: shared-memory parallelization with OpenMP and distributed-memory parallel programming with MPI. The main focus of the course will be on applications of parallel computing in the sciences (Engineering, Physics, Mathematics, etc.).
Prerequisites: MA 305 or MA 348.

MA 488 Numerical Methods in Fluids  3 Credits
This course explores the theory and applications of numerical methods in fluid mechanics. The topics covered will include numerical methods for incompressible flows; primitive variable and vorticity stream function on formulation; and numerical treatment for inviscid and viscous flows, including restricted to incompressible flow. Emphasis will be placed on numerical methods based on finite difference, finite volume, or finite element formulations.
Prerequisites: MA 441.

MA 490 Capstone Project  3 Credits
This course offers the student an opportunity to consolidate their knowledge of mathematics by investigating a computational problem in an application area consistent with their interest and experience. Students, typically working in teams, will develop mathematical paradigm that fits the problem and identify tools that might help solve it. They will then build and implement a mathematical model that contains critical elements of the problem and present both an oral and written report summarizing each work and possible extensions.
Prerequisites: MA 441.

MA 499 Special Topics in Mathematics  1-6 Credit
Individual independent or directed studies of selected topics in mathematics.

Mechanical Engineering (ME)

Courses
ME 199 Special Topics in Mechanical Engineering  1-6 Credit
Individual independent or directed studies of selected topics in Mechanical Engineering.

ME 200 Machine Shop Laboratory  1 Credit (0,1)
Introduction to machine shop techniques including familiarization with riveting, sheet metal forming, welding, and machining.

ME 208 Manufacturing Laboratory  1 Credit
This course is intended to introduce students to the practical aspects of mechanical systems. Mechanical assembly and disassembly of mechanical components will include topics such as basic hand tools, fasteners, and bearings. CAD and CAM tools will be used to design basic components, create manufacturing drawings, manufacture parts using CNCs, welding, and basic fabrication techniques, and inspect components.
Prerequisites: EGR 120.

ME 299 Special Topics in Mechanical Engineering  1-6 Credit
Individual independent or directed studies of selected topics in Mechanical Engineering.

ME 303 Vehicle Dynamics  3 Credits (3,0)
Prerequisites: ES 202 and ES 204.

ME 304 Introduction to Machine Design  3 Credits (3,0)
Detail design of machine components; application of analytical methods in the design of simple machines. Failure mode analysis, theories of failure, yield, fracture, deflection, and fatigue analysis of machine elements. Introduction to computer methods of stress and deflection analysis using finite element analysis.
Prerequisites: ES 202 and ES 204.
ME 306 Robotic Mechanisms 3 Credits (3,0)
This course studies the application and design of robotic systems. Rover drives, suspension systems, tracked vehicles, gimbal-mounted cameras/sensors and walking robots are covered with an emphasis on space and aerial robotic applications. Several hands-on projects will be conducted and a final design project is required.
Prerequisites: ES 204.

ME 307 Energy Conversion and Storage 3 Credits (3,0)
Improved and innovative energy conversion systems will play a critical role in meeting future energy needs. This course covers energy conversion and storage and introduces common concepts and tools used in this field, with particular emphasis on electromechanical energy conversion systems. Students who have taken this course should be able to analyze several alternative systems and determine which system is most compatible for an application. Applications to renewable energy projects, including photovoltaics, wind turbines, and others.
Prerequisites: EE 327.

ME 311 Robotics Technologies for Unmanned Systems 3 Credits (3,0)
An introduction to robotics with emphasis on sensors, actuators and computer control. Topics include the terminology used to describe unmanned systems, such as fly-by-wire control, teleoperation, and autonomy. Technologies studied include range finding systems (e.g., sonar, radar, ladar), position determination systems (e.g., GPS and landmark-based systems), optical sensors (infrared and visible light imaging), inertial guidance systems, servomotors, and safety systems. The course includes a microprocessor-based robotics project.
Prerequisites: EGR 115 or CS 223.

ME 313 Instrumentation and Data Acquisition 2 Credits (2,0)
This course will be a combination of theoretical and applied topics related to instrumentation, data acquisition, and hardware interfacing with mechatronic systems. This course covers aspects related to interfacing sensors and actuators with computers including sampling rates; sources of error and time delay; analog and digital signal conditioning circuits; and the influence of EMI, grounding, and noise in the power supply. Students will be exposed to data acquisition and control software (e.g., Labview).
Prerequisites: ME 314.

ME 314 Instrumentation and Data Acquisition Laboratory 1 Credit
The purposes of this course is threefold: (1) to teach the student the principles of a variety of measuring devices and how to take measurements and analyze the experimental data, (2) to expose students to data acquisition hardware and software, and (3) to expose students to project based learning.
Corequisites: ME 313.

ME 316 Thermodynamics II 3 Credits (3,0)
This is the second course in thermodynamics. Topics include energy conversion, vapor power cycles, gas power cycles, refrigeration, psychrometrics, and combustion
Prerequisites: ES 305.

ME 399 Special Topics in Mechanical Engineering 1-6 Credit
Individual independent or directed studies of selected topics in Mechanical Engineering.

ME 400 Vibration and Acoustics 3 Credits (3,0)
Basic concepts of vibration; free and undamped vibration; energy methods and Rayleigh's method for determination of natural frequencies; viscously damped vibration; various damping mechanisms; torsional vibration; harmonically excited vibration; transient vibration; multi degrees of freedom systems; rotor dynamics; basic principles of acoustics and wave propagation; electroacoustics; transducers, noise measurements; applications to land, airborne, and space vehicle acoustics generated by a structure's vibration or by aerodynamic sources.
Prerequisites: MA 345 and ES 202 and ES 204.
ME 401 Advanced Fluid Dynamics 3 Credits (3.0)
Development of application of Navier-Stokes equations, estimation of drag and lift, isentropic flow, normal and oblique shock waves, Fanno and Rayleigh flow, turbomachinery, introduction to computational fluid dynamics, application of CFD software.
Prerequisites: ES 309.

ME 402 Robotic Arms 3 Credits (3.0)
This course is an introduction to robotics with an emphasis on the kinematics and dynamics of robotic arms. The Space Shuttle arm and the Mars Rover arms will be analyzed. Topics include forward and inverse kinematics, trajectory generation, interpolation, and position sensing. Students will complete a project in which they program a robotic arm and/or a robotic welder.
Prerequisites: ES 204.

ME 403 Thermal Power Systems 3 Credits (3.0)
Availability and evaluation of thermodynamic properties. The thermodynamics of compressible flow. Thermodynamic power and refrigeration cycles and systems; psychometrics and environmental control; mixtures of ideal gases; introduction to combustion; internal combustion engines, gas turbines, fuel cells; and direct energy conversion. Design and optimization of power systems and climate control with applications to land vehicles, robotics, aircraft, and spacecraft.
Prerequisites: ES 305 and MA 345.

ME 404 Mechatronics 3 Credits (3.0)
Integration of mechanical, electrical, and computer systems. Application and interfacing of microcontrollers, sensors, actuators, and other electrical components commonly used in smart electromechanical devices.
Prerequisites: ES 204 and EE 327.

ME 405 Vehicle Power Systems 3 Credits (3.0)
Prerequisites: ES 305.

ME 407 Preliminary Design for Robotic Systems with Laboratory 4 Credits (3.3)
Mechanical design principles are developed and applied for robotic applications. The topic is selected and approved by the Mechanical Engineering Department. Principles of conceptual and detailed mechanical design, component design, manufacture, and production are covered. A complete system is designed, resulting in a complete set of specifications, supporting analysis, drawings, and performance report.
Prerequisites: ME 404 or (ME 313 and ME 314) and Senior standing Corequisites: ME 407L.

ME 408 Clean Thermal Power Systems 3 Credits
Students will apply engineering science principles to the analysis and design of plants for clean energy production, with emphasis on efficiency, performance and environmental impact. Clean energy plant configurations to be addressed include nuclear, geothermal, ocean thermal, fossil and biomass fueled. Classic vapor and gas power cycles are examined. Fundamentals of turbo-machinery performance and scaling laws are presented. Use of vendor data to select suitable plant components is addressed. The thermodynamics of combustion and psychometrics are introduced. Students develop MatLab models to facilitate power plant analysis and design projects.
Prerequisites: AE/ME students need C or better in ES 305 Corequisites: MA 345.

ME 409 Vehicle Aerodynamics 3 Credits (3.0)
Prerequisites: ES 201 and ES 204 and ES 206 and ES 305.
ME 410  Advanced Machine Design  2 Credits (2,0)
Design and analysis of mechanics system for fluctuating loading. Fatigue analysis. Application of design fundamentals to mechanical components, and integration of components to form systems. Fatigue failure of systems. Mechanical design of such systems as bearings, transmission gears, springs, joints, brakes, and clutches. Indeterminate systems.
Prerequisites: ES 320 and ME 304.

ME 411  Clean Kinetic Power Systems  3 Credits
Students will apply fundamentals of aerodynamics, controls, and structural dynamics to the analysis and design of wind and water turbines for clean energy production, with emphasis on efficiency and performance. Wind and water resource characterization. Aerodynamic prediction using 1-D momentum theory, Betz limit, blade element momentum method, and modern 3-D computational fluid dynamics. Turbine control strategies and safety issues. Beam theory for turbine blades. Structural dynamics model for wind and water turbine performance prediction. Statistical assessment of performance using resource characterization. Students will develop MatLab models to conduct wind and water turbine system analysis and design projects.
Prerequisites: AE/ME students need C or better in ES 305 Corequisites: MA 345.

ME 413  Preliminary Design for High Performance Vehicles with Laboratory  4 Credits (3,3)
Mechanical design principles are developed and applied for high performance vehicles. The topic is selected and approved by the Mechanical Engineering Department. Principles of conceptual and detailed mechanical design, and component design, manufacture, and production are covered. A complete system is designed, resulting in a complete set of specifications, supporting analysis, drawings, and performance report. For Senior undergraduate students only.
Prerequisites: ME 304 and ES 305 Corequisites: ME 413L.

ME 414  Preliminary Design for Energy Systems  4 Credits (3,3)
This course is designed to introduce students to engineering design and the design process through applied mechanical engineering related design projects. Emphasis shall be placed on professionalism, creativity, engineering, design logic and communication. The course will include material on selected subjects chosen to help bring together the students' knowledge. A large and long-term project (from fall through spring semester) will be assigned to facilitate practical implementation of engineering design and the design process.
Prerequisites: ME 304 and ES 403 Corequisites: ME 414L.

ME 424  Automation and Rapid Prototyping  3 Credits
Participants will study rapid prototyping and automated fabrication including the generation of suitable CAD models, current rapid prototyping fabrication technologies, and automation. The rapid prototyping processes will be illustrated by the design and fabrication of parts by the students.
Prerequisites: ME 304 or AE 318.

ME 428  Design for Manufacturing and Assembly  3 Credits
Prerequisites: MA 345 and MA 412 and ME 304 or AE 318.

ME 433  Senior Design for High Performance Vehicles with Laboratory  4 Credits (3,3)
This is a continuation of the preliminary design course and is the capstone course for the degree.
Prerequisites: ME 413 Corequisites: ME 433L.
ME 434  Senior Design for Energy Systems  4 Credits (3.3)
This is a continuation of the preliminary design course and is the capstone course for the degree.
Prerequisites: ME 414  Corequisites: ME 434L.

ME 436  Advanced Machine Design  3 Credits (3.0)
Design and analysis of mechanical systems for fluctuating loading. Fatigue analysis. Application of engineering mechanics analysis and design fundamentals to mechanical components such as shafts, screws, fasteners, joints and gears. Computer methods of stress and deformation analysis using finite element analysis (FEA). CAD simulation and FEA is performed using appropriate software.

ME 437  Senior Design for Robotic Systems with Laboratory  4 Credits (3.3)
This is a continuation of the preliminary design course and is the capstone course for the degree.
Prerequisites: ME 407  Corequisites: ME 437L.

ME 438  Model-Based Control System Design  2 Credits
This course is an introduction to model-based design, an efficient and systematic control design approach widely used in industry to reduce development costs and improve time to market. This course will familiarize students with the control system design and simulation tool Matlab/Simulink and expose students to each stage of the model-based design process including plant modeling, control system synthesis and analysis, system simulation, and controller programming.
Prerequisites: MA 345  Corequisites: ME 438L.

ME 438L  Model-Based Control System Design Laboratory  1 Credit
This course is the lab session companion to the lecture course ME 438 Model-Based Control System Design. This course will familiarize students with the simulation tool and laboratory instrumentation used in model-based control system design. By completing the lab assignments, students will go through each stage of the model-based design process including plant modeling, control system synthesis and analysis, system simulation, and controller programming.
Prerequisites: MA 345  Corequisites: ME 438.

ME 442  Biofluid Mechanics  3 Credits
Principles and foundations of fluid mechanics and computational methods applied to the human cardiovascular system. Anatomy and modeling of arterial vessels; blood flow in arteries; and coupled fluid-structure interactions in vasculature. Introduction to Bioheat transfer and blood perfusion. Viscoelastic modeling of biological tissues; and biomaterials used in different biomedical applications.
Prerequisites: ES 305.

ME 443  Heating, Ventilation, and Air-Conditioning  3 Credits (3.0)
Application of thermodynamics, heat transfer, and fluid flow to understand the psychrometric performance of systems and equipment. Evaluating heating and cooling loads for buildings, based on solar radiation, thermal comfort and indoor air quality.
Prerequisites: ES 305  Corequisites: ES 403.

ME 444  Biomechanics  3 Credits
Fundamentals and principles of biomechanics. An overview of musculoskeletal anatomy; application of statics to biomechanics; biodynamic analysis of forces in human function and movement as well as estimation of energy and power requirements in human activity; stress-strain analysis in biological tissues; viscoelastic modeling of biological tissues; and biomaterials used in different biomedical applications.
Prerequisites: ME 304 or AE 318 or CIV 304.

ME 445  Sustainable Design  3 Credits (3.0)
Sustainable Design addresses the trend of developing high performance, efficient, and healthy designs by defining effective ways to utilize energy. Students will examine the energy issue from the macro perspective to the micro perspective of the design and discover some of the natural and mechanical means of heating, cooling and ventilation for improved indoor air quality and cost savings. Students will analyze the energy use breakdown as a critical component of successful sustainable designs.
Prerequisites: ES 305  Corequisites: ES 403.
ME 448 Preliminary Design for Bio-Mechanical Systems with Laboratory  4 Credits (3,3)
This course is designed to introduce students to engineering design and the design process through applied mechanical engineering related design projects. Emphasis shall be placed on professionalism, creativity, engineering, design logic and communication. The course will include material on selected subjects chosen to help bring together student knowledge. A large and long-term project (from fall through spring semester) will be assigned to facilitate practical implementation of engineering design and the design process. Students on the Bio-Mechanical Systems track may participate in a number of existing projects. The entire group will be responsible for ensuring its completeness and organization. Students will work in interdisciplinary teams using concurrent engineering and systems engineering principles, as well as biofluid mechanics, bioheat transfer, and biomechanics, applied to the conceptualization, design, development, and implementation of a bio-mechanical device, system, and/or process. The project must be carried through the conceptual and embodiment phases. This is the first of a two-semester sequence. In Senior Design, students are required to complete the detailed design phase and build and test a prototype according to the design specification selected. At the end of each term, a single overall report will be required from each group that details the team’s work and integrates the various components into the complete design. Each student will be required to maintain an engineering logbook of the efforts on the project, keeping track of the time spent, the tasks being worked on, etc. In parallel, each student will be required to maintain a portfolio of his or her efforts that is synchronous with the logbook. Both the logbook and portfolio shall be submitted to the instructor at the end of each term.  
**Prerequisites:** ME 304  
**Corequisites:** ME 448L.

ME 458 Senior Design for Bio-Mechanical Systems with Laboratory  4 Credits (3,3)
This course is designed to introduce students to engineering design and the design process through applied mechanical engineering related design projects. Emphasis shall be placed on professionalism, creativity, engineering, design logic and communication. The course will include material on selected subjects chosen to help bring together student knowledge. A large and long-term project (from fall through spring semester) will be assigned to facilitate practical implementation of engineering design and the design process. Students on the Bio-Mechanical Systems track may participate in a number of existing projects. The entire group will be responsible for ensuring its completeness and organization. Students will work in interdisciplinary teams using concurrent engineering and systems engineering principles, as well as biofluid mechanics, bioheat transfer, and biomechanics, applied to the conceptualization, design, development, and implementation of a bio-mechanical device, system, and/or process. In Senior Design, students are required to complete the detailed design phase and build and test a prototype according to the design specification selected in the preliminary design phase. At the end of each term, a single overall report will be required from each group that details the team’s work and integrates the various components into the complete design. Each student will be required to maintain an engineering logbook of the efforts on the project, keeping track of the time spent, the tasks being worked on, etc. In parallel, each student will be required to maintain a portfolio of his or her efforts that is synchronous with the logbook. Both the logbook and portfolio shall be submitted to the instructor at the end of each term.  
**Prerequisites:** ME 448  
**Corequisites:** ME 458L.

ME 460 Biosolid Mechanics  3 Credits (3,0)
Fundamentals and principles of solid mechanics applied to biological systems. Stress-strain analysis of living tissues subjected to static and dynamics loading: arteries, skin, heart muscle, skeletal muscle, tendon, cartilage, and bone. Mathematical and analytical models, constitutive formulations, viscoelastic modeling, and biomaterials used in different biomedical applications. 
**Prerequisites:** ME 444 or Instructor Consent.
ME 499 Special Topics in Mechanical Engineering  1-6 Credit
Individual independent or directed studies of selected topics in Mechanical Engineering.

Meteorology (WX)

Courses

WX 201 Survey of Meteorology  3 Credits (3,0)
This is a survey course in meteorology that includes applications to flight. Included is a systematic development of the following topics: the composition and general structure of the atmosphere, energy and energy transfer, seasonal and daily controls on temperature, pressure, wind, local and regional circulations, atmospheric stability, vertical motion, turbulence, moisture, fog, clouds, precipitation, icing, the general circulation pattern, climate, jet streams, air masses, fronts, mid-latitude cyclones, tropical cyclones, thunderstorms, and weather observations and charts.

WX 261 Applied Climatology  3 Credits (2.5,0)
This course is an in-depth survey of the varied climates of the world and of the impact of climate on aviation. Emphasis is placed on understanding energy exchange processes that control climate and in describing in detail how and why temperature, precipitation and wind vary during the year and in relation to geography. Included is a treatment of climate variability, including how and why climate is thought to have changed in the past, and how it might change in the future, and of the tools used to understand this variability.
Prerequisites: WX 201 or WX 252.

WX 270 Weather Information Systems  3 Credits (3,0)
This course provides an introduction to the various weather-sensing equipment and the systems that deliver weather information to various users. The development of various sensing devices will be explored and current instrumentation technology explained. The course will provide an overview of how various instruments make measurements, the physical principles involved in the measurements, the limitations of the measurements, and how these data are used in weather operations and forecasts. The use of these measurements will be illustrated in class weather briefings, labs, and homework assignments. Students will be required to design, build, calibrate, and take data with a weather instrument.
Prerequisites: WX 201.

WX 272 Meteorological Instruments and Data Analysis  3 Credits (3,0)
Introduction to weather sensing equipment, systems to analyze weather data, and data analysis techniques. Current instrumentation technology; physical principles used in weather measurements; limitations of measurements; use of data in operations and forecasting; visual and computational analysis of meteorological data, and plotting of meteorological fields.
Prerequisites: WX 201 and CS 118 or EGR 115.

WX 280 Introduction to Broadcast Meteorology  3 Credits (1,2)
Effective approaches to weather and science communication and reporting. Delivery techniques for television, the internet, social media and a live audience; basic weather forecasting techniques; basic geography and geographical terms; public speaking, on-camera performance and stage movement; introduction to the television industry.
Prerequisites: WX 201.

WX 299 Special Topics in Applied Meteorology  1-6 Credit
Individual independent or directed studies of selected topics in applied meteorology.
WX 301  Aviation Weather  3 Credits (3,0)
The course is an expansion of WX 201 Survey of Meteorology with a focus on aviation weather hazards, including convective hazards (thunderstorms, hail, high winds), non-convective weather hazards (fog, icing, turbulence, wind shear, winter weather), and special weather hazards (volcanic ash and space weather). Meteorological concepts such as pressure, atmospheric forces, thickness, thermal wind, fronts, jet streams, cyclone formation, and atmospheric stability are expanded and applied to aviation operations. Emphasis is on navigating today's online environment for obtaining and analyzing real-time surface observations, upper-air observations, satellite data, and radar data, as well as both primary and supplementary aviation weather products. Lab exercises and projects complement the lectures through use of current and historic weather examples to provide practical experience in making informed weather-sensitive decisions.
Prerequisites: WX 201.

WX 305  Weather Support Operations  3 Credits (3,0)
An application of weather information and meteorological principles to support operational decision making for a specific operation, such as an air race or other mission (e.g., sports tournament, auto race, maritime race, space-launch operation). Determination of user requirements and weather sensitivities; sources of weather information; weather data collection; surface and upper-air analysis interpretation; satellite interpretation; radar interpretation; short range and long-range model forecast interpretation; weather hazards chart interpretation; weather product tailoring; evaluation of performance; application of improvement strategies. Typically only one operational mission type will be supported during the course.
Prerequisites: WX 301.

WX 327  Operational Analysis and Forecasting  3 Credits (2,1)
Introduction to operational weather analysis and forecasting using conceptual understanding of observations, numerical model output, and synoptic-scale processes. Meteorological time and date conventions; surface station plots; METAR and SYNOP code; upper-air station plots; isoplething of surface and upper-air isobaric charts; basic satellite and radar feature identification; temperature and vorticity advection; advection on upper-air and sea-level pressure charts; vorticity, divergence, and continuity; advection and relationship to vertical motion; pattern recognition and conceptual analysis using upper-air charts; pattern recognition and conceptual analysis using sea-level pressure charts; skew-T analysis; types of soundings; basic temperature and precipitation forecasting.
Prerequisites: WX 301.

WX 331  Operational Thermodynamic Meteorology  3 Credits (3,0)
Operational aspects of the physical processes that control the temperature of the atmosphere. Atmospheric radiation; conduction; convection; moisture; changes of state; adiabatic processes; saturated adiabatic processes; atmospheric stability.
Prerequisites: CS 120 or EGR 115 or BA 120 and MA 112 or MA 143 or MA 241 and PS 104 and WX 301.

WX 332  Operational Physical Meteorology  3 Credits (3,0)
The examination of physical processes which impact the atmosphere including electromagnetic radiation, heat budget of the Earth, Greenhouse effect, atmospheric optics, remote sensing, atmospheric chemistry, air pollution, formation of cloud droplets, precipitation processes, and lightning as related to operations.
Prerequisites: WX 331 and CHM 101 or CHM 110.
WX 344 Operational Dynamic Meteorology 3 Credits (3.0)
Development and quantification of the forces that drive atmospheric motion. Momentum equation; geostrophic, gradient, and cyclostrophic force balances and winds; effect of friction; baroclinic and barotropic atmospheres; thermal wind; vorticity; divergence; mass continuity equation, vertical motion; vorticity equation, planetary waves; evolution of mid-latitude cyclones; polar lows and tropical cyclones
Prerequisites: WX 327 and WX 331.

WX 361 Global Climate Change 3 Credits (3.0)
Global climate change is influenced by variations in Earth-Sun position and solar irradiance, shifting locations of the continents, mountain building, volcanic eruptions, and atmospheric composition alteration. However, none of these natural forces, individually or collectively, explain the rapid global climate change now taking place. This course examines the diverse dynamics of global climate change by synthesizing interdisciplinary ideas, observations, and forecasts. Through a review of the literature, lectures, presentations, and discussions accompanied by an analysis of websites, videos, and other media, students will gain insight into how climate change is altering the planet, potential future impacts, and ways to mitigate the negative effects.
Prerequisites: WX 201 and WX 261.

WX 363 Thunderstorms 3 Credits (3.0)
This course provides tools for analyzing and forecasting thunderstorms and their associated hazards. Key characteristics of the thunderstorm and its environment are explored using both case studies and real-time weather data. Students examine atmospheric soundings to determine the likelihood of storm development and the amount of energy available for thunderstorms. Vertical wind shear is analyzed for clues about storm organization and severity. Other information, such as weather charts, computer models, satellite imagery, and Doppler radar imagery, is used to observe the characteristics of thunderstorms and the weather patterns that favor them. Students gain a basic scientific understanding of thunderstorm behavior as well as practical experience observing and predicting them.
Prerequisites: WX 301 or WX 252.

WX 365 Satellite and Radar Weather Interpretation 3 Credits (3.0)
A practical introduction to meteorological interpretation of satellite and weather radar imagery. This course surveys the basic physics of electromagnetic (EM) radiation and shows how characteristics of the EM spectrum are exploited in passive (satellite) and active (radar) remote sensing to create digital images of geophysical information. The theory of radar signal propagation and precipitation estimation is applied to the meteorological interpretation of radar imagery and supplemented with practical analysis of various radar product types. Weather satellite image types, including visible, conventional infrared, and water vapor channels and their meteorological applications, are examined. Real-time satellite identification of meteorological phenomena will be emphasized, including mountain waves, mid-latitude cyclones, fronts, jet streams, troughs, ridges, vorticity, cloud types, fog, precipitation, ordinary and severe thunderstorms, tropical waves, and hurricanes. Surface and upper-air weather maps will be used to enhance the students’ understanding of satellite image signatures.
Prerequisites: WX 252 or WX 301.

WX 367 Thermodynamic Meteorology 3 Credits (3.0)
Application of calculus and calculus-based physics to the study of thermodynamics as applied to meteorology. Conservation of energy; Ideal Gas Law; temperature relationship to kinetic energy; specific heat, enthalpy, and entropy; 0th, 1st, 2nd Laws of Thermodynamics; atmospheric moisture; water phase changes; unsaturated and saturated air; Clausius-Clapeyron equation; thermodynamic diagrams; stability.
Prerequisites: MA 241 and PS 150 Corequisites: WX 272.

WX 368 Physical Meteorology 3 Credits (3.0)
The scientific explanation of atmospheric phenomena such as atmospheric structure. Composition of the atmosphere; radiation in the atmosphere; global radiative energy balance; remote sensing; optical phenomena; air contaminants; formation of droplets; and electrical phenomena within the atmosphere.
Prerequisites: CHM 110 and PS 150 and WX 272 and WX 367 and MA 242.
WX 374 Dynamic Meteorology I 3 Credits (3,0)
A calculus-based treatment of atmospheric dynamics with emphasis on the full development of the momentum equation on a rotating earth. Geostrophic balance and geostrophic wind; gradient balance and gradient wind; hydrostatic balance; hypsometric equation; thermal wind balance; baroclinic and barotropic atmospheres. Synoptic examples for illustration.
**Prerequisites:** MA 243 and WX 367.

WX 375 Dynamic Meteorology II 3 Credits (3,0)
Second course in calculus-based atmospheric dynamics focused on the development and application of equations governing atmospheric motion. Primitive equations; kinematics; absolute and barotropic vorticity equation; thermodynamic energy equation; quasi-geostrophic theory; Rossby wave dynamics; mid-latitude and tropical cyclogenesis.
**Prerequisites:** PS 160 and WX 374.

WX 378 Synoptic Analysis 3 Credits (2,1)
Subjective analysis techniques of synoptic motions. Mid-latitude cyclones; jet stream dynamics; baroclinicity and vorticity advection; diagnoses of large-scale vertical ascent; air masses and fronts; cyclogenesis; fronts; three dimensional structure of baroclinic and barotropic systems; diagnoses of precipitation types; polar lows.
**Prerequisites:** WX 327 and WX 368 and WX 374.

WX 380 Advanced Broadcast Meteorology 3 Credits (1,2)
Advanced approaches to weather and science communication and reporting. Advanced delivery techniques for television, the internet, social media and a live audience; practical weather forecasting applications; live in-studio and remote reporting; severe weather reporting; exposure to professional weather forecasting and graphics software and equipment; professional broadcast standards and practices.
**Prerequisites:** WX 280 and WX 327.

WX 381 Climate Dynamics 3 Credits (2,1)
Primarily quantitative introduction to physical and dynamical processes of climate, climate variability, and climate change. Atmospheric general circulation and relation to climate; climate sensitivity and feedback mechanisms; atmosphere-ocean interaction and coupling; El Nino and Southern Oscillation; atmospheric teleconnections; seasonal and long-range weather forecasting; climate modeling and climate model simulations; internally-forced (natural) climate variability; externally-forced (anthropogenic) climate change; quantitative understanding of future climate scenarios; review of Intergovernmental Panel on Climate Change (IPCC) report.
**Prerequisites:** WX 261 and WX 368 and WX 375.

WX 399 Special Topics in Applied Meteorology 1-6 Credit
Individual independent or directed studies of selected topics in applied meteorology.

WX 410 Weather for Commercial Air Transport 3 Credits (3,0)
Application of worldwide weather information to decision making for commercial aviation transport operations. Worldwide weather data collection and interpretation; short range and long-range forecast interpretation; airborne radar; satellite and nephanalysis chart interpretation; ground icing operations; space weather impacts on communication and navigation; volcanic ash; international weather information sources; flight planning for transoceanic flight.
**Prerequisites:** WX 301.
WX 422 Statistical Applications for Meteorological Data Analysis  3 Credits (3,0)
This course illustrates the applications of a broad range of statistical applications to meteorology, as well as more general data-analysis techniques. The course will include the following topics: basic statistical properties for various types of spatial and temporal data collections, including the standard statistical measures of mean, median, mode, standard deviation, and variance. Additional application topics will include correlations, confidence tests, probability distributions, and time-series sampling theory, as well as data-processing practices including regression analysis, Fourier analysis, and Eigen-vector analysis. The meteorological-specific applications include data assimilation error covariance functions, Model Output Statistics (MOS), Perfect Prog forecasts, statistical forecast models, and Ensemble forecasts of model uncertainties as well as a number of forecast verification metrics including such quantities as Probability of Detection, False Alarm Rate, and Critical Success Scores. The course will include a number of laboratory exercises using various computer software resources ranging from spreadsheet calculations through higher-level programming methods.
Prerequisites: BA 120 or CS 118 or CS 120 or EGR 115 and WX 327 or WX 378.

WX 436 Advanced Operational Forecasting  3 Credits (3,1)
Operational weather forecasting tools and techniques. Daily forecasting for locations across the nation and globe. Conceptual case study analysis; conceptual temperature, wind, and precipitation forecasting; numerical forecast model products; model-output statistics (MOS); National Weather Service (NWS) products and services; lake-effect snow; forecasting near terrain; cold-air damming; storm tracks; explosive cyclogenesis; tropical cyclone forecasting; severe storm forecasting
Prerequisites: WX 344 and WX 363 and WX 365.

WX 442 Operational Meteorology Seminar  3 Credits (3,0)
This course provides a capstone experience for Operational Meteorology majors. Operational weather support; customer requirements analysis; defining support methodologies; ethical principles; data collection and analysis; weather product tailoring; dissemination strategies; quality assessments; product refinement.
Prerequisites: WX 332 and WX 261 and MA 222 or WX 422.

WX 462 Numerical Weather Prediction  3 Credits (2,1)
Practical aspects of numerical solutions to differential equations of meteorological interest. Data assimilation methods; finite difference representations of spatial derivatives; discretization error; temporal integration and computational stability; parameterization of sub-grid meteorological processes; post processing; dynamical core; operational models; predictability; experimentation with simple prediction models.
Prerequisites: MA 345 and WX 272 and WX 375.

WX 466 Advanced Synoptic Analysis and Forecasting  3 Credits (2,1)
Weather forecasting tools and techniques. Daily forecasting for locations across the nation and globe. Temperature, wind, and precipitation forecasting; numerical forecast model products; model-output statistics (MOS); National Weather Service (NWS) products and services; applications of Quasi-Geostrophic (QG) theory; Potential Vorticity (PV) thinking and applications; isentropic analysis and applications; dynamically and physically-based case studies
Prerequisites: WX 375 and WX 378.

WX 478 Mesoscale Meteorology  3 Credits (2,1)
The scientific examination of boundary layer and mesoscale meteorological processes and phenomena. Boundary layer turbulence and mixing; surface energy budget; fronts and frontogenesis; dry lines; gravity waves; convective processes responsible for organized and isolated deep moist convection; vorticity, helicity, and shear; analysis of thermodynamic diagrams and hodographs; orographic and thermally forced mesoscale circulations.
Prerequisites: WX 375 and WX 466.
**WX 482** Research Methods in Meteorology  3
Credits (3,0)
This course provides a research capstone experience for meteorology majors. Defining and articulating a topic; literature reviews; designing research methodologies; ethical research practices; data collection and analysis; synthesizing information; graphics techniques; formulating conclusions; oral and written communication of results.
**Prerequisites:** WX 261 and WX 466 and WX 422.

**WX 499** Special Topics in Applied Meteorology  1-6 Credit
Individual independent or directed studies of selected topics in applied meteorology.

**Military Science Army ROTC (MSL)**

**Courses**

**MSL 101** Basic Military Science I  1 Credit (1,2)
A study of the defense establishment and the organization and development of the U.S. Army. A study of the roles that active Army forces, Army Reserve forces, and the Army National Guard play in our nation's defense. A study of military courtesy, customs, and traditions of the service. A historical perspective of the role of the different branches of the U.S. Army and the role they have played in the freedom of our nation. An introduction to physical readiness training. Course includes lectures and laboratory. Field training exercises normally include M16-A1 rifle firing, rappelling training, and airmobile helicopter operations.
**Corequisites:** MSL 101L.

**MSL 101L** Basic Military Science I Laboratory  0 Credits (1,5)
Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training is introductory in scope and includes operations and tactics and land navigation subjects. Practical training exercises familiarize students with the field environment and field survival skills. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

**MSL 102** Basic Military Science II  1 Credit (1,2)
Continued emphasis on physical readiness training. Course includes lecture and laboratory. Field training exercises normally include M16-A1 rifle firing, rappelling training, and airmobile helicopter operations.
**Corequisites:** MSL 102L.

**MSL 102L** Basic Military Science II Laboratory  0 Credits (1,5)
Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training continues the leader development process while remaining introductory in scope and develops basic operations and tactics and land navigation skills acquired in MY 103 Laboratory. Practical training exercises continue cadet field orientation with the focus on individual training. Special topics, including stream-crossing techniques, field survival skills, and bivouac techniques, are covered. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

**MSL 199** Special Topics in Military Science  1-6 Credit
Individual independent or directed studies of selected topics in general military science.

**MSL 201** Basic Military Leadership I  2 Credits (1,2)
A review of the customs and traditions of the service. The fundamentals of leadership development and the importance of understanding the principles that are important to effective leadership. This includes focus on goal setting, communication, problem solving, decision making, and group process. The course requires mandatory physical training and includes lecture and laboratory.
**Corequisites:** MSL 201L.
**MSL 201L Basic Military Leadership I Laboratory 0 Credits (1,1)**

Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training continues the development of cadet leadership and critical skills while remaining basic in scope and includes operations and tactics, land navigation, first aid, and general military subjects. Practical training exercises stress development of basic skills with the focus on soldier-team development at the squad/team level. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

**MSL 202 Basic Military Leadership II 2 Credits (2,2)**

The fundamentals of military geography and their application in the use of navigational aids for the military forces. A study of preventive medicine countermeasures and first-aid techniques that every leader must know. The course requires mandatory physical training and includes both lecture and leadership laboratory. Two weekend training exercises normally include M16-A1 rifle firing, rappelling training, and airmobile helicopter operations.

**Corequisites:** MSL 202L.

**MSL 202L Basic Military Leadership II Laboratory 0 Credits (2,2)**

Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences, with a strong focus on ethics, communication skills, time management, and leadership values. Training continues basic skills acquired in MY 203 Laboratory and includes operations and tactics and land navigation. Practical training exercises continue development of basic skills with the focus on soldier team development at the squad/team level. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

**MSL 299 Special Topics in Military Science 1-6 Credit**

Individual independent or directed studies of selected topics in general military science.

**MSL 301 Officership I 3 Credits (3,2)**

This course examines the foundations of officership, and the character, responsibilities, and status of being a commissioned officer. It is dynamic, challenging, and stressful, for it is the course that emphasizes the warrior ethic. The course covers a wide spectrum of subjects, from training in common military skills to fostering a value system that emphasizes service to the nation, readiness to persevere in the face of obstacles, and willingness to make personal sacrifices in pursuit of the greater good. This course includes lecture, advanced leadership laboratory, physical training, and practical field training exercises.

**Corequisites:** MSL 301L.

**MSL 301L Officership I Laboratory 0 Credits (2,5)**

Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training continues development of cadet competencies and confidence through intermediate leadership and technical/tactical instruction. Practical training exercises are supplementary in scope and include operations and tactics, land navigation, and weapons training. Special topics including tactical bivouac techniques, individual tactical techniques, tactical foot march techniques, squad tactics, and small unit patrolling are covered. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

**MSL 302 Officership II 3 Credits (3,2)**

A continuing development of the processes that distinguish commissioned military service from other professional endeavors. The main emphasis of this class will be the preparation of cadets for the six-week advanced camp they normally attend at the end of the junior year. Here their capability to conceptualize, innovate, synthesize information, and make sound decisions while under stress will be evaluated. This course includes lecture, advanced leadership laboratory, enhanced physical training, and practical field training exercises.

**Corequisites:** MSL 302L.
MSL 302L Officership II Laboratory 0 Credits (2,5)
Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training continues development of intermediate leader and critical skills in preparation for Advanced Camp. Practical training exercises focus on soldier-team development at squad/patrol level. Training is supplementary and includes tactics, land navigation, and weapons subjects. Special topics include tactical bivouac techniques, small unit patrolling, a mini-STRAC exercise, and drown-proofing. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

MSL 399 Special Topics in Military Science 1-6 Credit
Individual independent or directed studies of selected topics in general military science.

MSL 401 The Army Officer 3 Credits (3,2)
In this course, students will study, practice, develop, and apply critical thinking skills pertaining to Army leadership, officer skills, Army Values and ethics, personal development, and small unit tactics at platoon level. Students will be assessed on the execution of one or more missions assigned in classroom PE, Leadership Lab, or during a Leader Training Exercise (LTX) and will receive systematic and specific instructor and peer feedback on leader attributes, values, and core leader competencies using the Cadet Officer Evaluation Report (COER). At the conclusion of this course, you will be able to plan, coordinate, navigate, motivate and lead a platoon in future operational environments. Successful completion of this course is a requirement for commissioning.
Corequisites: MSL 401L.

MSL 401L The Army Officer Laboratory 0 Credits (3,2)
Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training culminates the leader development process at the pre-commissioning level. Training is supplementary and includes operations and tactics, land navigation, and radio wire communication subjects. Students perform as subject matter experts and are responsible for conducting and evaluating training. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.
Corequisites: MSL 401.

MSL 402 Advanced Military Leadership II 3 Credits (3,2)
A study of ethics and professionalism in the military and the role they play in carrying out the defense policy of the United States. The fundamentals of military law, its impact on the American military society, and its place in the jurisdictional system. A history of the military courts martial as it relates to the jurisdictional process of American society. A study of the Law of Land Warfare and its relationship to the conduct of soldiers in combat. This course includes lecture, laboratory, and physical readiness training.
Corequisites: MSL 402L.

MSL 402L Advanced Military Leadership II Laboratory 0 Credits (3,2)
Leadership laboratory with emphasis on military leadership and small unit tactics. Students develop leadership abilities through hands-on practical experiences. Training culminates development of leader skills emphasizing the transition from cadet to second lieutenant. Expands the frame of reference and gradually shifts it to orient on future assignments as an officer. Training is supplementary and includes operations and tactics, land navigation, and radio wire communication subjects. Students perform as subject matter experts and are responsible for conducting and evaluating training. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

MSL 499 Special Topics in Military Science 1-6 Credit
Individual independent or directed studies of selected topics in general military science.
Naval Science (NSC)

Courses

NSC 100 Naval Science Lab 0 Credits
Military drill, cruise preparation, customs, traditions, and special areas of knowledge required of commissioned officers in the Navy and Marine Corps. Required for all midshipmen.

NSC 101 Introduction to Naval Science 2 Credits
Introduction to the naval service with emphasis on the mission, organization, regulations, and components of the Navy and Marine Corps. Normally completed during the freshman year. Required for all Midshipmen without an authorized waiver. A grade of "C" or better is required to progress to the next level of Naval Science.

NSC 102 Seapower and Maritime Affairs 3 Credits
This course provides an understanding of the significance of sea power throughout U.S. history from the Revolutionary War through the post-Cold War era and the War on Terrorism. Included is discussion of how naval forces constitute a vital component in promoting the national interests, policies, and overall military strategy of the United States. Normally taken by Midshipmen during the spring of the freshman year, following the completion of NSC 101. A grade of "C" or better, as well as, full battalion participation are required to proceed to the next level of Naval Science.

Prerequisites: NSC 101.

NSC 201 Principles of Naval Leadership and Management 3 Credits
Theory and principles of management, focusing on the officer-manager as an organizational decision maker. Includes interpersonal skills, behavior factors, and group dynamics. Required for all midshipmen.

Prerequisites: NSC 100.

NSC 202 Navigation 3 Credits
This course provides a comprehensive study of ship navigation theory, principles, and procedures. Included is coverage of the international and inland rules for navigation, celestial and electronic navigation, piloting, dead reckoning, tides, weather, and use of navigational equipment, publications, and charts. All Navy Option Midshipmen are required to take this course. (Spring term only)

Corequisites: NSC 202L.

NSC 202L Navigation Laboratory 1 Credit (0,1)
Laboratory work in piloting and celestial navigation to complement NSC 202. One hour per week, either Tuesday or Thursday. All Navy Option Midshipmen are required to take this course. (Spring term only)

NSC 301 Naval Engineering 3 Credits (3,0)
Naval ship systems including hydrodynamic forces, stability, compartmentalization, electrical, and auxiliary systems. Theory and design of steam, gas turbine, and nuclear propulsion. Shipboard safety and firefighting.

Prerequisites: MA 111 and PS 103.

NSC 302 Naval Weapons Systems 3 Credits (3,0)
An introduction to the theory of weapons systems through the study of the fundamental principles of sensor, tracking, computational, and weapons delivery subsystems. Explosives, fusing, and naval ordnance. Required for all Navy option midshipmen. Not required for Marine Corps option midshipmen.

NSC 310 Evolution of Warfare 3 Credits (3,0)
This course is a survey of the art and concepts of warfare focused on selected historical periods. The intent of the curriculum is to build an understanding of the interrelations of political, strategic, operational, tactical, and technical levels of war. In addition, the course will introduce the student to the Marine Corps' doctrinal publication MCDP-1 "Warfighting". The text will serve as the "lens" thought which to examine historical battles. Finally, we will also study the application of these same concepts and principles in the context of modern warfare and their relevance and application in future conflicts.

NSC 311 Fundamentals of Maneuver Warfare 3 Credits (3,0)
This course introduces broad aspects of warfare and exposes students to maneuver warfare doctrine. It examines these ideas in the context of the warfighting philosophy of United States Marine Corps with the goal of producing students who can think critically and act decisively. The curriculum also examines historical influences on the current tactical, operational, and strategic environment and explores a way forward using maneuver warfare philosophy.
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NSC 401  Naval Operations and Seamanship  3
Credits (3,0)
This course provides an understanding of organizational interrelationships between authority, responsibility, and accountability, the concept of naval command and control, and concepts and philosophies of joint operations. Included is the study of ship handling, relative motion, basic forms of naval communications, and U.S. and adversarial weapons systems and platforms. All Navy Option Midshipmen are required to take this course. (Fall term only)
Corequisites: NSC 401L.

NSC 401L  Naval Operations and Seamanship Laboratory  1 Credit (0,1)
Laboratory work in maneuvering board (vector analysis) and communications, and conflict resolution to complement NSC 401. One hour per week, either Tuesday or Thursday. All Navy Option Midshipmen are required to take this course. (Fall term only)

NSC 402  Principles of Naval Management II/Leadership and Ethics  3 Credits (3,0)
This is the capstone leadership course for the four-year continuum of leadership development in NROTC. This course provides an understanding of the integration of professional competencies and qualities of effective leadership with emphasis on moral and ethical responsibilities, accountability communications and military law for the junior officer. This is a required course for all midshipmen.

Physical Education (PE)

Courses

PE 110  Lifetime Fitness Physical Activity  1 Credit
A physical education course designed to develop an appreciation and interest in lifetime fitness activity and an understanding of the physical, psychological, and social benefits of participation in various fitness activities.

Physical Science (PS)

Courses

PS 103  Technical Physics I  3 Credits (3,1)
A course in elementary physics. Stress will be placed on basic physics principles. Problem solving and problem-solving logic will be an important, integral part of this course. Topics will include Newton's Laws, projectile motion, circular motion, work, energy, conservation laws, and momentum. (Cannot be used for credit in physics toward degrees in Engineering Physics, Civil, Aerospace, or Electrical Engineering.)
Prerequisites: MA 111 or MA 140 Corequisites: MA 112 or MA 241.

PS 104  Technical Physics II  3 Credits (3,1)
Application of basic physics principles discussed in PS 103. Other areas will include fluids, properties of matter, thermodynamics, wave motion, sound, simple harmonic motion, kinetic theory, basic electromagnetic theory, and elementary circuits. Cannot be used for credit in physics toward degrees in Computer Science, Engineering Physics, Civil, Aerospace, or Electrical Engineering.
Prerequisites: PS 103 and MA 112 or MA 241 Corequisites: PS 115L.

PS 113  Introductory Physics I  3 Credits (3,0)
Survey course in elementary physics. Stress will be placed on basic physics principles. Problem solving and problem solving logic will be an important, integral part of this course. Topics will include Newton's Laws, projectile motion, circular motion, work, energy, conservation laws, and momentum. (Cannot be used for credit in physics toward degrees in Aerospace Engineering, Electrical Engineering, space Physics Astronomy or Aircraft Engineering Technology.)
Prerequisites: MA 111 or MA 120 or MA 140.

PS 113L  Introductory Physics I Laboratory  1 Credit (0,3)
Introductory Physics I Lab is comprised of experiments to give students hands-on experience with topics in mechanics: force, energy, momentum, torques and angular momentum. This lab is not required for PS 113; however, it is designed to complement the PS 113 course.
Corequisites: PS 113.
PS 115L Technical Physics Laboratory 1 Credit
Techniques for data analysis and laboratory methods and scientific inquiry in the context of experiments dealing with Newton's laws, energy, rotational motion, oscillatory motion, sound, heat, fluids, optics and electricity & magnetism. This laboratory is designed to give students a science laboratory experience introducing them to concepts covered in PS 103 and PS 104.
Prerequisites: MA 111 or MA 112 or MA 120 or MA 140 or MA 241.

PS 116 Foundations in the Sciences 3 Credits
A nonmathematical survey course intended for students majoring in the non-technical programs, highlighting the great ideas in the physical and biological sciences. Emphasis is on the process of science, the interrelationships of the sciences, and how core scientific principles relate to daily life.

PS 117 Introductory Physics II 3 Credits (3,0)
Application of basics physics principles discussed in PS 113. Other areas will include fluids, properties of matter, thermodynamics, wave motion, sound, simple harmonic motion, kinetic theory, basic electromagnetic theory and elementary circuits. Laboratory includes both descriptive and quantitative work. (Cannot be used for credit in physics toward degree in Aerospace Engineering, Electrical Engineering, Space Physics Astronomy or Aircraft Engineering Technology.)
Prerequisites: PS 113.

PS 117L Introductory Physics II Lab 1 Credit
Introductory Physics II Lab
Prerequisites: PS 117.

PS 150 Physics for Engineers I 3 Credits (3,0)
This course explores vectors and scalar quantities; kinematics; Newton's Law of Motion; work; work-energy; conversion of energy; conversion of momentum; center of mass and its motion; torque, equilibrium; and orbital motion.
Corequisites: MA 241.

PS 160 Physics for Engineers II 3 Credits (3,0)
This is a calculus-based study of the fundamental principles of classical mechanics. Topics include rotational motion, simple harmonic motion, waves, fluid, heat, kinetic energy, and thermodynamics.
Prerequisites: PS 150 or PS 226 Corequisites: MA 242.

PS 199 Special Topics in Physical Science 1-6 Credit
Individual independent or directed study of topics in the fields of the physical sciences.

PS 210 Physics II Laboratory 1 Credit
One three-hour laboratory session per week with experiments chosen primarily from fluids, temperature, heat, first and second laws of thermodynamics, wave motion, and acoustics.
Prerequisites: PS 226 and PS 226L and MA 241
Corequisites: PS 227.

PS 224 Astronomy 3 Credits (3,0)
A descriptive course dealing with the structure and evolution of the physical universe. Topics include the solar system (Earth, Moon, Sun, and planets), stars, black holes, galaxies, quasars, cosmology, and exobiology. Planetarium trips and night-observing sessions optional.

PS 224L Introductory General Astronomy Laboratory 1 Credit (0,3)
One three hour laboratory session per week to supplement the introductory Astronomy course, PS 224, in order to: (1) increase the options available for students to fulfill their general education science requirements; (2) provide an introductory astronomy laboratory early on as preparation for the existing senior level Observational Astronomy course (EP425) for those pursuing the Astronomy minor; (3) make available an observationally intensive astronomy experience for any student with a basic interest in astronomical observing without committing to either a degree program or degree minor.
Corequisites: PS 224.

PS 226 Physics I 3 Credits (3,0)
This is a calculus based introductory course in mechanics that explores units and order of magnitude analysis, vectors, kinematics, Newton's Law of Motion, momentum methods, work-energy principles, rotational kinematics, torque, gravitation and orbital motion.
Prerequisites: MA 241 Corequisites: PS 226L.

PS 226L Physics I Laboratory 1 Credit (0,3)
One three-hour laboratory session per week, with experiments chosen primarily from mechanics.
Corequisites: PS 226 or PS 150.
PS 227  Physics II  3 Credits (3,0)
This is a calculus-based introductory study of the principles of fluid dynamics, temperature, heat, laws of thermodynamics, simple harmonic motion, waves, acoustics and optics.
Prerequisites: PS 226 or PS 150 and PS 226L and MA 242.

PS 228  Physics III  3 Credits (3,0)
This course is a calculus based introduction to the physics of electromagnetic phenomena. The topics include: static electricity, Gauss's law, potential, Ohm's law, direct current circuits, magnetic fields, induced electromotive force, induction, alternating circuits, EM waves and the nature of light.
Prerequisites: PS 227 or PS 160 and MA 243.

PS 228L  Physics III Laboratory  1 Credit (0,3)
One three-hour laboratory session per week with experiments chosen primarily from thermodynamics, electricity and magnetism, and geometric optics.
Prerequisites: MA 243 Corequisites: PS 228 or PS 250.

PS 250  Physics for Engineers III  3 Credits (3,0)
This course is a calculus-based study of the fundamental principles of classical mechanics. It is the third course of a three-semester sequence, intended for students of science and engineering and is designed to provide the student with an appropriate background for more advanced physics and engineering course work. Topics of discussion include electric forces; electric field; Gauss's law; Ohm's law; Ampere's law; Faraday's law; Lenz's law; Kirchhoff's law and Maxwell's equations; electric potential and electrostatic potential energy; capacitance; simple DC circuit theory; magnetic force, magnetic field; inductance; electromagnetic oscillations and wave propagation; linear accelerators; and cyclotrons.
Prerequisites: PS 160 or PS 227 and MA 242.

PS 253  Physics Laboratory for Engineers  1 Credit (0,3)
One three-hour laboratory session per week, with experiments complementing the material of PS 250. Primarily lab report writing workshop, error analysis, damped harmonic oscillations, spectrometers, optics, atomic physics, thermodynamics and circuit theory.
Corequisites: PS 250.

PS 290  Physics Laboratory Practicum  0 Credits (3,0)
Required, noncredit course. Requires the student to direct the operation of a basic laboratory for one semester. Includes laboratory preparation, laboratory discussion, and grading of laboratory reports.
Prerequisites: COM 219.

PS 299  Special Topics in Physical Science  1-6 Credit
Individual independent or directed study of topics in the fields of the physical sciences.

PS 302  Evolution of Scientific Thought  3 Credits (3,0)
This course traces the development of science from the earliest times through the modern period, with particular emphasis given to our changing concepts of nature and of science itself. Students will receive either social science elective credit or physical science elective credit, but not both.
Prerequisites: HU 140 or HU 141 or HU 142 and PS 103.

PS 303  Modern Physics  3 Credits (3,0)
This is an introductory course in non-classical (modern) physics; it introduces students to the modern concepts in physics. Topics discussed include scattering of electromagnetic radiation; special relativity; wave-particle duality; the uncertainty principle and quantum theory of atomic structure; x-rays; lasers; and nuclear reactions.
Prerequisites: PS 228 or PS 250.

PS 305  Modern Physics Laboratory  1 Credit (0,3)
This course is the study of experiments in atomic and nuclear physics, including spectroscopy and interferometry, nuclear particle analysis, x-ray analysis and laser applications.
Prerequisites: PS 228L Corequisites: PS 303.

PS 314  Environmental Chemistry  3 Credits (3,3)
This course is an introduction to the chemistry of natural systems, including cycling of elements, complex equilibria, oxidation and reduction, atmospheric chemistry, nuclear processes, energy use, and toxic substances. Laboratory work includes wet and instrumental analyses related to environmental analytical chemistry.
Prerequisites: CHM 111.
PS 316 Introductory Astronomy and Astrophysics I 3 Credits (3,0)
A physics-based course dealing with the structure and evolution of the physical universe. Topics include the Solar System (Earth, Moon, Sun, and planets), planets orbiting other stars, astrobiology, star formation, stellar evolution, stellar nucleosynthesis, and exotic objects such as white dwarfs, neutron stars, and black holes.

PS 317 Introductory Astronomy and Astrophysics II 3 Credits (3,0)
A physics-based course dealing with the structure and evolution of the physical universe. Topics include the structure and history of our Milky Way galaxy, elliptical, spiral, and dwarf galaxies, galaxy clusters, active galactic nuclei, cosmology, the Big Bang, and primordial nucleosynthesis. Prerequisite PS 316.

PS 318 Introductory Astrophysics Laboratory 1 Credit (0,1)
One three hour laboratory session per week, to supplement the existing Introductory Astronomy and Astrophysics I/II sequence (PS 316, PS 317) in order to: (1) provide an introductory astronomy laboratory as preparation for the existing senior level Observational Astronomy course (EP 425); (2) make available at an early stage an observationally intensive astronomy experience for technical students with a passion for astronomy and astrophysics.

PS 320 Classical Mechanics 3 Credits (3,0)
Fundamentals of mechanics, oscillatory motion, systems of particles, varying mass, motion under central forces, motion in three dimensions, gyroscopic motion, generalized coordinates, normal coordinates, Lagrangian and Hamiltonian formulations. Students will write some simple computer programs.
Prerequisites: MA 345 and PS 228 or PS 250
Corequisites: PS 303.

PS 399 Special Topic in Physical Science 1-6 Credit
Individual independent or directed study of topics in the fields of the physical sciences.

PS 400 Senior Physics Laboratory I 3 Credits (1,3)
This course is a study of advanced laboratory techniques involving selected topics from modern and quantum physics, optics, and electromagnetics. Students will conduct a series of experiments, utilize a technical logbook, and make written and oral presentations of their experimental work.
Prerequisites: PS 305.

PS 401 Astrophysics 3 Credits (3,0)
This course is a study of the basic physical processes operating in the astronomical environment: stellar structure, stellar evolution, and the interstellar medium, galaxies. Astrophysical concepts are emphasized, thus underlining the common features appearing within many astronomical systems.
Prerequisites: MA 345 and PS 303.

PS 405 Atomic Nuclear Physics 3 Credits (3,0)
This course is a study of multi-electron atoms, x-rays and gamma rays, and radiative transitions in the atom and the nucleus. Topics include time-independent and time-dependent perturbation theory, scattering and the Born approximation, basic properties of nuclei, systematics of nuclear stability, dynamics of nuclear reactions, nuclear models, and nuclear forces.
Prerequisites: EP 440.

PS 408 Astrophysics II 3 Credits (3,0)
Study of the basic physical processes operating in the Galaxy and extragalactic astronomical environments: galactic structure and evolution, the expanding universe, and cosmology. Astrophysical concepts are emphasized, thus underlining the common features appearing within many astronomical systems.
Prerequisites: MA 345 and PS 401.

PS 410 Senior Physics Laboratory II 3 Credits
Binary stars, spectroscopic binaries, proper motion, galaxy rotation curves, image processing.
Prerequisites: PS 400 and PS 401.
PS 425 General Relativity 3 Credits (3,0)
Topics include tensor analysis, perturbation theory, theory of field Lagrangians, special relativity at an advanced level, and Einstein's theory of general relativity. These tools are applied to problems in solar system dynamics, stellar structure, gravity waves, and cosmology. In addition, there is an introduction to the ideas of quantum mechanics, as they pertain to gravitation.
Prerequisites: MA 345 and PS 228 or PS 250.
PS 499 Special Topic in Physical Science 1-6 Credit
Individual independent or directed study of topics in the fields of the physical sciences.

Psychology (PSY)
Courses
PSY 101 Introduction to Psychology 3 Credits (3,0)
An introduction to the field of Psychology, primarily a survey of the individual, group, and organizational factors affecting human behavior and mental processes. The course explores the breadth of psychology as a scientific discipline and primary research and practice areas within major psychology specializations. Emphasis is placed on the application of basic principles of psychology to aviation, engineering, and other STEM disciplines.
PSY 299 Special Topics in Psychology 1-6 Credit
Individual independent or directed studies of selected topics in psychology.
PSY 310 Sensation and Perception 3 Credits (3,0)
How organisms sense and perceive the environment. Topics discussed include types of stimuli affecting the sensory receptors, the anatomy and physiology of the sensory systems responding to those stimuli, and current knowledge and theories about perceptual abilities. Laboratory/research experience is included. The laboratory will include experimental investigations and demonstrations of sensory and perceptual phenomena. Vision, audition, taste, smell, the skin senses, and balance will be included.
Prerequisites: PSY 101.
PSY 312 Research Analysis in Psychology 4 Credits (3,1)
This course is an elementary program in data analysis and statistics. The focus is on basic statistical concepts for the social sciences. Although computer data analysis is a component of the course, it is secondary to statistical theory and computational procedures. The body of the course covers parametric procedures including t-tests, analysis of variance, correlational techniques, descriptive statistics, and frequency distributions. Some attention is devoted to nonparametric analysis. The emphasis is on decisions to choose the appropriate statistical technique and computational work. Statistical computations using computer software will be covered. Data setup and analysis, as well as graph generation and statistical output interpretation, will be focused on.
Prerequisites: MA 111 or MA 140 and PSY 101
Corequisites: PSY 312L.
PSY 312L Research Analysis in Psychology Laboratory 0 Credits (3,1)
Research Analysis in Psychology Laboratory Corequisites: PSY 312.
PSY 315 Cognitive Psychology 3 Credits (3,0)
Contemporary theories of human information processing. Major topics include attention, mental representations, categorization, short-term and long-term memory, psycholinguistics, reasoning, problem-solving, judgment, and decision making.
Prerequisites: PSY 101.
PSY 320 Aviation Psychology 3 Credits (3,0)
A study of the complexities of human factors research in aviation. Drawing extensively on such diverse areas as human physiology, basic learning theory, aviation safety, and pilot training. The course surveys the study of human behavior as it relates to the aviator's adaption to the flight environment.
Prerequisites: PSY 101.
PSY 322  Research Design  4 Credits (3,1)
This is a research design course that incorporates research design practices with direct experience in the laboratory that includes data collection and analysis and the description of research findings. The course includes coverage of various research models including surveys, scaling techniques, field studies, case studies, and experimentation. Techniques commonly used by human factors professionals are presented with considerable attention devoted to designing experiments. Concepts in controlling, manipulating, and measuring dependent and independent variables and the elimination of experimental confounds are applied to the experimental context. Topics such as sampling techniques, construct and content validity, reliability, error variance, sampling error, and ethical concerns are discussed. The course culminates in the design, conduct, analysis, and reporting of an experiment.
Prerequisites: PSY 312.

PSY 330  Learning and Motivation  3 Credits
This course is designed to help the student become aware of the main theories of learning in order to understand how people acquire behaviors and/or patterns of thinking. The course will also address motivational processes in order to make the student aware of how and why behaviors are initiated after learning takes place.
Prerequisites: PSY 101 or PSY 220.

PSY 335  Physiological Psychology  3 Credits (3,0)
A study of the neural and biochemical bases of behavior with special emphasis on sensory processing, motivation, emotion, learning, and memory. Both experimental analysis and clinical implications are considered. Activities are conducted on the anatomy and physiology of the nervous system, and on the development, evolution, and function of behavior.
Prerequisites: PSY 101.

PSY 340  Industrial-Organizational Psychology  3 Credits (3,0)
A survey of major topics in industrial-organizational psychology, with emphasis on organizational and personnel psychology applied to business, industry, and government. An examination and critical review of theories and research in selected areas of organizational behavior. Emphasis is on interpersonal behavior, such as motivation, job stress, and job satisfaction.
Prerequisites: PSY 101.

PSY 345  Training and Development  3 Credits (3,0)
This course is a review of the principles and techniques applicable to training and training development and provides a comprehensive understanding of group dynamics. The student will come to understand how groups form, work and disband. The student will also learn how dimensions such as cohesion, power, influence, conflict, decision-making, leadership and performance affect group functioning. The student should develop knowledge and skills so that he/she can lead a small group in its tasks, as well as developing personal skills to enable the student to be a high functioning group member.
Prerequisites: PSY 101.

PSY 350  Social Psychology  3 Credits (3,0)
This course is intended to provide students with an introduction to the interactional forces between groups and the individual in society. Topics include the following: introduction to social psychology, group influence, the self in a social world, prejudice-disliking others, social beliefs and judgments, attraction and intimacy, genes, culture and gender, altruism-helping others, conformity, and persuasion.
Prerequisites: PSY 101.

PSY 352  Personality: A Systems Approach  3 Credits (3,0)
Examines personality from a systems perspective as well as its psychological subsystems. Foundational theory will be reviewed when relevant but greater focus is placed on how personality systems are organized, and how personality develops. This class allows the student to shift focus from the study of theory to the study of the personality system itself. Application of material to human performance in social spheres, including the workplace, will be explored.
**PSY 365  Abnormal Psychology  3 Credits (3,0)**
This course is intended to familiarize students with the theory and research on the biological, cognitive-behavioral, and social-family perspectives and interventions of psychological disorders as problems that affect nearly everyone. Its emphasis on the research process, family issues, and the line between normal and abnormal behavior is intended to encourage students to think critically about social and personal issues, and to understand the strategies, methodologies, and the applicability of research in abnormal psychology.

**Prerequisites:** PSY 101.

**PSY 399  Special Topics in Psychology  1-6 Credits**
Individual independent or directed studies of selected topics in psychology.

**PSY 499  Special Topics in Psychology  1-6 Credits**
Individual independent or directed studies of selected topics in psychology.

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**Russian (LRU)**

**Courses**

**LRU 101  Elementary Russian I  3 Credits**
This course focuses on the basics of Russian. Topics include greetings, social interactions, geography, languages, university life, and daily schedules. Language topics include the Russian alphabet, Reading in Russian, nouns, adjectives, verbs and agreement rules. Students enrolled in Russian language courses receive instruction via a telepresence classroom.

**Corequisites:** LRU 101L.

**LRU 101L  Elementary Russian I Laboratory  0 Credits**
Elementary Russian I Laboratory.

**LRU 102  Elementary Russian II  3 Credits**
A continuation of LRU 101. The advanced beginner level course in Russian, with cultural aspects integrated throughout the course. Continued use of workbook, with a lab component in order to listen to authentic materials and practice speaking with peers and native speakers of Russian. Students enrolled in Russian language courses receive instruction via a telepresence classroom.

**Prerequisites:** LRU 101 
**Corequisites:** LRU 102L.

**LRU 102L  Elementary Russian II Laboratory  0 Credits**
Elementary Russian II Laboratory.

**LRU 201  Intermediate Russian I  3 Credits**
A continuation of LRU 102. The low intermediate level course in Russian, with cultural aspects integrated throughout the course. Continued use of workbook, with a lab component in order to listen to authentic materials and practice speaking with peers and native speakers of Russian. Students enrolled in Russian language courses receive instruction via a telepresence classroom.

**Prerequisites:** LRU 102 
**Corequisites:** LRU 201L.

**LRU 201L  Intermediate Russian I Laboratory  0 Credits**
Intermediate Russian I Laboratory

**LRU 202  Intermediate Russian II  3 Credits**
A continuation of LRU 201. The mid-intermediate level course in Russian, with cultural aspects integrated throughout the course. Continued use of workbook, with a lab component in order to listen to authentic materials and practice speaking with peers and native speakers of Russian. Students enrolled in Russian language courses receive instruction via a telepresence classroom.

**Prerequisites:** LRU 201 
**Corequisites:** LRU 202L.

**LRU 202L  Intermediate Russian II Laboratory  0 Credits**
Intermediate Russian II Laboratory 

**Prerequisites:** LRU 202.

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**Simulation (SIM)**

**Courses**

**SIM 200  Aviation Simulation Systems  3 Credits (3,0)**
This course emphasizes the importance of building a simulation system that delivers a flight experience that is realistic to the pilot. The student will develop a thorough understanding of the relationships between fidelity, FAA criteria for simulation approval, and pilot modal interaction with the simulation regarding senses, including pro-prioceptive, visual, tactile, and aural. Students will conduct an analysis of the need for motion and motion cueing to gain inferences on the associated effects on fidelity.
SIM 300  Flight Dynamics Algorithms  3 Credits
This course will derive the equations of motion of a 6 DOF aerospace vehicle. Stability derivative will be defined mathematically. The equations for static and dynamic stability of the longitudinal and lateral directional motion will be derived. Numerical integration methods in a suitable computer language will be used to solve these equations. Physical understanding of stability derivatives will be discussed at length.
Prerequisites: MA 345.

SIM 400  Instrumentation for Flight Test  3 Credits (3,0)
Advanced instrumentation setups for aircraft flight testing. The following aircraft quality transducers will be discussed theoretically: accelerometers, rate gyros, strap-down gyro packages, digital pressure transducers, thermocouples, linear displacement transducers, load cells, and RPM transducers. Installation of the above instruments will be discussed. Calibration and errors will be investigated. This course includes a lab for installation and calibration of transducers on an aircraft.
Prerequisites: SIM 300 or AE 413 Corequisites: MA 345.

SIM 402  Introduction to Flight Testing  3 Credits (3,0)
An overview of the role and function of flight testing in the aerospace industry. Major topics will include past, present, and future of flight test, FAA and DOD certification processes, risk management, test planning and reporting, and an overview of the principal flight test methods and procedures for aircraft and engine performance, stability and control, handling qualities, avionics systems performance and integration, human factors evaluation, production and maintenance flight test, homebuilt flight test, and DOD operational flight test. Final project will involve team evaluation of an aircraft using Embry-Riddle simulators, including test planning and reporting. Lab fee required.
Prerequisites: AS 309 and SIM 200.

SIM 404  Fly-By-Wire Aircraft Simulation and Design  3 Credits (3,0)
This course addresses recent advances in automated flight control systems. Fly-by-wire aircraft architecture will be discussed. Aircraft simulations will be used to enhance and stabilize aircraft stability and handling qualities. Strategies such as theta control, c-star, and flight path angle control will be addressed.
Prerequisites: AE 413 and MA 345.

SIM 405  Simulation Visual Systems  3 Credits (3,0)
This course focuses on what is required to develop a simulation visual system that is realistic to the end user. The student will develop a thorough understanding of the hardware and software required to develop and display a visual database. Students will also understand requirements for visual systems in FAA-qualified devices and understand how a display system is constructed. In the laboratory the student will obtain hands-on experience with visual database development software by designing and testing a model that meets an actual requirement of the flight department and incorporating that model into the departments global database.
Prerequisites: SIM 200.

SIM 406  Aviation Simulation Systems Integration  3 Credits (3,0)
This course addresses recent advances and new applications in the expanding field of telecommunications and computer networks and their relationship with computer-based simulations. Students learn the principles for creating a distributed interactive simulation (DIS) environment that realizes a common operational environment among the systems. The course addresses creation of a DIS environment that is coherent in time and space. Students learn aspects of networking necessary to create real-time seamless simulated flight environments. Topics include ATM (asynchronous transfer mode), SONET/SDH (synchronous optical network/synchronous digital hierarchy), gigabit ethernet, 10 gigabit ethernet, OSI (open systems interconnection) reference model, TCP/IP (transmission control protocol/Internet protocol) transmission media, network topologies, network protocols, and network performance.
SIM 410  Flight Test and Simulation  3 Credits
An interdisciplinary, capstone course in flight-testing and simulation. This course will rely on interdisciplinary groups to perform flight tests and simulation matching for typical FAA certification of aircraft and simulators. Lab fee required.
Prerequisites: AE 413 or HF 310 or SIM 300 or AS 340.

SIM 412  Operational Applications in Simulation  3 Credits (3,0)
An interdisciplinary project based course for students in the Flight Test and Simulation Minor. The course will offer a comprehensive review of simulation applications as they relate to modern aviation/aerospace systems with the opportunity to obtain hands-on experience with a real world simulation design and development project. Major topics of discussion will include: applications of virtual environments for pilot training, database development, fidelity, human factors in simulation and training, performance assessment in simulation, current research, and the impact of simulator applications throughout the aviation industry.
Prerequisites: SIM 200.

Social Science (SS)
Courses
SS 110  World History  3 Credits (3,0)
This course is primarily a survey of the development and evolution of World Civilization from 1500 to the present. Emphasis is placed on the effect of Western influence on the world.

SS 115  Introduction to International Relations  3 Credits (3,0)
Theories, concepts, and issues in international politics. Relations among nation-states and the global world system; how globalization may be changing the nature of politics. Conflict and security; international political economy; and contemporary issues. Incorporates political science, history, and philosophy.

SS 120  U.S. History  3 Credits (3,0)
This course is a survey of the United States history from the conclusion of the Civil War in 1865 to the present. Reconstruction, the age of big business, the United States as a world power, The Great Depression, World War II, The Cold War, Civil Rights, Vietnam, and its aftermath.

SS 130  History of Aviation in America  3 Credits (3,0)
A survey of the history of America in the 20th century, emphasizing the explosive growth of aviation as a major influence on the economic, military, and societal development of the United States.

SS 140  Introduction to Middle East Mediterranean World  3 Credits (3,0)
Introduction to the Middle East and the Mediterranean World is a survey of the Middle East, North Africa, and the Mediterranean World, their land and societies, as well as their cultural, economic and political development and contributions to world civilizations, from Ancient Mesopotamian, Egyptian, Greco-Roman, and Persian times to the present.

SS 199  Special Topics in Social Science  1-6 Credit
Individual independent or directed study of selected topics in the areas of history, sociology, psychology, and human culture in general.

SS 210  Introduction to Sociology  3 Credits (3,0)
Integrated survey of the fundamental concepts of culture, forms of collective behavior, community and social organization, social interaction, and social change. The social effects of aviation and the impact of science on the social order living in an air age will also be investigated.

SS 299  Special Topics in Social Science  1-6 Credit
Individual independent or directed study of selected topics in the areas of history, sociology, psychology, and human culture in general.

SS 302  Evolution of Scientific Thought  3 Credits
Traces the development of science from the earliest times through the modern period, with particular emphasis given to our changing concepts of nature and of science itself. (Also offered as PS 302. Students receive either Social Sciences elective credit or Physical Sciences elective credit, but not both.)
Prerequisites: HU 14X and (CHM 101 or PS 103 or PS 150) and PS 226.
SS 311 U.S. Military History 1775-1900 3 Credits (3,0)
Military history with an emphasis on military policy, organization and technology as they relate to political, social and economic developments from 1775 to the present. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: Lower Level General Education Equivalent.

SS 320 Government of the U.S. 3 Credits (3,0)
An introduction of basic issues of democracy in the U.S., constitutional principles and the executive, legislative and judicial branches of government. Prerequisite: Lower Level Social Science General Education Equivalent.

SS 321 U.S. Military History 1900-Present 3 Credits (3,0)
Military history with emphasis on military policy, organization, and technology as they relate to U.S. political, social, and economic developments from 1900 to the present. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 322 Modern Russian History 3 Credits (3,0)
This course is an overview of the land, the people, the culture and the history of Russia with emphasis on its historical development and impact of the latter on current events and policies on the world scene. Prerequisite is Lower-level General Education Social Science equivalent. Prerequisite: Lower Level Social Science General Education Equivalent.

SS 324 Topics in U.S. History 3 Credits
Specific problems, issues, crises and developments in U.S. History and their political, economic and social causes and impacts. Course topics vary according to instructor and are subject to approval by the department chair. May be repeated for credit when topics change. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 325 International Studies 3 Credits (3,0)
An overview of the land, the people, the culture, and the history of one region of the world, with emphasis on current events and policies on the world scene. Specific content varies from year to year. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 326 Russian-U.S. Relations 3 Credits (3,0)
This course explores the development of Russian-American economic and political relations, emphasizing the era of the 20th century. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 328 History of U.S. Intelligence 3 Credits
The history of United States civilian and military intelligence Revolution to the 21st Century. Prerequisite: Lower Level Social Science General Education Equivalent.

SS 331 Current Issues in America 3 Credits (3,0)
A course in selected political-economic issues of national and international importance. Extensive use of journals, magazines, and newspapers to supplement lectures and discussions. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 333 U.S. - Asian Relations 3 Credits (3,0)
This course explores the development of U.S.-Asian political, cultural, and economic relations, from their beginning in the 19th century to the present. The course will examine America’s domestic motivations for expanding into the Pacific, the various impacts that the United States has had on Asian nations, and Asia’s collaboration with and resistance to the American presence. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.
SS 334 Contemporary Africa and the World 3 Credits (3,0)
A historical examination of Africa’s land, societies, and cultures with a focus on the political and economic changes and challenges that have marked the continent’s relations with major world powers during and after the Cold War. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: Lower Level General Education Equivalent.

SS 336 The Modern Middle East in World Affairs 3 Credits (3,0)
A historical examination of the land, societies, cultures, economics, and politics of the Middle East from World War I to the present in relation to recent and current world events and policies. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 337 Globalization and World Politics 3 Credits (3,0)
This course is a study of the contemporary debate on globalization and new world order. Key topics include, but are not limited to, problems of definition in globalization; trans-border issues and the role of the state; multinational corporations; labor and the terms of international trade; issues of environmental degradation; international organizations and nongovernmental organizations in global affairs; terrorism, global crime and international security; human rights, democracy, and cultural nationalism; and technology and global communication.
Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 340 Modern U.S. Foreign Policy 3 Credits (3,0)
A survey of the evolution of present American foreign policy, stressing the factors that affect and shape this policy. Attention is given to current governmental offices, agencies, and departments, as well as the role each plays in policy formulation. Emphasis is on the period since World War II. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 353 Early U.S. Foreign Policy 3 Credits (3,0)
This course explores the cultural, economic, political and social aspects of U.S. foreign policy from the Colonial Era through World War I. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 363 Inter-American Relations 3 Credits (3,0)
This course explores the development of U.S. political and economic relations with Latin America from their beginnings in the 19th century to the present. Prerequisite: Lower Level Social Science General Education Equivalent.
Prerequisites: SS Lower Level General Education Equivalent.

SS 399 Special Topics in Social Science 1-6 Credit
Individual independent or directed study of selected topics in the areas of history, sociology, psychology, and human culture in general.

SS 499 Special Topics in Social Science 1-6 Credit
Individual independent or directed study of selected topics in the areas of history, sociology, psychology, and human culture in general.

Software Engineering (SE)
Courses
SE 299 Special Topics in Software Engineering 1-6 Credit
Individual independent or directed studies of selected topics in software engineering.

SE 300 Software Engineering Practices 3-4 Credit (3,0)
This variable credit course introduces students to the fundamental principles and methodologies of large-scale software development. Students learn about the theory and practice of software engineering and work as part of a team on a full life-cycle software project that includes planning, software specification, software design, coding, inspections, and testing. A closed laboratory is required, and includes activities that guide project teams through a software development process and support team project activities such as team building, planning, requirements analysis and specification, design, testing, and the use of tools.
Prerequisites: CS 225.
SE 310  Analysis and Design of Software Systems  3 Credits (3,0)
This course focuses on the fundamental methods employed in the analysis and design of software systems. Analysis is the process of determining a complete and consistent set of system requirements. Design is the process of producing a system architecture, both logical and physical, and determining an appropriate way to construct the software. The result of these processes is a documented model of the desired system. The student will learn and practice methods appropriate for both object-oriented and procedural systems.
Prerequisites: SE 300.

SE 320  Software Construction  3 Credits (3,0)
This course provides the student with advanced instruction in programming with an object-oriented programming language. The course objective is proficiency in use of a language widely used for general purpose software development. In addition, the student will be introduced to tools and processes appropriate for employing this language in a significant software development environment. Students attending this course must already be proficient in the use of one major programming language and have knowledge of basic software engineering practices.
Prerequisites: SE 300.

SE 399  Special Topics in Software Engineering  1-6 Credit
Individual independent or directed studies of selected topics in software engineering.

SE 410  Software Modeling  3 Credits (3,0)
This course focuses on the study of formal concepts and techniques used to model and analyze software artifacts (requirements, design, and code). The course includes a survey of mathematical modeling techniques used in software engineering. Course activities include reading, discussion, and exercises concerned with the use of formal mathematical models in software engineering. Examples include work on a formal specification project, study of concepts and technology of formal model checking, use of a formal modeling tool, and presentations on articles about recent work in application and research in formal methods.
Prerequisites: CS 222 and SE 300.

SE 420  Software Quality Assurance  3 Credits (3,0)
This course exposes the student to the key concepts and practices in software testing and quality assurance. The objective of this course is to introduce students to the concepts of software quality through testing, inspection, and walkthrough. The process of software testing and different testing techniques and methodologies will be covered. This course also covers topics related to the management of a testing project. Finally, different software-testing tools and their advantages and disadvantages will be discussed.
Prerequisites: SE 300.

SE 450  Software Team Project I  3 Credits (2,3)
This is the first course in the sequence of a two-course senior project (SE 450 and SE 451). The senior project sequence of courses is the continuation of SE 300. They provide for additional student activities with the management, analysis, design, implementation, and testing of a software system. Students work in teams and use a defined software process to develop or modify a software product. Project work is assessed using industrial software standards and review techniques. The senior project sequence is considered the capstone course for undergraduate students in software engineering. The first course in this sequence (SE 450) emphasizes the early stages of the software development life cycle (requirements, analysis, and design). The artifacts developed during this course will be used as the foundation for further development during the second course in the sequence (SE 451).
Prerequisites: SE 310 and SE 320.
SE 451 Software Team Project II 3 Credits (1,6)
This is the second course in the senior project sequence (SE 450 and SE 451). This is the continuation of SE 450. This course provides for additional student activities with the management, analysis, design, implementation, and testing of a software system. Students work in teams and use a defined software process to develop or modify a software product. Project work is assessed using industrial software standards and review techniques. The senior project sequence is considered the capstone course for undergraduate students in software engineering. The second course in this sequence (SE 451) emphasizes the later stages of the software development life cycle (design, implementation, testing, and maintenance). The artifacts developed during the first course (SE 450) will be used as the foundation for further development during this course (SE 451).
Corequisites: SE 450.

SE 499 Special Topics in Software Engineering 1-6 Credit
Individual independent or directed studies of selected topics in software engineering.

Space Studies (SP)
Courses

SP 110 Introduction to Space Flight 3 Credits
This course provides the student with a background in the major aspects of space flight. Topics covered include the history of space flight; propulsion theory; orbital mechanics fundamentals; Space Shuttle operations; U.S. space policy; and present and future commercial, industrial, and military applications in space.

SP 200 Planetary and Space Exploration 3 Credits
This is a survey course of U.S. and international space programs. The student will be introduced to the Earth and its space environment; to methods of scientific exploration; and to spacecraft and payload criteria at the introductory physics level.

SP 210 Space Transportation System 3 Credits
A survey course of the space transportation system (STS) at the introductory physics level. Included are manned space flight operations, supporting systems, and the space shuttle mission, both present and future. A review of space shuttle flight profiles, guidance and navigation control, proximity operations and rendezvous, and a brief review of hypersonic orbiter aerodynamics are included. Also covered are future STS applications to space station logistical operations, commercial applications, and Department of Defense operations.

SP 215 Space Station Systems and Operations 3 Credits
This course provides the student with a background in the major aspects of the International Space Station (ISS) and the Russian Mir spacecraft. Specific topics include commercial applications, logistical support, maintenance, servicing, and design concepts.

SP 220 Life Support Systems 3 Credits
This course is a survey, at the elementary physics level, of the requirements and design considerations for life support systems in space and on other planets. Included are an introduction to basic human physiology, a description of the space environment and a survey of historical life support systems, and a presentation of spacecraft limitations and requirements.

SP 299 Special Topics in Space Studies 1-6 Credit
Individual independent or directed studies of selected topics in space studies related topics.

SP 300 Satellite and Spacecraft Systems 3 Credits
Orbital satellites and spacecraft are discussed according to their application, design, and environment. The power system, shielding, and communication systems are reviewed along with their missions, space environment, and limitations.
Prerequisites: MA 112.
SP 340  Russian Space Operations and Technology  3 Credits
Dramatically different space programs in the United States and the Soviet Union accomplished many of the same goals, with one important difference. This course will examine the Russian space flight efforts in light of the dramatic race to space, from the first concepts of Tsiolkovsky to today's International Space Station project. Discussion of the highlights of Russia's well-known as well as obscure space programs will offer the student insight into the space flight record that is often missing because of the secretive Soviet Union.

SP 399  Special Topics in Space Studies  1-6 Credit
Individual independent or directed studies of selected topics in space studies related topics.

SP 400  Introduction to Space Navigation  3 Credits
This course will introduce the student to basic elements of space navigation at the introductory physics level. The consequences of Newton's law of gravitation and central force motion, including Kepler's three laws of planetary motion, are explained. The physical characteristics of the solar system and the Earth/Moon system are reviewed. The basic methods and techniques of navigating in near-Earth orbit and the Moon and planets are described.
Prerequisites: MA 112 and PS 103.

SP 425  Selected Topics in Space and Aerospace  3 Credits
This course introduces students to problems in space operations, space flight, or other space-related topics that can be critically addressed from a knowledge base of elementary calculus, elementary physics, and the subject matter of any two space studies courses. The specific topics will be selected by the course monitor and instructor and published in the Schedule of Courses in the preceding semester. This is a required course for the Space Studies minor.
Prerequisites: PS 104.

SP 499  Special Topics in Space Studies  1-6 Credit
Individual independent or directed studies of selected topics in space studies related topics.

Spanish (LSP)
Courses
LSP 101  Spanish I  3 Credits (3,0)
Basic grammar and reading. Introduction to conversation. Not open to students with two or more years of high school Spanish or the equivalent.

LSP 102  Spanish II  3 Credits (3,0)
A continuation of LSP 101.

LSP 201  Spanish III  3 Credits (3,0)
A continuation of LSP 102.

LSP 202  Spanish IV  3 Credits (3,0)
A continuation of LSP 201. Students will enhance their speaking skills, learn advanced forms of grammar, and begin reading and formal writing.

LSP 399  Special Topics in Spanish Language  1-6 Credit
Individual independent or directed studies of selected topics in the Spanish language.

LSP 499  Special Topics in Spanish Language  1-6 Credit
Individual independent or directed studies of selected topics in the Spanish language.

Systems Engineering (SYS)
Courses
SYS 299  Special Topics in Systems Engineering  1-6 Credit
Individual, independent or directed studies of selected topics in systems engineering. Student must have permission from instructor and department chair.

SYS 301  Introduction to Systems Engineering  3 Credits (3,0)
Provides an overview of systems engineering in the development of large systems, including genesis and need, characteristics of systems and system engineers, the system life cycle (from birth to death), design for operational feasibility, project management, structure, and system control, statistical/probabilistic models in dealing with risk inherent in large, complex systems. Emphasis on the importance of system requirements regarding total system performance, interfaces, cost, schedule, optimization, and trades.
Prerequisites: MA 242.
SYS 302  System Engineering Design Considerations  3 Credits (3,0)
This course examines the considerations in developing systems that meet specified system performance requirements while also achieving necessary levels of reliability, maintainability, and supportability consistent with the operational requirements. In addition, consideration is given to issues associated with producibility and disposability. Mathematical methods associated with reliability, maintainability, and supportability are discussed and applied. Liberal use of examples is incorporated to illustrate the interactions and relationships of these metrics, and how they are used to measure and trade off among these elements. The intent is to sensitize the systems engineer to the need for technical, schedule, and cost trade-offs to achieve desired yet safe and affordable system performance.
Prerequisites: SYS 301.

SYS 303  Optimization in Systems Engineering  3 Credits (3,0)
This course emphasizes that the optimization of some subsystems may be detrimental to others and hence to overall system performance or cost. Topics include traditional optimization methods, such as classical parameter optimization linear programming, dynamic programming, numerical methods (for example, perturbation and gradient techniques), and genetic algorithms. In addition, techniques such as Pareto or multi-objective optimization are examined with the aim of achieving a sufficient balance among subsystem performance and cost, ultimately to obtain an overall optimal system.
Prerequisites: SYS 301.

SYS 304  Trade Studies, Risk and Decision Analysis  3 Credits (3,0)
Methodologies for conducting comprehensive, traceable, and justifiable trades, as well as risk and decision-making analyses in Systems Engineering. Decision analysis methods for determining and selecting the appropriate alternative(s) based on various criteria are explored. Topics include Pugh matrices, Analytical Hierarchy Process (AHP), probabilistic decision making, and game theory. The student should develop a comprehensive understanding of trade studies and be able to apply risk and decision techniques in selecting appropriate choices.
Prerequisites: AE/ME students need C or better in MA 242.

SYS 399  Special Topics in Systems Engineering  1-6 Credit
Individual, independent or directed studies of selected topics in systems engineering. Student must have permission from instructor and department chair.

SYS 403  Systems Engineering Life Cycle Costing  3 Credits (3,0)
Current trends in system development indicate that, in general, complexity is increasing, and many systems in use today are not meeting the needs of customers. These trends, combined with past practices, have tended to create an imbalance between cost and effectiveness. This course addresses this important aspect of systems engineering by examining cost and economic factors under the general theme of design for affordability. An introduction to life-cycle costing is followed by a focus on costs as they occur throughout the system life cycle. Types of contracts (for example, fixed price, cost-plus) are studied. The steps in the life-cycle cost analysis process are examined through the use of examples, and the applications and benefits of life-cycle costing are summarized.
Prerequisites: MA 242.

SYS 405  Aerospace Systems Guidance and Control  3 Credits (3,0)
Provides a second, advanced course in control systems, with emphasis on the multidimensional state-space approach. Application of digital control systems in aerospace instrumentation, sensors, guidance, and navigation. Addresses optimal control systems, including multi-objective control, and introduction to advanced methods such as fuzzy systems control, neural networks, and genetic algorithms.
Prerequisites: EE 401.
SYS 410 Space Systems and Mission Analysis 3 Credits (3.0)
This course provides an arena for applying many of the important techniques in systems engineering through the development of a deep space exploration mission, from mission definition through system concept and design. Considerations will be given to all aspects of mission development and operations including, spacecraft design, communications, navigation, payload data handling, personnel, and cost. Students will be assigned to discipline teams, working together in a systems engineering context to produce project documents (concept of operations, project plans, schedules, budgets, mission operations plans, and system design documents).
Prerequisites: SYS 403.

SYS 415 Systems Engineering Practices: Specialty Engineering 3 Credits
Builds on basic concepts introduced in SYS 301 dealing with system testing and the specialty engineering disciplines of reliability, maintainability, supportability, producibility. Probability and statistics are reviewed and applied in these areas. Students gain a comprehensive understanding of the elements of specialty engineering, as well as the skills to apply those elements.
Prerequisites: SYS 301 and MA 412.

SYS 417 Systems Engineering Capstone Project I 3 Credits (3.0)
First course in the senior capstone design course sequence for the Systems Engineering track, focusing primarily on project objective(s)/definition, requirements development, functional analysis, and preliminary design. Although an electrical component is dominant, other disciplines, such as software, mechanical, or aerospace engineering, are involved. The course results in a preliminary design document and implementation plan for the capstone project.

SYS 418 Systems Engineering Capstone Project II 3 Credits
Second course in the senior capstone design course sequence for the Systems Engineering track. The preliminary design produced during the initial course is developed into a detailed design, then implemented, tested, and demonstrated. Deliverables include a final project/system description, test and evaluation plans, and documentation for sustained operation and maintenance of the system.
Prerequisites: SYS 417.

SYS 499 Special Topics in Systems Engineering 1-6 Credit
Individual, independent or directed studies of selected topics in systems engineering. Student must have permission from instructor and department chair.

University Student Success (UNIV)

University Student Success Courses

UNIV 101 College Success 1 Credit (2,0)
A course in which students assess and develop the personal, interpersonal, intellectual, and social skills necessary to succeed in college. Time management, study skills, goal clarification, career information, and college resources are included. This course is available to freshmen only.

UNIV 195A Professional Development Mentorship 1 Credit (1,0)
Investigation of academic disciplines and professional interests of the students. Topics also include improving study skills (learning how to learn); becoming a mentor for other students (and thus developing their own mentorship abilities); service learning opportunities on campus; and connecting academics and career plans. The course involves group and/or individual meetings to explore readings and to help develop a student?s identity and sense of purpose.
Unmanned Aircraft Flight (UA)

Courses

**UA 101 Remote Pilot Operations  1 Credit (0,1)**
This course develops the aeronautical knowledge required for certification as a Remote Pilot with a small Unmanned Aircraft rating. Topics include; regulations, airspace, weather, safety, chart use, communications, performance, airworthiness, and decision-making. Students will be required to pass the Unmanned Aircraft General exam.

**Corequisites:** AS 220 and proof of US citizenship.

**UA 201 Mapping Applications and Data Collection with UAS  1 Credit (0,1)**
This course trains aspiring remote pilots to apply UAS technology to meet contemporary commercial objectives. The course includes hands on acquisition of geospatial data as well as processing and synthesizing captured data to develop commercial products.

**Prerequisites:** UA 101 and proof of US citizenship

**Corequisites:** AS 390.

**UA 301 Complex UAS Flight Operations  1 Credit (0,1)**
During this course, the student will obtain the foundation for all future unmanned aviation training. The student will be introduced to the fundamentals of flight and become proficient in basic maneuvers and operating procedures required for solo flight of a complex unmanned aircraft system. The student will receive training in safety awareness, single-remote pilot resource management, and aeronautical decision making.

**Prerequisites:** UA 201 and proof of US citizenship.

**UA 401 UAS Mission Application  1 Credit (0,1)**
This laboratory addresses advanced Unmanned Aircraft System (UAS) application techniques and procedures. Students will complete UAS operations focused on payload employment with the expectation that they have gained proficiency in the UAS’ flight management system.

**Prerequisites:** UA 301 and proof of US citizenship.
Graduate Courses

A limited number of courses are offered as hybrids, bearing the HYB course designator. In hybrid courses, students and professors meet face-to-face, but some class sessions take place online. HYB courses have the same learning outcomes as regular courses and have comparable grading standards and assignments. HYB courses can present challenges to some students, however. For example, students enrolling in HYB courses should have excellent time management skills. For more information and to gauge whether or not to enroll in an HYB course, students should contact the corresponding instructor and/or department.

The following courses are not necessarily offered every term, nor are they necessarily offered at all campus locations.

Accounting (ACC)

Courses

ACC 517 Accounting for Decision Making 3 Credits (0,0)
A study of management’s use of accounting information to make decisions related to planning, controlling, and evaluating the organization’s operations. Using electronic spreadsheets, the budgeting function and use of performance reports is demonstrated. The behavior and management of costs, as well as techniques used to evaluate and control results of operations, are discussed. Topics include cost-volume-profit analysis, activity-based costing in production and service companies, decentralized operations, and differential analysis techniques. Through the use of case studies, current readings, and course projects, emphasis is placed on aviation and aviation-related industries.

Aerospace Engineering (AE)

Courses

AE 502 Strength and Fatigue of Materials 3 Credits (3,0)
Analysis of stress and deformation in rods, beams, plates, shells, and solids using the elementary theories of elasticity and plasticity. Theories of strength, impact fatigue, and creep. Computer methods and applications.

AE 504 Advanced Compressible Flow 3 Credits (3,0)

AE 505 Spacecraft Dynamics and Control 3 Credits (3,0)
Review of dynamic systems modeling and analysis; classical and modern linear and nonlinear control techniques; orbital dynamics, orbital maneuvers and control. Attitude sensors and sensing techniques. Passive attitude control techniques including spin, dual-spin, gravity-gradient, and magnetic stabilization. Active control using gas jet thrusters, momentum wheels, reaction wheels, and control moment gyros. Application of optimal control techniques to spacecraft maneuver problems; design of open loop and feedback controls for linear and nonlinear spacecraft dynamical systems; case studies.

AE 506 Airplane Dynamic Stability 3 Credits (0,0)

AE 507 Design, Build and Test 3 Credits (3,0)
Introduction to the complete design cycle from idea conception through implementation and testing. Design, build and test an experiment/system. Exposure to design, building and testing tools and practices. Undergo critical design review process, background search, and periodic status reports. Final comprehensive report and presentation documenting entire design process.
AE 508 Intermediate Heat Transfer 3 Credits (3,0)

AE 510 Aircraft Structural Dynamics 3 Credits (3,0)
Vibrations of deformable elastic structures using the assumed modes method. Analysis of a continuous system for specialized cases. Undamped and damped free and forced vibration of single-degree-of-freedom and multiple-degree-of-freedom system. Computer programming skills are necessary.

AE 511 Engineering Materials Selection 3 Credits (3,0)

AE 512 Combustion I 3 Credits (3,0)

AE 514 Introduction to the Finite Element Method 3 Credits (3,0)

AE 516 Computational Aeronautical Fluid Dynamics 3 Credits (3,0)
Potential flow theory. Panel methods. Applications of numerical methods and the digital computer to inviscid flow analysis. Lifting line, vortex lattice fundamentals. Use of computer codes. Prerequisite: Graduate Standing
Prerequisites: Graduate standing.

AE 520 Perturbation Methods in Engineering 3 Credits (3,0)
Investigation of gauge functions, asymptotic expansions, and singular perturbation problems. Use is made of the method of straining parameters and method of multiple scales along with the evaluation of self-excited systems. The Duffing equation. The Mathieu equation. Boundary-layer problems and gyroscopic problems are reviewed.

AE 521 Viscous Flow 3 Credits (0,0)

AE 522 Analysis of Aircraft Composite Materials 3 Credits (3,0)
AE 523  Modeling and Simulation of Linear Dynamic Systems  3 Credits (3,0)
The purpose of this course is to provide graduate students with fundamental modeling skills for creating mathematical models of multi-domain engineering systems which can be simulated on computer for system performance analysis and control system design. This course will cover modeling, analysis, and simulation of dynamic systems. A variety of tools will be introduced including transfer functions, state space equations, block diagrams, and bond graphs. Analysis techniques including vector analysis, matrix theory including vector and matrix norms, eigenvectors and eigenvalues, matrices as operators, and the solution of systems of linear equations are introduced. Additional topics include linearization of dynamic systems, input-output description of systems, and analysis of observability, controllability and stability. The application examples range from electrical circuits, to fluid, thermal systems and electro-mechanical systems, to aircraft and spacecraft. Concepts from discrete time systems are also introduced. A background in linear algebra is recommended.

Prerequisites: AE 432 or AE 434.

AE 524  Rocket Engine Propulsion Systems  3 Credits (0,0)

Corequisites: AE 504.

AE 525  Structural Design Optimization  3 Credits (3,0)
Review of numerical optimization techniques. Structural applications of linear and discrete methods, approximation techniques and sensitivity analysis, shape and topology optimization. Optimality criteria methods. Applications to trusses, frames and composite laminates. Optimization simulations using computer graphics software. Emphasis on modern optimization techniques linked to numerical methods of structural analysis (finite element method) through a structural design course project.

AE 526  Engineering Optimization  3 Credits (0,0)

AE 527  Modern Control Systems  3 Credits
This course covers modern control theory using continuous time state-space system models and implementations. State space representation is introduced and controllability, observability, and stability are reviewed. Control structures such as PID and state feedback controllers are introduced and applications are discussed. Continuous to discrete time conversions are discussed and the z-transform is introduced. Advanced topics such as model predictive control, adaptive control, robust control, and Kalman filters may be introduced at the instructor’s discretion. A background in classical controls and modeling of dynamic systems is recommended.

AE 528  Advanced Incompressible Aerodynamics  3 Credits (0,0)
Kinematics and dynamics, thin airfoil theory, finite wing theory, bluff body flow, the Panel Method, numerical techniques, unsteady loads, vortex flows.

AE 532  Failure Analysis of Materials  3 Credits (3,0)
Study of the different failure mechanisms for metals and alloys, ceramics, polymers and composites. Overview of non-destructive testing methods, fractography and metallurgy with microscopy (optical and electron), including capabilities and limitations. Future analysis investigation techniques. Emphasis on case study examples, project and use of microscopes.

Prerequisites: AE 316.
AE 534 Smart Materials in Engineering  3 Credits (3,0)
This course covers the general area of smart materials used for aerospace structures. Current research in material development, diverse applications, design, modeling, and control are introduced to learn their potentials and challenges as smart actuators and sensors. Various types of smart materials are discussed including piezoelectric, active fiber composites, electrostrictive, magnetostrictive, electroactive polymers, shape memory alloys, electro and magnetorheological fluids, and optical fibers. Prerequisites: Graduate standing.

AE 536 Rotorcraft Aerodynamics  3 Credits

AE 538 Theory of Elasticity  3 Credits (3,0)
Theory of elasticity is a branch of continuum mechanics. This course covers the following topics: linear stress and strain analysis (constitutive equations, boundary conditions, compatibility equations, plane stress and strain problems); Airy stress function method; two-dimensional problems in various coordinate systems; thermal stress in plates and thick-wall cylinders; stress and strain analysis of three-dimensional problems; torsion of prismatic bars, introduction to theory of plasticity.

AE 540 Structural Health Monitoring  3 Credits (3,0)
General introduction of structural health monitoring and nondestructive evaluation techniques of mechanical and aerospace structural components. Passive and active damage analysis through intelligent actuation and sensing systems. Damage detection, diagnosis, and prognosis are discussed utilizing signal processing techniques and physics based approaches.

AE 542 Mechanics of Structures: Variational and Computational Methods  3 Credits (3,0)
A study of the energy and variational principles in applied mechanics using fundamental theorems from variational calculus and solid mechanics. Derivation of equations of mechanics from energy and variational principles (i.e. virtual work principles). Approximate solution to problems in structural mechanics, such as bars, beams, plates, and composite laminates by use of variational method.

AE 544 Analytical Dynamics  3 Credits
Relevant rigid body kinematics and dynamics for aircraft and spacecraft, providing the foundation for advanced dynamics and controls courses as well as research on dynamics and control of vehicle systems. Particle motion, Newton's Laws, rigid body dynamics, methods of analytical dynamics, and application to spacecraft orbital mechanics and aircraft performance; Rigorous modeling of rotational and translational motion of rigid and lightly flexible bodies.

AE 546 Nonlinear Systems Analysis  3 Credits
This is an introductory course on nonlinear stability analysis. The topics covered are Review of Linear Systems Theory, Introduction to Discrete Time Systems, Metric Spaces and Contraction Mappings, Convergence and Stability, Continuous Time System Solution Behavior, LaSalle's Invariance Principle, Nonautonomous Systems, Barbalat's Lemma; Applications in Autonomous Systems.

AE 548 Introduction to Continuum Mechanics  3 Credits (3,0)
Analysis of stress and deformation at a point. Derivation of the basic equations of a continuous medium by applying the laws of conservation of mass, linear momentum, moment of momentum, and those of thermodynamics. Study of constitutive axioms and constitutive relations for fluids and solids. Specialization of the field equations to simple boundary-value problems of solid mechanics and fluid mechanics with solutions.
AE 550 Thermodynamics: Classic and Modern Perspectives 3 Credits (3,0)
Develop classical thermodynamics from a set of postulates to develop macroscopic thermodynamics and thermodynamic properties. Kinetic theory will be covered to develop classical thermodynamic relations using Maxwell's velocity distribution. Introduction to chemical thermodynamics, equilibrium and kinetics. Develop modern thermodynamics from a microscopic perspective using quantum mechanics and statistical mechanics. Develop the tools needed to analyze very high temperature flows such as hypersonic applications.

AE 590 Graduate Seminar 1-3 Credit (0,0)
A study of the most current advancements in a particular field of study as determined by the instructor of the course. The course will have a different topic each term depending on the varied interests of the students, the graduate faculty, or the research requirements of the Aerospace Engineering department.

AE 596 Graduate Internship in Aerospace Engineering 1-3 Credit
Temporary professional or industrial work appointments made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. They are academic/ professional activities coordinated by the University between offering organizations and the graduate student.

AE 606 Finite Element Aerospace Applications 3 Credits (3,0)

AE 610 Advanced Computational Fluid Dynamics 3 Credits (0,0)
Application of vortex lattice, panel element, and boundary element methods to incompressible and compressible three-dimensional aerodynamics flow problems. Wing and wing-body analysis. Incorporation of boundary integration for more complete modeling.

AE 612 Analysis of Aircraft Plate and Shell Structures 3 Credits (3,0)

AE 616 Advanced Aircraft Structural Dynamics 3 Credits (3,0)

AE 618 Aeroelasticity 3 Credits (3,0)
This course focuses on fundamentals of aeroelasticity; the interaction between elastic, inertial, and aerodynamic forces with emphasis on aeronautical applications. It presents the theoretical and computational foundations of structural dynamics, aerodynamics, static and dynamic aeroelasticity, and studies the related performance issues such as flutter, control effectiveness, and divergence.

Prerequisites: AE 510.

AE 623 Atmospheric Navigation, Guidance and Control 3 Credits
This course will focus on the theory and application of automatic flight controls. During the course, the student will be exposed to the academics required to perform guidance, navigation and control of a small autonomous aircraft. This will include sections of Kalman Filtering, LQ control laws, data acquisition and state determination, control laws and an introduction to fault tolerant controls. In addition, there is a lab component that will have student exercise theory to the application of a real UAV built in teams.

Prerequisites: AE 506.
AE 625 Hypersonic Aerospace Propulsive Flows 3 Credits
This course deals with the aerodynamic and propulsive flows associated with hypersonic vehicles. Lecture topics include hypersonic inviscid flow approximations, viscous effects, high-temperature chemical and thermodynamic effects, rocket plumes, scramjets, experimental facilities, best practices in numerical simulation. Projects will emphasize approximate use of analytical approximations and computational fluid dynamic simulation.

AE 626 Aircraft Fault Tolerance and Advanced Control Theory 3 Credits
This course explores concepts for the analysis of causes and dynamic effects of fixed wing abnormal flight conditions along with the design of fault tolerant flight control techniques to compensate them. Topics discussed includes modeling and simulation of upset conditions; linear and non-linear adaptive control techniques; failure detection, identification and evaluation; and flight envelope estimation.
Pre-requisites by topics: Mathematical modeling of dynamic systems; background in control theory; flight dynamics; experience with Matlab and Simulink.

AE 627 Adaptive Control of Aerospace Structures 3 Credits
Considerations of the dynamic behavior of mechanically flexible aerospace structures in both air and space vehicles. Experimentation, both air and space based, and large-scale simulation to understand and control these structures. Online capabilities to control aerospace structures. This course introduces the fundamental ideas of adaptive systems and develops a foundation from which to assess the voluminous literature. Special emphasis on approaches most amenable to flexible aerospace structure control.

AE 629 Robust Control Systems 3 Credits
This is an advanced course on multivariable feedback control. The topics covered are: multivariable frequency response analysis; relative gain array (RGA) and its interpretation; multiple-input multiple output (MIMO) robustness; formulation of the general control problem; control of multivariable plants. The topics of robust stability and performance analysis for MIMO systems are covered are also covered. H-2 and H-infinity control designs are employed to illustrate the application of the theory. Last but not least model and controller reduction are introduced and applied to practical examples.
Prerequisites: AE 523.

AE 631 Aeroacoustics 3 Credits (0,0)
Sound and wave characteristics, levels and directives, hearing and physiological effects of noise, noise control criteria and regulations, instrumentation, acoustic materials and structures, aircraft components, acoustic analogy, computational aeroacoustics.

AE 633 Optimal Control 3 Credits
This course studies basic optimization methods and the fundamental principles of optimal control. Deterministic and stochastic problems are considered for both continuous and discrete-time systems with state and control constraints. The course will cover various solution methods such as numerical search algorithms, dynamic programming, calculus of variations, applications of Pontryagin’s maximum principle, and model predictive control. The optimal control methods covered in the course will be applied to various aerospace, mechanical, and electrical systems.

AE 635 Flow Stability and Control 3 Credits (3,0)
Prerequisites: AE 521.
AE 640  Turbine Engine Propulsion Systems  3 Credits (0,0)
Advanced theory of turbojet, multispool fan jet, variable cycle engines, and bypass air-breathing propulsion systems. Design and off-design performance analysis, theory and design of inlets, compressors, burners, and turbines. Component matching, cooling, regenerative systems, test methods, and corrections. Engine post-stall behavior. **Prerequisites:** AE 440.

AE 646  Nonlinear Dynamical Systems and Chaos  3 Credits (0,0)
Mathematical and experimental methods for the study of bifurcation and chaos in dynamical systems are described. Systems described by difference equations. Bifurcations of equilibrium points. Systems described by ordinary differential equations. Phase plane analysis. Limit cycles, nonlinear oscillations, and chaotic vibrations. Chaotic transitions, period doubling, and intermittency. Examples of chaos in mechanical, electrical, magnetic, fluid, chemical, and biological systems.

AE 648  Thermal Stresses in Aerospace Engineering  3 Credits (3,0)

AE 652  Turbulent Flows  3 Credits (0,0)

AE 699  Special Topics in Aerospace Engineering  1-6 Credit (0,0)
Guided independent study of selected topics not offered in regularly scheduled classes. Arrangements and work requirements established by prior agreement of instructor and students. Students should expect to spend at least 60 hours of research for each credit hour.

AE 700  Thesis  1-9 Credit
A master-level research project in Aerospace Engineering conducted under the supervision of the student’s advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.

AE 800  Dissertation  1-9 Credit
A doctoral-level research in Aerospace Engineering including an oral defense and a written dissertation satisfying all doctoral degree program guidelines. The work is supervised by the student’s advisor and dissertation committee. The approval of the dissertation committee is required to receive final dissertation credit.

**Aircraft Airworthiness Engineering (AWE)**

**Courses**

AWE 502  Airworthiness Process & Procedures  3 Credits
AWE 510 Aircraft Airworthiness Engineering Principles 3 Credits
Guiding, physical and scientific principles related to the definitions of airworthiness requirements of aircraft are studied. A general treatment of flight dynamics, mission operations, maintenance and the life cycle environments are studied as they relate to established criteria used in airworthiness certification requirements for manned and unmanned air vehicle systems. The approach is foundational, adding substance to the qualitative nature of MIL-HDBK-516C while exploring the relevant military and civilian specifications such as Joint Service Specification Guides (JSSC) and Title 14, Code of Federal Regulations as they apply in the formulation of an air system's airworthiness certification basis. Principles of aircraft mission definition, systems and components design, substantiation, validation, manufacture and serviceability are addressed.

AWE 520 Aircraft Airworthiness Capstone Project 3 Credits
Principles of aircraft airworthiness certification through application of systems engineering and airworthiness principles applied to projects to provide experience in the development of certified aircraft. Relates the certification requirements of an air vehicle, its entire air system and selected subsystems, from the general mission specification through to first flight minimum data requirements. This delves into identifiable or proposed methods of compliance for the determination of airworthiness of manned and unmanned air systems. This capstone course provides students with a project-based opportunity to apply the needed precepts and notions of airworthiness certification. To ensure that minimum-level design metrics for safe operation and maintenance are achieved throughout the air system life cycle. Working in teams, students are presented with specifications and mission requirements for an air system. Student teams will develop and present solutions with appropriate rationale for achieving airworthiness certification. Projects will require a systems engineering approach, synthesizing and applying the program prerequisite topics.

AWE 552 Continued Airworthiness 3 Credits
An investigation as to how risk monitoring and safety performance are a key part of a Safety Management System (SMS) in regard to continued airworthiness. Identifying hazards and building suitable knowledge-based information for risk and safety performance analysis. Risk modelling and data analysis, developing safety performance indicators and how they are part of the SMS.

Aviation Finance (FIN)
Courses
FIN 518 Managerial Finance 3 Credits
A study of the theoretical and practical approaches to effective financial management. Planning, analyzing, and controlling investment, and short- and long-term financing are examined for decision-making purposes. Emphasis is placed on the application of these methods in the aviation and aviation-related industries. Topics include capital budgeting, risk and diversification, asset liability management, airport financing, aircraft financing, financial derivatives, financial engineering, swaps, options, financial future, and international finance.

FIN 615 Investments 3 Credits
This course provides a survey of investments including security markets, investment vehicles, investment analysis, and portfolio management. Specific topics include the concept of risk and return, types of financial instruments, security valuation, mechanics of trading, the survey of investment companies, asset allocation for individual and an institutional investors, the concept of efficient markets, equity and bond portfolio management, and portfolio performance evaluation. The course is taught from the viewpoint of both an individual and institutional investor. The course uses case studies from the airline and aerospace industries, Web-based investment simulation, and current economic and capital market information to provide practical application of the course materials.

Prerequisites: BA 518.
FIN 618 Advanced Corporate Finance 3 Credits
Airlines, airports, and manufacturers are complex, capital-intensive enterprises operating volatile, international markets. Consequently, participants in the industry rely on a variety of financial instruments to raise necessary capital and to manage financial risk arising from uncertain demand and supply markets. While building on the finance concepts developed in Managerial Finance, this course examines the complicated financial structures and advanced financial tools employed in the aviation industry. Concepts covered include project finance, financial derivatives (real options, interest rate swaps and hedges, forward contracts and futures), financial modeling using simulation and optimization techniques, and international financial management (foreign exchange exposure management, foreign investment and capital allocation, multinational cash and tax management). The course relies on current articles and cases to explore the application of advanced financial concepts to the aviation industry.

Prerequisites: FIN 518.

FIN 620 Air Transport Economic Modeling 3 Credits
This course introduces students to several important advanced mathematical and statistical techniques that are used to build and test econometric models, and provide solutions addressed by the institution. Emphasis will be placed on developing an understanding of the essentials underlying various methods and the ability to relate the methods to important issues faced by an analyst carrying out econometric analysis on airline economic and/or financial data. That is, how to choose the right method and how to make the right decision. Students will learn how to conduct time series analysis using EVIEWS, cross-sectional analysis using SPSS, and panel data analysis using LIMDEP. In this course students are expected to utilize a systematic and careful reasoning to solve managerial problems.

Prerequisites: BA 523.

FIN 621 International Aviation Finance 3 Credits
Airlines, airports, and aircraft manufacturing are complex, capital-intensive enterprises operating in volatile, international markets. Consequently, participants within the industry rely on a variety of financial instruments to raise necessary capital and to manage financial risk arising from uncertain demand and supply markets. While building upon the finance concepts developed in Managerial Finance, this course examines the complicated financial structures and advanced financial tools and financial modeling employed within the aviation industry in an international context. Concepts covered include leasing, cross border mergers, financial distress, foreign exchange exposure management, foreign investment and capital allocation, multinationl cash and tax management. The course relies upon current articles and cases to explore the application of advanced financial concepts to the aviation industry in an international setting.

Prerequisites: BA 518.

FIN 622 Aircraft and Airline Financing 3 Credits
The financial issues facing airlines and the markets available to them are different than those for any other industry. Being in a highly capital intensive and cyclical industry with volatile cash flows, airlines have very special financing requirements. Access to capital is a key concern faced by many airlines. The course provides an in depth review of the airline financing market and tools. Specific topics include: airline credit risk assessment; fleet financing tools (commercial loans, operating and financial leases, tax leases, export credit, securitization, etc.); aircraft valuation, the asset risk, and residual value guaranties; state of the financing market and availability of financing tools; leasing companies (market dynamics, size and depth of market); banking market (major players in aircraft financing, market evolution); legal environment and tax considerations (repossession, bankruptcy law, and jurisdictional tax impact); structure of a lease document; structure of a loan facility document; and risk management and insurance in airlines (what risks are covered, insurance markets, and jurisdictional considerations).

Prerequisites: BA 518.
FIN 623  Aircraft Funding Legal and Financial Analysis  3 Credits (3,0)
The course provides an in depth review of aircraft selection strategies, the legal and regulatory framework surrounding aviation, aircraft funding sources and risk management. Specific topics include: airline credit risk assessment; fleet financing tools (commercial loans, operating and financial leases, tax leases, export credit, securitization, etc.); aircraft valuation, the asset risk, and residual value guaranties; state of the financing market and availability of financing tools; leasing companies (market dynamics, size and depth of market); banking market (major players in aircraft financing, market evolution); legal environment and tax considerations (repossession, bankruptcy law, and jurisdictional tax impact); structure of a lease document; structure of a loan facility document; and risk management and insurance in airlines (what risks are covered, insurance markets, and jurisdictional considerations).
Prerequisites: BA 518.

FIN 624  Aircraft Transaction and Risk Modeling  3 Credits (3,0)
The airline industry is a highly capital intensive and cyclical industry with volatile cash flows. Airlines have very special aircraft financing requirements, access to capital being one of them. This course reviews the principles of maintenance reserve; maintenance reserve economics and rate setting; maintenance reserve management; aircraft portfolio and risk management; residual value management; transaction modeling for aircraft returns using advanced Excel simulations; and lease negotiations between the lessor and the lessee. Students learn advanced Excel skills (calculation of IRRs, Multiples, NPV analysis, return of capital, pay back periods, lease earnings), test the model functionality, and interpret data.
Prerequisites: FIN 623 and FIN 518.

FIN 696  Graduate Internship in Finance  1-3 Credit
Temporary professional or industrial work appointments made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. They are academic/professional activities coordinated by the University between offering organizations and the graduate student. Prior approval of the graduate program coordinator is required.

FIN 699  Special Topics in Finance  1-6 Credit
The election to perform a special, directed analysis and/or independent study in an area of particular interest. Candidates selecting this elective must prepare a detailed proposal for the desired project and present the proposal to the graduate program chair or department chair for faculty review. Proposals must be submitted at least four weeks prior to the start of the term in which the elective is being taken.

Business Administration (BA)
Courses

BA 511  Operations Research  3 Credits (0,0)
An advanced study in the use of mathematical and scientific tools and techniques in managerial decision-making. Operations research seeks to determine how best to design and operate a system, usually under conditions requiring the allocation of scarce resources. Emphasis will be on the applications of these methods in aviation and aviation-related industries. Topics include linear programming, probabilistic dynamic programming, game theory, forecasting, queuing theory, transportation, decision making under uncertainty, network models, and Markov chains.
BA 514 Strategic Marketing Management in Aviation 3 Credits (0,0)
The traditional role of marketing management is enlarged to include the development, implementation, and control of marketing strategies in the dynamic aviation/aerospace organization. Emphasis is on the application of the strategic marketing process in the turbulent global aviation business environment. Strategic marketing decisions, analysis, and issues are integrated with the goal of achieving customer satisfaction to gain a sustainable competitive advantage in the aviation industry.

BA 518 Managerial Finance 3 Credits (0,0)
A study of the theoretical and practical approaches to effective financial management. Planning, analyzing, and controlling investment, and short- and long-term financing are examined for decision-making purposes. Emphasis is placed on the application of these methods in the aviation and aviation-related industries. Topics include capital budgeting, risk and diversification, asset liability management, airport financing, aircraft financing, financial derivatives, financial engineering, swaps, options, financial future, and international finance.

BA 520 Organizational Behavior, Theory, and Applications in Aviation 3 Credits (0,0)
This course focuses on current organizational issues that have a direct impact on management in the aviation industry. The emphasis is on human development and the development of effective work elements as well as the personnel concerns that must be resolved for successful leadership. Topics will provide insights into behavior, structure, authority, motivation, leadership, organizational development, and social responsibility.

BA 523 Advanced Aviation Economics 3 Credits
A study of economic applications to the aviation and aerospace industry. Students will examine the evolution of market forces in the industry with particular emphasis on airlines, airports, and manufacturing. Concepts of yield management, air passenger demand forecasting, price and cost study, airport economics, air and land space optimization strategies, government's role in aviation, international implications of competition and government regulation, economic analysis of safety, and other relevant industry issues are examined. Emphasis is placed on an increasingly international air transportation environment.

BA 590 Graduate Seminar 1-3 Credit
A study of the most current advancements in a particular field of study as determined by the instructor. The course will have a different topic each term depending on the varied interests of the students, the graduate faculty, or the research requirements of the Aviation Business Administration department.

BA 603 Aerospace Production and Operations Management 3 Credits (0,0)
An advanced study of production and operations management as it relates to the planning, coordinating, and executing of all activities that create goods and services in a global aeronautical/aerospace environment. Special quantitative and qualitative emphasis is placed on the blending of the concepts of industrial engineering, cost accounting, reliability and availability, and general management in the context of core production and control decision activities, such as capacity planning, product design, layout of facilities, selecting of locations for facilities, quality assurance, fleet planning, scheduling, inventory management, and project management. Special emphasis is placed on the examination of recent trends in global competition, increased reliance of quality for competitive technology transfer into production systems, and the increased value added by worker involvement in problem solving and decision making.

BA 604 International Management and Aviation Policy 3 Credits (0,0)
An advanced study of international management and aviation policy through the examination of major trends and issues challenging the aviation manager. Cross-cultural situations are evaluated from the perspective of interpersonal relationships in a diverse domestic and foreign environment, and in the context of evolving global trends. Strategic planning and negotiation are examined by defining the major tasks involved in organizing for international aviation, such as designing the organization and staffing. Managing workforce diversity is examined from culture-based and comparative perspectives, along with the function of control through the examination of effective control systems for overseas operations that ensure environmental interdependence through social responsibility and ethical behavior.
BA 607  Human Resource Development  3 Credits (0,0)
This course emphasizes the integration of the individual into the organization by studying the current and fundamental issues in organization theory and organizational behavior as they relate to the individual. The effectiveness of the individual in the organization is examined in terms of personal traits such as communicative abilities, leadership style and potential, and beliefs about organizational ethics and social responsibility.

BA 609  Airline Operations and Management  3 Credits (40,0)
An integrated study of airline operations and functions. Domestic and international regulation of air carriers and the industry’s changing structure due to alliances and globalization are addressed. Airline economics, airline marketing and pricing, computer reservation and revenue management systems, fleet planning and scheduling, aircraft maintenance, aircraft finance, labor relations, organizational structure, and strategic planning are studied.

BA 610  Airline Optimization and Simulation Systems  3 Credits (0,0)
The airline industry provides an application-rich environment for the field of optimization and simulation systems. This course explores a variety of optimization models and simulation techniques commonly adopted by and integrated into airline decision making for the solution of multiple scheduling and planning problems. This course examines the technical aspects of modeling in network transportation systems, including issues involved in optimizing scheduling, fleet assignment, aircraft routing, crew pairing, gate assignment, and irregular operations. Discrete-event simulation models will be explored to determine their applications in the schedule-planning process. The course explores how airline companies handle their short, medium, and long-term schedule planning using these methodologies.

Prerequisites: BA 511.

BA 612  Data Analytics for Aviation Business  3 Credits (3,0)
Introduction to methods, techniques, and analytical tools to handle large datasets with applications on aviation and aerospace data. Topics include the pipeline of handling large data such as data collection, cleaning, standardization, mining, analysis, visualization and reporting, and different types of data analytics techniques such as descriptive, inferential, predictive, and prescriptive analytics.

Prerequisites: Graduate student in good standing.

BA 615  Investments  3 Credits (0,0)
This course provides a survey of investments including security markets, investment vehicles, investment analysis, and portfolio management. Specific topics include the concept of risk and return, types of financial instruments, security valuation, mechanics of trading, the survey of investment companies, asset allocation for individual and an institutional investors, the concept of efficient markets, equity and bond portfolio management, and portfolio performance evaluation. The course is taught from the viewpoint of both an individual and institutional investor. The course uses case studies from the airline and aerospace industries, Web-based investment simulation, and current economic and capital market information to provide practical application of the course materials.

Prerequisites: BA 518.

BA 616  Electronic Commerce  3 Credits (0,0)
This course seeks to develop knowledgeable users and effective managers of Electronic Commerce (E-commerce), with a focus on aviation and aerospace management applications. A combination of technical and managerial material is presented in order to achieve an understanding of the operational and strategic uses of Electronic Commerce within the aviation industry. Emphasis is placed on today’s electronic marketplace and the use of computers as a selling, marketing, and communications tool.
BA 618 Advanced Corporate Finance  3 Credits (0,0)
Airlines, airports, and manufacturers are complex, capital-intensive enterprises operating volatile, international markets. Consequently, participants in the industry rely on a variety of financial instruments to raise necessary capital and to manage financial risk arising from uncertain demand and supply markets. While building on the finance concepts developed in Managerial Finance, this course examines the complicated financial structures and advanced financial tools employed in the aviation industry. Concepts covered include project finance, financial derivatives (real options, interest rate swaps and hedges, forward contracts and futures), financial modeling using simulation and optimization techniques, and international financial management (foreign exchange exposure management, foreign investment and capital allocation, multinational cash and tax management). The course relies on current articles and cases to explore the application of advanced financial concepts to the aviation industry. **Prerequisites:** BA 518.

BA 620 Organizational Theory  3 Credits (0,0)
This course is an advanced study of the history, theory, and principles behind organizational design, and the role of structure in organizational effectiveness. Other topics include the impact of reengineering and organizational changes on employee and firm performance, and designing for a global and electronic environment.

BA 625 Airline Marketing  3 Credits (0,0)
A study of the functions and basic concepts of marketing air transportation services. Discussion includes passenger and cargo markets, determinants of travel demand, growth factors, seasonality, and cargo traffic categories characteristics. Product and service elements, roles of advertising and travel agents, marketing unit structure, pricing and cost environment, and schedule planning are also among the topics examined.

BA 630 Aviation/Aerospace Systems Analysis  3 Credits (0,0)
This course is a study of systems theory and its relationship to aviation/aerospace systems management. The course covers a brief history of systems theory and the system life cycle concept, and explains the major activities in each phase of a systems life cycle. Also examined are specific topics related to system design and support, including reliability, maintainability, availability, customer support, product improvement, and the role of data collection and analysis. Related topics covered are cost effectiveness analysis and sensitivity analysis. The course examines applications and case studies specific to aviation/aerospace, including military applications and computer simulation models.

BA 632 Seminar in Aviation Labor Relations  3 Credits
A study of the union movement, labor legislation, representation elections, the collective bargaining process, contract administration, and conflict resolution. The focus of the course will be on current issues in labor relations, and the evolution of private and public sector bargaining practices in the aviation industry. The impact on human resource management is analyzed.

BA 635 Business Policy and Decision Making  3 Credits (3,0)
This is a capstone course in the MBA program that expands on the skills, knowledge, and abilities the students have achieved in their core courses. Students examine applications of short and long-term planning and strategic management tools in aviation, aerospace, and other key industries, and formulate the strategic vision and policies to achieve and sustain competitive advantage. Concepts of strategic management, total quality management, and evolving management methodologies are examined. Applications of these concepts are to various organizational settings and sectors.
BA 636 Venture Creation - an Entrepreneurial Approach to Starting and Building a New Enterprise 3 Credits
This course examines the process of starting and scaling an enterprise from an idea and business plan into a company. The course recognizes the importance of execution: turning a business plan into a high-growth company. The course covers: (1) capturing value from a winning idea (2) delivering effective investor presentations; (3) building a team of employees, partners, and investors; (4) managing growth from 0 to 50 employees, 50 to 150, and beyond; (5) achieving excellence in product development, marketing, sales, and operations without blowing your limited budget; (6) exit strategies. Students' understanding of these topics will be enriched by case studies and invited entrepreneurs in a workshop environment. A key deliverable of the course will be a business plan presentation event at the conclusion of the term.
Prerequisite: Graduate Student in Good Standing
GOALS: This is an experimental elective course that can be applied to the Master of Business Administration, Master of Business Administration - Aviation Management, and any other Master's degree program that allows open/specified electives. The course will be of interest to graduate students interested in the applied lessons of creating a new venture. Topics to be covered include the legalities around forming a company, sources of funding, protection of intellectual property, assembling the founding team, developing the appropriate pro-forma financial documents, sourcing suppliers and marketing to customers. A key deliverable of the class will be the development of a business plan suitable for presentation to investors, managing growth, and exit strategies. Students' understanding of these topics are enriched by case studies and invited entrepreneurs in a workshop environment. Students deliver a business plan presentation event at the conclusion of the term.
Prerequisites: Graduate students in good standing.

BA 645 Airport Operations and Management 3 Credits (0,0)
A study of the management and operation of public-use airports. Specifically, traffic forecasting, sources of revenues and expenses, management of passenger and cargo terminal buildings, ground handling of passengers and baggage, ground access systems, and the U.S. Federal Aviation Administration Regulations dealing with airport operations. Current problems with environmental impact, land-use planning and control, airport capacity and delay, public relations, airport finance, airport privatization, liability, and economic impact will be covered.

BA 646 Air Cargo Logistics Management 3 Credits (0,0)
This course provides an introduction to different topics related to the planning and operations of air cargo systems. These topics include identifying the main components of an air cargo system, the competition between air cargo and other surface-transportation modes, network and capacity planning, demand analysis and trends in the domestic and international markets, air cargo revenue management, cargo strategic alliances, revenue proration agreements, supply chain in air cargo management, shipper and forwarder interaction, ground/sorting operations, airport relations, e-commerce in air cargo management, marketing air cargo service, and air cargo security. The course also introduces students to several air cargo management and logistics computer software and applications. It also presents several study cases in air cargo management and market analysis.

BA 650 Airline/Airport Relations 3 Credits (0,0)
This course is a comprehensive examination and analysis of the symbiotic and yet often volatile relationship between airline and airport management. This course focuses on the varying perspectives toward issues that airline and airport management must address in order to effectively operate. The student will develop an understanding of current issues impacting the relationship between airlines and airports. A historical overview, current airport and airline operational and financial characteristics, legal perspectives, current financial practices, rates and charges, use and lease agreements, air service development and future issues are studied.
Prerequisites: BA 609 or BA 645.
BA 651 Strategic Airport Planning  3 Credits (0,0)
An advanced study of airport operations and management designed from a strategic management perspective. In the course, a number of management tools emphasizing computer software applications used in strategic airport planning will be introduced.
Prerequisites: BA 609 or BA 645 or BA 650.

BA 655 Aviation Law and Insurance  3 Credits (0,0)
Examination of the governmental regulatory functions affecting statutory and administrative law pertaining to aviation. The national and international impact of these laws on aviation policies and operations are studied. The legal aspects of business contracts, negotiable instruments, and commercial codes as they relate to aviation are analyzed. The course concludes with an overview of the principles of insurance and risk applied to aviation.

BA 683 Supply Chain Management  3 Credits
The focus of this course is on supply chain management. Topics include the evolution and objective of supply chain management; the major stages and processes involved in planning and managing supply chains; and why the concept of strategic fit is so important to supply chain managers. Successful students will also understand the major drivers of supply chain performance; key metrics for managing performance; and how to plan and forecast demand under conditions of uncertainty to meet desired customer service levels. This course also addresses the purpose and content of the Supply Chain Operations Reference (SCOR) Model. Case studies and problems are used throughout the course to highlight important principles and best practices in supply chain management.

BA 696 Graduate Internship in Aviation Business Administration  1-3 Credit
Temporary professional or industrial work appointments made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. They are academic/professional activities coordinated by the University between offering organizations and the graduate student. Prior approval of the graduate program coordinator is required.

BA 699 Special Topics in Business Administration  1-6 Credit
The election to perform a special, directed analysis and/or independent study in an area of particular interest. Candidates selecting this elective must prepare a detailed proposal for the desired project and present the proposal to the graduate program chair or department chair for faculty review. Proposals must be submitted at least four weeks prior to the start of the term in which the elective is being taken.

BA 699HYB Special Topics in Business Administration  1-6 Credit
Please Note: The HYB designator indicates that this course will be taught in a hybrid delivery format. In the hybrid format, some face-to-face class sessions are replaced with online activities. Hybrid courses are best suited for students who are technically competent, self-disciplined and highly motivated.

BA 700 Thesis  1-9 Credit
A written document on an aviation/aerospace topic supervised throughout its preparation by the student's thesis committee, which demonstrates the student's mastery of the topic and is of satisfactory quality for publication.
Prerequisites: BA 522.

BA 705 Advanced Aviation Economics  3 Credits (3,0)
This course provides a study of application of economic theory and mathematical modeling to the aviation and air transportation industry. Students will analyze the evolution of market forces and the industry structure with an emphasis on airlines, airports, and manufacturing. Concepts of air passenger demand, revenue management, price and cost study, airline global alliances, market structure and the implications of these for airlines will also be studied. Particular emphasis will be placed on current research and applications in the airline industry. International air transportation issues and other relevant industry issues are also examined.
BA 710 Advanced Marketing Management in Aviation 3 Credits (3,0)
Marketing management principles applied to the global airline, airport and aerospace industries. Market segmentation, consumer research and satisfaction measurement, new product and service development, communication strategies in a digital environment, global distribution systems, pricing decisions and impact on revenue management systems.

BA 715 Advanced Aviation Accounting 3 Credits (3,0)
This course provides a study of application of economic theory and mathematical modeling to the aviation and air transportation industry. Students will analyze the evolution of market forces and the industry structure with an emphasis on airlines, airports, and manufacturing. Concepts of air passenger demand, revenue management, price and cost study, airline global alliances, market structure and the implications of these for airlines will also be studied. Particular emphasis will be placed on current research and applications in the airline industry. International air transportation issues and other relevant industry issues are also examined.

BA 720 Advanced Managerial Finance in Aviation 3 Credits (3,0)
This course is an advanced study of the theoretical and practical approaches to effective financial management in aviation. Airlines, airports, and airspace manufacturers are complex and capital-intensive enterprises that operate in volatile global markets. Financial managers in the industry use a variety of methods and financial instruments to raise necessary capital and to manage financial risks, as well as plan, analyze and control investments. This course emphasizes the application of advanced methods and techniques in financial decision making in aviation business settings. Topics include capital budgeting and financing, risk and diversification, asset and liability management, asset valuation, derivatives and hedging, project finance, and international financial management.

BA 725 Advance Organizational Behavior in Aviation 3 Credits (3,0)
In this doctoral seminar we will take an in depth look at the key theories and research streams that have emerged in organizational behavior with a focus on the application of these theories and research in the aviation context. OB draws on theory and research in a variety of fields, including management, sociology, industrial/organizational psychology, and social psychology to explore individual, interpersonal, and group processes in organizations. Each week will focus on a particular topic within OB, beginning with micro topics including personality and moving into meso and macro issues such as group dynamics, leadership, justice, trust, diversity, and culture. The literature reviews will focus on how these topics have emerged in the aviation context.

BA 805 Statistics and Multivariate Analysis 3 Credits (3,0)
This course introduces students to several important advanced mathematical and statistical techniques that are used to build and test econometric models, and provide solutions to various data-centric problems. Emphasis will be placed on developing an understanding of the essentials underlying various statistical methods and the ability to relate the methods to important issues faced by an analyst carrying out econometric analysis on airline economic and/or financial data. Students will use statistical software such as SPSS/ EVIEWS/ LIMDEP/ R to do computational studies with economic/ financial data. In this course students are expected to utilize a systematic and careful reasoning to solve managerial problems and apply these methods for empirical research.

BA 810 Advanced Topics in Business Quantitative Methods 3 Credits (3,0)
Provides an overview on operations research and quantitative methods including mathematical programming, linear and integer optimization, search algorithms and metaheuristics. Provides also an overview on stochastic modeling and simulation. Emphasis is also placed on the application of these methods in aviation business settings.
BA 815  Seminars in Research Methods  3 Credits
(3,0)
How to conduct advanced social science research emphasizing development of a scholarly research proposal. Evaluation of published empirical research articles; constructing a researchable question; research method selection; data collection techniques, instrumentation, sampling, ethical considerations, and reliability and validity assessment.

BA 830  Research Seminar/Special Topics in Airline Management  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 835  Research Seminar/Special Topics in Air Cargo and Logistics  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 840  Research Seminar/Special Topics in Aviation Operations  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 845  Research Seminar/Special Topics in MIS Applications in Aviation  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 850  Research Seminar/Special Topics in Airport Management  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 855  Research Seminar/Special Topics in Aviation Supply Chain Management  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 860  Research Seminar/Special Topics in Aviation Entrepreneurship  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 865  Research Seminar/Special Topics in Globalization in Aviation  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 870  Research Seminar/Special Topics in Leadership in Aviation  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 875  Research Seminar/Special Topics in Aviation Human Factors  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 880  Research Seminar/Special Topics in Aviation Law  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 885  Research Seminar/Special Topics in Advanced Aviation Finance  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 890  Research Seminar/Special Topics in Advanced Aviation Economics  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 895  Research Seminar/Special Topics in Aviation Business Administration  3 Credits
Research seminars expose students to the latest research areas within the discipline.

BA 901  Dissertation  3-9 Credit
A doctoral-level research in Aviation Business including an oral defense and a written dissertation satisfying all doctoral degree program guidelines. The work is supervised by the student’s advisor and dissertation committee. The approval of the dissertation committee is required to receive final dissertation credit.

Civil Engineering (CIV)

Courses

CIV 502  Wind Engineering  3 Credits (3,0)
Effects of wind loading on civil infrastructure (e.g. buildings, bridges, and towers) including characterization of wind fields using probabilistic methods, resulting pressures on building envelopes, development of structural models for main wind force resisting systems, components and cladding, dynamic response of structures due to wind loading for fatigue and vibration analysis, and main wind force resisting system design using structural steel and reinforced concrete. A series of demonstration labs will be performed by students using the wind tunnel at ERAU.
CIV 504 Bridge Engineering  3 Credits (3,0)

CIV 506 Transportation Systems Engineering  3 Credits (3,0)
Overview of different transportation systems with focus on planning, design, maintenance and operational issues for traffic engineering. Linkage of highway system to aviation and other transportation modes. Human factors in transportation, transportation modes and characteristics, traffic flow theory, capacity analysis, traffic safety and transportation planning.

CIV 508 Environmental Engineering  3 Credits (3,0)
Physico-chemical processes in sustainable engineered and natural systems, natural water quality management and drinking water treatment, waste treatment, air pollution, and solid and hazardous waste management in the context of governing laws and regulations. System dynamics and life-cycle approaches will treat mass and energy balance, mass transport and reaction kinetics, dilute aqueous chemistry, microbial processes, and groundwater remediation modeling topics.

CIV 510 Design and Analysis of Airfield and Highway Pavement  3 Credits (3,0)
Theories, principles, and procedures in the structural design of highway and airfield pavements. Design of rigid and flexible highway pavements and airfield. Construction and maintenance procedures for pavements and stabilized bases. Mechanistic pavement design concepts.

CIV 512 Intelligent Transportation Systems  3 Credits (3,0)

CIV 514 Advanced Concrete Analysis and Design  3 Credits (3,0)
Students will learn advanced topics related to the behavior and design of reinforced concrete. The advanced topics include flexural behavior of reinforced concrete, the behavior and design of slender columns and two-way slab systems, and the use of strut and tie modeling for design of structural components, frame joints, and torsion. Behavior of reinforced concrete structures, with emphasis on ductility and detailing of frames, slabs, and detailing for seismic loads will be covered. Building codes, American Concrete Institute (ACI) specifications, material specifications, test methods, and recommended practice documents.

CIV 516 Advanced Steel Analysis and Design  3 Credits (3,0)
This course covers the behavior and design of advanced components used in steel structures. These components include flexural members with slender webs (plate girders?), composite beams and columns, and beam-to-column connections. Ability to design these components using the AISC construction manual (Load and Resistance Factor Design) and apply knowledge to the design of steel structures.

CIV 518 Structural Reliability  3 Credits (3,0)
This course introduces concepts and applications of structural reliability to graduate students. Topics include probability theory and random processes, fundamentals of structural reliability theory, First- and second-order, and simulation methods of reliability analysis, structural component and system reliability, reliability sensitivity measures, Bayesian reliability analysis methods, and bases for probabilistic design codes.
CIV 520 Railroad Engineering and High Speed Rail  3 Credits (3,0)
The course objective is to gain basic understanding of railroad and High Speed Rail (HSR) design, construction, operation and maintenance. The current government policies supporting the development of rail and high speed rail corridors throughout the country and Florida make this course a strategic opportunity for students to learn basic design fundamentals and terminology used in railroad and HSR design.

CIV 522 Advanced Geometric Design of Highways and Streets  3 Credits (3,0)
This course is designed to continue developing skills in the highway design process. It includes consideration of cross section elements, vertical and horizontal alignment, super elevation and intersection design. This course will also cover the latest policy on geometric design of highways and streets and exposes students to the tools and concepts needed to practice highway design in the field of civil engineering.

CIV 524 Access Management  3 Credits (3,0)
This course introduces the concept, issues, methods, and contemporary technologies in controlling and managing accesses. Topics covered include: driveways, street connections, median openings, auxiliary lanes interchanges, signalized intersections and unsignalized intersections.

CIV 526 Advanced Geotechnical and Foundation Design  3 Credits (3,0)
This course is designed to provide methods of analysis and design for various geotechnical systems. Topics covered include: subsurface investigations; excavations; design of sheeting and bracing systems; control of water; footing; pile foundations; drilled shaft and cofferdam methods of construction; geotechnical and foundation stabilization and improvement methods.

CIV 528 Structural Health Monitoring in Civil Infrastructure  3 Credits (3,0)
General introduction of structural health monitoring and nondestructive evaluation techniques of civil infrastructure components. Passive and active damage analysis through intelligent actuation and sensing systems. Damage detection, diagnosis, and prognosis are discussed utilizing signal processing techniques and physics based approaches. Tools and skills to develop sustainable maintenance and rehabilitation schemes and programs and to provide quantitative means to assess the structural integrity loss of a system sustains after a natural disasters and other hazardous events. Basic data analysis and MATLAB programing techniques will also be introduced.

CIV 530 Composites in Civil Infrastructure  3 Credits (3,0)
Advanced course on engineering mechanics and structural applications of composite materials. Fiber reinforced composites in civil-infrastructure; Viscoelastic response; Fracture, fatigue and impact behavior; Durability; Characterization of structural composite materials; Strength and stiffness design criteria; Engineered Interfaces; Connections; Bridge structures; Strengthening of Reinforced Concrete; Strengthening of Wood.

CIV 532 Transportation Planning  3 Credits (3,0)
This course covers the traditional and contemporary methodologies of urban and regional transportation planning. Topics covered include: transportation in society, urban passenger transport modes, transportation planning process, travel demand forecasting models, and transportation network analysis.

CIV 534 Transportation Simulation and Modeling  3 Credits (3,0)
Modeling and simulation methods are essential elements in the design and operation of transportation systems. This course studies theories and applications of transportation models and simulation techniques. It provides an in-depth study of the world's most sophisticated traffic simulation models, demand modeling methods, and related analytical techniques. This course investigates the application of simulation modeling and the effect of driving behavior; traffic congestion, traffic flow models and simulation methods (microscopic, mesoscopic, and macroscopic).
CIV 602 Transportation Safety 3 Credits (3,0)
This course introduces fundamental concepts of traffic safety and the systematic approaches to conduct quantitative safety analyses. Applications of statistical methods in determining and evaluating the safety performances will be presented. Topics covered include: human factors; fundamentals of crash characteristics; safety management process; predictive methods to estimate crash frequency and severity; safety performance functions; and crash modification factors.

CIV 604 Advanced Signal Control and Design 3 Credits (3,0)
This course is designed to provide traffic control theories and signal timing concepts for design, operation, and management of traffic signals. Topics covered include: unsignalized intersection control, MUTCD review, advanced signal timing design, interchange control, and adaptive signal system control.

CIV 700 Thesis 1-9 Credit
A master-level research project in Civil Engineering conducted under the supervision of the student’s advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.

Computer Engineering (CEC)

Courses

CEC 500 Engineering Project Management 3 Credits
Concepts, principles, methods, and practice of project management as an engineering discipline. The issues of scope, time, cost, quality, human resources, communication, risk, procurement, and integration are discussed. The course provides a solid introduction to the understanding of project management covering all of the essential aspects of the discipline of project management in areas of project requirements and planning, estimating workload and duration, risk management, team leadership, variance analysis, and status reporting. Considering the nature of modern software intensive systems, particular attention will be focused on software project management. The students will be given the opportunity to make decisions and test project management knowledge on case studies.

CEC 510 Digital Signal Processing 3 Credits

CEC 526 Sensor Data Fusion 3 Credits
Techniques to exploit sensor data from multiple sources (both homogenous and heterogeneous). Students analyze and model a variety of sensor modalities. System state estimation using statistical techniques including Kalman Filters, (linear and extended), Bayesian Networks, Dempster-Shafer, etc. Artificial Neural Network techniques for multi-sensor fusion and fuzzy set theory for sensor data fusion.

CEC 527 Mobile Sensor Networks 3 Credits
Issues relevant to the development of wireless sensor networks via autonomous/unmanned systems. Issues fundamental to sensor network design including low-power communication, timing/synchronization, mesh networking, etc.

CEC 530 Image Processing and Machine Vision 3 Credits
Fundamental topics of image processing and machine vision: Geometric transformations, linear filtering, edge detection, image segmentation, feature-based alignment, object recognition, motion estimation, and stereo vision. Concepts of machine learning and artificial intelligence applied to machine vision. Applications, including control and sensor packages for unmanned and autonomous systems.

CEC 599 Special Topics in Computer Engineering 1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in the area of particular interest. The student should submit to the department chair and graduate committee, a detailed proposal of the desired project and identify a faculty sponsor.
CEC 600  Computer System Safety  3 Credits
Concepts, principles, methods, and process applied for development of safety-critical and mission-critical software-intensive systems. The issues of system safety, requiring additional analysis and design techniques, are discussed from the perspective of computer hardware and software. The course discusses the safety requirements, hazard and risk analyses, failure modes and effect analysis, fault tolerance, basics of hardware and software reliability, levels of integrity, nature of faults and redundancy, and issues of verification, validation, and certification. Safety related requirements, design, and implementation techniques are discussed and illustrated by examples and practical exercises. Safety standards across application domains, including SAE ARP 4754 & ARP 4761 and RTCA DO-178B and DO-254 for safety considerations in development of complex electronics hardware and digital software for aircraft, and selected software tools supporting safety and reliability assessment of hardware and software products are introduced. The course material may require research in development of safe systems, laboratory experiments with tools, and producing appropriate reports.

CEC 610  State and Parameter Estimation  3 Credits
Autoregressive and moving-average models, state estimation and parameter identification (including least square and maximum likelihood formulations), observability theory, synthesis of optimum inputs, Kalman-prediction (filtering and smoothing), steady-state and frequency domain analysis, on-line estimation, colored noise, and nonlinear filtering algorithms.
Prerequisites: EE 510 and EE 515.

CEC 690  Graduate Project  3 Credits
A master-level design project in Computer Engineering conducted under faculty supervision, including a final report and a public presentation.

CEC 696  Graduate Internship in Computer Engineering  3 Credits
Temporary professional or industrial work appointments made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. Internships are academic/professional activities coordinated by the University between participating organizations and a graduate student.

CEC 699  Special Topics in Computer Engineering  1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in the area of particular interest. The student should submit to the department chair and graduate committee, a detailed proposal of the desired project and identify a faculty sponsor.

CEC 700  Graduate Thesis  1-9 Credit
A master-level research project in Computer Engineering conducted under the supervision of the students advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.

Computer Science (CS)

Courses

CS 525  Current Topics in Cybersecurity  3 Credits (3,0)
As the field of cybersecurity is rapidly changing, this course aims at studying the most recent, often still developing, issues in the field. The course content highly dependent on current trends at the time of offering.

CS 527  System Exploitation and Penetration Testing  3 Credits (3,0)
This course explores common vulnerabilities and how an adversary can exploit vulnerabilities to disrupt a system’s integrity. The course covers the common attack techniques that can be used for penetration testing but also can help understand how to avoid common exploits that creep into systems during design and implement phases.
CS 528 Multi-Agent Systems  3 Credits
The advanced artificial intelligence topic of multi-agent systems. Agent-based paradigm, communications, interaction protocols, and architectures followed by distributed problem solving, distributed search algorithms, distributed decision making, distributed learning, distributed control algorithms, and swarming.

CS 529 Computer Security  3 Credits
Security issues pertinent to computer-based infrastructure and the information-driven nature of contemporary enterprises. Threats, assumptions, assurance, confidentiality, integrity, availability, access control matrix and policies, security models, requirements imposed by policies, protection models, covert channels, formal methods for security, designing and evaluating systems, intrusion detection, auditing, and other contemporary issues.

CS 532 Software Security Assessment  3 Credits (3,0)
This course explores the assessment of software security not just for developing new systems but also for legacy systems. The topics covered include software vulnerability fundamentals, auditing and black box testing, design, implementation, and operational vulnerabilities, design and operational review, attack surface; insecure defaults; access control; secure channels, application review process, code-auditing strategies, software vulnerabilities, assessing memory corruption, synchronization and state, vulnerabilities in practice, documentation of findings.

CS 538 Applied Cryptography  3 Credits (3,0)
This course explores concepts of cryptography for enhancing security properties of systems that are being designed, implemented, and maintained. Common cryptanalysis techniques and tools are covered.

CS 540 Database and Data Retrieval  3 Credits (3,0)
Introduction to design, administration, and applications of database systems, big data and modern data-intensive systems. Topics include advanced data modeling and design, implementation, database scripting, database transaction, query processing and optimization strategies for relational database systems, parallel and distributed database systems, NoSQL, database-as-a-service, and database security.

CS 602 Big Data Analytics for Cybersecurity  3 Credits (3,1)
Introduction to advances in big data analytics techniques for assessing, predicting, and enhancing cybersecurity, including applications, tools, and infrastructures at the level of individual systems, as well as statistical and computational methods for securing computational infrastructure for data science. Students learn to achieve a truly secure cyberspace by leveraging data science to analyze and detect cyberthreats and identify vulnerabilities, and employ big data analytics to provide more accurate, timely, and actionable decisions for cybersecurity.
Prerequisites: MA 540.

CS 690 Cybersecurity Engineering Capstone Project  3 Credits (3,0)
A master-level capstone project in Cybersecurity Engineering conducted under the supervision of the student’s advisor. Submission of a final report, approved by the advisor and the program coordinator are required for capstone credits to be earned.

CS 700 Graduate Thesis  1-9 Credit (1-6,0)
A master-level research project in Cybersecurity Engineering conducted under the supervision of the student’s advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.

CS 800 Dissertation  1-6 Credit
A Ph.D. grade research project under the supervision of the student’s advisor and dissertation committee. Submission of a final report, approved by the dissertation committee, and an oral defense of the research work are required for dissertation credits to be earned.
Doctorate in Aviation (DAV)

Courses

DAV 701 Residency Seminar I 2 Credits
This course is designed to provide new Ph.D. students the knowledge they will need to become successful in their doctoral program. Upon completion, doctoral students will be able to navigate the ERAU online environment, understand and apply the academic policies and best practice standards set forth by the ERAU graduate academy, and demonstrate the ability to access support services and resources provided by ERAU to ensure their success. Students will gain the knowledge to effectively use Blackboard for their coursework, and to employ various statistical techniques using SPSS and research methods to common aviation research problems. Additionally, course objectives will reflect the responsibilities of doctoral students as they become members of The Academy, critical thinking and life transformation, scholarly research and writing seminar, time management and organization, forming a cohort of doctoral scholars at ERAU, and ethics in research. Students will have the opportunity to present their goals and objectives, and initial thoughts about their intended research areas.

DAV 702 Residency Seminar II 2 Credits
This seminar course will focus on the selection of appropriate and significant research problems for doctoral dissertations. Students will gain additional knowledge of elements of research, including selecting, validating and managing dissertation topics; conducting literature reviews; research design; and statistical methods. Case reviews of published dissertations will be conducted with emphasis on relevancy and importance in the aviation body of knowledge. Students will have the opportunity to present a preliminary proposal on a research topic of interest. Students will gain an understanding of the qualifying exam process and strategies for successful completion of the exam.

Prerequisites: DAV 701.

DAV 703 Residency Seminar III 2 Credits
This seminar should be taken at or near the end of all course work. The seminar will focus on the dissertation prospectus. Students will present a summary of their preliminary literature review, their research plan, and their research question(s). Students will also function as mentors for other residency students enrolled in DAV 701 and DAV 702.

Prerequisites: DAV 702.

DAV 704 Residency Seminar IV 0 Credits
Students will function as mentors for other students enrolled in DAV 701, DAV 702 and DAV 703. Pre-Requisite: Permission of the Department Chair.

DAV 711 Foundations of Aviation 3 Credits
This course will explore the origins of aviation including certain events, developments, milestones, concepts and activities that have helped shape the modern world of aviation. To present the evolution of aviation, its structures, values and cultural impact; to examine the growth of aviation knowledge; and to discuss how these factors affect modern day practices.

DAV 712 Aviation Safety Management Systems 3 Credits
This course provides an in-depth study of Safety Management Systems (SMS) including safety risk management (i.e., hazards, risk, and controls); positive safety culture; quality management principles; reactive, proactive, and predictive safety management tools and methods; safety assurance; SMS implementation; forensic versus proactive safety management; and proactive airline safety programs, including data sharing issues.
DAV 713  The Economic Environment of Aviation  3 Credits
Economic applications to the aviation industry including the economics of an airline and how economic problems are analyzed. Demand analysis and its relation with price and economic conditions. Costs and supply and the interaction of demand. An in-depth examination of the economic aspects of the air transportation industry, with microeconomic analysis applied to decision making in the airline, general and corporate aviation, and airport businesses. Topics include: basic economics of air transport supply and demand; demand forecasting; cost drivers; network structures and strategies; ratemaking; yield, revenue and capacity management; regulatory issues; political influences; unique economic characters of international commercial aviation; capitalization and credit facilities; economic and structural analytical tools and models.

DAV 714  The Legal Environment of Aviation  3 Credits
This course will examine established national and international law and regulations affecting the aviation industry. Emphasis will be placed on the administrative law process, its rulemaking authority, associated laws, and judicial review. Aviation professionals will be introduced to the legal aspects of labor relations, tort liability, contract obligations, and property issues as they relate to aviation operations and decision making. The course will also look at the global impact of treaty law pertaining to passenger rights, cargo, foreign immunity, aircraft registration, and negligence liability.

DAV 715  Human Factors in Aviation  3 Credits
This course is intended to provide students with an understanding of the origins and current state of human factors in the aviation industry. Each module in this course will present students with fundamental instruction on core human factors concepts as well as include practical exercises to demonstrate the application of these concepts in the aviation domain (e.g., cockpit crew, air traffic control, aviation maintenance, spaceflight operations).

DAV 716  Management of Systems Engineering  3 Credits
This course addresses the fundamental principles of engineering management in the context of systems engineering and explores issues related to effective planning, scheduling and assessment of technical progress, and identifying the unique challenges of the technical aspects of complex engineering systems and systems of systems, and the ability to manage them in the aviation domain. Focusing on applications in aviation, key topics include systems engineering methods and standards; concept definition, design and development; interface definition; requirements development and management; system architecture development; schedule analysis and management; risk assessment, systems integration; system-of-systems resilience; and verification and validation. The course also covers an examination of processes and methods to identify, control, audit, and track and manage the evolution of system characteristics throughout the system life cycle. Aviation-oriented areas of concentration will also include strategic management, organizational transformation, and organizational environments attendant to the management of systems engineering operations or projects.

DAV 717  Instructional Design in Aviation  3 Credits
This course is designed to assist students in developing those skills essential for instructional course development, planning, and implementation at school and work sites. Utilizing relevant theory, research, and best practices, various processes for development, instruction, and assessment in aviation will be explored. In addition, trends, historical perspectives, and frameworks for instruction in aviation will be examined.

DAV 718  Foundations of Aviation Education  3 Credits
This course will provide the student a classical and philosophical foundation of education concentrating on the infusion of aviation into the human consciousness and the resulting education vectors. It begins with the ancients and traces the influence of world conflicts such as World War I on the development of aviation education. It examines the roles of regulators, accrediting bodies and the U.S. Congress on aviation education.
DAV 719 Regulatory Environment of Aviation Safety 3 Credits
This required course in the Ph.D. in Aviation safety specialization prepares students to assimilate broad knowledge of commercial aviation safety regulations, guidance, policies, and procedures. Students demonstrate an understanding of the global regulatory environment of aviation safety through problem-based scenarios and apply that knowledge and skills in project-based research and publishable scholarship.

DAV 720 Faculty Development 3 Credits
This course will provide the student a variety of hands on, service experiences that a university faculty member would normally encounter. These experiences include participation as a faculty member in: a promotion and tenure committee; a Title IX case analysis; a grant writing exercise; a new course proposal development; a faculty search committee; and a shared governance exercise.

DAV 721 Quantitative Research Methods in Aviation 3 Credits
This course provides an in-depth study of quantitative research methods and their integration with mixed methods research including the underlying philosophical and methodological schools of thought that form the foundation for the statistical analyses to test the hypothesis. Multiple worldviews and approaches to knowledge creation are examined. Course foundation techniques focus on the analysis of published research methods that employed statistical techniques. Students will create and manipulate databases; perform exploratory data analysis; interpret and present data graphically; test probability distributions and variances; generate random numbers; perform variable transformation; run statistical models; and make statistical inferences. The students will study the following statistical tests: tests of independence, regression, correlation, and analysis of variance. SPSS GradPack is required. Pre-Requisite: Introduction to Inferential Statistics.

DAV 724 Advanced Quantitative Data Analysis - Data Mining and Modeling 3 Credits
This course develops knowledge and skills of advanced quantitative data analysis through research applications of data mining and statistical modeling approaches. Major topics include the data mining process, data mining techniques, structural equation modeling approach, confirmatory factor analysis, and structural equation modeling.

Prerequisites: DAV 721 and DAV 726.

DAV 725 Research Methods 3 Credits
This course develops the student’s understanding of the essential research methods used in social science research, including how to both choose and implement those methods. Major topics include research method selection, data collection techniques, instrumentation, sampling, ethical considerations, reliability, validity, data treatment plan, presenting results, and interpreting findings.

Prerequisites: DAV 721.

DAV 726 Quantitative and Qualitative Data Analysis 3 Credits
This course develops understanding and skills of quantitative and qualitative data analysis techniques in the social sciences, when to use what technique, how to perform the data analysis, and how to interpret results. Major topics covered in this course include: differences between quantitative and qualitative data analysis, data analysis technique selection, major steps of the data analysis process, multivariate data analysis techniques, qualitative data analysis techniques, and reporting and interpreting results.

Prerequisites: DAV 721.

DAV 732 Aviation Organizational Dynamics 3 Credits
This course develops the student’s understanding of the multi-faceted aviation organizational dynamics that interact within the global marketplace. In this course students will analyze current theory in organizational dynamics, ethics, leadership, group behavior, interaction with the global aviation environment, organizational adaptation, and the lifecycle process. The theories of organizational dynamics will be evaluated and applied to aviation organizations.
DAV 733 Multicultural Team Operations in Aviation 3 Credits
This doctoral course focuses on the theoretical foundations of multicultural teams and practical applications in the aviation field. Students examine Hofstede’s cultural dimensions of power distance, individualism/collectivism, gender difference, and uncertainty avoidance to understand effective intercultural group leadership, communication, decision making, and problem-solving. They demonstrate this knowledge through independent scholarship and apply these skills within diverse groups to achieve common academic goals.

DAV 734 Operations Research & Decision-Making 3 Credits
This course develops the student's understanding of modeling and decision making theory as well as historic operational decisions and their consequences. The theory, formulation, solution techniques and sensitivity analysis of optimization problems includes linear, goal, integer, network flow and dynamic programs. Additional decision tools covered are project management, queuing theory, simulation, and decision models such as analytical hierarchy process. Software packages will be employed.

DAV 735 Current Practices and Future Trends in Aviation 3 Credits
This course develops the student's understanding of the current state of the global aerospace industry and its probable future evolutions. It identifies potential applied research studies and other opportunities that may result in significant improvements in short-term and long-term aviation-related advances. Sample activities include identifying national governments? roles in defining the future of aviation; appraising and projecting probable impacts that the global industry will experience as technologies advance and markets emerge and evolve; and examining industry involvement in technological innovations, the political decision-making process, and the role that the academic community has in supporting the modernization of the global airspace system.

DAV 736 User-Centered Design in Aviation 3 Credits
In this course, students will examine important user-centered design theories, principles, and practices, and demonstrate their application to guide the design of advanced aviation technologies (e.g., cockpit displays, crew stations, air traffic management systems, etc.). Specific emphasis will be placed on designing for situation awareness, which is critical for ensuring aviation safety and successful human performance outcomes. Students will be required to complete a design project that synthesizes the concepts presented throughout the course and promotes students' critical thinking and problem solving skills. The design project will provide students with an opportunity to apply their newly acquired knowledge and skills in user-centered design to address a real world design challenge in the aviation domain.
Prerequisites: DAV 715.

DAV 737 Topics in Safety Management Systems 3 Credits
Safety Management Systems (SMS) in the aviation workplace in both ground and flight operations will be explored from both philosophical and pragmatic perspectives. The course will address SMS approaches set forth by the Federal Aviation Administration (FAA), International Civil Aviation Organization (ICAO), and American National Standards Institute (ANSI). Emphasis will be placed on exploring various research topics of concern for purposes of enhancing understanding of SMS and for constructing a concise and informative, professional publication or presentation.
Prerequisites: DAV 712.

DAV 738 Fundamentals of Aviation Education and Training 3 Credits
This course provides students with the educational underpinnings to implement and assess basic educational theories and practices in aviation educational and training settings. Students assess fundamental education and training theories and practices in various aviation settings, and create, implement, and assess education/training modules in aviation safety, human factors, operations, or other interdisciplinary areas in both online and face-to-face instructional settings.
DAV 801 Qualifying Examination 0 Credits
The qualifying exams test the student's mastery of core and specialization subject matter of the program. The exam will be conducted over a two-day period. Questions on the exam are prepared and subsequently graded by a committee of the program faculty with the oversight and approval of the department chair. The exams will be graded for course subject mastery which will include organization of the response, clarity of thought, depth of understanding, accuracy of information presented, and quality of writing. The student will be admitted to candidacy status upon successful completion of the qualifying exam, and will be enrolled in DAV 901 in the subsequent semester.

DAV 899 Special Topics in Aviation 1-3 Credit
This course allows the student to be assigned a directed study in an area of interest to the student and the faculty advisor. The student must develop a detailed proposal and present it to the faculty advisor for approval. This course may be repeated with different subject matter and with approval from the faculty advisor.

DAV 900 Dissertation Proposal 3 Credits
The student works with the dissertation chair to select a dissertation topic, prepares a dissertation prospectus, has the prospectus approved, and takes the Qualifying Examination. The purpose of the prospectus is to inform the doctoral program of the student's intended dissertation topic, prepare the student to complete the Qualifying Examination, and start developing the full dissertation proposal. The prospectus consists of the research title, research problem, purpose statement, research questions/hypotheses, literature review, research methodology, feasibility factors, and references.

DAV 901 Dissertation Research 1 3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the Executive Committee, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required. Pre-Requisite: Instructor Permission.

DAV 902 Dissertation Research 2 3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required.

DAV 903 Dissertation Research 3 3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required.

DAV 904 Dissertation Research 4 3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required.
DAV 905  Dissertation Research 5  3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required.

DAV 906  Dissertation Research 6  3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required.

DAV 907  Dissertation Research 7  3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required.

DAV 908  Dissertation Research 8 3-9 Credit
The student prepares a proposal for a detailed research study, has that proposal approved by the department chairperson, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required. Pre-Requisite: Instructor Permission.

DAV 916  Dissertation Research 16  3 Credits
The student prepares a proposal for a detailed research study, has that proposal approved by the Executive Committee, is assigned a dissertation committee, completes the proposed study, and defends the completed draft in a dissertation oral examination. The topic of the dissertation is original, significant to the field of aviation, grounded in the existing literature, and doable by one person. The dissertation is a systematic exploration of a topic from problem statement through analytic procedures and methodology to findings and conclusions. A minimum of 18 hours of dissertation credits are required. Pre-Requisite: Instructor Permission.

**Electrical Engineering (EE)**

**Courses**

EE 500  Digital Control Systems  3 Credits
A digital control system is a computer-based control system that is part of a larger system, such as a robot or UAV; it can make control decisions and communicate with various peripheral devices. Microcontrollers are single-chip computers, and this course deals with microcontroller-based control systems, also known as embedded systems. This course covers the following topics: basic architecture of microcontrollers; basic analog and digital input/output, including analog-to-digital converters and digital-to-analog converters; advanced communications with other intelligent devices; hardware design for embedded systems, including the applications of many different types of sensors and actuators as well as input and display devices; and firmware programming for embedded systems using high-level programming languages. Various projects will be included in this class.
EE 505 Advanced Mechatronics 3 Credits
Advanced study of the modeling and analysis of dynamic systems, system identification techniques, control sensors and actuators, analog and digital control electronics, interfacing sensors and actuators to a microcomputer/microcontroller, analog and digital controller design, and real-time programming for control.

EE 510 Linear Systems 3 Credits
Theory and application of linear systems, including fundamentals of linear algebra and matrix theory; state-space representation of linear systems; eigenvalues, eigenvectors, and eigenfunctions; and orthonormal representation of signals.

EE 515 Random Signals 3 Credits
Theory and application of random processes, including probability theory, random signals and noise, correlation, stationary and ergodic random processes, and the response of linear systems to random signals. Students are provided with a thorough grounding in probability and stochastic processes, as well as demonstrations of their applicability to real-world problems.

EE 525 Avionics and Radio Navigation 3 Credits
Fundamentals of avionics and aeronautical radio navigation. A foundation of radio wave propagation, antenna types, and the radio spectrum will be included. The capabilities and limitations of major radio navigation systems will be studied. Both the technical aspects and historical context of these aids will be considered, including the technological limitations at the time of their development, and the implications for modern systems. Systems to be covered include LORAN, NDB, VORTAC, ILS, GPS, and aircraft radar.

EE 527 Modern Control Systems 3 Credits
This course covers modern control theory using continuous time state-space system models and implementations. State space representation is introduced and controllability, observability, and stability are reviewed. Control structures such as PID and state feedback controllers are introduced and applications are discussed. Continuous to discrete time conversions are discussed and the z-transform is introduced. Advanced topics such as model predictive control, adaptive control, robust control, and Kalman filters may be introduced at the instructors discretion. A background in classical controls and modeling of dynamic systems is recommended.

EE 528 Sensors and Data Links 3 Credits
A survey of topics in practical sensing and communications. Characterization of major sensors, capabilities, and data rate requirements by application. Description, analysis, and design considerations among major aspects of data links.

EE 529 Electro-Optical Systems 3 Credits
Principles and practices in electro-optical sensing systems. Modern optics and optical devices. Microelectronics for remote sensing and integrated sensing systems. Technologies discussed include LIDAR, multispectral imaging, RFID, and phased-array radars, among others.

EE 599 Special Topics in Electrical Engineering 1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in the area of particular interest. The student should submit to the department chair and graduate committee, a detailed proposal of the desired project and identify a faculty sponsor.

EE 620 Digital Communications 3 Credits
Basic topics of digital communication theory based on advanced mathematical concepts, such as linear algebra, matrix theory, probability theory, and random processes. The major topics of this course are: base-band and pass-band signal representations; matched filter and optimal detection of symbols in the presence of noise; and analysis of communication performance in terms of bit error rates.

Prerequisites: EE 510 and EE 515.
EE 625 Satellite-Based Communications and Navigation 3 Credits
Introduction of satellite communications and navigation system design including microwave transmission, satellite transponders, earth station hardware and satellite networks. Topics include types of orbits and their applications, available satellite system technologies, propagation effects, earth station design, modulation techniques, satellite communications networks, and satellite navigation. A design project is required.

EE 690 Graduate Project 3 Credits
A master-level design project in Electrical Engineering conducted under faculty supervision, including a final report and a public presentation.

EE 696 Graduate Internship in Electrical Engineering 3 Credits
Temporary professional or industrial work appointments made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. Internships are academic/professional activities coordinated by the University between participating organizations and a graduate student.

EE 699 Special Topics in Electrical Engineering 1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in the area of particular interest. The student should submit to the department chair and graduate committee, a detailed proposal of the desired project and identify a faculty sponsor.

EE 700 Graduate Thesis 1-9 Credit
A master-level research project in electrical Engineering conducted under the supervision of the student's advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.

EE 800 Dissertation 1-6 Credit
A Ph.D. grade research project under the supervision of the student's advisor and thesis committee. Submission of a final report, approved by the dissertation committee, and an oral defense of the research work are required for dissertation credits to be earned.

Engineering Physics (EP)

Courses
EP 501 Numerical Methods for Engineers and Scientists 3 Credits
Numerical methods for the solution of engineering physics problems: systems of linear equations, ordinary differential equations including one-dimensional initial value problems and boundary value problems; partial differential equations (PDEs) including elliptic, parabolic, and hyperbolic PDEs; finite difference method. Application to problems such as diffusion, transport, remote sensing, inversion, and plasma waves. Emphasis will be on computer implementation of numerical solutions. Knowledge of at least one programming language is required, with MATLAB strongly recommended.

EP 505 Spacecraft Dynamics and Control 3 Credits
Review of dynamic systems modeling and analysis; classical and modern linear and nonlinear control techniques; orbital dynamics, orbital maneuvers and control. Attitude sensors and sensing techniques. Passive attitude control techniques including spin, dual-spin, gravity-gradient, and magnetic stabilization. Active control using gas jet thrusters, momentum wheels, reaction wheels, and control moment gyros. Application of optimal control techniques to spacecraft maneuver problems; design of open loop and feedback controls for linear and nonlinear spacecraft dynamical systems; case studies.

EP 507 Astrophysics I 3 Credits (3.0)
This course is a study of the basic physical processes operating in the astronomical environment: stellar structure, stellar evolution, and the interstellar medium, galaxies. Astrophysical concepts are emphasized, thus underlining the common features appearing within many astronomical systems.

Prerequisites: EP 455 and PS 320 and MA 345.
**EP 508  Astrophyhsics II  3 Credits (3,0)**
Study of the basic physical processes operating in the Galaxy and extragalactic astronomical environments: galactic structure and evolution, the expanding universe, and cosmology. Astrophysical concepts are emphasized, thus underlining the common features appearing within many astronomical systems.

**EP 509  Advanced Space Physics  3 Credits**

**EP 520  Advanced Planetary Sciences  3 Credits**
Study of the planetary system: origin, evolution, composition, present configuration, dynamics, interiors, surfaces, atmospheres, and magnetospheres of the planets and, where appropriate, similar aspects of the satellites, asteroids, and comets. Interpretations of existing data and definition of future experiments to aid in determination of the origin and evolution of the solar system are stressed.

**Prerequisites:** PS 303 and MA 345.

**EP 525  Observational Astronomy  3 Credits (3,0)**
Basic design and use of an optical telescope, fundamentals of astronomical optics including refracting and reflecting systems, principles and applications of optical filters and adaptive optics. Design optimization and trade-offs in an observing system. Telescope system calibration and techniques for enhancing tracking accuracy. Visual observation and analysis of images of the sun, moon, planets, stars, nebulae, and galaxies. Electronic imaging including quantification of radiant energy, spectroscopy, and techniques for reducing the effects of noise sources. Optical and detector design trade-offs for measurement optimization.

**EP 600  Experimental Methods in Space Science  3 Credits**
Measurement techniques for ground-based, rocket, and satellite-borne experiments are explored. Advantages, disadvantages, and limitations are quantitatively developed. In situ atmospheric composition measurements, charged particle detection for plasma characterization, optical remote sensing, and imaging techniques are included.

**EP 605  Spacecraft Power and Thermal Design  3 Credits**
Spacecraft power and thermal energy management. Spacecraft power systems; sources of power; power subsystem function and design; energy storage devices; future concepts in spacecraft power systems. Review of the modes of heat transfer: conduction, radiation, and convection. Space environment, heating fluxes. Spacecraft thermal analysis. Thermal control hardware and design; active and passive thermal control. Emphasis on the design needs of instruments and their detector systems’ power and thermal requirements.

**EP 696  Graduate Internship in Engineering Physics  1-3 Credit**
Temporary professional or industrial work appointments are made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. They are academic/professional activities coordinated by the University between offering organizations and the graduate student. Prior approval of the graduate program coordinator is required.

**EP 699  Special Topics in Engineering Physics  1-6 Credit**
Guided independent study of selected topics not offered in regularly scheduled classes. Arrangements and work requirements established by prior agreement of the instructor and students, subject to approval of the program committee and department chair.
EP 700 Thesis 1-9 Credit
A master-level research project in Space Science/Engineering Physics including an oral thesis defense and a written report satisfying all graduate school guidelines. The work is supervised by the student's advisor and thesis committee. The approval of the thesis committee is required to receive final thesis credit.

EP 701 Analytical Techniques in Engineering Physics 3 Credits
This is a graduate course on mathematical techniques in engineering physics. It focuses on the application of advanced mathematical topics including Fourier and wavelet analysis, functional analysis, rotation groups and algebras, Legendre polynomials and functions and Bessel, Hermite and Laguerre polynomials to space science and spacecraft engineering problems.

EP 702 Theoretical Mechanics and Astrodynamics 3 Credits
This graduate course is organized into two major parts: theoretical mechanics and astrodynamics. The first part is essentially a modern treatment of Lagrangian and Hamiltonian dynamics, as well as variational methods. The first part also covers several other advanced topics in analytical dynamics, including canonical transformations, Hamilton-Jacobi theory and canonical perturbation methods. The second part includes Keplerian and non-Keplerian motion, patched-conic orbits, perturbation methods, Lagrange's Planetary Equations, Gauss' Variational Equations and advanced topics in space navigation.

EP 703 Electrodynamics of Space Environment 3 Credits
This is a graduate course on static and dynamic properties of electromagnetic fields. The objective of the course is to develop advanced concepts in electrostatics, magnetostatics and electrodynamics. This course also emphasizes various mathematical techniques for solving practical electromagnetic problems encountered in space plasma, antennas, propagation and scattering using Maxwell's equations.

EP 704 Stochastic Systems in Engineering Physics 3 Credits
This course is an advanced graduate course in stochastic processes and their applications in physics and engineering. The course covers rigorously continuous-time and discrete-time random processes and principles of optimal estimation. It focuses on the following topics: foundations of the stochastic processes theory based on probability space and s-algebras of events, Gaussian processes, Markov processes, Brownian motion, and multidimensional Wiener process and their relation with the notion of "white noise", stochastic Ito integrals and stochastic differential equations, stationary processes and their spectral properties, conditional expectations and optimal estimation techniques, Kalman filtering and time-series.

EP 705 Optimal Dynamical Systems 3 Credits
An advanced graduate course in optimal control systems. The course covers the principles of optimal control. It focuses on the following topics: classical calculus of variations, LQR and LQG methods, Pontryagin maximum principle, time-optimal control. The course is structured to emphasize some of the recent research activity in optimal dynamical systems analysis and control.

EP 706 Electro-Optical Engineering 3 Credits
Investigates the basic aspects of digital and analog fiber-optics communication systems. Topics include sources and receivers, optical fibers and their propagation characteristics and optical fiber systems. The characteristics of lasers, optical amplifiers and detectors and noise will be investigated, and systems design of fiber optic communication systems will be addressed. Quantitative development of electro-optical remote-sensing systems such as LIDARs, Hyper Spectral Imaging, Multi-directional high throughput temperature imagers, very low light level white light and monochromatic visible and infrared-red all-sky cameras. New high quantum efficiency, low thermal and read out noise detectors. Compact and rugged zed space-borne facilities and integrated multi-instrument observing systems. Digital processing and analyses of various images recorded with satellite instrumentation as well as ground-based recording of all-sky monochromatic and wide band pass images. Application of all the above to medical, drug, hazardous chemical testing and detection as well as to industrial and space exploration needs.
EP 707 Nonlinear Dynamical Control Systems 3 Credits
This course is a second graduate course in nonlinear dynamical control systems, organized into three major parts: differential geometric nonlinear control, advanced topics in feedback linearization and input-output and advanced stability analysis. The course is structured to emphasize some of the recent research activity in nonlinear dynamical systems analysis and control. It uses concepts from differential geometry, however the course is self contained in that the necessary mathematics will be taught as part of the course.

EP 708 Remote Sensing: Active and Passive 3 Credits
Introduces students to concepts in remote sensing in the microwave and RF bands. The course will cover the fundamentals of radar and passive remote sensing. This includes the underlying physics of scattering and radiative transfer, analytical techniques, system design and examples illustrating the use of radiometer and radar as tools for monitoring the natural environment. The course will provide a systems perspective to remote sensing instrument design. The students will obtain the knowledge and ability to perform basic systems engineering calculations, evaluate tradeoffs and evaluate advanced systems.

EP 709 Upper Atmospheric Physics 3 Credits
In this course, we reveal the fundamental processes controlling the structure, composition, dynamics and energetics of the terrestrial upper atmosphere (the near-Earth space environment). Topics include vertical structure of the atmospheric gases, solar radiation and photolysis, collisional processes, photochemistry and transport, thermodynamics, radiative processes, dynamics of the upper atmosphere, aurora and airglow phenomena, layered phenomena: metallic atoms, noctilucent clouds, and radio echoes and energy balance of the atmosphere and global change.

EP 710 Space Plasma Physics 3 Credits
This course is a graduate course in advanced plasma physics and its space applications. A strong background knowledge of electrodynamics and a previous introductory course (at the undergraduate level) in plasma physics is strongly recommended. It will start from the microscopic fundamentals, and then derive useful approximations such as Vlasov theory, two-fluid theory and magnetohydrodynamics. Waves and instabilities in each of these descriptions will be investigated. Applications to the space environment will form a core component of this course.

EP 711 Computational Atmospheric Dynamics 3 Credits
This is a second graduate course in atmospheric dynamics. Here, we emphasize the numerical solution of the governing fluid equations for various types of fluid flows. Various numerical methods and their associated limitations are discussed. Comparisons between real observations and simulations will be made wherever possible. Students will gain experience running large simulation code on a supercomputer. In addition to exams, students will be required to complete a hands-on project.

EP 712 Geophysical Fluid Dynamics 3 Credits
This is the first graduate course in atmospheric dynamics. The thermodynamics of fluids and conservation laws are introduced, which lead to the Navier-Stokes equations describing fluid flow. Effects of rotation on fluids are described. Wave motions occurring in the atmosphere and oceans are described, and include gravity waves, Rossby waves and Kelvin waves, as well as tidal motions. Instability processes, some triggered by waves, are discussed, and the cascade of energy to smaller scales through turbulence is described. Global scale "mean" motions (winds and Hadley cells) are discussed. The dissipative effects of molecular diffusion in rarefied gases are also described.

EP 799 Special Topics in Engineering Physics 1-6 Credit
Guided independent study of selected topics not offered in regularly scheduled classes. Course work Requirements are established by the instructor and the arrangement is made between the instructor and students, subject to approval of the Ph.D. program committee and department chair.
EP 800 Dissertation  3-9 Credit
A doctoral-level research in Engineering Physics including an oral defense and a written dissertation satisfying all doctoral degree program guidelines. The work is supervised by the student’s advisor and dissertation committee. The approval of the dissertation committee is required to receive final dissertation credit.

Human Factors and Systems (HFS)

Human Factors Courses

HFS 500 Systems Concepts, Theory, and Tools  3 Credits (3,0)
The ability to think at a systems level will be developed. Formal systems principles; systems requirements analysis; knowledge acquisition techniques; information modeling; information management; decision support; systems evaluation.

HFS 510 Research Design and Analysis I  3 Credits
Foundation and procedures of research techniques, tools, and methods. Course reviews the principal concepts of research design and evaluation. The application of experimental, case study, survey, and non-experimental techniques are explored. Identification, isolation, and treatment of dependent and independent variables covered. Existing published research or data used to highlight principles. Lab is a required part of this course.

HFS 515 Ergonomics  3 Credits (3,0)
This class will address the basic concepts of ergonomics and their application to the design of human-machine systems and products. Consideration of human physiological, biomechanical, and biological capabilities and limitations in design for human efficiency, safety, and comfort; anthropometry. Ergonomic issues related to the design of control and display systems, instrument panels, workplaces, seating, and tools will be addressed.

HFS 520 Team Performance  3 Credits (3,0)
The performance of teams and groups working collaboratively is crucial to achieving and optimizing organizational goals and objectives. This class focuses on understanding the dynamics of team behavior from formation to dissolution through review of the theory and research in team psychology and performance. Particular emphasis will be given to team functioning in technologically advanced environments, such as aviation, aerospace, gaming and defense.

HFS 521 Modeling Humans in Complex Systems  3 Credits
This course exposes students to concepts in modeling and simulating human and human behavior through experience with programming applications and software architecture. Practical applications for the modeling human complex mental and physical behavior are provided through a variety of software, including MATLAB, ARENA and state-of-art ergonomics/biomechanics tools. Topics of digital human modeling, human learning and decision making, and neural network will be introduced. Students will get hands-on experiences to become familiar with contemporary software approaches to modeling human in realistic situations to aid in system design, improve efficiency and safety.PREREQUISITE: Permission of Instructor.

HFS 525 Human and Social/Organizational Factors in Emerging Technologies  3 Credits (3,0)
Individuals today are immersed in a world full of rapidly evolving technology. Mobile devices, tablet computers, on-line gaming, and virtual worlds are just a few of the options we now have in our work and leisure environments. This class focuses first on how humans think about and relate to emerging technologies and how the interaction of humans and technology creates new and interesting behavior. The second part of the class will emphasize how emerging technology shapes social, organizational and cultural behaviors, in domains such as work, ethics, education, leisure and interpersonal relations. Last, the class will discuss what a future of technological immersion and continuous enhancement may look like and how it will continue to shape behavior at both micro (human) and macro (organizational and societal) levels. Readings for the class will be drawn from current theory and research related to human behavior and emerging technology.
HFS 526  Aerospace Physiology  3 Credits (3,0)
This course emphasizes the adaptability of physiological systems to unique aerospace environments. The student will learn the structure and function of the central and peripheral nervous systems, cardiac and pulmonary systems, as well as muscular and sensory neuroscience. The impact of acceleration, hypo and hyperbaric environments, microgravity, and spatial disorientation on human capability will be discussed. This course brings together the operational demands of physiology, medicine, and behavioral science. The student will learn the effects of environmental conditions (lighting, noise, heat, cold, humidity, air movement) and of shift work (day, evening, and night work; shift schedules) on task performance in order to improve human productivity in the workplace. The student will understand the limitations of human life as well as the ingenuity required to design systems capable of creating artificial life-sustaining support systems.
Prerequisites: BIO 120.

HFS 527  Psychopharmacology  3 Credits (3,0)
Drugs play a very important role in our lives for better and for worse. It's important to know something about drugs since we use them so often. You will learn about drugs that we use in our homes, drugs that are approved and not approved for flight (and why), as well as about illegal drugs and how they got that way. We will cover the societal and the medical issues for drugs as we focus on psychoactive compounds; effects and side effects.

HFS 590  Graduate Seminar  3 Credits (3,0)
A study of current topics and advancements in human factors, aviation psychology, and related areas as determined by the instructor of the course. The course will have a different topic each time it is offered depending on the varied interests of the faculty, students, or availability of visiting professors.

HFS 600  Human Factors in Systems  3 Credits (3,0)
Survey of human factors literature. Introduction to topics including human capabilities and human interfaces with human-machine systems, workload, anthropometrics, perception, workspace design, and visual momentum. The course will study human limitations in the light of human engineering, human reliability, stress, and human physiology. The course will discuss human behavior as it relates to the aviators adaptation to flight, air traffic, and maintenance environments.

HFS 605  Systems Engineering II  3 Credits (3,0)
Studies of the value of prototyping in the application of design, build, and test processes. In-depth focus on the innovation of conceptual designs in short time-cycle engineering. Lab is a required part of this course.
Prerequisites: HFS 500 and HFS 505.

HFS 610  Research Design and Analysis II  3 Credits (2,0)
This course is the advanced program in experimental design and analysis. The focus is the design, planning, and considerations involved in complex, multivariate experiments. Major areas of examination will include factorial designs, nested variables, linear models, multiple regression, measures of covariance, and Latin square designs. Considerations in selecting the appropriate experimental design is the focus of this course. Examination of appropriate statistical techniques is integrated with the theoretical and practical concepts of experimental design. Lab is a required part of this course.
Prerequisites: HFS 510.

HFS 612  Human Factors Methods  3 Credits
The course involves the introduction and application of advanced measurement, design, and evaluation of core human factors performance. This analysis will include theoretical frameworks and technical methods to analyze domains that may include but are not limited to workload, error measurement, situation awareness, job and task analysis, cognitive behavior, time and motion studies, or additional factors that influence behavioral work performance.
Prerequisites: HFS 600.

HFS 614  Human Factors in Medicine  3 Credits (3,0)
Seminar style course covering topics applicable to the medical domain; Topics include high reliability organizations and teams; error; telemedicine; debriefs; medical simulations; human performance assessments; and organizational culture; covers theory, research and practice.
HFS 615 Sensation and Perception 3 Credits
This class will address advanced issues in human information processing with specific regard to the physical and psychological variables associated with sensory and perceptual phenomena. Attention will be paid to all the human sensors, with particular focus on perceptual issues related to system design, evaluation, and certification. Although all the senses will be covered, special attention will be paid to the visual and auditory senses. Lab is a required part of this course.

HFS 616 Human Factors of Transportation 3 Credits (3,0)
Basic principles of Human Factors Psychology in transportation; Research, principles, and methods beneficial (and essential) in optimizing people and machine transportation. HFS 600 is a prerequisite course.

Prerequisites: HFS 600.

HFS 618 HF in Aging: Behavioral and Biological Foundations 3 Credits (3,0)
Behavioral and biological foundations of aging; Theories of aging; Evidence of psychological, perceptual, motor, and physical changes associated with aging; Strengths and limitations of research investigating the effects of aging on performance of complex behaviors like driving and flying; Rationale behind methodology used in aging research.

HFS 620 Memory and Cognition 3 Credits (3,0)
This course will examine the tremendous gains in memory and cognition research to obtain an understanding of how these theoretical and empirical advances have been, or might be, applied to problems of human-machine interactions and system design. Topics include the total range of memory and cognitive processes and their potential application to systems design: sensation perception, pattern recognition, attention, language, memory, concept formation, thinking, decision making, problem solving, timesharing, reaction time, action, manual control, and the impact of automation. Lab is a required part of this course.

HFS 622 Human Factors in Entertainment Systems 3 Credits (3,0)
Human factors research and design principles applied to entertainment systems. Game mechanics; gamification; flow and engagement; control and display interfaces including simulation and virtual reality; skill inventories; psychological factors including social dynamics, personality, addiction, and ethical behavior.

HFS 624 User Experience 3 Credits (3,0)
Experiential course on User Experience metrics and methods; hands-on experience with the methods; conducting industry-style projects. Techniques include qualitative and quantitative data collection, analysis, and industry-style report writing.

HFS 625 Applied Testing and Selection 3 Credits (3,0)
Issues in selecting and testing applicants for a broad range of positions in aviation and related industries are the focus of this course. An examination of the methodologies used since World War I through the present is covered. The change in methodologies used and the level of sophistication of assessment techniques involved is examined across pilot, air traffic controller, maintenance, and aviation security screener personnel. A significant portion of this course is devoted to an understanding of the performance assessment techniques used to evaluate selection systems as well as the personnel selection instruments used. Problems in both criterion and assessment measurement are discussed in detail.

Prerequisites: HFS 510 and HFS 610.

HFS 626 Human Factors Principles of Visual Communication 3 Credits (3,0)
Experiential course on visual communication; Cognitive and perceptual principles and theories underlying development of effective visual communication; design for scientific graphs, info graphics, and other forms of data visualization; Best practices concerning power point and design of scientific poster presentations; Hands-on experience for presentations, posters, and graphics to communicate with diverse audiences.
HFS 630  Applied Cognitive Science  3 Credits
(3,0)
Cognitive Science has a fundamental focus on the mind and its ability to process information. In order to understand information processing, cognitive science draws from the fields of philosophy, psychology, artificial intelligence, linguistics, neuroscience and other areas. Drawing from research and theory in the diverse areas comprising the field of cognitive science, this class will explore how humans acquire, represent, reason about, and use information. Special emphasis will also be given to how knowledge in the discipline has been applied in areas such as artificial intelligence, machine learning, probabilistic modeling, and understanding human mind and consciousness.
Prerequisites: HFS 600 and HFS 620.

HFS 635  Human-Computer Interaction  3 Credits
(2,0)
This course stresses the importance of good interfaces and the relationship of user interface design to human-computer interaction. Other topics include interface quality and methods of evaluation; interface design examples; dimensions of interface variability; dialogue genre; dialogue tools and techniques; user-centered design and task analysis; prototyping and the iterative design cycle; user interface implementation; prototyping tools and environments; I/O devices; basic computer graphics; color; and sound. A lab is a required part of this course.

HFS 637  Managing Human Errors in Complex Systems  3 Credits
This class will address the basic concepts of the application of human factors principles and theories to the effective design and operation of various aviation/aerospace applications. It will address these areas from a historical perspective and in relation to the future operational concepts of the applications. Issues to be addressed could include function allocation between human and machine, human-computer interface, work environment (for example, stress circadian rhythms), person-to-person communications, performance measurement, and research and development needed.

HFS 640  Aviation/Aerospace Psychology  3 Credits (3,0)
This survey course covers the primary areas of work in the aviation psychology specialization. Topic areas may include the effects of alcohol on performance, aviation safety and accident investigation, cockpit and air traffic control automation, display and control issues and design, personnel selection, task analysis, workload assessment, training research and development, scale development methodologies, and crew resource management. The topic areas change from semester to semester depending on the focus of the current research environment. This course has a strong emphasis on methodological issues, problematic research concerns, and statistical issues. Most of the coursework involves extensive readings in the specialization from conference proceedings, journal articles, and training manuals. A critical analysis of research is the focal point for this course.

HFS 650  Human Factors of Aviation/Aerospace Applications  3 Credits (3,0)
This class will address the basic concepts of the application of human factors principles and theories to the effective design and operation of various aviation/aerospace applications. It will address these areas from a historical perspective and in relation to the future operational concepts of the applications. Issues to be addressed could include function allocation between human and machine, human-computer interface, work environment (for example, stress circadian rhythms), person-to-person communications, performance measurement, and research and development needed.
HFS 675  Multivariate Statistics: Factor Analysis and Data Reduction  3 Credits
Building on the first course in multivariate statistics, this course provides an introduction to several widely-used methods in the analysis of social science data. Topics include introductory treatments of structural equation models (path analysis, multiple latent variable models, confirmatory factor analysis, and latent growth models), principle components analysis, and exploratory factor analysis. Additionally, students will also be introduced to canonical correlation and clustering techniques (cluster analysis). Consideration will be given to the basic logic and application of covariance structure analysis as well as limitations and criticisms of the practice of latent variable modeling.

Prerequisites: HFS 510 and HFS 610.

HFS 680  Graduate Seminar: Current Applications in Human Factors  3 Credits (3,0)
Knowledge about current and future HF applications; Relevant and topical theories and skills in the field; application of HF methods; In depth examination of specific, current or future topics in Human Factors likely to impact students as they enter the world of work or research; Taught by various Human Factors Faculty based on application(s) being covered.

HFS 690  Graduate Student Capstone  3 Credits
This seminar-style course involves an in-depth investigation of one or more influential bodies of research and theory in human factors and systems, integrating skills obtained in prior coursework into a capstone project. This course will provide evidence of the student's ability to critically think about complex domains of inquiry and demonstrate written and oral skills.

HFS 696  Graduate Internship in Human Factors and Systems  1-3 Credit (3,0)
Supervised placement in an industrial, governmental, or consulting setting. The student completes a specific project under the supervision of an organizational sponsor and a faculty member.

HFS 699  Special Topics in Human Factors and Systems  1-6 Credit
Completion of an area of study under the direct supervision of a faculty member. The course requirements and area of study are negotiated between the faculty member and the student with the approval of the department chair.

HFS 700  Thesis  1-9 Credit
The performance and a written description of a master-level research project. The topic of the thesis will be approved and supervised throughout its preparation by the students major professor and thesis committee. This project will provide evidence of the students ability to perform applied research at the graduate level.

HFS 705  Small N Designs and Non-Parametric Analysis  3 Credits
This course uses applications of research evidence-based practices that address practical problems experienced by individuals across a variety of human factors and industrial settings. Topics covered include behavioral assessment techniques, graphing data, single subject and small ?n? experimental designs with interventions. It will introduce students to a natural science approach to designing, conducting, and critically evaluating research applications of the experimental analysis of behavior. The course differs from other research methods courses (e.g., those involving simply qualitative methods or group designs) with its focus on objective, repeated measurement and analysis of performance at the level of the individual.

HFS 710  Current Topics in Human Factors  3 Credits
This seminar style class provides Ph.D. students opportunities to review the present and future trends in human factors research. The scope of the coverage includes all areas of human factors, with special concentration on aviation human factors, human error, medical human factors and design of complex systems. Through weekly discussions with different faculty members, the students will have the opportunities to learn about the research of different faculty members, methods and approaches applied in the human factors research and get involved with faculty research projects.

HFS 715  Supervised Teaching Experience  3 Credits (3,0)
Development of skill in teaching and presenting; shadow introductory HF or PSY course; assignment of faculty teaching mentor; knowledge acquisition in classroom management, grading, syllabus development, testing, teaching skills, presentation materials; actual instructor of record for small section of class that was shadowed.
HFS 799  Special Topics in Human Factors  1-6 Credit
Guided independent study of selected topics not offered in regularly scheduled classes. Arrangements and work requirements established by prior agreement of instructor and students.

HFS 800  Dissertation  3-9 Credit
An oral defense and written description of a Ph.D. level research project are required to pass this course. The topic of the research must be approved and supervised by the student’s faculty advisor and Ph.D. committee.

Master of Science in Aeronautics (MSA)

Courses

MSA 508  Advanced Airport Modeling  3 Credits
A study of advanced airport and airspace planning to support day-to-day operations, resource allocation, and strategic analysis. Emphasis is put on the use of computer software to create working airport and airspace models to solve common airport and airspace operational problems. Airport and airspace background material and procedures will be covered in supplemental lectures. Total Airport and Airspace Modeler (TAAM) software will be used as the primary planning and analysis tool. TAAM is the most advanced and comprehensive interactive software available for this type of analysis. Students are taught how to use the TAAM software on a UNIX-based SUN workstation. To accomplish this task, students will be divided into research teams for purposes of developing a simulation and conducting the group object portion of the course. Each team will be assigned a project of completing a realistic working simulation model of an actual airport, which they will then use to solve an operational problem.

MSA 511  Earth Observation and Remote Sensing  3 Credits (3,0)
U.S. and International solar system exploration programs are reviewed and related to the current and proposed Earth?research projects. Examination of these research programs will be structured towards defining problems related to environmental changes and resource exploration. Formatted research data from Earth-resource satellites and EOS sources will be used for demonstrating specific research techniques, exploration methods, and economic and social elements of exploration.

MSA 512  Space Mission and Launch Operations  3 Credits (3,0)
This course introduces the student to launch, mission operations, and facilities for manned and unmanned missions at U.S. and foreign sites. Satellite and spacecraft launch facility system discussion covers safety, meteorology, communications, and tracking, as well as navigation and control systems. Examples of mission control, operations, and systems include spacecraft project descriptions and control site operations. U.S. mission operations will include NASA, DoD, and commercial space operations and launch sites. Legacy spacecraft operations including the Space Shuttle (STS) and Russian Soyuz are examined along with future commercial space transportation programs.

MSA 513  Space Habitation and Life Support Systems  3 Credits (3,0)
This course addresses the problems related to spaceflight induced changes in the major body systems that need to be solved in this decade, to develop countermeasures for maintaining the health of crewmembers on long duration space operations. Physiological elements of zero gravity environment, radiation hazards, and protection measures are explored, along with physical and chemical closed loop life support systems for long duration space missions. More elaborate life support systems for larger manned missions and colonies are outlined for further student development.

MSA 514  Computer Based Instruction  3 Credits (3,0)
This course addresses the analysis, design, development, implementation, and evaluation of web/computer-based training (W/CBT) as it applies to applications in the aviation/aerospace industry. The course offers practice in the systematic design of computer-based instruction with emphasis on tutorials, drill and practice, and simulation. W/CBT lessons are developed using available authoring systems.
MSA 515 Aviation/Aerospace Simulation Systems 3 Credits (3,0)
The course focus is on a comprehensive examination of simulation in modern aviation/aerospace that includes history, state-of-the-art, and current research and development. Discussions focus on the extent and impact of simulator application throughout the industry and the effects on training costs and safety. Topics range from basic design principles to flight crew training for initial qualification, continuation and currency purposes. The course emphasizes implementation of training that is transferable from simulated to real world environments. Systems simulators to the simulation models used in management, flight operations, scheduling, or air traffic control, are examined in detail.

MSA 516 Applications in Crew Resource Management 3 Credits (3,0)
In this course, students examine the common concepts of crew resource management (CRM) as developed by major air carriers and explore the theoretical basis of such training. Topics such as supervision of crewmembers, counseling, manner and style, accountability, role management, and use of simulators and computer-based instruction will be studied. Each student has the opportunity to become knowledgeable in a specific area of CRM by assisting in the development of a CRM research document as part of the course.

MSA 518 Online Learning Environment 3 Credits
This course focuses on what is required to develop an online learning environment that is realistic to the end user. The student will develop a thorough understanding of the hardware and software required to develop and display an online environment. This course is designed to be an elective offered within the MSA Education Specialization. This course discusses the theory and practice involving an online learning environment. It explores models of online learning environment (OLEs) as applied to the aviation/aerospace industry. Students will investigate the theoretical, conceptual, instructional, and technical framework of implementing and using this environment. Online Learning Environment is designed to help students become proficient in educational cyberspace. Topics include overview of online learning environments, how people learn, applying the multimedia principles; use of words and graphics rather than words alone, applying the coherence principle; adding interesting material can hurt learning, applying the personalization principle; use conversational style and virtual coaches, personalization principle one; use conversational rather than formal style, design practice in e-learning, practice principle one: interactions should mirror the job, psychological reasons for job-relevant practice, evidence for the benefits of practice, learning together on the web, learning control versus program control, the effectiveness of learner control in e-learning and asynchronous learning interactions.
MSA 520  Introduction to Air Traffic Control
Tower  3 Credits (1,2)
This course is required as part of the MSA ATM Track 2 Program. This course provides students with a fundamental knowledge of VFR tower operations in the U.S. air traffic control system and develops content knowledge in the following areas: control tower equipment and operating positions; the airport traffic area; navigation aids; airspace; VFR traffic patterns; controller/pilot phraseology; aircraft taxi instructions; control of vehicle movement; interagency communications and intra-facility coordination; federal aviation regulations; notification and handling of emergency aircraft; flight progress trip marking; aircraft recognition and characteristics; wake turbulence and its effects on arriving/departing aircraft; VFR and IFR ATC procedures; runway incursions; using ATIS; NOTAMs; and criteria for runway selection. The course also provides essential information that is useful for pilots and other aviation professionals. Students are required to research an aviation topic on ATCT operations in the NAS.
Prerequisites: AT 305.

MSA 521  Professional Pilot Operations I  1 Credit
In this course the student will demonstrate knowledge of professionalism as it pertains to the FAA certificated private pilot. The student will attain FAA certification as a private pilot with airplane single engine land ratings and will complete a project or other deliverable demonstrating an understanding of professionalism as a private pilot.
Corequisites: AS 121 and FA 121.

MSA 531  Robotics and Control  3 Credits (3,0)
The purpose of this course is to analyze the concepts of modeling, design, planning, and control of robotic systems. The student will evaluate robotics and control design decisions specific to unmanned systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems. Course topics include robotics foundations in kinematics, dynamics, control, motion planning, trajectory generation, programming, telemetry, sensor integration, remote operation, and design. Course applications include task and motion planning for utilization within unmanned system technology.

MSA 532  Professional Pilot Operations II  1 Credit
In this course the student will demonstrate knowledge of professionalism as it pertains to the FAA certificated instrument pilot. The student will, depending on their flight track; attain either as FAA instrument rating on their private pilot single engine certificate or an FAA multi engine and instrument rating on their private pilot certificate. The student will complete a project or other deliverable demonstrating an understanding of professionalism as an instrument rated private pilot.
Prerequisites: MSA 521 Corequisites: AS 221 and FA 221.

MSA 533  Unmanned Aerospace Systems  3 Credits (3,0)
This course offers a conceptual approach to overall system design of unmanned aircraft and spacecraft systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems. Course will include the concepts of communication systems, payload systems, control stations and related systems, vehicle specific systems, and support systems. The requirements for system architecture development and conceptual level assessment of major system elements will be examined as they relate to use in industry. The major system elements will be evaluated from a systems engineering perspective to include consideration for cost and weight estimation, basic aircraft performance, safety and reliability, lifecycle topics, vehicle subsystems, and system integration.

MSA 534  Application of Unmanned Systems  3 Credits (3,0)
This course prepares students to understand the application of unmanned systems and their respective elements and technology to the operational domains, including atmospheric, exo-atmospheric, ground, and maritime environments. It includes applications, business cases, selection criteria, limitations and constraints, and ethical, safety, and legal considerations. Students will research, appraise, and recommend unmanned system tasking, environmental operational requirements, and system collaboration opportunities.
MSA 543 Professional Pilot Operations III  1 Credit
In this course the student will demonstrate knowledge of professionalism as it pertains to the FAA certificated commercial pilot with airplane multi engine ratings. The student will attain an FAA commercial pilot certificate with airplane multi engine land ratings. The student will complete a project or other deliverable demonstrating an understanding of professionalism as a commercial multi engine pilot.
Prerequisites: MSA 532
Corequisites: AS 321 and (FA 321 and FA 323) or (FA 324 and FA 326)

MSA 550 Aviation Education Foundations  3 Credits (3,0)
This course assists in developing contexts and concepts in which educational problems and issues may be understood, particularly the role of aviation in education. Emphasis is placed on aviation education and its historical and philosophical foundations.

MSA 552 Introduction to Research Methods and Statistical Analysis  3 Credits (3,0)
An Introduction to Research Methods and Statistical Analysis is designed to provide graduate students with a foundational overview of quantitative and qualitative inquiry and research methods. The course will provide an overview of the important concepts of research design, data collection, statistical and interpretative analysis, and final report presentation. Special emphasis is placed on the selection of appropriate methodologies for a variety of problem solving situations. Students will gain foundational prerequisite knowledge and skills to perform the basic computations associated with descriptive, parametric and non-parametric inferential statistics including: scales of measurement, variability, central tendency, z tests, t tests, correlational testing, analysis of variance (ANOVA), and post-hoc methods.

MSA 590 Graduate Seminar  1-3 Credit
A study of the most current advancements in a particular field of study as determined by the instructor of the course. The course has a different topic each term depending on the varied interests of the students, the graduate faculty, or the research requirements of the Aeronautical Science department.

MSA 601 Applications in Space: Commerce, Defense, and Exploration  3 Credits (3,0)
The scientific, military, and commercial interests in international and domestic space programs are examined throughout the history of space flight. The needs of commercial space endeavors and methods of expanding space technology into manufacturing are contrasted to the importance of scientific exploration, and the requirements of military space operations. The justification, development, and costs of scientific exploration programs, defense-related projects, and commercial endeavors are used to study the evolution of space missions and the development of future programs.

MSA 602 The Air Transportation System  3 Credits (3,0)
Air Transportation is a complex and rapidly evolving industry that plays a substantial role in global and national economies and in efforts to improve environmental quality and promote sustainable development. Major components include the human, technological, environmental and operational aspects of airports, airspace, air traffic management, aircraft and aircraft component manufacturing and design, airlines, and other airspace users. This course is foundational for the Master of Science in Aeronautics degree and focuses on the complex global air transportation system infrastructure, its strengths and vulnerabilities, and the influences by and impacts to global and national economies, environmental sustainability, and technological advancement.

MSA 604 Human Factors in the Aviation/Aerospace Industry  3 Credits (3,0)
This course presents an overview of the importance of the human role in all aspects of the aviation and aerospace industries. Emphasis is on issues, problems, and solutions of unsafe acts, attitudes, errors, and deliberate actions attributed to human behavior and the roles supervisors and management personnel play in these actions. Students examine the human limitations in the light of human engineering, human reliability, stress, medical standards, drug abuse, and human physiology. Discussions include human behavior as it relates to the aviator’s adaptation to the flight environment, as well as the entire aviation/aerospace industry’s role in meeting the aviator’s unique needs.
MSA 608  Aviation/Aerospace Accident Investigation and Analysis  3 Credits (3,0)
This course covers all aspects of the aircraft accident investigation process starting with preparation for investigation through report writing. Particular emphasis is placed on the study of human factors connected with flight and support crew activities in aviation operations. The course provides students with knowledge of the process of investigating accidents and incidents in an aviation organization. A critical analysis of selected aircraft accidents and an evaluation of causal factors are covered.

MSA 609  Aircraft Maintenance Management  3 Credits (3,0)
This course features a detailed analysis of commercial air carrier and general aviation aircraft maintenance that includes regulation, organization and structure, capabilities and limitations, maintenance levels, inspection and reporting requirements, and prevention and correction inspections. Case studies of typical and unique maintenance scenarios are utilized. A major course objective is to heighten awareness of the critical interface of maintenance with flight, supply, and training activities. This course features a detailed analysis of commercial air carrier and general aviation aircraft maintenance that includes regulation, organization and structure, capabilities and limitations, maintenance levels, inspection and reporting requirements, and prevention and correction inspections. Case studies of typical and unique maintenance scenarios are utilized. A major course objective is to heighten awareness of the critical interface of maintenance with flight, supply, and training activities.

MSA 610  Applied Aviation Safety Programs  3 Credits
This course covers the U.S. proactive voluntary programs that are part of the Federal Aviation Administration ? National Aeronautics and Space Administration (FAA-NASA) integrated safety research plan, as well as the voluntary aviation safety information sharing in the air carrier industry. Air Traffic Control (ATC) performance monitoring programs such as the Performance Data Analysis and Reporting System (PDRS) and the Air Traffic Safety Action Plan (ATSAP) complement programs such as Flight Operations Quality (FOQA) and Aviation Safety Action Plan (ASAP), which compile air carrier data. Programs used by carriers such as the Advanced Qualification Program (AQP) and Line Operations Safety Audit (LOSA) address discovered threats and add to the synoptic review. Organizational safety includes the Individualized Education Program (IEP) and the Voluntary Disclosure Reporting Program (VDRP). Confidentiality and protection of the data, as codified in Part 91 for ASRS and later in Part 193, are integral to the success of the programs.

MSA 611  Aviation/Aerospace System Safety  3 Credits (3,0)
This course emphasizes the specialized integration of safety skills and resources into all phases of a system’s life-cycle. Accident prevention, beginning with systems engineering together with sound management, are combined in this course to enable the student to fully comprehend their vital roles in preventing accidents. The total program, from basic design concepts through testing, maintenance/ systems management, and operational employment, is fully examined and evaluated.

MSA 613  Airport Operations Safety  3 Credits
A study of airport operations safety as applied to day-to-day operations. A review and analysis of all federal regulations applicable to operations and safety are conducted.

MSA 614  Advanced Aviation/Aerospace Curriculum Development  3 Credits (3,0)
This course will investigate the traditional manner of curriculum development and then proceed to prepare an instructional framework for a variety of aviation and aerospace instructional programs.
MSA 616  Leadership and Critical Decision Making in the Aviation Industry  3 Credits (3,0)
This course examines practical leadership skills and applications for aviation leaders. Students will understand the complexity of effective leadership, the source of knowledge about leadership in aviation organizations, and the limitations of this knowledge. Through the use of case studies in Air Traffic Management, Aviation Logistics, Aviation Maintenance and Aviation Production and Procurement, students will analyze leadership in aviation, critical decision making concepts and apply learned concepts to resolve problems in the industry. Goals: This is a graduate-level course in the Master of Science in Aeronautics degree program. This course is designed to give students in the Air Traffic Management Aerospace Operations and Aerospace Management, and other related specializations a practical and comprehensive understanding of leadership theories and practice as well as critical decision making processes that can be applied in government FAA organizations and the aviation/aerospace industry.

MSA 617  En route Radar Operations  3 Credits
This course expands on the skills, knowledge, and abilities the student has acquired in previous ATC classes. This course presents more demanding and complex traffic scenarios that require higher level performance and decision-making skills and prepares the student for initial training in any ATC specialization. Students will also gain an appreciation for the challenges of implementing large-scale changes in the National Airspace System. Upon successful completion of this course, students will demonstrate the knowledge and technical aptitude required for entry-level qualification as an air traffic control specialist. Students will demonstrate their ability to research, analyze, prepare, and present a paper in class that addresses a problem or question derived from the FAA's National Airspace System Capital Investment Plan. Problems will be analyzed through assignments and discussion.

MSA 618  En route Non-Radar Operations  3 Credits
This course introduces students to the non-radar procedures and minima prescribed in FAAH 7110.65 and builds upon knowledge gained in prerequisite courses, all in a simulated environment. Training includes the vertical, lateral, and longitudinal separation of aircraft in the departure, en route, and arrival phases of flight. Phraseology, strip marking, instrument and visual approaches, and the coordination procedures necessary to complete these functions are included in the simulated ATC scenarios. Students will demonstrate their ability to research, analyze, prepare, and present a paper in class that addresses a problem or question derived from the FAA's Next Generation Air Transportation System (NGATS).

Prerequisites: AT 305 and AT 401 and MSA 617.

MSA 619  Airport Certification and Operations Safety  3 Credits (3,0)
This course covers the essential skills and methodology needed to plan and manage an effective aviation safety program. Emphasis is placed on understanding the principles of risk management, and the principles, tools, and techniques used in a Safety Management System. Methods to achieve enhanced safety, moving beyond mere compliance with regulatory requirements are studied.

MSA 620  Air Carrier Operations  3 Credits (3,0)
This course is an overview of air carrier operations from the viewpoints of the cockpit flight crew, cabin crew, operational specialists, managers, and dispatchers. Topics include airline history, organization, crewmember requirements, training programs, duty time, aircraft airworthiness, dispatch, flight operations, and maintenance. Air carrier operational problems, both domestic and internationally since deregulation and 9/11, will be explored.

MSA 621  Aviation/Aerospace Safety Program Management  3 Credits (3,0)
This course covers the essential skills and methodology needed to plan and manage an effective aviation safety program. Emphasis is placed on understanding the principles of risk management, and the principles, tools, and techniques used in a Safety Management System. Methods to achieve enhanced safety, moving beyond mere compliance with regulatory requirements are studied.
MSA 622 Corporate Aviation Operations 3 Credits
The establishment and operations of a corporate flight department are examined along with the procedures and techniques generally accepted as standards by professional corporate flight operations. Included is a practical view of the corporate aviation mission of management mobility and use of the resources available to accomplish it.

MSA 628 Data Analytics for Aviation Safety 3 Credits (3,0)
Proactive use of data analytics to identify operational hazards and risks to accidents in aviation; identification of data sources such as data for accident investigation and flight safety databases; applications of flight data management software to analyze and depict flight profiles, techniques for processing, analyzing, and interpreting various types of aviation-related data, such as FOQA, and the potential use of various data for predictive safety; intervention recommendations based on data analysis.
Prerequisites: MA 540.

MSA 632 Unmanned Systems Command, Control, and Communications 3 Credits (3,0)
This course provides a detailed examination of the command, control, and communication (C3) of unmanned systems. The student will examine and evaluate elements and components, interoperability, human factors, operator controls and interactions, situational awareness, teaming, supervisory control, infrastructure, and considerations associated with C3. Course applications include identifying current unmanned system C3 issues, recommending strategies or solutions to address issues, and evaluating appropriate C3 elements, components, or technology to support unmanned system missions and tasks.

MSA 636 Advanced Aviation/Aerospace Planning Systems 3 Credits
Planning and decision-making techniques and strategies used in the aviation industry are emphasized. The types and sources of data needed for decisions about route development and expansion, fleet modernization, and new markets are examined. The methods of collecting, analyzing, and applying the data through computer applications, modeling, heuristic, value theory, and payoff tables are studied. The limitations and problems associated with strategic planning are discussed.

MSA 637 Unmanned Aerospace Systems Operations and Payloads 3 Credits (3,0)
This course focuses on the operational and payload capabilities of unmanned systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems, under a variety of mission standards. Operational course content includes typical software and hardware installations, launch and recovery procedures, normal and emergency procedures, and the appropriate selection of payload based upon mission requirements. Students will research current and future payloads and sensor systems utilized in unmanned aircraft and space systems. An exploration of multi-mission payload applications and requirements, including state-of-the-art, secure uplink and downlink telecommunications, signals intelligence, precision geo-location, airborne cellular network, and software-defined communications relay will be conducted.

MSA 638 Human Factors of Unmanned Aerospace Systems 3 Credits
This course is designed to present an overview of the importance of major human factors issues associated with unmanned systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems operations across a variety of platforms employed in both commercial and military operations. Emphasis will be placed on the differences and commonalities between occupied and unoccupied systems, with a focus on the human factor issues encountered by individual unmanned operators (pilots and sensor operators) as well as UAS teams. Students will become familiar with human factor issues surrounding unmanned launch, recovery, long duration operations, fatigue, human performance, Ground Control Station (GCS) design, use of automation, Situation Awareness (SA), Crew Resource Management (CRM), integration into the National Air Space (NAS), attitudes and perspectives of both government agencies and public entities, use of technology to compensate for no-pilot-onboard, and regulatory issues and solutions. Discussions of human capabilities and limitations as it relates to safe and effective operation of unmanned aircraft and space systems in a variety of commercial and military operations will be included.
MSA 641 Production and Procurement Management in the Aviation/Aerospace Industry 3 Credits
The evolution of an air carrier aircraft from design concept to delivery is examined from the perspectives of the purchaser, manufacturer, component manufacturer, operator, and certificator/regulator. The study of the process begins with demand analysis and continues through purchase contracting, manufacturing, marketing, certification, pre-delivery activities, and introduction into service.

MSA 642 International Aviation Policy 3 Credits (3,0)
This course addresses international management and aviation policy through the examination of major trends and issues challenging the aviation manager. Cross-cultural situations are evaluated from the perspective of interpersonal relationships in a diverse domestic and foreign environment, and in the context of evolving global trends. Strategic planning and negotiation are examined by defining the major tasks involved in organizing for international aviation, such as designing the organization and staffing. Managing workforce diversity is examined from culture-based and comparative perspectives, along with the function of control through the examination of effective control systems for overseas operations that ensure environmental interdependence through social responsibility and ethical behavior.

MSA 644 Integrated Logistics Support in Aviation/Aerospace 3 Credits (3,0)
This course is a study of the elements of a modern integrated logistics system. The organizational structure, inventory management, principles of warehousing, traffic management, international logistics, and quality management principles as they apply to logistics are key elements. The impact of just-in-time systems and quality management principles on physical distribution and their relationship with integrated package and cargo carriers, advancements in intermodal transportation, and the deregulation of the transportation industry are probed. The characteristics of system design to meet requirements of reliability, maintainability, and supportability are examined. The economic feasibility of a logistics system, including a life-cycle cost analysis, is explored. The explosion of computer technology and its effect on electronic data interchange capability as they influence logistics policies and practices are explored. The use of computer software to solve logistics problems is introduced.

MSA 654 Adult Teaching and Learning Techniques 3 Credits (3,0)
The major instructional strategies used in education with particular emphasis on higher education and adult learning are the core of this course. Multiple approaches as they relate to academic disciplines and grade levels are studied. The unique “flight deck classroom” environment will be discussed and evaluated.

MSA 661 Human-Computer Interaction 3 Credits
This course discusses the importance of good interfaces and the relationship of user interface design to human-computer interaction (HCI). Topics include interface quality and methods of evaluation; interface design examples; dimensions of interface variability; dialogue genre; dialogue tools and techniques; user-centered design and task analysis; prototyping and the iterative design cycle; user interface implementation; prototyping tools and environments; I/O devices; basic computer graphics; and color and sound.
MSA 662  Statistical Analysis for Aviation/Aerospace  3 Credits
This course includes the review, design, planning, analysis, and statistical interpretation of data from the aviation/aerospace industry. Students will build on statistical theory and learn advanced techniques that can be applied to problem solving, research analysis, and numerical interpretation of data from the aviation/aerospace industry. Students will learn to identify parametric and non-parametric statistics, develop correlation methods for linear and non-linear data, and statistical significance testing between samples and within samples. Students will undertake projects using computer programs for data that is derived or given. Statistical results will be presented in tabular, graphical, and numerical formats in accordance with the American Psychological Association style of writing.

Prerequisites: MSA 662.

MSA 670  Research Methods in Aviation/Aerospace  3 Credits
This course is designed to equip students with the theoretical techniques and skills needed to identify, apply, and solve qualitative and quantitative aviation/aerospace research problems. The course introduces the need for non-numerical data analysis and how part of a methodology can allow for in depth analysis of complex issues and relationships. Sampling and data gathering in a systematic manner is incorporated into research methodologies. The use of numerical analysis on qualitative data is covered to result in significance solutions and recommendations.

Prerequisites: MSA 662.

MSA 672  Systems Integration in Aviation/Aerospace  3 Credits (3,0)
This course examines the fundamental principles of systems integration in the context of aviation/aerospace applications. It explores issues related to effective planning, scheduling and assessment of technical progress, identifying the unique challenges of complex engineering systems and the "systems of systems" concept, and the ability to manage them in the aviation/aerospace domain. Key topics include systems integration methods and standards; concept definition, design and development; interface definition; requirements development and management; system architecture development; schedule analysis and management; risk assessment; system-of-systems resilience; and verification and validation. Prerequisite: MSA 662.

Prerequisites: MSA 662.

MSA 674  Project Management in Aviation/Aerospace  3 Credits (3,0)
This course examines the concepts and principles of project management in the aviation/aerospace industry. It addresses the ten knowledge areas of project management: integration, scope, time, cost, quality, human resources, communications, risk, procurement, and stakeholders. Process areas of initiation, planning, execution, control, and closure of projects are studied. Emphasis is placed on strategies for developing projects in an aviation/aerospace environment. Project management software is utilized as appropriate. Prerequisite: MSA 662.

Prerequisites: MSA 662.
MSA 691  Graduate Capstone Research Project  3 Credits (3.0)
The Master of Science in Aeronautics Capstone Course is a culminating effort of the student's entire learning experience in the MSA degree. It is a written document on an aviation/aerospace topic that exposes the student to the technical aspects of writing. This course is included in the MSA curriculum to provide the student with the opportunity to research a project of special interest, but not to the level of a thesis. This is a required course for those students who choose not to write a thesis. Students will work with designated faculty to formulate, develop, and complete the aviation/aerospace project. The completion of the Capstone Course is designed to document significant evidence that all Program Learning Outcomes have been met, and provides the student evidence of experience to show to current and prospective employers. The Capstone Course will be taken at the end of the student's degree program.
Prerequisites: MSA 662 and MSA 670.

MSA 696  Graduate Internship in Aeronautical Science  1-3 Credit
The Master of Science in Aeronautics (MSA) Internship is designed to give graduate students the opportunity to apply the knowledge, skills, and aptitude gained at Embry-Riddle in a professional environment while gaining real-world experience. The Internship incorporates professional experience with required weekly progress reports and a formal final report. The Internship allows the student to use an MSA Program Coordinator and Career Services approved internship (MSA 696) as a graduate course. In this option, MSA 696 (1-3 Credits) is combined with a corresponding Special Topics course (MSA-699, 1-2 Credits) in order to give the student a total of 3 Credits for this graduate course option.

MSA 699  Special Topics in Aeronautical Science  1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in an area of particular interest. A detailed proposal of the desired project must be developed and presented to the center director or department chair for faculty review and recommendation at least three weeks prior to the end of registration for a term.

MSA 700  Thesis  1-9 Credit
The Master of Science in Aeronautics Thesis is a culminating effort of the student's entire learning experience in the MSA program. It is a written document on an aviation/aerospace topic supervised throughout its preparation by the student's Thesis Committee. The Thesis demonstrates the student's mastery of the chosen topic and the research and results are of sufficient quality for publication.
Prerequisites: MSA 662 and MSA 670.

Mathematics (MA)

Courses

MA 502  Boundary Value Problems  3 Credits
Basic techniques of solving boundary-value problems of partial differential equations by employing the methods of Fourier series orthogonal functions, operational calculus including Laplace transforms, other integral transforms, and Cauchy's residue calculus. Applications to heat transfer, fluid mechanics, elasticity, and mechanical vibrations. Computer applications.
Prerequisites: MA 441.

MA 504  Theory of the Potential  3 Credits
Prerequisites: MA 502.

MA 505  Statistics I  3 Credits
Descriptive statistics and graphical depiction of data; confidence intervals and hypothesis testing for the mean, difference between two means, variance, ratio of two variances, proportion, and difference between two proportions; simple and multiple regression, including model development, inferences, residual analysis, outlier identification, and verification of assumptions; fundamental concepts of design of experiments; justification of linear models; construction and analysis of basic designs including one-way, block designs, and Latin squares; multiple comparisons.
Prerequisites: MA 243.
MA 506 Probability and Statistical Inference 3 Credits
Review of basic statistics concepts and introduce concepts in experiment design, including use factorial designs and an introduction to techniques for nonlinear or non-normally distributed data. Several nonparametric statistical techniques, including Mann-Whitney test and Kruskall-Wallis test. Advanced regression topics, including the use of transformations, weighted least squares regression. Use of statistical software packages.

MA 510 Fundamentals of Optimization 3 Credits
Overview of several important general types of optimization problems; development of mathematical models; linear programming; the simplex method; introduction to sensitivity analysis, networks; applications involving Maple and Excel.
Prerequisites: MA 243.

MA 520 Mathematical Programming and Decision-Making 3 Credits
A continuation of MA 510. Development of mathematical modeling techniques with an emphasis on integer programming, nonlinear programming, and multiple-criteria decision-making techniques; case studies from aviation/aerospace involving mathematical programming and decision-making.
Prerequisites: MA 510.

MA 540 Data Mining 3 Credits (3,0)
Data Mining is to gather, assimilate, and make sense of large amounts of data. The course includes techniques, algorithms, and open-source software to automatically classify data, to discover novel and useful patterns, and to help predict future outcomes. Prerequisites are Statistics, Multivariate Calculus, and familiarity with either Java, C/C++, MATLAB or R.

MA 541 Introduction to Mathematical Analysis 3 Credits
Careful treatment of the theoretical aspects of the calculus of functions of a real variable. Topics include the real number system, limits, continuity, derivatives, the Riemann integral, elementary notions of topology and metric spaces.

MA 543 Complex Variables 3 Credits
Algebra of complex numbers; complex functions, analytic functions; mapping by elementary functions; conformal mappings and their applications; additional topics may include complex integration, power series expansion.

MA 544 Data Visualization 3 Credits
Introduction to different aspects of information and scientific visualization, computer graphics and related mathematics concepts; representation of data graphically and using exploratory data analytics to gain understanding and insight into data; application software packages for interactive display and analysis of data.

MA 546 Application-Based Advanced Engineering Mathematics 3 Credits
This course is designed to present a general approach of introducing a survey of core advanced engineering mathematics topics. The general approach is sought is to present a representative physical circumstance then subsequently develop the mathematical representation (mathematical model) fitting that circumstance noting areas where approximations are needed and introduced or dismissals are applied.

MA 550 Partial Differential Equations 3 Credits
Physical models leading to partial differential equations. Fourier series and Fourier transforms. Solution of linear partial differential equations, including solutions of the wave, heat and Laplace’s equation.

MA 553 High Performance Scientific Computing 3 Credits
This course is an introduction to high performance computing in computational mathematics and sciences with practical applications. The course provides an overview of parallel computing and study of program efficiency on high performance computers. It concentrates on the two major parallelization paradigms: shared-memory parallelization with OpenMP and distributed-memory parallel programming with MPI. The main focus of the course will be on applications of parallel computing in the sciences (Engineering, Physics, Mathematics, etc.).
Prerequisites: MA 305 or MA 348.
MA 588 Numerical Methods in Fluids 3 Credits
This course explores the theory and applications of numerical methods in fluid mechanics. The topics covered will include numerical methods for incompressible flows; primitive variable and vorticity stream function on formulation; numerical treatment for inviscid and viscous flows, including restricted to incompressible flow. Emphasis will be placed on numerical methods based on finite difference, finite volume, or finite element formulations.

MA 605 Statistical Quality Analysis 3 Credits
Fundamental concepts of statistical quality control, including Shewhart charts, cusum charts, EWMA charts, multivariate charts, tolerance limits, and capability analysis. Further development of concepts in statistical design of experiments including use of factorial designs, fractional factorial designs, and use of central composite designs. Several nonparametric statistical techniques, including sign test, signed rank test, rank-sum test, Kruskal-Wallis test, runs test, and Kendall's Tau. Advanced regression topics, including the use of transformations, weighted least squares regression, and detection of influential points. Throughout the course, industrial applications will be emphasized, including the use of several case studies.
Prerequisites: MA 505.

MA 610 Multivariate Optimization 3 Credits
Multiple objective optimization with an emphasis on response surface methodologies and goal programming; inclusion of group decision-making techniques in model development; case studies from aviation/aerospace emphasizing multivariate model development, and determination of optimal solutions.
Prerequisites: MA 520 and MA 605.

MA 615 Data Driven Modeling 3 Credits (3,0)
Methods for complex systems & big data with emphasis on data driven modeling, model validation, and simulation; dynamic system and agent-based modeling, Monte Carlo, Markov chain, data fitting, data transformations for natural language processing and image processing; advanced data mining techniques such as cost sensitive machine learning, data compression, feature selection, and deep learning; hands- on experience on software tools such as R, MATLAB, and Python, to solve and evaluate solutions to data- enabled research problems.
Prerequisites: MA 540 and CS 540.

MA 625 Computing for Data Compression, Image and Signal Processing 3 Credits (2,1)
Study of algorithms to perform linear algebra operations, matrix operations, and numerical approximations, as a foundation to understand electrical engineering and computer science concepts. Integration with other disciplines through applications in data compression, signal processing, image processing, telecommunication, and computational finance. Arithmetic complexity, accuracy, stability, and performance of algorithms in connection to numerical linear algebra problems.

MA 630 Complex Networks and Applications 3 Credits (2,1)
Introduction to complex network theory and its applications in big data system identification, and in capturing and exploring connections at the petabyte level of information in physics, biology and social sciences; basic graph theory and foundations of statistical physics with applications to real world networks; network models such as small world networks, scale free networks, spatial and hierarchical networks; network visualization techniques and complex network tools.
Prerequisites: MA 540.

MA 680 Data Science Capstone Project 3 Credits
Apply the Mathematics, Statistics, and computer science knowledge to solving common problems in today’s business environment; more practical industrial techniques in data mining, visualization, and modeling to help meet deadlines; introduce practical challenges such as business problem assessment; analysis design; data collection and quality control; computer programming; analytical solutions; and technical communication.
Prerequisites: MA 540 and CS 540.

MA 690 Graduate Research Project 3 Credits
An applied problem on an aviation/aerospace topic that requires the use of optimization and/or quality-improvement skills.

MA 699 Special Topics in Mathematics 1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in an aviation area of particular interest. A detailed proposal of the desired project must be developed and presented to the department chair or center director for faculty review and recommendation, three weeks prior to the end of registration for the term.
MA 700 Thesis Research 1-9 Credit
Written and defended documentation of a research project conducted under the supervision of a faculty committee. The research must be at the level of a published paper in an appropriate journal, as determined by the faculty committee.

ME 501 Modeling Methods in Mechanical Engineering 3 Credits

ME 503 Unmanned and Autonomous Vehicle Systems 3 Credits
A systems-level overview of theory and practice of unmanned and autonomous vehicle systems, including hardware, software, and algorithm development. Topics include an overview of locomotion platforms (including land, air, and marine platforms), actuators and motion control, sensors and perception (including GPS, inertial, magnetic, active ranging, computer vision, photo detectors, and encoders), planning and navigation (including reactive, deliberative, and hybrid approaches to autonomy), and shortest path algorithms (including the Dykstra and A* algorithms). Case studies, readings from current literature, and guest lectures present best practices in the field.

ME 506 Design for Manufacturing and Assembly 3 Credits

ME 508 Hybrid and Electric Vehicles 3 Credits
The emphasis of the course is on physical system modeling and simulation of hybrid and electric automotive power systems. This includes conventional powertrains as a baseline and subsequent comparison to HEVs, PHEVs, and BEVs or EVs. Modern advanced internal combustion engines and powertrain components including torque converter, clutch, transmission, and differential final drive will be presented and modeled in detail. Hybrid, Plug-In Hybrid, and Battery-Electric power system simulation also includes electrical and electro-mechanical components such as energy storage systems (flywheels, super caps, batteries), inverters, generators, traction motors, and the associated low-level and supervisory-level control systems. Electro-chemical battery packs with associated cooling system will also be discussed. EPA drive cycles will be studied including industry-standard city and highway cycles FTP, UDDS, US06, HWFET, and others. Hybrid electric classifications such as micro-, mild-, and full-hyrbrids will be discussed along with the basic topologies of series, parallel, series-parallel, and other power-split arrangements. Power management strategies for each will be presented. Battery-electric vehicles (BEVs), or EVs will be discussed and optionally simulated in detail. Range, MPGGE, fuel economy (mpg), emissions (g/mi.) will all be discussed, compared, and contrasted with current vehicles on the market. Hydrogen fuel cells and Fuel Cell Vehicles (FCV) vehicles will be discussed although with less emphasis than HEV, PHEV, and EVs.
ME 510  Micro-Electrical Mechanical Systems  3 Credits
This course introduces modeling and design fundamentals for micro-electro-mechanical systems (MEMS). Basic principles covered include reviews of electrical and mechanical concepts, static-dynamic mechanical MEMS beams with emphasis on capacitor-based sensing and actuation, electromagnetic modeling of MEMS switches. Applications covered include pressure sensors, accelerometers, gas microsensors, and microfluidic systems.

ME 514  Introduction to the Finite Element Method  3 Credits (3,0)

ME 520  Sensor Processing with Applications  3 Credits
This course applied sensor processing in the context of robotic and mechatronic systems. Topics include signal conditioning and filtering, system identification, and controller design and implementation. Advanced techniques covered include Kalman filtering, neutral networks, and other types of adaptive and learning control systems. Students collect data and implement sensor-processing techniques using software tools such as LabVIEW and MATLAB. A background in instrumentation, signal processing, and control is recommended.

ME 521  HVAC Systems  3 Credits
Application of thermodynamics, heat transfer, and fluid flow to understand the psychometric performance of systems and equipment; evaluating the performance characteristics of various types of HVAC systems including refrigeration/chiller equipment, cooling coils, heat exchangers, ducts, fans, heat pump and open air cycles for aircrafts. Students entering this course should have a background knowledge of Thermodynamics and Heat Transfer.

ME 522  Mechanical System Design  3 Credits
This course provides students with the opportunity to learn the theory of 3D solid modeling through heuristic problem solving. Students will learn how to leverage the appropriate combination of CAD design principles to solve a range of engineering design challenges. A background in design/machine design is recommended.

ME 523  Modeling and Simulation of Linear Dynamic Systems  3 Credits
The purpose of this course is to provide graduate students with fundamental modeling skills for creating mathematical models of multi-domain engineering systems which can be simulated on computer for system performance analysis and control system design. This course will cover modeling, analysis, and simulation of dynamic systems. A variety of tools will be introduced including transfer functions, state space equations, block diagrams, and bond graphs. Analysis techniques including vector analysis, matrix theory including vector and matrix norms, eigenvectors and eigenvalues, matrices as operators, and the solution of systems of linear equations are introduced. Additional topics include linearization of dynamic systems, input-output description of systems, and analysis of observability, controllability and stability. The application examples range from electrical circuits, to fluid, thermal systems and electro-mechanical systems, to aircraft and spacecraft. Concepts from discrete time systems are also introduced. A background in linear algebra is recommended.

ME 525  Structural Design Optimization  3 Credits
An introduction to numerical and graphical optimization techniques associated with structural design and analysis. This course will include linear and discrete methods, approximate techniques, sensitivity analysis, and optimality criteria. Methods will be applied to structures, such as trusses, frames and composite laminates. Emphasis will be placed on modern optimization techniques linked to numerical methods. A background in solid mechanics, structures and/or machine design is recommended.
ME 527 Modern Control Systems  3 Credits
This course covers modern control theory using continuous time state-space system models and implementations. State space representation is introduced and controllability, observability, and stability are reviewed. Control structures such as PID and state feedback controllers are introduced and applications are discussed. Continuous to discrete time conversions are discussed and the z-transform is introduced. Advanced topics such as model predictive control, adaptive control, robust control, and Kalman filters may be introduced at the discretion of the instructor. A background in classical controls and modeling of dynamic systems is recommended.

ME 530 Advanced Kinematics and Mechanics  3 Credits (3,0)
This course studies modeling, design, and analysis of mechanisms with a focus on robotic systems. Course topics include development of kinematic and dynamic models of motion, the Jacobian, coordinate transformations, graphical and analytical design of mechanisms, and integration of actuators and sensors. Application studies will include wheeled, tracked, walking, and biologically inspired robotic systems. The course will include several hands-on projects including a final design project.

ME 540 Mechanical Engineering Practicum  3 Credits
This course provides students with a supervised applied practicum experience. Students are expected to work collaboratively in groups to complete a specific project under the supervision of a faculty member and organizational sponsor.

ME 542 Biofluid Mechanics  3 Credits (3,0)
Principles and foundations of fluid mechanics and computational methods applied to the human cardiovascular system. Anatomy and modeling of arterial vessels; blood flow in arteries; and coupled fluid-structure interactions in vasculature. Introduction to Bioheat transfer and blood perfusion.

Prerequisites: MS Mechanical Engineering students.

ME 544 Biomechanics  3 Credits
Fundamentals and principles of biomechanics. An overview of musculoskeletal anatomy; application of statics to biomechanics; biodynamic analysis of forces in human function and movement as well as estimation of energy and power requirements in human activity; stress-strain analysis in biological tissues; viscoelastic modeling of biological tissues; and biomaterials used in different biomedical applications.

ME 546 Structural Crashworthiness and Impact Safety  3 Credits (3,0)
Impact mechanics of ring and ring systems; thin-walled structures under transverse and axial loading conditions; finite element method for impact simulations; structural impact and inertia effect; tearing damage; cylindrical and spherical shells subjected to impact; mechanical behavior of cellular solids (honeycomb, polymeric and metal foams etc.); impact behavior of composite laminates and sandwich structures; applications of impact analysis in the auto industry.

ME 548 Introduction to Continuum Mechanics  3 Credits (3,0)
Analysis of stress and deformation at a point. Development of the basic equations of a continuous medium by applying the basic laws of conservation of mass, linear momentum, moment of momentum and those of thermodynamics. Study of constitutive axioms and constitutive relations for fluids and solids. Specialization of the field equations to simple boundary-value problems of solid mechanics and fluid mechanics with simple solutions.

ME 560 Biosolid Mechanics  3 Credits (3,0)
Fundamentals and principles of solid mechanics applied to biological systems. Stress-strain analysis of living tissues subjected to static and dynamics loading: arteries, skin, heart muscle, skeletal muscle, tendon, cartilage, and bone. Mathematical and analytical models, constitutive formulations, viscoelastic modeling, and biomaterials used in different biomedical applications.

Prerequisites: ME 444 or Instructor Consent.
ME 601  Advanced Modeling Methods in Mechanical Engineering  3 Credits (3,0)
Development of a Method of Weighted Residuals (MWR) foundation framework for the formulation of finite differences, finite volumes, finite elements, boundary elements, and Meshless collocation methods. Principles and fundamentals of radial-basis functions (RBF) and their application to global and local interpolation, least-squares, and differentiation. Boundary element method (BEM) and Meshless method (MM) formulation and their application to heat transfer, fluid flow, vibrations, and solid mechanics.

ME 610  Automation and Additive Manufacturing  3 Credits
Conceive, design, and implement a product using rapid prototyping (also called additive manufacturing or direct digital manufacturing) methods and computer-aided tools. The course will covers the design process, problem solving methods, interdisciplinary teamwork, current industrial practice, and manufacturing process capabilities. The course emphasizes a hands-on learning approach to additive manufacturing
Prerequisites: ME 522.

ME 611  Computational Heat Transfer and Fluid Flow  3 Credits
This course will cover modeling thermal-fluid science problems using finite-element methods and computational fluid dynamics. Topics will include heat conduction, heat convection, conjugate heat transfer, and advanced meshing.
Prerequisites: ES 403 or AE 508.

ME 612  Computer Integrated Manufacturing  3 Credits (3,0)
Review of the Design for Manufacturing and Assembly principles. This course covers the integration of 3D solid modeling theory and the principles of automation in multiple manufacturing environments. Student will create 3D solid models and produce actual components utilizing additive and subtractive manufacturing. Additional topics will cover manufacturing drawings, geometric dimensioning and tolerancing (GO&T), machine tool operations, and simulations.

ME 613  Advanced Model-Based Control Design  3 Credits
This course provides an introduction to rapid control prototyping and hardware-in-the-loop (HIL) simulation. This course is intended to familiarize students with advanced tools for rapid prototyping and HIL simulation (e.g., Simulink Coder and Real-time Windows Target). The topics covered in the course include critical issues associated with real-time execution of models. A series of projects will be included in the course to provide hands-on experience of using the advanced tools. Students should have a background including graduate-level control systems prior to entering this course.
Prerequisites: ME 527.

ME 614  Multidisciplinary Design Optimization  3 Credits
Review of Structural Optimization and Finite Element Analysis. Introduce students with the formulation and basic understanding of parametric optimization for multidisciplinary optimization study. Formulation of the multidisciplinary design optimization and multi-objective optimization problems. Introduce concepts related to design of experiments, sensitivity, genetic algorithms, response surface based approximations, robustness and reliability studies. Integration of various disciplines (Structures, Fluids, Thermal, Manufacturing and Cost) in real-time analysis into a multidisciplinary optimization problem. Multidisciplinary course project with use of computer-aided engineering tools (for example: CATIA, FEMAP, NASTRAN, ANSYS CFX, SEER and HEEDS).

ME 615  Pattern Recognition and Machine Learning  3 Credits
This course teaches students many concepts, techniques and algorithms in machine learning and pattern recognition with a focus on statistical inference as it provides a foundation for most of the methods covered in this course. Course fields of interest include classification, regression and reinforcement learning. Specific topics that will be covered in the course will include foundational methods such as Bayesian theory as well as modern implementations such as support vector machines and hidden Markov models.
Prerequisites: ME 520.
ME 616 Design and Manufacturing of Biomedical Devices 3 Credits
Manufacturing processes and life cycle design for the biomedical industry. Selection of biomaterials for biomedical devices. Manufacturing processes (maching, casting, molding, stamping, forming, forging, extrusion and 3-D printing) with biomedical products-related case studies. Design for manufacturing and product assembly. Quality and lean six sigma concepts in manufacturing. Biomedical applications include traboidal stents, biopsy micro-forceps, micro-needle arrays, wrist implants, spinal spacers, and fixtures. Simulations using computer graphics software. Design and manufacturing course project.

ME 618 Vehicle Safety and Occupant Protection 3 Credits (3,0)
Overall of automotive safety; Frontal crash safety design and regulations; Side crash safety design and regulations; Rollover safety and regulations; Occupant kinematics, restraint systems, crash pulse; Injury databases and injury assessment; Interior impact; Energy dissipation management; Numerical simulations of vehicle crash.
Prerequisites: ME 503.

ME 620 Advanced Vehicle Dynamics 3 Credits
All concepts necessary to create a physics-based ground vehicle mobility simulator; 3D rigid body motion with Newton-Euler equations of motion; 3D orientation kinematics using Euler Angles, Euler parameters, or quaternions as necessary; 3D kinematics to relate track or tire contact forces to vehicle position and velocity over a 3D terrain; the basics of soft-soil terramechanics if modeling off-road terrain; Pacejka tires models if modeling on-road tire contact patch forces; Optimum G and Optimum K software use to leverage exerimental on-road tire and race car chassis data; 3D visualization and soft-real-time computing for 3D vehicle and terrain visualization. Automated path navigation and waypoint following for simulating virtual laps around pre-defined paths.

ME 622 Path Planning and Navigation 3 Credits (3,0)
A detailed investigation of current practices and techniques used for path planning and navigation of autonomous systems. Derivations of traditional path planning techniques (such as LPA* and anytime planning) as well as methodologies that make use of dynamic models (such as RRTs) will be discussed. Other course topics include multi-agent control, particle swarm optimization, object segmentation and characterization. The course includes readings from current literature, case studies and demonstrations to supplement material presented in class.
Prerequisites: ME 503.

ME 690 Graduate Research Project 1 3 Credits
Culminating effort of the student's MSME track learning experience. The student will complete a project that provides significant evidence of experience in their chosen MSME track. Students will work with designated faculty to formulate, develop, and complete the project. The completion of the Graduate Research Project is designed to document significant evidence that all Program Outcomes have been met, and provides the student evidence of experience to show to current and prospective employers. The GRP must be taken at the end of the student's degree program.
Prerequisites: ME 700A or SYS 560.

ME 692 Graduate Research Project 2 3 Credits
Culminating effort of the student's MSME track learning experience. The student will complete a project that provides significant evidence of experience in their chosen MSME track. Students will work with designated faculty to formulate, develop, and complete the project. The completion of the Graduate Research Project is designed to document significant evidence that all Program Outcomes have been met, and provides the student evidence of experience to show to current and prospective employers. The GRP must be taken at the end of the student's degree program.
Prerequisites: ME 700A or SYS 560 and ME 690.

ME 700 Graduate Thesis 1-9 Credit
A master-level research project in Mechanical Engineering conducted under the supervision of the student's advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.
ME 700A Research Methods 3 Credits
Establishing or advancing understanding of research through critical exploration of research language, ethics, and approaches. Language of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approaches; critical review literature, determine how research findings are useful in informing understanding of their environment (work, social, local, global); basics principles of program management.

ME 800 Dissertation 3-9 Credit (1-6,0)
A Ph.D.-level research project in Mechanical Engineering conducted under the supervision of the student's advisor and thesis committee. Submission of a final report, approved by the dissertation committee, and an oral defense of the research work are required for dissertation credits to be earned.

Software Engineering (SE)

Courses
SE 500 Software Engineering Discipline 3 Credits
This course introduces students to the concepts and methods for disciplined software engineering processes. Students learn about and practice individual planning, tracking, analyzing, and managing of their time and defects, to fit the needs of small-scale program development. Students also study and use a team project process. The course provides a framework for the application and analysis of managed software engineering practices. Also discussed are the latest common and practical processes used in industry. Students will work individually and as a team to complete the course assignments.

SE 505 Model-Based Verification of Software 3 Credits
This course is concerned with engineering practices that use formalized models as a basis for analyzing software artifacts. The course covers the key software engineering skills required, surveys a variety of techniques for model building and analysis, and includes sample problems and real-world systems for discussion and analysis. Applications of the techniques in the requirements, design, and coding phases of software development are investigated.

Corequisites: SE 500.

SE 510 Software Project Management 3 Credits
This course addresses management considerations in software systems development. It provides advanced material in software planning mechanisms for monitoring and controlling projects, and leadership and team building.

Corequisites: SE 500.

SE 520 Formal Methods for Software Engineering 3 Credits
A study of mathematical logic and proof techniques, discrete structures, and other mathematical topics that are used in software engineering; the use of formal methods in software specification; and an overview of the use of formal methods throughout the software life-cycle.

SE 530 Software Requirements Engineering 3 Credits
This course is concerned with the development, definition, and management of requirements for a software system or product. Topics include the software requirements process, requirements elicitation, requirements analysis, requirements specification, requirements verification and validation, requirements management, and requirements standards and tools. Students will participate in individual and group exercises related to software requirements engineering tasks.

Corequisites: SE 500.

SE 535 User Interface Design and Evaluation 3 Credits
This course provides an introduction to designing, implementing, and evaluating human-computer interfaces of various types. The theoretical foundation for designing interfaces is complemented by practical classroom exercises and the design and development of a prototype in a team-based setting using previously learned software engineering principles. Students will become acquainted with the literature related to user interface design and with the design of experiments for evaluating user interfaces.
SE 545 Specification and Design of Real-Time Systems 3 Credits
This course addresses basic concepts and methods used in software specification and the design of real-time systems. The characteristics of real-time systems and the role of software design in software development are explored. The course reviews software design methods specifically suited for real-time systems. Selected methods are analyzed and case studies are used to illustrate the design process. The course material may require research in real-time aspects of software design, laboratory experiments with software development tools and real-time development environment, and producing appropriate reports.
Prerequisites: SE 500.

SE 550 Current Trends in Software Engineering 3 Credits
Current techniques, methods, procedures, and paradigms of software engineering are studied. Students perform literature searches, collect data from software development experiments, and prepare written and oral reports on current software engineering practices.
Prerequisites: SE 500.

SE 555 Object-Oriented Software Construction 3 Credits
This course addresses the basic concepts of object-oriented software development. It provides an integrated view of subjects related to the different phases of software development using object-oriented techniques. The course covers object-oriented analysis and design (OOA/OOD), object-oriented programming (OOP), and object-oriented testing (OOT) techniques. Also covered in the course are object-oriented metrics and case studies in object-oriented software development.
Prerequisites: SE 500.

SE 565 Concurrent and Distributed Systems 3 Credits
The objective of this course is to teach principles of software development for concurrent and distributed systems. Specification, design, implementation, and performance evaluation techniques for concurrent and distributed applications will be presented and complemented by examples and practical exercises. The various paradigms used for concurrent and distributed systems, including high performance clusters, along with the implementation issues for each will be discussed. A survey of languages suitable for implementing concurrent solutions will also be covered.
Prerequisites: SE 500.

SE 575 Software Safety 3 Credits
The objective of this course is to teach principles of software development for safety and mission critical systems. Safety-related specification, design, and implementation techniques are described and illustrated by examples and practical exercises. Principles and practices of safe software development, including a survey of programming language and operating system issues for implementing safety-related software are discussed. The course discusses safety requirements, hazard and risk analyses, fault tolerance, basics of software reliability, and issues of verification, validation, and certification. Various safety standards and guidelines across application domain and selected tools supporting safety assurance of software products are introduced. The course material may require research in development of safe systems, laboratory experiments with tools, and producing appropriate reports.
Prerequisites: SE 500.

SE 580 Software Process Definition and Modeling 3 Credits
This course provides students with the fundamental knowledge for software process definition and modeling. Software process content includes a framework for process definition and modeling, process evaluation, enactment of processes, process tailoring, and description of the process properties. Course projects include analysis of existing process and design and modeling of new processes.
Prerequisites: SE 500.
SE 585 Metrics and Statistical Methods for Software Engineering 3 Credits
This course is concerned with the topics of software measurement, statistical tools and methods, and applied experimental design in software engineering. Students will be introduced to the principles and concepts relevant to measurement in software engineering, including the representational theory of measurement, collection, analysis, and validation of data. Also studied are frameworks such as Goal-Question-Metric and Quality Function Deployment paradigms for guiding measurement efforts. Also explored are the concepts of experimental design, analysis of experiments, model building, ethics, and presentation of experiments.
Prerequisites: SE 500.

SE 590 Graduate Seminar 3 Credits
This course is a study of the current advancements in a particular field of software engineering, as determined by the instructor of the course. The course will focus on a different topic each term, depending on the varied interests of students, the graduate faculty, and the existing departmental research requirements.

SE 599 Special Topics in Software Engineering 1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in an area of particular interest. The student should submit to the department chair and graduate committee a detailed proposal of the desired project and identify a faculty sponsor.

SE 600 User Interface Design for Unmanned Systems 3 Credits
Introduction to user interfaces for unmanned systems. Approaches to human-system interactions for unmanned systems including graphical user interfaces, non-visual feedback (haptic, aural, etc.), gesture-based controls, voice-based controls, telepresence, and more. Design considerations (i.e. constraints and capabilities) for each technology area. Case studies of user interface technologies for real-world unmanned systems. Hands-on experience with one or multiple user interface technologies.

SE 610 Software Systems Architecture and Design 3 Credits
This course is concerned with the principles and concepts of engineering large software systems and programs. Software architecture is an abstraction of system details that helps in managing the inherent complexity of software systems development. Software architecture provides opportunities for early evaluation of user needs, analysis of requirements and design, and prediction of system properties. Architectural styles, views, notations, and description languages provide systematic frameworks for engineering decisions and design practices. The focus of the course is on advanced topics related to software architecture practices, technologies, and artifacts. Students participate in individual or group projects related to developing architectural representations of software systems.
Prerequisites: SE 530.

SE 625 Software Quality Engineering and Assurance 3 Credits
This course describes the overall approach to specifying software quality, achieving quality, and mapping a quality specification into a set of engineering activities. This course provides a framework for understanding the application of software verification and validation (V&V) processes and techniques throughout the software development life cycle. The course covers the economics of software quality and provides a guide to organizing a project to achieve quality both in terms of the software product and the software process.
Prerequisites: SE 530.

SE 655 Performance Analysis of Real-Time Systems 3 Credits
The objective of this course is to teach principles of performance analysis of computer systems, with a focus on real-time applications. Performance modeling and analysis techniques are described and illustrated by examples and practical exercises using elements of mathematical statistics. Principles and practices of software development to achieve required or optimal performance, including design analysis and assessment of the implementation in terms of works case execution time and schedulability, will be addressed. An actual project in instrumentation of software for performance evaluation is an essential element of this course.
Prerequisites: SE 500.
SE 660  Formal Methods for Concurrent and Real-Time Systems  3 Credits
The course includes study of the formal specification of reactive systems, temporal logic, and current research in the specification of concurrent and real-time systems. There is also discussion of verifying software designs based on formal specifications.

Prerequisites: SE 520.

SE 690  Graduate Research Project  3 Credits
This course provides the student with an opportunity to pursue a topic area of special interest. The Graduate Research Project is an individual investigation or software development effort culminating in a formal written report, requisite artifacts, and an oral presentation to the faculty. The focus is on an advanced topic in software engineering that may be theoretical or practical.

SE 696  Graduate Internship in Software Engineering  1-3 Credit
This course involves temporary professional or industrial work appointments made available to students enrolled in graduate programs at the University. An internship provides graduate students with an opportunity to extend their academic endeavors through the application of the theories and philosophies studied in the classroom to specific professional activities common to the workplace. Internships are academic/professional activities coordinated by the University between participating organizations and a graduate student.

SE 697  Software Engineering Practicum  3 Credits
The practicum is a capstone course that builds on the other core MSE courses. It consists of a faculty-mentored team software development project that extends from concept to delivery. All phases of the development life-cycle are included: requirements, architecture, detailed design, implementation, and verification and validation. Disciplined software engineering practices are used (for example, PSP, TSP, project management). Deliverables for the course are a validated functioning system, a comprehensive set of development artifacts, a final report, and a formal presentation.

Prerequisites: SE 510 and SE 555 and SE 610.

SE 699  Special Topics in Software Engineering  1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in an area of particular interest. The student should submit to the department chair and graduate committee a detailed proposal of the desired project and identify a faculty sponsor.

SE 700  Graduate Thesis  1-9 Credit
A master-level research project in Software Engineering conducted under the supervision of the student's research advisor and a thesis committee designated by the Department Chair. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credit to be earned.

Prerequisites: Graduate Student Standing and Department Chair permission.

SE 800  Dissertation  1-9 Credit
A doctoral-level research in Software Engineering including an oral defense and a written dissertation satisfying all doctoral degree program guidelines. The work is supervised by the student's advisor and dissertation committee. The approval of the dissertation committee is required to receive final dissertation credit.

Systems Engineering (SYS)

Courses
SYS 500  Fundamentals of Systems Engineering  3 Credits
This fast-paced course provides an overview of systems engineering in the development of multi-disciplined systems. Topics address definition of systems, roles, and qualities of system engineers, principles of systems thinking, and management of the total system life cycle (from birth to death). The basic framework spans user need and concept development, through development and deployment, and ultimately to phase-out and disposal. Emphasis is on the total system view including system requirements and their traceability, reliability, maintainability, system support, interfaces, cost, schedule, optimization, and trades as they affect total system performance, fulfillment of user needs, and impact the operational environment. The course also addresses ancillary concerns including characteristics of contract types, and legal and ethical considerations.
SYS 505  System Safety and Certification  3 
Credits
Concepts, principles, methods and process applied for development of safety-critical and mission-critical software-intensive systems. The issues of system safety, requiring additional analysis and design techniques, are discussed from the perspective of computer hardware and software. The course discusses the safety requirements, hazard and risk analysis, failure modes and effect analysis, fault tolerance, basics of hardware and software reliability, levels of integrity, nature of faults and redundancy, and issues of verification, validation and certification. Safety standards across application domains, including SAE, ARP4754 ARP4761 and RTCA DO-178C & DO-254 for safety considerations in development of aircraft systems are analyzed. The related certification roles, process, objectives, and activities are discussed. Selected software tools supporting safety and reliability assessment of hardware laboratory experiments with tools, and producing appropriate reports.

SYS 530  System Requirements Analysis and Modeling  3 Credits
This course is concerned with the development, definition, and management of requirements for system or product. Topics include the system requirements process, requirements elicitation techniques, alternative requirements analysis techniques, requirements specification, requirements verification and validation, requirements management, and requirements standards and tools. Issues such as stakeholder identification, risk analysis, trade off analysis as it relates to the requirements will be covered.

SYS 560  Introduction to Systems Engineering Management  3 Credits
This course addresses the fundamental principles of engineering management in the context of systems engineering and explores issues related to effective technical planning, scheduling and assessment of technical progress, and identifying the unique challenges of the technical aspects of complex systems and systems of systems and ability to control them. Topics will include techniques for life cycle costing, performance measurement, modern methods of effective engineering management, quality tools, quality management, configuration management, concurrent engineering, risk management, functional analysis, conceptual and detail design assessment, test evaluation, and systems engineering planning and organization, communication and SE management tools and techniques. The course covers an examination of processes and methods to identify, control, audit, and track the evolution of system characteristics throughout the system life cycle. The course includes the development of a Systems Engineering Management Plan, Integrated Master Schedule and/or Integrated Master Plan.

SYS 599  Special Topics in Systems Engineering  1-6 Credit
Students may elect to perform a special, directed analysis and/or independent study in the area of particular interest. The student should submit to the department chair and graduate committee, a detailed proposal of the desired project and identify a faculty sponsor.
SYS 610  System Architecture Design and Modeling  3 Credits
Concepts and techniques for architecting systems and the process of developing and evaluating architectures. Generating a functional, physical and operational architecture from a top level operations concept for the allocation and derivation of component-level requirements. Modeling and analysis approaches; the generation of analyzable architecture models for evaluating the behavior and performance of candidate system concepts. Interface design; architecture frameworks; enterprise engineering; design for reliability, maintainability, usability, supportability, producibility, disposability, and life cycle costs; validation and verification of systems architecture; the analysis of complexity; methods of decomposition and re-integration; trade-offs between optimality and reusability; the effective application of COTS; and practical heuristics for developing good architectures. Specialized areas of design and architecture may be addressed, such as spacecraft design, design of net centric systems, or smart engineering systems architecture.

SYS 625  System Quality Assurance  3 Credits
This course presents the managerial and mathematical principles and techniques of planning, organizing, controlling and improving the quality, safety, reliability and supportability of a system throughout the system life cycle. The course focuses on the importance of structuring and controlling integration and test activities. Topics include establishing a baseline control during the integration and test phases; cognitive systems engineering and the human-systems integration in complex systems environments; establishment of criteria for planning tests; the determination of test methods; subsystem and system test requirements; formal methodologies for measuring test coverage; sufficiency for test completeness; and development of formal test plans to demonstrate compliance. Also covered are methods of developing acceptance test procedures for evaluating supplier products. The quality related topics including fitness for use, quality costs, quality planning, statistical quality control, experimental design for quality improvement, concurrent engineering, continuous improvement and quality programs such as ISO 9001:2000, ISO 14001, CMMI, Malcolm Baldrige and TQM. Reliability related topics covered include reliability prediction using discrete and continuous distribution models. Supportability related topics include system supportability engineering methods, tools, and metrics and the development and optimization of specific elements of logistic support. Quality and safety is a key theme throughout the course.

SYS 660  Organizational Systems Management  3 Credits
This course introduces concepts of organizational management and leadership, which are approached from a systems and complex systems perspective to explain the behavior of systems. Focus areas will include strategic management, organizational transformation, and organizational environments. Models will be drawn from a variety of areas including marketing, finance, organizational behavior, and strategic and operational management.
SYS 690  Systems Engineering Project  3 Credits
This course consists of a project in systems engineering that the student will undertake at the conclusion of the academic coursework for this program. It will culminate in a written document on a project chosen and carried out by the student under the guidance of the student’s Capstone Project Committee. The project will be expected to demonstrate the student’s mastery of his topic, and must be of a quality suitable for publication.

SYS 700  Graduate Thesis  1-9 Credit (1-9,0)
A master-level research project in Systems Engineering conducted under the supervision of the student’s advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credit to be earned.

Unmanned and Autonomous Systems Engineering (UAS)

Courses

UAS 501  Introduction to Unmanned Aircraft Design  3 Credits
Broad overview of unmanned aircraft system (UAS) design. Survey major UAS sub-systems including airframe, propulsion, power, communication, embedded computer hardware/software, detect-and-avoid, automation, and ground control station. Literature and case studies exploring current engineering practices, technologies used, and past lessons learned. Culminates with development of design specification for a UAS given requirements specification and knowledge acquired in the course.

UAS 691  Unmanned and Autonomous Systems Capstone Design Project I  3 Credits
The Capstone Design Project courses provide a coherent and significant design experience resulting in fabrication of a prototype, and/or publication of refereed article. The emphasis will be on projects which require the synthesis of most of the topics emphasized by this degree including design of airframe, innovative propulsion systems, autonomy, guidance and navigation and control systems, payloads, networking, electronics, advanced manufacturing, as well as systems engineering and end-to-end integration of components and systems in meeting requirements and specifications.

UAS 692  Unmanned and Autonomous Systems Capstone Design Project II  3 Credits
The Capstone Design Project courses provide a coherent and significant design experience resulting in fabrication of a prototype, and/or publication of refereed article. The emphasis will be on projects which require the synthesis of most of the topics emphasized by this degree including design of airframe, innovative propulsion systems, autonomy, guidance and navigation and control systems, payloads, networking, electronics, advanced manufacturing, as well as systems engineering and end-to-end integration of components and systems in meeting requirements and specifications.

UAS 700  Thesis  1-9 Credit
A master-level research project in Unmanned and Autonomous Systems conducted under the supervision of the students advisor and thesis committee. Submission of a final report, approved by the thesis committee, and an oral defense of the research work are required for thesis credits to be earned.
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But that’s not all we do.


College of Arts and Sciences (p. 473)
Departments of Human Factors & Behavioral Neurology, Humanities & Communication, Mathematics, Physical Sciences and Security Studies and International Affairs.

College of Aviation (p. 480)
Departments of Aeronautical Science, Applied Aviation Sciences, Aviation Maintenance Science, School of Graduate Studies, Flight.

David B. O'Maley College of Business (p. 485)
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College of Engineering (p. 487)
Departments of Aerospace Engineering; Civil Engineering; Electrical; Computer, Software and Systems Engineering; Engineering Fundamentals; Mechanical Engineering

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Shannon Trebbe
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Civil Engineering

John Wheeler
Humanities/Social Sciences
**Legend**

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<th>Letter</th>
<th>Description</th>
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<tbody>
<tr>
<td>A</td>
<td>Airplane</td>
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<tr>
<td>C</td>
<td>Commercial Pilot</td>
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<tr>
<td>G</td>
<td>Glider</td>
</tr>
<tr>
<td>H</td>
<td>Helicopter</td>
</tr>
<tr>
<td>I</td>
<td>Instrument</td>
</tr>
<tr>
<td>L</td>
<td>Land</td>
</tr>
<tr>
<td>P</td>
<td>Private Pilot</td>
</tr>
<tr>
<td>S</td>
<td>Seaplane</td>
</tr>
<tr>
<td>AD</td>
<td>Aircraft Dispatcher</td>
</tr>
<tr>
<td>IA</td>
<td>Inspection Authorization</td>
</tr>
<tr>
<td>ME</td>
<td>Multi-Engine</td>
</tr>
<tr>
<td>SE</td>
<td>Single-Engine</td>
</tr>
<tr>
<td>A&amp;P</td>
<td>Airframe and Powerplant Maintenance Technician</td>
</tr>
<tr>
<td>AGI</td>
<td>Advanced Ground Instructor</td>
</tr>
<tr>
<td>ATP</td>
<td>Airline Transport Pilot</td>
</tr>
<tr>
<td>BGI</td>
<td>Basic Ground Instructor</td>
</tr>
<tr>
<td>CFI</td>
<td>Certified Flight Instructor</td>
</tr>
<tr>
<td>CTO</td>
<td>Control Tower Operations</td>
</tr>
<tr>
<td>DME</td>
<td>Designated Mechanic Examiner</td>
</tr>
<tr>
<td>DWE</td>
<td>Designated Written Examiner</td>
</tr>
<tr>
<td>GROL</td>
<td>General Radiotelephone Operator License</td>
</tr>
<tr>
<td>HTA</td>
<td>Heavier Than Air</td>
</tr>
<tr>
<td>IGI</td>
<td>Instrument Ground Instructor</td>
</tr>
<tr>
<td>LTA</td>
<td>Lighter Than Air</td>
</tr>
<tr>
<td>SME</td>
<td>Single- and Multi-Engine</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communication Commission</td>
</tr>
<tr>
<td>FE</td>
<td>Flight Engineer</td>
</tr>
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</table>
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