EMBRY-RIDDLE
Aeronautical University

2011-2012
Undergraduate/Graduate Catalog
Daytona Beach, FL
embryriddle.edu/db

EMBRY-RIDDLE
Aeronautical University

Leading the World in Aviation and Aerospace Education

DAYTONA BEACH, FLORIDA, CAMPUS
Embry-Riddle Aeronautical University
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-6000
Admissions: (386) 226-6100 or (800) 862-2416
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E-mail (Admissions): dbadmit@erau.edu
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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
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prescott.erau.edu

WORLDWIDE CAMPUSES AND ONLINE
Embry-Riddle Aeronautical University
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-6910
Admissions: (866) 509-0743 or (800) 522-6787
Financial Aid: (866) 567-7202
E-mail (Admissions): wwem@erau.edu
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http://www.erau.edu

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Academic Programs

2011-2013 Academic Calendar

Fall Semester 2011

(August 29 – December 18)*

August 24-28	Orientation and Registration
August 29	Classes Begin
September 5	HOLIDAY – Labor Day
October 19-20	Industry Career Expo
October 21-24	Student Fall Break
November 11	HOLIDAY - Veterans Day
November 23-25	HOLIDAY - Thanksgiving
December 8	Last Day of Classes
December 9	Study Day
December 10, 12-14	Final Examinations
December 18*	Commencement

Spring Semester 2012

(January 11 – May 7)*

January 9-10	Orientation and Registration
January 11	Classes Begin
January 16	HOLIDAY - Martin Luther King Jr. Day
February 20	HOLIDAY - Presidents Day
March 19-23	Spring Break
April 26	Last Day of Classes
April 27	Study Day
April 28, 30; May 1-2	Final Examinations
May TBD*	Commencement

Summer Semester (Term A) 2012

(May 10 – June 25)

May 8-9	Orientation and Registration
May 10	Classes Begin
May 28	HOLIDAY - Memorial Day
June 21	Last Day of Classes
June 22	Study Day
June 23, 25	Final Examinations

Summer Semester (Term B) 2012

(June 28 – August 13)

June 26-27	Orientation and Registration
June 28	Classes Begin
July 4	HOLIDAY – Independence Day
August 9	Last Day of Classes
August 10	Study Day
August 11,13	Final Examinations

Fall Semester 2012

(August 27 – December 20)*

August 22-26	Orientation and Registration
August 27	Classes Begin
September 3	HOLIDAY – Labor Day
October TBD	Industry Career Expo
October 26-29	Student Fall Break
November 12	HOLIDAY - Veterans Day
November 21-23	HOLIDAY - Thanksgiving
December 6	Last Day of Classes
December 7	Study Day
December 8, 10-12	Final Examinations
December TBD*	Commencement

Spring Semester 2013

(January 9 – May 12)

January 7-8	Orientation and Registration
January 9	Classes Begin
January 21	HOLIDAY - Martin Luther King Jr. Day
February 18	HOLIDAY - Presidents Day
March 18-22	HOLIDAY - Spring Break
April 25	Last Day of Classes
April 26	Study Day
April 27,29,30; May 1	Final Examinations
May TBD*	Commencement

Summer Semester (Term A) 2013

(May 9 – June 23)

May 7-8	Orientation and Registration
May 9	Classes Begin
May 27	HOLIDAY - Memorial Day
June 20	Last Day of Classes
June 21	Study Day
June 22, 24	Final Examinations

Summer Semester (Term B) 2013

(June 27 – August 12)

June 25-26	Orientation and Registration
June 27	Classes Begin
July 4	HOLIDAY – Independence Day
August 8	Last Day of Classes
August 9	Study Day
August 10, 12	Final Examinations

*Commencement dates are subject to change. See www.eraugraduation.com for the latest information.

This catalog becomes effective July 1, 2011.

The 2011-2013 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 currently under review and 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, gender, creed, national and ethnic origin, age, or disability in any of its policies, procedures, or practices. 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 programs and activities.

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.

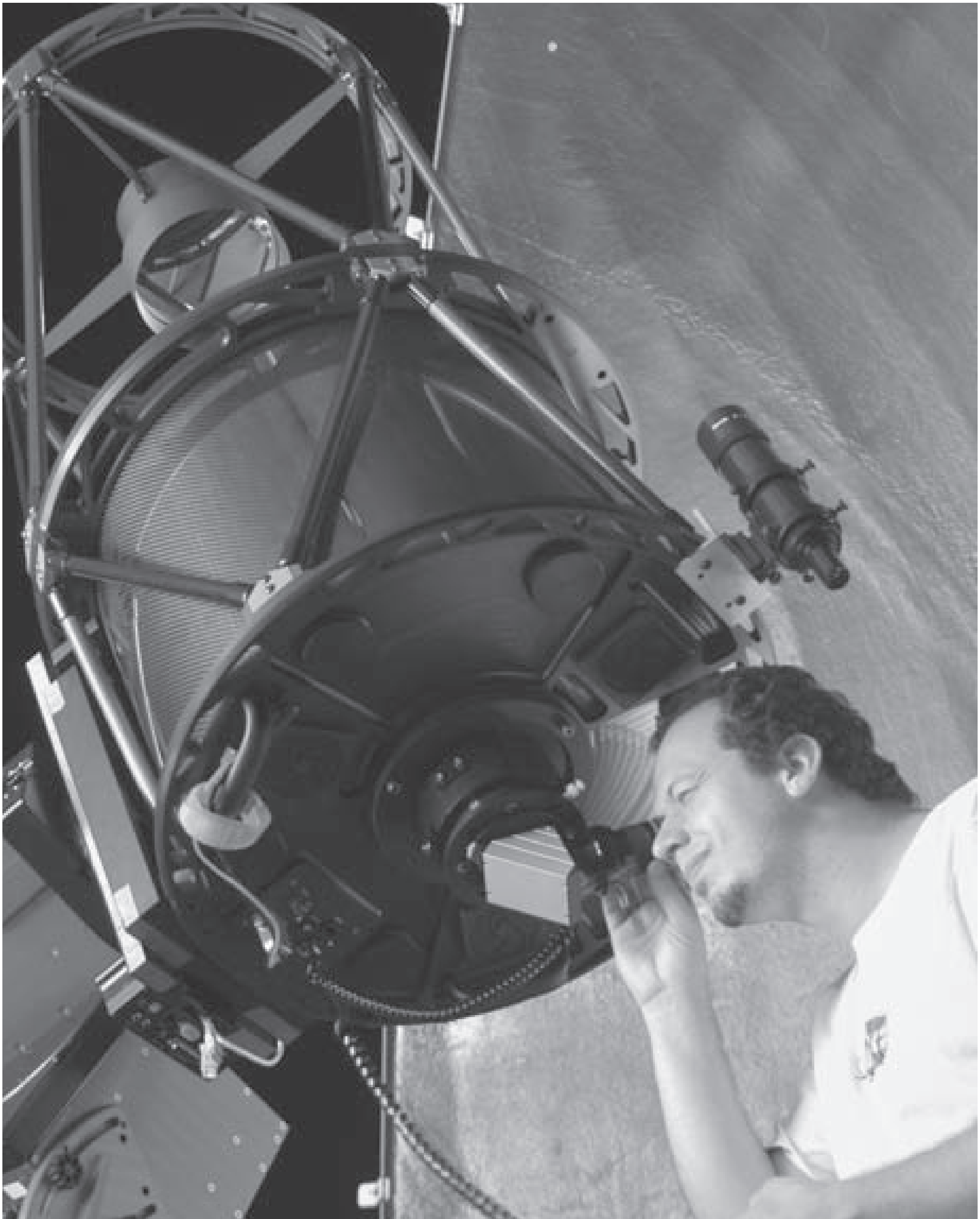
2011-2012 Graduate Program Calendar

Deadlines for Daytona Beach Campus

Admission	Fall 2011	Spring 2012	Summer 2012	Fall 2012	Spring 2013
For U.S. Students	07/01/11	11/01/11	03/01/12	07/01/12	11/01/12
International Students	07/01/11	11/01/11	03/01/12	07/01/12	11/01/12
Graduation Application	10/27/11	03/11/12	07/01/12	10/27/12	03/11/13
Thesis Defense	10/27/11	03/11/12	07/01/12	10/27/12	03/11/13

To be considered a Fall or Spring graduate, thesis defense must take place by specified dates.

To be considered a Summer A or Summer B graduate, students should check with their graduate program coordinator.



MESSAGE FROM THE PRESIDENT

To Our Students:

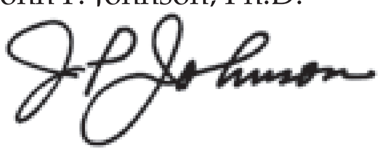
Thank you for choosing Embry-Riddle Aeronautical University for one of the most important investments you will make in your future. With thousands of students enrolled in our programs today, and over 100,000 alumni, you are now a member of a worldwide family of leaders in the aviation and aerospace industry.

Our commitment is to provide you with quality programs and faculty, as well as responsive and caring student services. In reviewing this catalog, you will see a broad range of academic opportunities that prepare our graduates for fulfilling careers within our dynamic industry. Many courses include projects where you will work with others as a team to solve real-world challenges.

As you read the history of Embry-Riddle, it will be clear that our University is evolving. In 85 years we have grown from the world's finest aviation institute to an internationally respected comprehensive university, committed to teaching, research, and professional service to the aviation and space community. With more than 150 locations all over the world, we can truly say that the sun never sets on Embry-Riddle.

I welcome you to an exciting and global University, and to the Embry-Riddle experience.

John P. Johnson, Ph.D.



Mission of the University

Our Mission

At Embry-Riddle, our mission is to teach the science, practice and business of aviation and aerospace, preparing students for productive careers and leadership roles in service around the world.

Our technologically enriched, student-centered environment emphasizes learning through collaboration and teamwork, concern for ethical and responsible behavior, cultivation of analytical and management abilities, and a focus on the development of the professional skills needed for participation in a global community. We believe a vibrant future for aviation and aerospace rests in the success of our students. Toward this end, Embry-Riddle is committed to providing a climate that facilitates the highest standards of academic achievement and knowledge discovery, in an interpersonal environment that supports the unique needs of each individual. Embry-Riddle Aeronautical University is the world's leader in aviation and aerospace education. The University is an independent, non-profit, culturally diverse institution providing quality education and research in aviation, aerospace, engineering and related fields leading to associate's, baccalaureate's, master's and doctoral degrees.

Our Vision

Embry-Riddle will be the world's source for innovation and excellence in aerospace education and applied research.

Our Values

The strength of our university is firmly rooted in our values. We expect that our students, faculty and staff share and demonstrate the values of student success, a positive learning environment and mind-set, safety first in all situations, personal growth, integrity, honesty, trust, diversity, open communication, teamwork, character, change for progress, fiscal soundness, healthy investments, and a can-do attitude.

"The strength of our university
is firmly rooted in our values"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EMBRY-RIDDLE AT A GLANCE

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.

T. Higbee Embry

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.

John Paul Riddle

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.

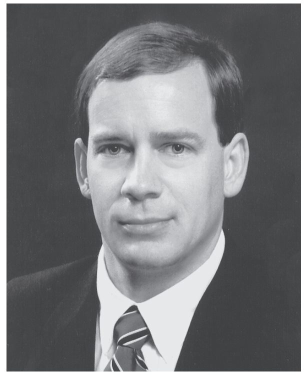
Jack R. Hunt

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.

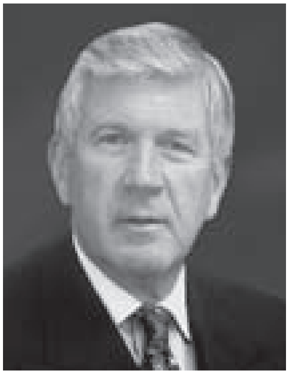
Lt. Gen. Kenneth L. Tallman

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.



Steven M. Sliwa

Embry-Riddle's fourth president, Dr. George H. Ebbs, led the University from 1998 through 2005. During his tenure the annual college guide produced by U.S. News & World Report consistently ranked Embry-Riddle's aerospace engineering program No. 1 in the nation among schools without doctoral programs, a ranking the University has achieved every year since 2001. Embry-Riddle's program in aerospace engineering is the largest in the nation, as are its programs in aeronautical science and engineering physics.


Dr. George H. Ebbs

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

Dr. John P. Johnson is the University's 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 has expanded its research activity; has launched its first doctoral degree programs, in aviation and in engineering physics; and is developing a global strategy to take its aviation and aerospace expertise overseas, most recently by opening a Singapore location. Working with the FAA and industry leaders, Dr. Johnson has positioned the University as one of the nation's leaders in the development of next-generation air traffic management technology.

For his leadership in aerospace education and research he received the Jimmy Doolittle Fellowship Award from the U.S. Air Force Association in 2007. He also received the 2010 John K. Lauber Award for Aviation Safety from the University Aviation Association, honoring the University's record of safe flying and operations as part of the safety-culture initiative established by Dr. Johnson. The National Aeronautic Association awarded Embry-Riddle the prestigious 2008 Collier Trophy for the development and implementation of ADS-B technology under his stewardship

ACCREDITATIONS AND AFFILIATIONS

University Accreditation

Embry-Riddle Aeronautical University, including the Daytona Beach Campus, the Prescott Campus, and the Worldwide Campus, is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS-COC) (1866 Southern Lane, Decatur, GA 30033-4097, Telephone: 404-679-4501) to award degrees at the associate, baccalaureate, master, and doctoral levels*.

Campus Specific Program Accreditations

Daytona Beach Campus:

The bachelor degree programs in Aerospace Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Engineering Physics, Mechanical Engineering, and Software Engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) (111 Market Place, Suite 1050, Baltimore, MD 21102-4012; Telephone: 410-347-7700). The bachelor degree programs in Aeronautical Science (Professional Pilot), Air Traffic Management, Applied Meteorology, and Aviation Forensics and Occupational Safety are accredited by the Aviation Accreditation Board, International (AABI) (3410 Skyway Drive, Auburn, AL USA 36830, Phone 334-844-2431). The bachelor degree programs in Business Administration, majors in Management and in Air Transportation, and the Master of Business Administration program, including the Specialization in Aviation Management are accredited by the Association of Collegiate Business Schools and Programs (ACBSP) (11520 West 119th Street, Overland Park, KS 66213, 913-339-9356). The Aviation Maintenance Science programs (associate and bachelor degrees) are accredited by AABI; for the bachelor degree, this includes two areas of concentration: Maintenance Management and Flight. The certificate programs in Aviation Maintenance Technology (airframe, power plant, and airframe and power plant) are certified by the Federal Aviation Administration (FAA).

Prescott Campus:

The bachelor degree programs in Aerospace Engineering, Computer Engineering, and Electrical Engineering are accredited by ABET. The bachelor degree programs in Aeronautical Science and Aviation Business Administration are accredited by AABI.

At Both Residential Campuses:

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

* Contact information for SACS Commission on Colleges is included in order to enable interested constituents (1) to learn about the accreditation status of the institution, (2) to file a third-party comment about the institution's decennial review of accreditation, (3) to file a complaint against the institution for alleged non-compliance with a standard or requirement, or (4) to provide a note of exemplary service or quality standards related to the institution.

Please note: Normal inquiries about the institution, such as admission requirements, financial aid, educational programs, etc., should be addressed directly to the institution and not to the Commission's office.

For Embry-Riddle -

Daytona Beach, call (386)226-6000
Prescott, call (928)777-3728
Worldwide, call (386)226-6910

Our Student Philosophy

Adopted by Jack R. Hunt in 1975
Updated and reaffirmed by President John P. Johnson, Ph.D., in 2010

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 flesh-and-blood 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?

University Information

Embry-Riddle Aeronautical University is the world's oldest and 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 Worldwide Campus locations around the globe; and through online learning.

Embry-Riddle offers its students a wide array of undergraduate and graduate degree programs in aviation, aerospace, transportation, business, engineering, and related high-tech fields.

In 2010, the University launched its first doctoral degree programs, the Ph.D. in Aviation and the Ph.D. in Engineering Physics. The aviation doctorate, the first of its kind in the nation, is designed for working professionals who want to enhance their contributions to the aviation and aerospace organizations that employ them. The engineering physics doctorate builds on the University's solid program of space research, which is funded by NASA, the National Science Foundation, the U.S. Air Force, and other agencies.

These new doctoral programs expand the applied research opportunities in which Embry-Riddle faculty and students assist the aviation/aerospace industry and governmental agencies, among others, in meeting real-world challenges.

The University's 185-acre eastern campus in Daytona Beach is adjacent to Daytona Beach International Airport, with Orlando and Kennedy Space Center each only an hour's drive away. Currently under construction is the James Hagedorn

Aviation Complex, an expansive three-building facility that will provide a new location for the campus's flight training operations, aircraft maintenance training, and fleet maintenance. Recent additions to the campus include the High-Altitude Normobaric Lab, the College of Business academic hall, and the Apollo residence hall. Also of note: the College of Aviation academic hall, the Lehman Engineering & Technology Center, and the Advanced Flight Simulation Center. The Sim Center contains an FAA-certified Level-6 CRJ200 simulator and Level-6 Frasca flight-training devices that provide a level of on-campus training unique to Embry-Riddle.

With active faculty advisement, student teams from the Daytona Beach campus regularly take top honors in competitions such as SAE engineering events and NASA Means Business and in flight competitions such as NIFA SAFECON and the Women's Air Race Classic.

The University's 539-acre western campus is located in Prescott, Arizona, 100 miles north of Phoenix. Recent additions to the campus include the Aviation Safety and Security Archives and four labs that support study and research in the areas of Air Traffic Control, Ergonomics, High Performance Vehicles, and Industrial Hygiene. Also of note are the Udvar-Hazy Library & Learning Center, the Aerospace Experimentation & Fabrication Building, Haas Memorial Chapel, the Visitors Center, Academic Complex I, the King Engineering & Technology Center, and the Robertson Flight Simulation Center, which houses advanced Frasca flight-training devices.

The Worldwide Campus provides educational opportunities for working civilian and military professionals. Its academic programs are offered at more than 150 locations in the United States, Europe, Asia, Canada, and the Middle East and through Web-based online learning. Based on their unique requirements, classroom students can select online courses, and deployed military students can shift from classroom to 100% online course delivery. With Worldwide's new EagleVision technology, students at different geographical locations can receive instruction at the same time.

As aviation and aerospace continue to evolve, so does Embry-Riddle. The University is committed to the expansion of opportunities for students to work more closely with the aviation industry in the United States and in other nations. 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.

Admission to the Daytona Beach Campus

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.

Term	Filing Priority	Notification	Deposit
Fall	March 1	Rolling	May 1
Spring	November 1	Rolling	November 1
Summer Term A	April 1	Rolling	As requested
Summer Term B	June 1	Rolling	As requested

For more information and to request an application, contact the Admissions Office at:

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

First-Year Applicant

The University defines a first-year candidate 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 grades, rank in class (if available), 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.

English Language Proficiency

Admissions encourages all of our applicants for whom English is not the primary language spoken at home to take the TOEFL 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-

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

For more information, contact the Embry-Riddle Language Institute at:

Daytona Beach Campus
(386) 226-6192
(386) 226-6165 (fax)
email: erli@erau.edu

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.

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. 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. 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

1. Transfer credit may be granted under the following conditions:
   a. Appropriate coursework completed at another accredited institution 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 agency. Academic credit is accepted without regard to the date the course was completed. 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. When reviewing the student's application, unique circumstances are taken into account prior to determining whether the applicant should be a first-year or transfer student. 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. Persons interested in applying as non degree-seeking students can get more information from the Admissions Office.

International Applicants

Refers to nonresident, non immigrant students planning to study in the United States (typically on an F-1 or a J-1 visa). The following items must be provided:

1. Completed application form and $50 application fee (nonrefundable).
2. 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. Both original language documents and English translations are required.
3. Standardized Test Scores
   The SAT I: Reasoning Test or the ACT is strongly recommended for admission. Standardized test results are always reviewed in conjunction with a student's academic record and are never the sole factor used to determine eligibility. For information about the SAT/ACT test dates and locations please contact:

   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

   -OR-

   ACT
   500 ACT Drive
   P.O. Box 168
   Iowa City, IA 52243-0168
   (319) 337-1270
   http://www.act.org
4. TOEFL Scores
   To be admitted into a degree program, international students who will not be graduating from an English educational system or for whom English is not the primary language must submit official TOEFL scores. The preferred score for admissions is 213 (computer based), 550 (paper based), or 79 (IBT-Internet based). 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. 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. This additional 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)
1-877-0863-3546
http://www.toefl.org

Additional information about the Embry-Riddle Language Institute is available by contacting the program at:

Daytona Beach Campus
(386) 226-6192
(386) 226-6165 (fax)
email: erli@erau.edu

5. Transcripts from international postsecondary institutions. An official copy of record of study, grade obtained, examinations passed, and any diplomas, certificates, or degrees received at all secondary, postsecondary, university, and professional schools attended must be sent directly to Embry-Riddle by the school. These records must arrive in the Admissions Office in the original envelope with an unbroken seal to be considered official. Both native documents and English translations are required. In addition, applicants may be required to have these transcripts evaluated by an outside evaluation service. If so required, the applicant will receive specific instructions about obtaining the evaluation during the admission process. The fee charged for this service is the responsibility of the applicant. The service provider must send the evaluation directly to Embry-Riddle. Following is a list of international translation and evaluation providers approved by Embry-Riddle:

American Association of Collegiate Registrars & Admissions Officers (AACRAO)
One Dupont Circle, NW
Suite 520
Washington, DC 20036-1135
(202) 296-3359
(202) 872-8857 (fax)

Academic Credentials Evaluation Institute Inc.
P.O. Box 6908
Beverly Hills, CA 90212
(310) 275-3530
(Request an evaluation relative to courses in the Embry-Riddle catalog.) (This is the preferred evaluator service for the Prescott campus.)

Educational Credential Evaluators Inc.
P.O. Box 92970
Milwaukee, WI 53202-0970
(414) 289-3400
(Request course-by-course evaluation.)

Foreign Credential Evaluations Inc.
1425 Market Blvd.
Suite 330
PMB #305
Roswell, GA 30338
(770) 642-1108
(770) 641-8381 (fax)

International Education Research Foundation Inc.
P.O. Box 66940
Los Angeles, CA 90066
(310) 258-9451
(Request a course-by-course evaluation.)

Josef Silny & Associates
P.O. Box 248233
Coral Gables, FL 33124
(305) 273-1616
email: info@jsilny.com
(Request course-by-course evaluation.)

World Education Services (WES)
P.O. Box 745, Old Chelsea Station
New York, NY 10113-0745
(800) 937-3898 -or- (212) 966-6311

(212) 966-6395 (fax)
email: info@wes.org
(Request course-by-course evaluation.)
I-20 Requirements for International Students. Upon application, international students must submit the following:

a. Affidavit of Financial Support for International Students (download from the website http://www.erau.edu/international)

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 advance tuition deposit, along with an admitted student enrollment form to confirm enrollment to the University. This form will be provided to accepted students by the Admissions Office. 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 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.

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

6. 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.
7. 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/.

English as a Second Language–Embry-Riddle Language Institute (ERLI)

The Embry-Riddle Language Institute (ERLI) is an intensive English program providing english language instruction and cultural orientation to non-native speakers of english. Most of our students plan to attend Embry-Riddle Aeronautical University, but we also welcome others who want only to improve their English language ability. If you desire to become more proficient in listening, speaking, reading, and writing the English language, this intensive English program is for you. Students benefit from a computer laboratory with up-to-date language-learning software and TOEFL preparation software. Students who wish to attend Embry-Riddle Aeronautical University can be granted conditional acceptance pending completion of our program or a passing TOEFL score, assuming they meet all other University admission requirements. Eligible students are also able to earn a part-time recommendation after successful completion of a semester at ERLI, which allows them to begin their University studies while continuing their English language studies. Other benefits of our program include field trips, social events, and full access to all Embry-Riddle Aeronautical University facilities.

For more information please contact:
Embry-Riddle Language Institute
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-6192
fax: (386) 226-6165
email: erli@erau.edu
www.erli.us

Admitted Student Information

Domestic students accepted for admission must submit a $200 advance 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.

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 his/her background warrants consideration for advanced standing may submit appropriate evidence of credentials for evaluation.

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.

Immunizations

To register for classes, 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, at least 60 calendar days prior to the desired enrollment date.

Graduate Admissions

Embry-Riddle seeks graduate 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 graduate programs. We use the guidelines in the next section to determine which applicants are to be granted full admission to a graduate program. Students who fail to meet these guidelines but who are judged to have potential for success in a graduate program may be granted conditional admission (subject, of course, to openings in the graduate program). Students admitted under conditional status will have to prove their ability to pursue a graduate program by meeting specific performance criteria after matriculation at the University.

Admission actions are often taken in the anticipation of the applicant successfully completing the baccalaureate 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 graduate study.**

Specific programs may require that potential degree candidates display a mastery of a number of topical areas critical to the initiation of graduate-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

Applicants must possess an earned baccalaureate degree or equivalent.

If earned in the United States, this degree must be from an appropriately accredited college, university, or program.

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 appropriately accredited college, university, or program in the United States. Applicants educated at foreign schools may be required to submit an evaluation by submitting official certified documentation of their educational achievements to an international education 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 graduate 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.

In most cases, students required to

complete undergraduate prerequisites as conditions of their admission will receive conditional status admission. Upon successful completion of the appropriate undergraduate prerequisite courses, these students will transition to full graduate student status. While in conditional status, these students are not eligible for assistantship opportunities.

Program-Specific Criteria

In addition to the general criteria for admission, some of our graduate programs have additional program-specific admission criteria.

Master of Science in Aeronautics (MSA)

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

- Psychology
- Economics
- Computer Applications
- Mathematics

If they do not possess such knowledge, they may be required to register for undergraduate prerequisite courses in these areas. The student should possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. If the CGPA is lower than 3.00, the GRE exam will be required.

Master of Science in Aerospace Engineering (MSAE) and Master of Aerospace Engineering (MAE)

An applicant's degree should be a Bachelor of Science degree in Aeronautical or Aerospace Engineering, or equivalent. If earned in the United States, the degree must be from an ABET-accredited program. The student should possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher. During the course of study the student will not be permitted more than three C's in order to continue in the program. Furthermore, if the student fails a course during the course of study he/she will be dismissed from the program. The GRE exam, although not required, will be considered for scholarship/assistantship purposes if scores are submitted.

Students with a Bachelor of Science or equivalent degree in other engineering disciplines, mathematics, or physical science, who otherwise meet the requirements for full admission, may also be admitted to the MSAE or MAE program.

Master of Business Administration (MBA)

Applicants for admission to the MBA program are required to take the Graduate Management Admission Test (GMAT) prior to matriculation. Students who have not taken the GMAT and/or achieved the minimum score will not be permitted to register for MBA classes regardless of their status. Coordinators may waive the requirement if another master degree has been completed. The student should possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher.

Upon completion of the admission process, but before classes begin, students are required to complete an MBA preparatory system of learning units. 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. The system must be completed before class enrollment is allowed.

For information on GMAT Administration, see http://www.mba.com.

Master of Science in Electrical and Computer Engineering

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.

Master of Science in Human Factors and Systems (MSHFS)

Applicants for admission to the MSHFS program must have prerequisite knowledge in the areas of

- Psychology
- Statistics

If they do not possess such knowledge, they may be required to register for undergraduate prerequisite courses in these areas. The student should possess a strong academic record, generally evidenced by a CGPA of 3.0 or higher.

Applicants to the MSHFS program must submit GRE scores.

Note: The MSHFS program starts new students only in the Fall semester of each academic year. All applications submitted will be processed for a Fall admission date.

Master of Software Engineering (MSE)

Applicants for admission to the MSE 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)

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

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

Master of Science in Engineering Physics (MSEP)

Applicants for admission to the MSEP program must possess a baccalaureate degree in engineering, physics, chemistry, or mathematics. The GRE exam, although not required, is strongly encouraged for this degree program. The student must possess a strong academic record, generally evidenced by a CGPA of 3.00 or higher.

Conditional Admission

1. Students who fail to satisfy the guidelines for full admission but are judged to have potential for success in a graduate program may be granted conditional admission. Students admitted under conditional status must prove their ability to pursue a graduate program by meeting specific performance criteria after matriculation at the University.
2. Students admitted on conditional status

will be monitored closely as to scholarly performance. Students who are admitted conditionally will be on conditional status until they have completed nine hours of graduate work. During this period, students may receive no grade lower than a B. Students will not be permitted to repeat courses during this period.

3. The conditions of admission will be communicated to applicants in the letter of admission. Students are fully admitted to the program when the conditions have been properly satisfied.

Procedures for Admission

Applications will not be processed until all required documents are received. Applications received after the submission deadlines stated in the following sections will be processed as quickly as possible, but acceptance for admission may not be early enough for the applicant to begin the program as soon as desired. From the day of the receipt of all application documentation, admission notifications are usually sent within three weeks.

Daytona Beach applicants should submit their applications for admission to

Embry-Riddle Aeronautical University

Graduate Admissions Office
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114
(800) 388-3728 - or - (386) 226-6176
(386) 226-7070 (fax)
Financial Aid: (800) 943-6279
email: graduate.admissions@erau.edu
http://www.erau.edu/graduate

Prescott applicants should submit their application to

Embry-Riddle Aeronautical University

Graduate Admissions Office
3700 Willow Creek Road
Prescott, AZ 86301-3720
(800) 888-3728 - or - (928) 777-6993
(928) 777-6958 (fax)
email: prmsss@erau.edu
http://www.erau.edu/graduate

United States Citizens and Permanent Residents of the United States

All applicants must submit the following items to the Graduate Admissions Office prior to the application deadline:

1. Completed application form and $50 application fee. Please note: Permanent residents must provide a photocopy of their ARC (Alien Registration Card).
2. **Transcripts**.
   a. Official sealed transcripts for all college coursework earned (both graduate and undergraduate). Transcripts must be sent directly from the institutions attended to Embry-Riddle. A minimum of a bachelor degree is required.
   b. Course descriptions for all graduate coursework to be considered for transfer.
3. **Statement of objectives**. The statement of objectives is an important part of your application. You should give your reasons for wishing to do graduate work in the field you have chosen, incorporating your interests and your background as well as your long-term professional goals, defining how Embry-Riddle's programs support those interests and goals. This should be at least three or four paragraphs.
4. **Three graduate applicant reference forms**, two academic and one professional.

5. **Resume.** A current resume outlining your education, work experience, special activities, and awards.
6. **Assistantships.** If interested in assistantship opportunities, submit an assistantship application declaring your interest in research, teaching, or administrative fields. Indicate any special skills that you feel may qualify you for an assistantship. To be eligible for an assistantship, a student must have a minimum 3.00 GPA in their undergraduate degree and have full graduate status (conditional admission eliminates a student from eligibility until all conditions are removed). Additional departmental restrictions and test scores are required for some positions.
7. **Test Scores.**
   a. MBA applicants should have GMAT scores sent directly to Embry-Riddle by the testing agency. For more information on the GMAT exam, refer to http://www.mba.com. Indicate school code number 5190.
   b. GRE scores, although not required by all programs, are desired for review by some program coordinators. See specific requirements under the program of your choice in this section of the catalog. For more information on the GRE exam, refer to www.gre.org. Indicate school code 5190.

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Special Requirements for International 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.

In addition to the above required documents, **international applicants must also submit the following**:

1. All applicants whose native language is not English, or who were educated at schools where English was not the language of instruction in all disciplines, must submit their official TOEFL scores sent directly from the testing authority. The minimum acceptable score is 550 written/213 computer-based/79 iTOEFL.
2. In addition to official sealed transcripts, for any transcript not in English, a notarized English translation must also be submitted.

I-20 Requirements for International Students

Upon application, international students who require an initial or renewed student visa must submit the following:

1. An affidavit of financial support and a supporting bank letter verifying appropriate funds on deposit. Please refer to the student's acceptance packet for the specific dollar amount requirement. 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.

2. The I-20 Form must be in the student's possession before departure and must be presented to the nearest U.S. embassy or consulate to obtain the necessary entry visa before departure to the United States.

The I-20 will be issued to the student upon admission to the University, if all required documentation has been received.

These rules and procedures apply equally to international students already studying in the United States who wish to pursue graduate study at Embry-Riddle. The only exception is that they must follow the procedures required by the U.S. Bureau of 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.

Admission Time Limit

Applicants who have been accepted for admission into Embry-Riddle graduate programs must enroll in Embry-Riddle graduate courses in one year from the date of the semester for which they were accepted. Those who do not enroll in the specified time period must reapply for admission according to the regulations and procedures in effect at the time of reapplication.

A student who cancels the application at any point in the application process may reactivate the application at any time up to one year from the date of application. After one year, a new application, fee, and supporting documents must be submitted.

Admission Deposit

At least 30 calendar days prior to matriculation, admitted students must submit a $200 tuition deposit, along with an admitted student enrollment form to confirm enrollment at the University. This form is provided to admitted students by the Office of International and Graduate Admissions.

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 a student has not matriculated, the deposit is forfeited.

Credit for Prior Academic Work and for Courses Taken at Other Institutions

Students applying prior academic work toward their Embry-Riddle graduate program requirements must submit appropriate documentation for such credit as part of the admission process. The request must be in writing and must be accompanied by official transcripts or equivalent evidence of such work. Requests must be approved by the academic department chair or their designee.

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.

Credit (called transfer credit) may be received for graduate work done at another appropriately accredited college or university.

Credit (called escrow credit) may be received for certain graduate courses taken by Embry-Riddle undergraduates.

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

The combined total credit applied to an Embry-Riddle graduate degree may not exceed 12 credit hours.

In order to satisfy a graduate degree program requirement, the academic work for which such credit is sought must be determined to be specifically relevant to the applicant's graduate 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 graduate student at Embry-Riddle (in the case of graduate courses, this normally means that the course was completed with a B or better [3.00 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 graduate 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 graduate 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 graduate 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 graduate degree program, a student may elect to apply to another graduate degree program at this university. After meeting admissions requirements and receiving notification of acceptance, a student may request that up to 12 hours of credit be transferred to the new degree program if the hours are applicable to the newly elected degree program. The transfer of these hours is at the discretion of the appropriate college dean or their designee.

Intra-University Transfer

Graduate students who have matriculated on either the Daytona Beach, Prescott, or Worldwide Campuses who are continuously enrolled students, and who have met their financial obligations on the campus where they matriculated, may transfer from one campus to the other. Transfers are not automatic and certain conditions must be met. Additionally, a vacancy must exist in the program to which the student wishes to transfer, either permanently or as a visiting student.

Students are urged to begin this process at least 45 days before the first day of classes in order to avoid any interruption in the progress toward their degree.

Academic Regulations and Procedures

Undergraduate Regulations and Procedures

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 Handbook, the Flight Operations Manual, the Residence Hall Regulations pamphlet, the Curriculum Manual, and the Academic Policies and Procedures Manual. These documents are available for reference 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 his/her academic advisor, program coordinator, or the Office of Records and Registration. 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.

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

Students are required to register for each term of enrollment. Most students will be allowed to register via Web registration. However, first-year students and students in academic difficulty will be denied access to Web registration. They must see their academic advisor for approval of course selection prior to registration. Once the schedule is approved the advisor will release their hold allowing them to register on the Web. Registration for flight blocks is conducted one week ahead of regular registration and must be accomplished in person at the flight line. 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.

Penalties will be charged for late payment of fees. 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. Special circumstances can be appealed through the dean of the college. Due to the scheduling requirements associated with flight training, flight course registration continues throughout the term.

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.

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.

Academic Integrity/Conduct

Embry-Riddle is committed to maintaining and upholding intellectual integrity. All students, faculty, and staff have obligations to prevent violations of academic integrity and take corrective action when they occur. The adjudication process will include the sanction imposed on students who commit the following academic violations, which 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, including attempted violations of computing facilities.
4. Conduct that disrupts the educational process of 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.

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 term is six credit hours. Students enrolled in fewer credits than the minimum full-time load are classified as part-time. All audited courses and 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 nine hours during summer terms. A student whose cumulative grade point average (GPA) is 3.00 or higher may register for an overload with advance approval of the appropriate program coordinator or designee.

A student with more than 27 completed credit hours and a cumulative ERAU GPA of 3.00 or higher may enroll 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.

Grading System

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

Letter Grade	Student Performance	Grade Points Per Credit Hour
A	Superior	4
B	Above average	3
C	Average	2
D	Below average	1
F	Failure	0
WF	Withdrawal from the University-Failing	0
W	Withdrawal from a course	0
AU	Audit	0
I	Passing but incomplete	0
P	Passing grade (credit)	0
S	Satisfactory (noncredit)	0
T	Transfer credit	0
N	No grade submitted by instructor	0
X	Credit by means other than course equivalency examinations	0
XP	Credit by course equivalency exam	0
IP	In progress	0
NC	No credit awarded	0

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.
- 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 his/her 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.

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:

First-Year:	fewer than 28 hours
Sophomore:	28-57 hours
Junior:	58-87 hours
Senior:	88 hours or more

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, D, F, and WF only.

Dropping a Course

Students may drop a course, with no notation of course enrollment on their transcripts, during the drop period only. 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 W if they withdraw from a course by the end of the 10th week of spring and fall terms and the fourth week of summer terms. If they withdraw from a course after this period, they receive an F. 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 may not drop or withdraw from a basic skills course without written permission from the chair of the department offering the course.

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 with the Academic Support Center and officially process a withdrawal clearance through the Office of Records and Registration. 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.

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 automatically converts to an F.

The period to convert an incomplete I grade extends through the fourth week of the subsequent term.

In Progress 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 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.

Repeating a Course

With the exception of flight courses, which may be repeated only once, a student may repeat any University course. 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 at a course replaces the previous grade a maximum of two times.

Course Equivalency Exams

Students who believe they possess sufficient knowledge and who have not previously failed that particular course may apply to take the course equivalency examination for a maximum of 15 credit hours. Course equivalency examinations must be completed prior to the time the student reaches the last 30 credits for a bachelor's degree.

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.

Dean's List and Honor Roll

To be eligible for term honors, students must have maintained at least a 2.00 CGPA and must not have received a D or F during the term. In addition, students must have achieved a term GPA of 3.50-4.00 for inclusion on the Dean's List or 3.20-3.49 for inclusion on the Honor Roll. A term is defined as one term (full-time status). Additionally, the appropriate notation is made to the student's academic transcript.

Academic Warning, Probation, Suspension, and Dismissal

Warning

A student whose cumulative grade point average (CGPA) is less than 2.00 for one term is placed on academic warning.

Probation

A student whose CGPA is less than 2.00 for two consecutive terms is 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. The academic programs of students on warning or probation may be restricted. 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 student who has a single/term GPA of less than 1.00 may also be placed on academic probation or suspension in accordance with University academic policies.

Suspension

A student whose CGPA is less than 2.00 for three consecutive terms, or a student on academic probation whose CGPA at the end of the subsequent period is below 2.00, is suspended from the University unless the student maintains a term GPA greater than 2.00.

A student who has a term GPA of less than 1.00 may be suspended or placed on academic probation.

Dismissal

A student who has been suspended and readmitted is on probationary status until the CGPA has been raised to 2.00. If the term GPA falls below 2.00 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.

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 must apply for readmission with the same campus to the Office of Records and Registration.

A student who has been academically suspended may apply for readmission after 12 calendar months following the suspension or after completing a minimum of 15 hours of academic credit with a CGPA of 2.50 or higher from an accredited institution. If the University readmits such students, they will be admitted with probationary status.

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 with 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 (See Grade Appeal Process – Student Handbook). 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 appropriate faculty/staff member with responsibility 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 Student's office. The Dean of Students office will follow the following Formal Process:

- The Dean of Students or his/her designee will meet with the student to discuss options.
- Students who wish to file a written grievance or complaint will be requested to submit a report via electronic means, if possible. Students are encouraged to include details, specific information, and a complete description of the issue of contention.
- The written complaint will be electronically filed in the Student Conduct Data Management System for record keeping purposes. A copy of the report will be forwarded with High Importance notation to the appropriate Department Chair, Director or College Dean as appropriate, along with a request for review and follow up.
- Students will be encouraged to follow up with the Dean of Students office regarding the status of their grievance and/or to seek guidance regarding any next phases in the process.
- The Dean of Students office will keep a record of all correspondence regarding student grievance cases, up to and including resolution.

In the event that a student wishes to file a grievance or complaint against another student, the ERAU student Honor Code and applicable judicial procedures may be applied (See Honor Code Judicial Process – Student Handbook).

When it is appropriate, the Dean of Students office offers formal mediation services for dispute resolution. Mediation may take place in lieu of judicial 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.

Areas of Concentration and Minor Courses of Study

Areas of concentration give students specialized preparation in a degree program. Minor courses of study are coherent academic programs designed to satisfy students' personal interests and to meet their professional needs. Students may consult with their program coordinators if assistance is needed in choosing areas of concentration or minors. Once a decision is reached, students who wish to declare an area of concentration or minor should contact Records and Registration. Some minor courses of study are not open to students pursuing particular degree programs. A minor must be in a discipline outside the student's major field of study.

The student becomes subject to the requirements of the minor as stated in the catalog in effect at the time of matriculation or the current catalog in effect at the time the minor is declared. The department/program chair responsible for a particular minor determines how students fulfill deficits in credits for a minor and certifies that students are qualified to receive the minor.

Areas of concentration and minor courses of study are posted on the student's academic transcript at the time the student graduates with a baccalaureate degree.

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 Degrees of the Same Rank

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.

Continuous Enrollment

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

1. Enroll at another institution without advance written approval.
2. Fail to enroll in at least one course at Embry-Riddle in any two calendar year period.
3. Have been suspended or dismissed from the University.

Students failing to maintain continuous enrollment for any reason are required to reapply for admission under the catalog in effect at that time.

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 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 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 Records and Registration 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. After the courses are deemed equivalent, the student's program coordinator evaluates the petition, considering such factors as the reasons for petitioning and the availability of the courses in the University curriculum.

Students may not co-enroll at a local or any other institution. When not enrolled at Embry-Riddle, students who are local residents must follow normal petition procedures to enroll in courses at another local institution. A local resident constitutes a student who attended a high school in Volusia County or a student who resided in Volusia County prior to initial matriculation. Under certain circumstances, students may be permitted to take courses in ethnic studies or foreign languages as electives at an approved local institution.

After initial matriculation, students may not earn more than a total of 18 semester hours or the equivalent at another institution.

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 Records Office 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 baccalaureate 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. Exceptions to the 40-hour upper-division requirement are authorized only when the specified required courses preclude achievement in the minimum credit hour requirements in the catalog listing for the degree. In such cases, all electives taken must be upper-level.
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. Candidates for the B.S. in Aerospace Engineering, B.S. in Civil Engineering, B.S. in Computer Engineering (B.S. in Computer Engineering and Software Engineering candidates must also earn a minimum CGPA of 2.00 in all AE, EE, ES, ET, SE, and CEC courses that fulfill any of the degree requirements), B.S. in Electrical Engineering,B.S. in Mechanical Engineering 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.
8. Students will not be issued a diploma or

transcript of their records until all debts or obligations owed to the University have been satisfied.

9. 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.
10. 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.
11. 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:

Honors Level	CGPA
Summa Cum Laude	At least 3.90
Magna Cum Laude	At least 3.70 and less than 3.90
Cum Laude	At least 3.50 and less than 3.70

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

Transcript Requests

A signed request for an official academic transcript, accompanied by a fee, may be submitted by the student to the Office of Records and Registration. Transcripts will not be released to students who have failed to meet their financial obligations to the University.

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 file a request for nondisclosure at the Office of Records and Registration. Directory information consists of student name, address, telephone number, date and place of birth, major fields of study, dates of attendance, degrees and awards received, most recent previous school attended, photograph, and e-mail address.

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 be considered official by the recipient, subject to their policies, security measures, and validation procedures. In addition to the faxed transcript, an official validated transcript will be mailed directly to the recipient.
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 Records and Registration Office. The Records and Registration Office 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 Records and Registration or the Dean of Students Office.

Flight Course Related Information

All flight training at Embry-Riddle is done 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.

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.

See the University Academic Regulations and Procedures section of this catalog for additional information about University policies on flight courses. The Embry-Riddle Flight Operations Manual also contains information on flight line policies and procedures.

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

Credit for Flight Training After Matriculation

All students desiring to complete off-campus flight training for credit after matriculation must be approved in writing in advance by the Flight Department. The credit that will be awarded (advanced standing) and the procedures for requesting credit when training is completed will be specified in the written approval (Off Campus Authorization Form). The following general rules apply as specified under each heading. Please address any questions to the Flight Department. Credit for AS courses will not be awarded for flight certificates and ratings attained after matriculation (only FA credit).

Aviation Accreditation Board International (AABI) Accredited Programs:

The Aeronautical Science (AS), and Aviation Maintenance Science (AMS; All AMS Concentrations except Flight) degrees are accredited by the AABI (formerly the Council on Aviation Accreditation) and are governed by the following criteria. Students in AABI accredited programs will be awarded credit for FAA certificates held prior to matriculation to Embry-Riddle, and may be approved to complete one certificate or rating 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. Except as provided above, after a student matriculates all flight training for credit must be completed at Embry-Riddle or approved at another AABI accredited program. In all cases students must satisfactorily complete at least one FA course on campus after advanced standing is awarded or AABI program courses are transferred. These requirements pertain to credit for flight certificates and ratings applied to Flight Minors and open elective credit in AABI programs as well. Students should refer to their catalog to verify if their degree program is AABI accredited.

Flight Minors, Majors, Areas of Concentration or Specialization:

Students who are not in AABI accredited programs who are pursuing flight minors, majors, areas of concentration or specialization, that have a required FA course, must satisfactorily complete at least one approved FA course on campus after completion of the approved off campus flight training. This flight course must include an FAA practical exam that results in the issuance of a certificate or rating. If students declare a change of program to an AABI accredited program, the advanced standing credit for flight training after matriculation may not transfer.

Open Elective Credit:

Students who are not in AABI accredited programs, and are not pursuing Flight Minors, Majors, Areas of Concentration or Specialization, who desire to complete off campus flight training for credit after matriculation must receive approval by the Flight Department in writing and in advance of the anticipated training. If students declare a change of program to an AABI accredited program, the advanced standing credit for flight training after matriculation may not transfer. Declaring Flight Minors, Majors, Areas of Concentration or Specialization would necessitate satisfactorily completing at least one FA course on campus after the awarding transfer credit and advance standing.

Awarding Advance Standing:

Upon completion of the approved flight training, all students must show their copy of the approved "Off Campus Training Authorization Request" form, in addition to the appropriate documents of their training, to the Flight Department. Approved advanced standing credit will be applied to the student's transcript

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 Embry-Riddle Records Office prior to being allowed to start flight training:

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 International Students Office. Please contact the Aeronautical Science Department for more information.

Mandatory Student Drug Testing

Success in the aviation industry requires a commitment to excel and the discipline to avoid unsafe practices. The use of illegal drugs constitutes an unsafe practice and is incompatible with an aviation environment. Therefore, the University reserves the right to immediately suspend or dismiss any student who uses or possesses illegal drugs. In the effort to maintain a work and educational environment that is safe for its employees and students, the University has established a mandatory student drug testing program. Embry-Riddle may test for drugs, synthetic drugs, alcohol, and any substance that may compromise safety.

Scope

The drug testing program applies to all students who engage in flight training at the University.

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 Student Handbook.
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.

Testing

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.

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.

Graduate Academic Regulations and Procedures

All University graduate 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 graduate 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 his/her academic advisor or the office of Records and Registration. University regulations will not be waived because a student is unaware of established standards and procedures.

Academic Advising

The graduate program coordinator is the student's academic advisor. Academic advisors help students choose and schedule courses that meet their educational goals. The advisor's signature is required on all registration and add/drop forms.

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

Registration

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 Records and Registration. 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.

Schedule of Classes

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

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, 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.

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 WF. 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.

Course Loads

Full-time graduate 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 college dean or designee. 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.

The Grading System

The following indicators are used on grade reports and transcripts.

Letter Grade	Student Performance	Grade Points Per Credit Hour
A	Excellent	4
B	Satisfactory	3
C	Passing	2
F	Failure	0
WF	Withdrawal from the University-Failing	0
W	Withdrawal from a course	N/A
AU	Audit	N/A
I	Passing but incomplete	N/A
IP	In progress	N/A
N	No grade submitted by instructor	N/A
P	Passing grade (credit)	N/A
S	Satisfactory (noncredit)	N/A
T	Transfer credit	N/A

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.

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 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.

Thesis Project Grading

A final grade of P or F is awarded upon completion of the thesis. If the student is making progress, a grade of IP is awarded at the end of each term. The P grade will replace the IP grade for all terms. If the student has not made progress, a grade of F will be issued and will result in a change from IP to F for all thesis credits. A student enrolled for a thesis will receive a grade each term, as determined by the student's thesis committee. Students must continually register for one credit hour of thesis until complete.

Graduate Research Project Grading

A final grade of P is awarded upon completion of the graduate research project. 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 must continually register for one credit hour of 690C until the graduate research project is complete.

Internship Grading

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

Dropping a Course

Students may drop a course, with no notation of course enrollment on their transcripts, during the drop period only. 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 a grade of W if they withdraw from a course before the 10th week of Spring and Fall semesters and the fourth week of Summer terms. If they withdraw from a course after this period, they receive a grade of F. If students stop attending their classes and fail to withdraw from the University, a grade of 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 the initial attempt at the final phase check receive a grade of W.

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.

An I grade must be redeemed in a time period to be determined by the instructor, but no later than the end of the fourth week of the subsequent term.

Repeating a Course

A Student with graduate 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 project as well.

Undergraduate Enrollment in Graduate Courses

During their senior year, Embry-Riddle undergraduate students may take selected Embry-Riddle graduate courses, normally 500-level, for credit toward their undergraduate or graduate 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 graduate program, and have at least a 2.50 CGPA to qualify for enrollment in graduate courses while an undergraduate. Credits earned at the 500 level normally can be applied either to undergraduate or graduate 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.

Academic Probation and Dismissal

Probation
Full-time students whose cumulative grade point average (CGPA) falls below 3.00 are placed on Academic Probation. Students on Academic Probation 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 graduate 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 graduate courses.
- A final grade of F has been received for any two graduate 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 graduate hours attempted after the semester/term in which the student is placed on academic warning.
- The cumulative grade point average drops below 2.50.

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 Associate Vice President for Academics or designee within 30 days of the receipt of the dismissal notice. The Associate Vice President for Academics or designee will refer the student petition to the appropriate appeals committee for recommendation. Upon recommendation of the appeals committee, the Associate Vice President 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.

Transfer Between Graduate Degree Programs

A graduate student who wishes to transfer from one program to another must prepare a written petition before the transfer will be considered. Requests for transfer of credits from Embry-Riddle or other institutions and/or advanced standing credits should be included in this petition.

The department responsible for the new program, however, has the prerogative to accept or reject the student's request and to determine the courses applicable to the new program. Students should contact the appropriate graduate program coordinator.

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

Additional Graduate Degrees

A graduate student is allowed to apply up to 12 applicable credit hours from one graduate degree program to meet the requirements of another graduate degree program. In order to be awarded a second graduate degree, the student must satisfy all the requirements of the degree sought.

Catalog Applicability

1. A petition to come under the provisions of a later catalog requires approval from the department chair or designee.
2. Former graduate 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 graduate 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 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 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.

Loss of Graduate Status and Readmission

Under certain circumstances (other than graduation), a graduate 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 graduate program within seven years of starting the graduate 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.

Withdrawal from the University

Students who leave the University for any reason must officially process a withdrawal clearance through the office of Records and Registration. 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.

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, and other academic requirements, as appropriate, must be met.
2. The student is not on Academic Warning.
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 graduate degree program and who have excelled academically throughout their graduate careers are recognized through the publication of graduation honors. 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 that apply to specific degree requirements.

Transcript Requests

A signed request for an academic transcript, accompanied by a fee, may be submitted by the student to the appropriate Records and Registration office. Transcripts will not be released to students who have failed to meet their financial obligations to the University.

Privacy of Student Records

The University respects the rights and the privacy of students in accordance with the Family Educational Rights and Privacy Act (FERPA).

The University may disclose certain items of directory information without the consent of the student, unless the student submits a written nondisclosure at the Office of Records and Registration. Directory information consists of the student's name, address, telephone number, date and place of birth, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, the most recent education institution attended by the student, and other similar information.

FERPA allows disclosure of educational records or components thereof under certain conditions. Students desiring additional information regarding FERPA should contact the office of Records and Registration.

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.

Substance Abuse

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 University Health Services and Counseling offices.

FINANCIAL INFORMATION

Student Accounts

At the time of acceptance for admission, a University account is opened for each student. This account remains open until graduation. The primary use of this account is for University charges and payments. If an account shows credit balances, a student may request a refund in the form of cash or a check. A student may also complete authorization and have these funds directly deposited to a checking account. Each student is encouraged to open and maintain an account at a local bank for personal matters.

Billing Address

Residential campus students are assigned an Embry-Riddle email address, which is their primary address for all University correspondence. Billing-address change forms are available through the Web site http://www.erau.edu.

All student account information may be obtained on Embry-Riddle's Web site.

Payment Procedures

Cash, Visa, MasterCard, Discover, American Express, and personal checks are acceptable forms of payment. Payments made by mail should be addressed to the campus Cashier Office and timed to arrive prior to the 10 day payment deadline. Charges incurred subsequent to registration are due 30 days from the date of invoice or the last day of class, whichever occurs first. All payments should include the student's name and identification number.

Bills for tuition and fees, issued at the end of registration, are due 10 days prior to the first day of classes. If full payment cannot be made by this date, tuition-payment agreements on outstanding balances are available. There will be fees incurred for deferring payment.

Books and Supplies

Purchases are made directly from the University Bookstore. Cash, checks, Eagle Dollars, Visa, MasterCard, and American Express are accepted. Students whose estimated financial aid is higher than the total amount for tuition and fees may request these funds from the Bursar Office for book purchases.

Payment Deadlines

Payment of tuition and fees must be received 10 days prior to the first day of classes in order to retain the student's schedule.

2011-12 Payment deadlines are:

- 2011 Fall - August 19, 2011
- 2012 Spring - January 3, 2012
- 2012 Summer A - April 30, 2012
- 2012 Summer B - June 18, 2012
- 2012 Fall - August 17, 2012
- 2013 Spring - December 31, 2012
- 2013 Summer A - April 29, 2013
- 2013 Summer B - June 17, 2013

Payments must be received by these dates, so please plan accordingly:

- For mail delivery – allow 10 business days
- For online payment – allow 3 business days
- By ERNIE Student Services tab – immediate!

Delinquent Accounts

When a student's account is delinquent, registration for that term is subject to cancellation and registration for any subsequent semester will be denied. A delinquent student account will result in suspension of all academic processing and information on class performance, grades, and transcripts will be withheld. Continued delinquency may result in administrative withdrawal from the University. Administrative withdrawal will not relieve a student of the obligation to pay outstanding debts. Sums remaining unpaid will be charged interest at the maximum rate allowed by law. The student is also subject to the costs of collection, including collection-agency fees (33-50%) and reasonable attorney's fees for making such collection. Delinquent accounts may be reported to one or all three major credit bureaus.

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 completed credit hours and a cumulative GPA of 3.00 or higher may enroll 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 spring semester will be used for fall semester eligibility. Completed credit hours and a cumulative GPA at the end of the summer semester will be used for spring eligibility.

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 2011/2012 financial insert at: http://www.erau.edu/er/costs.html.

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 expected at the completion of each training session.

If your method of payment cannot be processed for whatever reason, the training session will be charged to your student account. A hold will be placed on your flight account until this transaction is paid. Any further instruction, not already scheduled, will be suspended until payment is received.

If you do not wish to use a credit card or do not have one, Eagle Dollars give you another option. Any combination of these payment methods may be used at any time.

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 at http://www.erau.edu/er/costs.html.

- Student Government Association fee
- Health service fee
- International student insurance fee
- International student service fee
- Insurance
- Technology fee
- Student facility fee

User Fees

Other fees apply for services that are not considered mandatory. Please see the financial insert at http://www.erau.edu/er/costs.html.

A Graduate Internship Fee based on the cost of one credit hour in a student's degree program is charged for the semester of internship.

Refund Policy

Students who officially withdraw from all classes are eligible for partial refund of tuition. Spring and fall tuition refunds at the Daytona Beach Campus for reduction of hours are not available after the last day of add/drop. Summer term refunds are calculated on a per-course basis. During all terms the effective date of the withdrawal, as determined by the Records Office, governs refund computations. 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
- Insurance fee
- Student facility fee
- Meal plans – unused balance at time of withdrawal

University Withdrawal/Refund Schedule

Fall/Spring Semesters

Period I	Class days 1-5	100%
Period II	Class days 6-10	80%
Period III	Class days 11-15	60%

Period IV	Class days 16-20	40%
Period V	Class days 21-25	20%
Period VI	Class days 26 and after	0%

Summer A/B terms

Period I	Class days 1-3	100%
Period II	Class days 4-6	80%
Period III	Class days 7-9	60%
Period IV	Class days 10-12	40%
Period V	Class days 13-15	20%
Period VI	Class days 16 and after	0%

Requests for refunds 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.

A request for refund must be submitted within 60 days of the date that the student completed a change of registration. Refund petition requests will normally be processed within 10 business days. Personal appeals for denied requests must contain additional documentation not previously presented.

Department of Education Withdrawal/Refund Policy

Students receiving financial aid who withdraw will be subject to the refund policies specified by the U.S. Department of Education.

Required Advance Tuition Deposit (new students only)

The deposit is refundable in full, provided written notice is furnished at least 60 days before the first day of registration for the semester.

Housing Contracts

Students who have housing contracts must contact the Housing 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 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 section (http://www.embryriddle.edu). 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.

Eligibility Requirements

To be considered eligible to apply for most financial programs, students must:

1. Be U.S. citizens or eligible noncitizens
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 federal application (FAFSA) at http://www.fafsa.ed.gov. Each year, students are required to reapply for financial aid.

All students are encouraged to complete the FAFSA by Embry-Riddle's priority deadline of March 1.

Programs Available

The major categories of financial assistance programs include grants, scholarships, 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.

Grants

Federal (Undergraduate Only)

- Federal Pell Grant
- Federal Supplemental Educational Opportunity Grant

State and Institutional (Undergraduate Only)

- Family Grant
- Florida Student Assistance Grant
- Florida Resident Access Grant
- Florida Bright Futures Scholarship Program
- Grants from other states

Loans

Federal

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

Employment

Federal

- Federal Work-Study Program

Embry-Riddle

- Embry-Riddle Student Employment
- Off-Campus Referral Program
- Resident Advisor Program

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.

Other Financial Assistance Programs

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

Veterans Education Benefits

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 (DVA).

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 DVA 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. The DVA 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 DVA will determine eligibility for reinstatement of benefits, based in part on the school's recommendation.

A veteran's progress will be measured according to University standards as published in this catalog, and the rules and regulations of the DVA 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 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 DVA 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 the Veterans Certifying Official at the campus they plan to attend.

Extended Payments

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 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.

Athletic Grants

The University offers a limited number of Athletic Grants for qualified students. Awards are available for baseball, men's basketball, men's and women's cross country, men's and woman's golf, men's and women's soccer, men's and women's tennis, men's and women's track & field, and women's volleyball. The maximum value permitted by the NAIA is the actual cost of tuition, room, board, books, and fees. However, most grants are awarded as partial tuition waivers. To qualify, students must meet both University and NAIA eligibility requirements. The grants are highly competitive, and interested students should contact the Athletic Department for specific details.

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

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.

Graduate Assistantships

Graduate 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 18 graduate credits in the discipline. A graduate research assistant is involved in research activities under the direction of a faculty member or a research associate. A graduate administrative assistant assists departments or faculty with curriculum development, special projects, and other duties as assigned. To be eligible for a graduate 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 effectively carry out their assignments. 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. All 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.

Student Life and Services

Student Activities & Campus Events

The mission of the Department of Student Activities & Campus Events on the Daytona Beach Campus is 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 Activities & Campus Events staff supports and enhances holistic development by providing advocacy for and to students, building community, complementing the academic experience, and advancing life skills.

There are over 160 student organizations on the Daytona Beach Campus. The campus 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 Activities & Campus Events 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 organizations at the fall and spring Activities Fair.

The Department of Student Activities & Campus Events is also the point of contact for the Student Government Association and its divisions – the Programming Board (Touch-N-Go Productions), Eagles FM Radio, and the Avion newspaper – as well as leadership development, campus events and event planning logistics and Homecoming activities.

For specific information, contact the Department of Student Activities at (386) 226-6039.

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 and will be mailed to each underage student prior to their scheduled arrival. The waiver expires the day the student reaches the age of 18.

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 activities. 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; lawyer service; lockers; banners; color printer; and free faxing. SGA members also participate on almost every committee, and the president of the SGA is a member of Embry-Riddle's Board of Trustees. Direct questions, comments, or concerns to sga-pres@erau.edu or call (386) 226-6045.

Dean of Students Office

The Dean of Students Office at the Daytona Beach Campus offers a variety of services to assist students with problems such as personal and family emergencies, and provides advocacy and referrals to campus and local assistance. The department oversees all student judicial issues and disciplinary records. The Dean of Students Office annually produces the Student Handbook.

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 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 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 Intercollegiate Athletics provides highly competitive varsity sports on the Daytona Beach Campus. All Embry-Riddle students are admitted to regular-season home events free of charge, and everyone is encouraged to get involved and support the Eagles. The University is a member of the National Association of Intercollegiate Athletics (NAIA) and successfully competes against opponents from all levels of college athletics. Most of the University's sports programs are ranked among the top 25 teams in the nation and are perennial contenders for conference, regional, and national championships. The 1999-2000 year saw the Eagles basketball program win the NAIA Division II national championship. The Eagles baseball team has made eight appearances in the NAIA World Series since 1999, including a national runner-up finish in 2005. Women's soccer has participated in the national tournament six times in the past nine years, while the men's soccer team has made seven appearances during that same time period. Women's golf was the national runner-up in 2008 and has finished in the top six in the country for seven consecutive years. The men's and women's tennis teams have had tremendous success as well, with the men making 10 consecutive national championship appearances, including five consecutive Final Four appearances and the women earning national championship bids nine of the last 10 years. The cross country and track & field teams have also had tremendous success, with multiple top-10 finishes in recent years.

Collectively, the Daytona Beach Campus has won the Sun Conference Commissioner's Cup for best all-around athletic program for 10 consecutive years. In addition to their prowess on the fields and courts, the student-athletes have posted a cumulative grade point average higher than the campus average for 10 consecutive years.

The University sponsors 16 intercollegiate sport programs at the Daytona Beach Campus, including men's baseball, basketball, cross-country, golf, soccer, tennis, indoor/outdoor track and field; women's cross-country, golf, soccer, tennis, indoor/outdoor track and field, and volleyball; and co-ed cheerleading. Any student who meets both University and NAIA 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, or to sign up for the Daytona Beach Campus student athletic support group, The Flock, log on to http://www.embryriddlesports.com.

For tryout information, contact the Intercollegiate Athletics department.

First Year Programs

Dedicated to helping students achieve their academic goals, the First Year Programs (FYP) team consists of highly qualified academic advisors, student assistants, 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 Doolittle Annex, 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, tutoring, and supplemental instruction, 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 also offers 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, while the First Class Program is designed to give select first year students a head start in their university experience during the Summer B semester.

For more information, contact:

First Year Programs
Student Academic Support Center
Doolittle Annex
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-7073
(386) 226-6165 (fax)

Hunt Library

The mission of the Hunt Library is to provide materials, services, and facilities to students, faculty, and staff in support of the University's commitment to excellence in teaching, learning, and research for both the Daytona Beach and Worldwide Campuses.

Visitors to the Hunt Library will find resources in a variety of formats: books, government documents, periodicals, microforms, conference proceedings, reports, videos, and DVDs. An extensive collection of electronic resources is available to Embry-Riddle students, faculty, and staff through the library's website: http://library.erau.edu. Many can be accessed from off-campus and provide full-text access to periodicals, documents, and other research materials.

The library also houses a special collection of historical aviation materials that originated from the Manufacturers' Aircraft Association. Materials that are not available in the Hunt Library's collection can be obtained through the library's Interlibrary Loan service.

Library users can access the Internet on public-use computers or sign on to computers equipped with productivity software to aid in the completion of course-related research. Reference librarians are available to assist students with research strategies.

With a variety of seating options, the Hunt Library is a comfortable, popular venue to browse magazines, 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 Embry-Riddle Web portal, known as ERNIE (Embry-Riddle Network for Information Exchange), can be found at http://ernie.erau.edu. ERNIE accounts are provided to all students. ERNIE gives students one-stop-shopping for class and University information as well as details on campus events. ERNIE also provides a number of services that students can access, such as email, unofficial transcripts, class grades, class schedules, account balances, and flight schedules. ERNIE can be accessed from any computer with an Internet connection.

- Information Technology also provides the following services:
- Computerized labs and classrooms
- Various academic software titles (access via the labs and some available though ERNIE)
- University Email accounts (Microsoft Live@edu)
- 25GB online storage on Windows Live SkyDrive
- Network storage space for class assignments
- Storage space for personal Web pages
- 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 in most buildings and residence halls

As the technology used in the aviation and aerospace industries grows and advances, so are the tools of teaching future aviation and aerospace pioneers.

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. Students must provide original documentation to prove identity and employment eligibility prior to employment.

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.

Safety and Security

Safety and security is provided by the Campus Safety & Security Department, an in-house unit consisting of full-time officers and part-time student assistants. The Safety & Security Department provides patrol and escort services, parking and traffic services, life safety systems, crime prevention, and communications/dispatch services.

The Patrol and Communications sections provide coverage to the campus and its satellite locations. Safety officers respond to routine requests for service as well as to emergency situations. They also conduct field investigations as required and provide specialized security service to the campus flight line. The Parking & Traffic Services section manages campus parking, traffic, and associated enforcement functions. It also provides support for special events. The Crime Prevention section engages in safety education 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.

Campus Ministry

The Campus Ministry staff nurture the spiritual life of students, staff, faculty, and alumni. We recognize that your spiritual life is not limited to religious inclinations, but also is inclusive of any search for meaning, purpose, direction, and belonging in your life. Our chaplains are available to assist you as you explore the dimensions of your spiritual life and wrestle with the questions that may arise in your search.

We also serve as a resource for the student religious clubs on campus, and work to foster a healthy interfaith community, respecting people of various religious traditions. In addition, the chaplains provide support during emergencies and hospitalizations, and are available to assist with both funerals and weddings.

The Interfaith Chapel is open daily from 6 a.m. until midnight, with spiritual activities scheduled regularly during the fall and spring semesters. Prayer rooms for different faiths are located in the chapel and available for individual prayer, meditation, and reflection. In addition, we have resources to help you connect with a nearby religious community of your tradition.

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 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 enrollment or participate in campus-based immunization clinics. The Medical Report form supplied by University Admissions indicates the immunizations that students must document in order to register for courses and 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. 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.

International students with an F-1 or J-1 visa must demonstrate proof of coverage that meets the State Department's requirements and the coverage must be from a U.S-based company. All International student athletes who have private health insurance must have their policies reviewed by the Assistant Director of Sports Medicine. Non-international students should contact the International Student Advisor (386) 226-6579 to arrange a review of their individual insurance plan.

Counseling Services

College is a time of BIG changes! The experience can be both exciting and stressful. Many students at ERAU find the Counseling Center a safe place to discuss personal, social, and academic concerns with a caring professional. The Center is a calm and supportive environment where you can reflect on your issues, gain insights and develop a plan for coping with challenges. Services are confidential and free!

Everyone at one time or another can benefit from counseling. While most students seek individual counseling for personal concerns, counselors can meet with couples, provided both members of the couple are currently enrolled students at ERAU.

The Center can help with a wide range of concerns such as relationship issues, family problems, stress, procrastination, homesickness, depression, anxiety, loneliness, low self-esteem and many more. The Center's goal is to assist you in becoming a healthier, happier, and more successful student.

Other services provided include:

- Crisis intervention,
- Computerized biofeedback training for stress reduction,
- Lending library, including books, DVD's, and CD's.
- Referral services for students seeking long-term therapy or specialized services, including psychiatric evaluation and medication.

The Residence Life Program

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 campus community living environment 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 campus housing system 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 vending facilities, laundry 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 academic buildings, students should provide their own personal computers for use in residential housing.

First-year students are typically assigned to buildings that are specially designated for new students. Upper-class students may choose to live in a variety of campus residences, including suites and apartments, on a space-available basis. Accommodations for disabled students are available. Requests for these spaces should be made to the Associate Director of Housing.

Residency and Board Requirements

Residency Policy: All first-year students under 21 years of age with less than 28 earned credit hours are required to live in ERAU-managed housing for their first full academic year (fall and spring semesters). 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.

Exceptions to the residency and board requirements are as follows:

- Students 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, and
- Students who are full-time, year-round residents of Volusia County, Florida, for a minimum of one year prior to entering Embry-Riddle.

All requests for an exception must be submitted in writing to the Director of Housing & Residence Life with supporting documentation of circumstances.

Housing Application Process

New students accepted to Embry-Riddle will receive instructions on how to submit the housing contract online. Completed contracts along with the housing deposit must be submitted online to the Housing & Residence Life officec by June 1 in order to receive priority consideration. New students, 21 years of age and older, may apply for ERAU-managed housing; however, assignments are made on a space-available basis.

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.
- Debit Card: Your EAGLEcard offers two debit accounts that are managed by the University. 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: www.erau.edu/db/eaglecard. The Flight Account can only be used to pay for on-campus flight training activities.
- Meal Plans: These are accessed via your EAGLEcard. (See the Dining Services section for more information regarding meal plans.)

Deposits

The Eagle Dollars and Flight Account minimum deposit is $1.00. Deposits to either account can be made at the Cashier's Office, at one of the on-campus Value Transfer Stations, or via the Web through your Blackboard account at the "EAGLEcard tab". 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 Blackboard account. Up to 90 days' of history is available.

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. Flight Account refunds can be requested upon flight course completion or withdrawal from the flight program. 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 Eagle Dollars 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 4 p.m.), the Safety Office after business hours, or via the Web through the "EAGLEcard tab" on their Blackboard 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 deactivated.

Replacement of Lost/Stolen or Replacement Cards

A replacement fee of $10.00 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. Temporary cards are available free of charge for up to seven days. 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.

Dining Services

A variety of nutritious and satisfying dining services and meal plan options are offered. Dining facilities are conveniently throughout the campus with eight different locations. 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. 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 director of Dining Services.

Please note the following information regarding meal plan requirements.

All first-year students under 21 years of age with less than 28 earned credits hours are required to live in ERAU managed housing for their first full academic year (fall and spring semesters). 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 www.eraudining.com.

Mail

Prior to a student's arrival at Embry-Riddle and during their attendance, all personal mail being sent to them by the USPS, UPS, and Federal Express should be addressed as follows:

If box number is known:

Student Name (include middle initial)
Mail # 14-XXXX
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3977

If box number is unknown:

Student Name (include middle initial)
"New Student"
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3977

All students are required to have a mailbox and are asked to check it on a daily basis.

Career Services Office

Career Services provides career resources and career development assistance to all Embry-Riddle students.Visit the Career Services website, which offers students and alumni job search tools, including cooperative education/internship information, interview tips, links to employment web sites, and sample resumes/cover letters. To get started, activate your account on the EagleHire Network, a web-based resume referral and job search database, and upload a resume.

Aviation, aerospace, manufacturing, government and other industry-specific companies recruit Embry-Riddle students and alumni for both co-op/internship and full-time positions. The Career Services Office hosts many of these employers throughout the year, participating in events such as information sessions, on-campus interviews, the annual Industry/Career Expo, and the Virtual Hiring Event.

Career Services employs a staff of program managers to provide career advisement, mock interviews, and resume critique services. Career Services encourages students to contact them early in their education to explore career options and to develop a successful job search strategy.

For more information, contact:

Career Services, C-Building, Suite 408
(386) 226-6054
www.erau.edu/career

International Student Services

The International Student Services Office serves as the central point of contact for issues concerning international students at Embry-Riddle. 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. The office provides services that include assisting students with financial matters, and health insurance requirements in the United States. The office also assists international students with the processing of forms and documentation of status required by foreign governments, sponsors, the U.S. government, and the University.

For more information, contact:

International Student Services
Doolittle Annex
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386)226-6579
(386) 226-6165 (fax)

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 decides on programming of educational, cultural and entertaining nature.

For more information, contact:

International Student Services
JPRiddle Student Center
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386)226-6039
(386) 226-6014 (fax)

Embry-Riddle Language Institute (ERLI)

The Embry-Riddle Language Institute (ERLI) is an intensive English program providing English-language instruction and cultural orientation to nonnative speakers of English. Most of our students plan to attend Embry-Riddle, but we also welcome others who just want to improve their English-language ability. If you desire to become more proficient in listening, speaking, reading, and writing the English language, this intensive English program is for you. Students benefit from a computer laboratory with up-to-date language-learning software and TOEFL (Test of English as a Foreign Language) preparation software. Additionally, students who wish to attend Embry-Riddle can be granted conditional acceptance pending completion of our program or a passing TOEFL score, assuming they meet all other University admission requirements. Eligible students are also able to earn a part-time recommendation after successful completion of a semester at ERLI, which allows them to begin their University studies while continuing their English-language studies. Embry-Riddle Language Institute students have full access to all Embry-Riddle facilities.

For more information, contact:

Embry-Riddle Language Institute
Doolittle Annex
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-6192
(386) 226-6165 (fax)
erli@erau.edu
www.erli.us

ACADEMIC PROGRAMS

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. Detailed information about specific degree programs begins on page 82 of this section of the catalog. Minor courses of study are described in the following section.

The University currently offers the following programs at the Daytona Beach Campus.

General Education Program

College of Arts and Sciences

B.S. in Communication
B.S. in Computational Mathematics
B.S. in Engineering Physics
Accelerated Program in Engineering Physics
M.S. in Engineering Physics
Ph.D. in Engineering Physics
B.S. in Human Factors Psychology
B.S. in Human Factors Psychology/
M.S. in Human Factors and Systems
M.S. in Human Factors and Systems
B.S. in Interdisciplinary Studies
B.S. in Space Physics
Still Exploring

College of Aviation

B.S. in Aeronautical Science
B.S. in Aeronautics
M.S. in Aeronautics
B.S. in Air Traffic Management
B.S. in Applied Meteorology
A.S. in Aviation Maintenance Science
B.S. in Aviation Maintenance Science
B.S. in Homeland Security
B.S. in Safety Science
B.S. in Unmanned Aircraft Systems Science
Ph.D in Aviation
Still Exploring

College of Business

B.S. in Business Administration
M. of Business Administration
M. of Business Administration in Aviation Management
Accelerated Program in Business Administration
B.S. in Aerospace Studies/Master of Business Administration (5-Year Program)
B.S. in Communication/Master of Business Administration (5-Year Program)
B.S. in Human Factors/Master of Business Administration (5-Year Program)
Executive Master of Business Administration
Still Exploring

College of Engineering

B.S. in Aerospace Engineering
Accelerated Program in Aerospace Engineering
M. of Aerospace Engineering
M.S. in Aerospace Engineering
B.S. in Civil Engineering
B.S. in Computer Engineering
B.S. in Computer Engineering/
M.S. in Software Engineering
B.S. in Computer Science
M.S. in Electrical and Computer Engineering
B.S. in Electrical Engineering
B.S. in Mechanical Engineering
M.S. in Mechanical Engineering
B.S. in Software Engineering
B.S. in Software Engineering/
M.S. in Software Engineering
M. of Software Engineering
Still Exploring

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.

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 020, Fundamentals of Communication, a reading, writing, and critical thinking skills course. Quantitative skills courses (MA 004, MA 006) 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 008, Academic English, and COM 018, Advanced Academic English.

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.

General Education Program Requirements

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 course work in the following areas.

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 college algebra as a prerequisite.

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.

Humanities

3-6 hours lower-level
*3 hours 300-400 level
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

3-6 hours lower-level
*3 hours 300-400 level
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 Requirement
36 Hours Total

* In order to experience advanced studies in either the Humanities or Social Sciences, students must choose at least one upper-level course in the Humanities or Social Sciences.

University General Education Competencies

While taking General Education required courses, students develop a basic set of General Education skills (i.e., competencies, listed below) based on course learning outcomes. This skills set will be instrumental to student success in upper level courses within their degree program; in these courses students will practice application of this skill set, eventually demonstrating mastery before graduation. As a result, students will 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.

Critical Thinking

The student will apply knowledge at the synthesis level to define and solve problems within professional and personal environments.

Quantitative Reasoning

The student will demonstrate the use of digitally-enabled technology (including concepts, techniques and tools of computing), mathematics proficiency & analysis techniques to interpret data for the purpose of drawing valid conclusions and solving associated problems.

Information Literacy

The student will conduct meaningful research, including gathering information from primary and secondary sources and incorporating and documenting source material in his or her writing.

Communication

The student will communicate concepts in written, digital and oral forms to present technical and non-technical information.

Scientific Literacy

The student will be able to analyze scientific evidence as it relates to the physical world and its interrelationship with human values and interests.

Cultural Literacy

The student will be able to analyze historical events, cultural artifacts, and philosophical concepts.

General Education Program Approved Courses

Communication Theory and Skills. 9
COM 122, 219, 221, 222

Mathematics. 6
MA 111, MA 112, MA 120, MA 140, MA 142, MA 143, MA 145, MA 220, MA 222, MA 241, MA 242, MA 243

Computer Science 3
BA 120, CS 118, CS 120, EGR 115, EGR 120

Physical and Life Sciences 6
All students participate in a laboratory experience
PS 101, PS 102, PS 103, PS 104, PS 105, PS 107, PS 140, PS 142, PS 150, PS 160, PS 208, PS 215, PS 219, PS 250, PS 301, PS 302, PS 303, PS 320

Humanities. 6
(3-6 Lower-Level; *300-400 Level) * Must choose at least one upper-level HU or SS.
HU 140, HU 141, HU 142, HU 143, HU 144, HU 145, HU 146, HU 300, HU 302, HU 310, HU 316, HU 325, HU 330, HU 338, HU 341, HU 345, HU 375, HU 415, HU 420, HU 399/499, HON 150, HON 250, HON 350

Social Sciences 6
(3-6 hours; 3 hours Upper-Level)
EC 200, EC 210, EC 211, SS 110, SS 120, SS 130, SS 302, SS 311, SS 320, SS 321, SS 325, SS 326, SS 331, SS 333, SS 334, SS 336, SS 337, SS 340, SS 353, SS 363, SS 399/499, PSY 101, PSY 310, PSY 315, PSY 335, PSY 340, PSY 350, PSY 365

TOTAL CREDITS **36**

Still Exploring Engineering Freshman

Students exploring engineering who have not selected a specific degree program may, during their freshman year, enroll in the courses listed in the common engineering first-year catalog description. This enables an engineering student interested in engineering to explore the content of all the engineering programs over their freshman year prior to declaring a major at the beginning of their sophomore year. The courses apply toward any engineering degree. Still Exploring students should follow the common freshman engineering program (see the common freshman year outline in the College of Engineering section of this catalog), then select a degree program upon completion. After a degree program is chosen, an advisor will be assigned to the student to discuss courses to take and future career goals. Precollege 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, students should understand it may take them longer to complete the degree they choose.

The Common First-Year Engineering Program

The Common Freshman Engineering Program is a joint responsibility between the College of Engineering and all departments in the College. The purpose of this coordination is to ensure success of all engineering programs at the freshman level. In industry, engineers in a certain discipline have to work with engineers in other disciplines, so it is in the best interest of our engineering students that they interact with students in other engineering programs. This is accomplished via team projects, common engineering courses, and invited colloquium speakers.

The First-Year Program ensures that instructors involved in the program have the appropriate quality and experience to teach the freshman courses. The program maintains consistency in the continuous processes of outcomes assessment throughout all of the College of Engineering curricula as required by the program's accrediting agencies. The program also deals with personal matters that may arise in freshman engineering courses.

The College of Engineering First-Year Advising Program focuses on advising and retaining all engineering freshmen starting from the time they make their tuition deposit until they finish their first year.

Graduate Programs

Introduction

Status quo is virtually an unknown concept in the aviation industry. The technology with which aviation works and the national and international regulations by which it must abide are subject to rapid, frequent, and sweeping change. Aviation 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 graduate courses are nonsequential, allowing study to begin in any term. Electives needed to complete the requirements of any graduate degree are selected from among the 500/600 numbered courses (except BA 503 and the AED course series) listed in this catalog.

Graduate Internships

Graduate internships are temporary professional or industrial work opportunities available to graduate students in some programs. There are two types of internships: resident
and nonresident. Resident internships are professional work activities supported by a partnership between the University and industry and conducted on campus under the supervision of a faculty/staff sponsor. 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 elective credit for their professional work service.

Graduate students who have full graduate status in a degree program, are in good standing with a minimum of six completed graduate credit hours, and who earn 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 must register for the approved number of credit hours in the appropriate departmental internship course and pay all fees. Graduate 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 as an elective toward degree requirements in many degree programs. Students are advised to consult with their graduate program coordinator for approval to use internship credits toward their degree program.

Thesis and Graduate Research Project Options

Requirements

Students who elect a thesis or graduate research project must obtain approval of the research topic. The University encourages graduate students to select thesis and graduate research 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 research project, the faculty member who is directing the student's research should generally be the student's research advisor. The graduate research project option may not be available for all programs.

Doctoral Programs

Doctor of Philosophy in Aviation

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 Web site: http://aviationphd.erau.edu.

Doctor of Philosophy in Engineering Physics

The objective of this Ph.D. program is to provide 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 EP 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. 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 60 hours beyond a master's degree, to include 18 hours in core, a minimum of 6 hours of electives and 36 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 and at the program Web site: http://www.erau.edu/db/degrees/phd-engineeringphysics.html

College of Arts and Sciences

Dr. William F. Grams, Dean

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, Engineering Physics, Space Physics, Human Factors Psychology, and Interdisciplinary Studies. At the graduate level, the College offers a Master of Science in Engineering Physics, a Master of Science in Human Factors and Systems, and a Ph.D. in Engineering Physics. 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 nontraditional 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.

Communication

Bachelor of Science

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, environmentalism, medicine, and technology. Communication students work in traditional written media, such as newspapers, newsletters, magazines, and journals, as well as in cutting-edge information retrieval and delivery systems, including Web sites and networked blogs.

This focused, yet flexible, course of study requires students to hone specialized communication skills and to produce portfolios displaying those skills. These graduates, the next generation of communication specialists, are positioned to enter three specific career paths, including 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, and 3) communicating news to general audiences through print and electronic media.

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-division courses (300-400 level)

The Communication program requires coursework in General Education, the Communication Core, Communication Specified Electives, a Minor, and Open Electives:

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Courses	**Credits**
Communication Theory & Skills	9
Computer Science	3
Lower-Level Humanities*	3
Mathematics	6
Physical and Life Sciences	6
Lower-Level Social Sciences*	6
HU/SS 300-400 level*	3
Total Credits	**36**

* Embry-Riddle courses in the general education categories of Communication Theory and Skills, Humanities, and Social 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.

Communication Theory and Skills
COM 122, 219, 221

Humanities
Lower-Level:
HU 140-146
Upper-Level:
300-400 level

Social Sciences
Lower-Level:
EC 200, 210, 211 (EC 200 is not acceptable together with EC 210 or EC 211 or their equivalent), PSY 101, SS 110, 120, 130
Upper-Level:
SS 325, 326, 333, 334, 336, 337, 340, 353, 363

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 eight courses, including the following:

Course	Title	Credits
COM 225	Science & Technology Communication	3
COM 260	Introduction to Media	3
COM 265	Introduction to News Writing	3
COM 320	Mass Communication Law & Ethics	3
COM 322	Aviation & Aerospace Communication	3
COM 350	Environmental Communication	3
COM 360	Media Relations I	3
	-OR-	
COM 410	Advanced Professional Writing	
COM 399/499	Directed Study	
	-OR-	
CE 396/397	Internship/Co-Op	3
Total Credits		**24**

Aviation/Aerospace Foundation Courses

This component of the Communication Core requires students to complete two courses from among the following:

Course	Title	Credits
AS 120	Principles of Aeronautical Science	3
SP 110	Introduction to Space Flight	3
SS 130	History of Aviation	3
Total Credits		**6**

Science Foundation Courses

This component of the Communication Core requires students to complete two courses from among the following:

Course	Title	Credits
HU 302	Contemporary Issues in Science	3
HU 335	Technology & Modern Civilization	3
SS/PS 302	Evolution of Scientific Thought	3
Total Credits		**6**
Total Credits for Communication Core		**36**

Specified Electives

To supplement coursework from the Communication Core, students complete five classes selected from among the following specified electives in Communication, Humanities, and Social Sciences:

Course	Title	Credits
COM 230	Digital Photography	3
COM 268	Introduction to Sports Writing	3
COM 364	Visual Design	3
COM 411	Web Design Workshop	3
COM 412	Advanced Technical Writing	3
COM 415	Nonverbal Communication	3
COM 460	Media Relations II	3
HU 143	Introduction to Rhetoric	3
HU 319	Advanced Speech	3
HU 375	Nature of Language	3
HU 420	Applied Cross-Cultural Communication	3
International Relations Course(s), including SS 325, 326, 333, 334, 336, 337, 363		3 each
Total Credits		**15**

Minor

In consultation with their advisor and/or Communication program coordinator, students select 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	15
Aviation Weather	15
Business Administration	18
Environmental Studies	15-16
Human Factors	15
International Relations	15
Space Studies	15
Total Credits	**15-18**

Open Electives

Students complete open electives, experiencing the breadth of curriculum offerings of the University or selecting an additional minor.

Open Electives: Total Credits	**15-18**
Total Degree Credits	**120**

Computational Mathematics

Bachelor of Science

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 computing, mathematical modeling and visualization to solve complex problems that arise in the physical, natural, and behavioral sciences as well as engineering. Students have a strong core of computing, physics, and engineering science courses as well as an exposure in depth to numerical methods, modeling and visualization. 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 strong emphasis on applied mathematics, computing tools, and science applications, this program provides an excellent background for graduates to work in a variety of aviation or aerospace industries as well as to enter graduate programs in applied mathematics or one of the sciences or engineering fields.

General Education Requirements

For a full description of Embry-Riddle Aeronautical University's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Courses	Credits
Communications Theory and Skills	9
Computer Science/Information Technology	3
Humanities/Social Sciences Lower Level	6
Humanities Upper Level General Education Requirement	3
Mathematics	6
Physical and Life Sciences	6
Social Sciences Upper Level General Educational Requirement	3
Total Credits General Education	**36**

SEMESTER ONE

Course		Title	Credits
		Social Science Lower Level	3
COM	122	English Composition and Literature	3
CS	233	Scientific Programming in C	3
MA	241	Calculus and Analytic Geometry I	4
Total Credits			**13**

SEMESTER TWO

Course		Title	Credits
		Humanities Lower Level	3
MA	242	Calculus and Analytic Geometry II	4
PS	150	Physics for Engineers	3
		-OR-	
PS	215	Physics I	3
		-AND-	
PS	216	Physics Laboratory	1
		Area of Specialization Course	2/3
		Open Elective	2/3
Total Credits			**16**

SEMESTER THREE

Course		Title	Credits
COM	219	Speech	3
MA	243	Calculus and Analytic Geometry III	4
PS	160	Physics for Engineers II	3
		-OR-	
PS	208	Physics II	3
		Area of Specialization course	3
Total Credits			**13**

SEMESTER FOUR

Course	Title	Credits
COM 221	Technical Report Writing	3
MA 345	Differential Equations and Matrix Methods	4
MA 412	Probability and Statistics	3
PS 219	Physics III	3
	-AND-	
PS 220	Physics Laboratory III	1
	-OR-	
PS 250	Physics for Engineers III	3
	Area of Specialization course	3
Total Credits		**17**

SEMESTER FIVE

MA 432	Linear Algebra	3
MA 441	Advanced Engineering Mathematics I	3
	Area of Specialization Course	6
	Open Electives	3
Total Credits		**15**

SEMESTER SIX

	Humanities/Social Sciences Upper Level	3
MA 348	Numerical Analysis I	3
MA 350	Partial Differential Equations	3
	-OR-	
MA 444	Scientific Visualization	3
MA 442	Advanced Engineering Mathematics II	3
	Area of Specialization	3
Total Credits Semester 6		**15**

SEMESTER SEVEN

	Humanities/Social Sciences Upper Level	3
MA 443	Complex Variables	3
	Area of Specialization	3
	Open Elective	6
Total Credits		**15**

SEMESTER EIGHT

MA 488	Numerical Methods in Fluids	3
	-OR-	
MA 453	High Performance Scientific Computing	3
MA 490	Capstone Project	3
	Open Electives	10
Total Credits		**16**
TOTAL DEGREE CREDITS		**120**

Engineering Physics

Bachelor of Science

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 Engineering Physics degree program has a full engineering accreditation by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21204-4012, telephone: 410-347-7700) and is administered by the Physical Sciences Department. 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." The educational objectives of the Engineering Physics program ensure that our graduates:

- Effectively use mathematical, scientific, and modern engineering tools in the professional practice of engineering.
- Pursue successful careers built on understanding of ethical and professional responsibility, good citizenship, and the ability to be a lifelong learner.
- Demonstrate oral and written communication skills, and the ability to work in teams across many disciplines.
- Demonstrate the ability to identify, formulate, and solve real-world technical problems, incorporating political, economic, and environmental considerations.

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.

Space Systems Area of Concentration

The Engineering Physics degree with an area of concentration in Space Systems is specifically designed for students with interests in space physics, applied mathematics, and aerospace engineering sciences. Graduates of this program automatically earn a minor in mathematics. 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. Graduates of this program automatically earn a minor in mathematics. 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 130 credit hours. 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 in MA 241, MA 242, MA 243, PS 208, PS 215, and PS 219.

General Education Requirements

For a full description of Embry-Riddle's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Courses	Credits
Communications Theory and Skills	9
Computer Science/Information Technology	3
Humanities/Social Sciences Lower Level	6
Humanities Upper Level General Education Requirement	3
Mathematics	6
Physical and Life Sciences	6
Social Sciences Upper Level General Educational Requirement	3
Total Credits General Education	**36**

* Any of the Embry-Riddle courses in the general education categories of Communication Theory and Skills, Humanities and Social Sciences, and the Engineering Electives 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 above in the Engineering Physics vertical outline.

Communication Theory and Skills
COM 122, 219, 221, 222, 360

Humanities
LOWER-LEVEL:
HU 140-146, 250
UPPER-LEVEL:
HU 300-400

Social Sciences
LOWER-LEVEL:
EC 200, PSY 101, SS 110, 120, 130, 204, 210
UPPER-LEVEL:
HF 300, PSY 350, 365, SS 300 level

Engineering Electives
AE/AEL/CEC/CIV/CS/EE/EGR/EL/EP/ES/ME/SE 300-400 LEVEL

Spacecraft Systems Area of Concentration

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills*	6
		Lower-Level Humanities*	3
		Lower-Level Social Sciences*	3
EGR	111	Engineering Drawing	2
EP	101	Current Topics in Space Sciences	1
MA	241	Calculus and Analytic Geometry I	4
MA	242	Calculus and Analytic Geometry II	4
PS	140	Chemistry for Engineers	4
PS	141	Chemistry for Engineers Laboratory	1
PS	215	Physics I	3
PS	216	Physics Laboratory I	1
Total Credits			**32**

SOPHOMORE YEAR

Course		Title	Credits
		Communication Theory and Skills*	3
		Humanities Elective*	3
CS	223	Scientific Programming in C	3
ES	201	Statics	3

Course		Title	Credits
ES	202	Solid Mechanics	3
ES	204	Dynamics	3
MA	243	Calculus and Analytic Geometry III	4
MA	345	Differential Equations and Matrix Methods	4
PS	208	Physics II	3
PS	219	Physics III	3
PS	220	Physics Laboratory III	1
PS	290	Physics Laboratory Practicum	0
Total Credits			**33**

JUNIOR YEAR

Course		Title	Credits
EE	335	Electrical Engineering I	2
EE	336	Electrical Engineering Laboratory I	1
EP	320	Electro Optical Engineering	3
EP	340	Introduction to Space Systems Design	2
EP	391	Microcomputers and Electronic Instrumentation	3
EP	393	Spaceflight Dynamics	2
EP	394	Space Systems Engineering	3
ES	206	Fluid Mechanics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
MA	442	Mathematical Methods for Engineering & Physics II	3
ME	200	Machine Shop Laboratory	1
PS	303	Modern Physics	3
PS	305	Modern Physics Laboratory	1
PS	320	Classical Mechanics	3
Total Credits			**33**

SENIOR YEAR

Course		Title	Credits
		Engineering Elective*	3
		Upper-Level HU/SS Elective*	3
EP	410	Space Physics	3
EP	440	Engineering Electricity and Magnetism	3
EP	455	Quantum Physics	3
EP	496	Space Systems Design I	2
EP	497	Space Systems Design II	3
ES	305	Thermodynamics	3
ES	320	Engineering Materials Science	2
ES	321	Engineering Materials Science Laboratory	1
		Open Electives	6
Total Credits			**32**
TOTAL DEGREE CREDITS			**130**

Spacecraft Instrumentation Area of Concentration

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills*	6
		Lower-Level Humanities*	3
		Lower-Level Social Sciences*	3
EGR	111	Engineering Drawing	2
EP	101	Current Topics in Space Sciences	1
MA	241	Calculus and Analytic Geometry I	4
MA	242	Calculus and Analytic Geometry II	4
PS	140	Chemistry for Engineers	4
PS	141	Chemistry for Engineers Laboratory	1
PS	215	Physics I	3
PS	216	Physics Laboratory I	1
Total Credits			**32**

SOPHOMORE YEAR

Course		Title	Credits
		Communication Theory and Skills*	3
CEC	220	Digital Circuit Design**	3
CEC	222	Digital Circuit Laboratory**	1
CEC	315	Signals and Systems**	3
CEC	320	Microprocessor Systems**	3
CEC	322	Microprocessor Systems Laboratory**	1
CS	223	Scientific Programming in C	3
MA	243	Calculus and Analytic Geometry III	4
MA	345	Differential Equations and Matrix Methods	4
ME	200	Machine Shop Laboratory	1
PS	208	Physics II	3
PS	219	Physics III	3
PS	220	Physics Laboratory III	1
PS	290	Physics Laboratory Practicum	0
Total Credits			**33**

JUNIOR YEAR

Course		Title	Credits
		Humanities Elective*	3
CEC	410	Digital Signal Processing**	3
CEC	411	Digital Signal Processing Laboratory**	1
EP	340	Introduction to Space Systems Design	2
EP	391	Microcomputers and Electronic Instrumentation	3
EP	393	Spaceflight Dynamics	2
EP	394	Space Systems Engineering	3
EP	430	Spacecraft Instrumentation**	3
MA	441	Mathematical Methods for Engineering & Physics I	3
MA	442	Mathematical Methods for Engineering & Physics II	3
PS	303	Modern Physics	3

PS	305	Modern Physics Laboratory	1
PS	320	Classical Mechanics	3
Total Credits			**33**

SENIOR YEAR

Course		Title	Credits
		Engineering Elective*	3
		Upper-Level HU/SS Elective*	3
EE	401	Control Systems Analysis and Design**	3
EP	320	Electro-Optical Engineering	3
EP	410	Space Physics	3
EP	440	Engineering Electricity and Magnetism	3
EP	455	Quantum Physics	3
EP	496	Space Systems Design I	2
EP	497	Space Systems Design II	3
		Open Electives	6
Total Credits			**32**
TOTAL DEGREE CREDITS			**130**

*May be taken in the fourth or fifth semester. 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.

Accelerated Program in Engineering Physics

Bachelor of Science in Engineering Physics

Master of Science in Engineering Physics

The 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 151 credit hours as listed below.

FIRST YEAR

Course		Title	Credits
		Communication Theory and Skills	6
		Lower-Level Humanities	3
		Lower-Level Social Sciences	3
EGR	111	Engineering Drawing	2
EP	101	Current Topics in Space Sciences	1
MA	241	Calculus and Analytic Geometry I	4
MA	242	Calculus and Analytic Geometry II	4
PS	140	Chemistry for Engineers	4
PS	141	Chemistry for Engineers Laboratory	1
PS	215	Physics I	3
PS	216	Physics Laboratory I	1
Total Credits			**32**

SECOND YEAR

Course		Title	Credits
		Communication Theory and Skills	3
CS	223	Scientific Programming in C	3
ES	201	Statics	3
ES	202	Solid Mechanics	3
ES	204	Dynamics	3
HU/SS		Upper-Level HU/SS Elective	3
MA	243	Calculus and Analytic Geometry III	4
MA	345	Differential Equations and Matrix Methods	4
PS	208	Physics II	3
PS	219	Physics III	3
PS	220	Physics Laboratory III	1
PS	290	Physics Laboratory Practicum	0
Total Credits			**33**

THIRD YEAR

Course		Title	Credits
EP	320	Electro-Optical Engineering	3
EP	340	Introduction to Space Systems Design	2
EP	393	Spaceflight Dynamics	2
EP	394	Space Systems Engineering	3
EP	501	Numerical Methods for Engineers & Scientists	3
ES	206	Fluid Mechanics	3
ES	305	Thermodynamics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
MA	502	Boundary Value Problems	3
PS	303	Modern Physics	3
PS	305	Modern Physics Laboratory	1
PS	320	Classical Mechanics	3
Total Credits			**32**

SUMMER SESSION

Course		Title	Credits
HU/SS		Upper-Level HU/SS Elective	3
ES	320	Engineering Materials Science	2
ES	321	Engineering Materials Science Lab	1
EE	335	Electrical Engineering I	2
EE	336	Electrical Engineering I Laboratory	1
Total Credits			**9**

FOURTH YEAR

Course		Title	Credits
		Engineering Physics Graduate Elective	3
EP	391	Microcomputers and Electronic Instrumentation	3
EP	410	Space Physics	3
EP	440	Engineering Electricity and Magnetism	3
EP	455	Quantum Physics	3
EP	496	Space Systems Design I	2
EP	497	Space Systems Design II	3
EP	505	Advanced Spacecraft Dynamics & Control	3
ME	200	Machine Shop Laboratory	1
Total Credits			**24**
TOTAL DEGREE CREDITS			**130**

GRADUATE-LEVEL STUDIES

Course		Title	Credits
EP	509	Advanced Space Physics	3
EP	600	Experimental Methods in Space Science	3
EP	605	Spacecraft Power & Thermal Design	3

Option I - Thesis

Course		Title	Credits
EP	700	Thesis	9
		-AND-	
		Graduate Elective	3

Option II - Non-Thesis

Course		Title	Credits
		Graduate Electives	12
Total Credits			**21**
TOTAL BS/MS DEGREE CREDITS			**151**

Master of Science in Engineering Physics (MSEP)

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

Option	Core Courses	Electives	Thesis	Total
Thesis	15	6	9	30
Non-Thesis	15	15	0	30

Core Courses

Course		Title	Credits
EP	501	Numerical Methods for Engineers and Scientists	3
EP	505	Advanced 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

Course		Title	Credits
AE	508	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 Eng. Physics	1-3
EP	699	Special Topics in Eng. Physics	1-3
EP	700	MSSPS Thesis	1-9
MA	502	Boundary Value Problems	3
MA	504	Potential Theory	3
MA	506	Probability for Engineers	3
MA	510	Fundamentals of Optimization	3
MSE	500	Software Engineering Concepts	3
MSE	545	Specification and Design of Real-Time Systems	3
MSE	585	Metrics and Statistical Methods for Software Engineering	3
MSE	610	Software Architecture and Design	3
MSE	655	Performance Analysis of Real-Time Systems	3

Human Factors Psychology

Bachelor of Science

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, survey methods, computer techniques, and other research methodologies.

Degree Requirements

The Bachelor of Science in Human Factors Psychology can be earned in eight semesters assuming appropriate background and full-time enrollment. Successful completion of a minimum of 123 credit hours is required.

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 15 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's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Courses*	**Credits**
Communication Theory and Skills	9
Mathematics	6
Computer Science	3
Physical and Life Sciences (one course must include a laboratory)	6

Lower-Level Humanities 3
Lower-Level Social Sciences 6
HU/SS 300-400 level. 3

Total Credits **36**

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.

Communication Theory and Skills

COM 122, 219, 221, 222, 351, 360, 364, 410, 411, 412
HU 143, 319, 351, 355, 370, 375, 420

Mathematics

MA 111, 112, 140, 142, 145, 222, 241, 242, 243

Computer Science

CS 118, CS 120, BA 120

Physical and Life Sciences

PS 101-109, 142, 302, 304, 308, 309

Humanities

LOWER-LEVEL:
HU 140 series
UPPER-LEVEL:
HU 300-400 level

Social Sciences

LOWER-LEVEL:
PSY 101 (required) and 3 credits from the following: EC 200-211, SS 110-130, 204, 210
UPPER LEVEL:
SS 302-361

Core Requirements**

College Success

UNIV 101

Total Credits **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.
COM 360, 364, 410, 411, 415, 460
HU 335, 375, 415, 420

Total Credits **3**

Computer Science

Six credit hours from CS courses listed below. These courses are in addition to those taken as General Education.
CEC 220, 222
CS 118, 125, 223
EGR 115, 120
IT (All courses in the curriculum may be used)
SE 300

Total Credits **6**

Psychology and Human Factors

Course		Title	Credits
HF	300	Human Factors I: Principles and Fundamentals	3
HF	302	Human Factors II: Analytic Methods and Techniques	4
HF	305	Human Factors III: Test and Evaluation	4
HF	310	Human Computer Interaction	3
HF	312	Ergonomics and Bioengineering	3
HF	400	Human Factors IV: System Design	4
HF	412	Simulating Humans in Complex Systems	3
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
Total Credits			**41**

Aviation

Course		Title	Credits
AS	120	Principles of Aeronautical Science	
		-OR-	
SP	110	Introduction to Space Flight	
		-OR-	
WX	201	Meteorology I	
		-OR-	
		Private Pilot Certificate	3
Total Credits			**3**

Practicum

Course		Title	Credits
HF	490	Practicum in Human Factors Psychology	3
Total Core Credits			**57**

Specified Electives

Take two courses from each of the following two groups of courses and any one additional course from either group (15 credit hours total).

Group I: Applied Systems in Human Factors

Course		Title	Credits
HF	315	Automation and Systems Issues in Aviation	3
HF	325	Human Factors and System Safety	3

HF	326	Human Performance in Extreme Environments	3
HF	330	Human Factors in Space	3
HF	335	Human Factors in Air Traffic Control	3
HF	340	Human Factors and Product Liability	3
HF	410	Human Factors in Crew Station Design	3
HF	415	Human Factors in Simulation Systems	3
HF	422	Applied Ergonomic Design, Analysis, and Evaluation	3
HF	440	Aerospace Physiology	3

Group II: Psychological Foundations of Human Factors

Course		Title	Credits
PSY	320	Aviation Psychology	3
PSY	340	Industrial-Organizational Psychology	3
PSY	345	Training and Development	3
PSY	350	Social Psychology	3
PSY	365	Abnormal Psychology	3
PSY	400	Introduction to Cognitive Science	3
		(Other courses with approval of advisor.)	
Total Specified Elective Credits			**15**
Open Elective Credits			**15**
Total Elective Credits			**30**
TOTAL DEGREE CREDITS			**123**

Suggested Program 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.

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills*	6
		Computer Science*	3
		Lower-Level Humanities*	3
		Mathematics*	6
		Physical and Life Sciences*	3
HF	300	Human Factors I: Principles and Fundamentals	3
		HU/PSY/SS 300-400 level*	3
PSY	101	Intro to Psychology*	3
UNIV	101	College Success	1
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
		Advanced Communication**	3
		Communication Theory and Skills*	3
		Lower-Level Social Sciences*	3
		Physical and Life Sciences*	3
		Computer Science**	3
HF	302	Human Factors II: Analytic Methods and Techniques	4
PSY	312	Research Analysis in Psychology	4
PSY	335	Physiological Psychology	3
AS	120	Principles of Aeronautical Science	
		-OR-	
SP	110	Introduction to Space Flight	
		-OR-	
		FAA Private Pilot Certificate	
		-OR-	
WX	201	Meteorology I**	3
		Open Electives	3
Total Credits			**32**

JUNIOR YEAR

Course		Title	Credits
		Computer Science**	3
HF	305	Human Factors III: Test and Evaluation	4
HF	312	Ergonomics and Biomechanics	3
HF	490	Practicum in Human Factors Psychology	3
HF/PSY		Specified Electives	6
PSY	310	Sensation and Perception	3
PSY	315	Cognitive Psychology	3
PSY	322	Research Design	4
Total Credits			**29**

SENIOR YEAR

Course		Title	Credits
HF	310	Human Computer Interaction	3
HF	400	Human Factors IV: System Design	4
HF	412	Simulating Humans in Complex Systems	3
HF/PSY		Specified Electives	9
		Open Electives	12
Total Credits			**31**
TOTAL DEGREE CREDITS			**123**

* General Education Requirement

** Degree Core Requirement

‡ All Psychology and Human Factors courses must be passed with a “C” or better to count toward degree completion.

Human Factors Psychology/ Master of Human Factors and Systems

Bachelor of Science in Human Factors Psychology /
Master of Human Factors and Systems

In conjunction with the Bachelor of Science in Human Factors Psychology and the traditional master's degree in Human Factors and Systems, the Department of Human Factors and Systems also offers a five-year master's degree program in Human Factors and Systems. The five-year master's program offers upper-level undergraduates in the major the chance to begin their graduate work while completing their bachelor's degree program. The program is open to all undergraduate Human Factors students who meet eligibility requirements that include a CGPA of 3.20 and junior-year standing.

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 500 and one additional graduate course (six credits) that will fulfill requirements for the bachelor and the master degree programs, respectively. Five-year master's students are required to complete 30 credits of graduate work to complete the degree program. Both the Bachelor of Science degree in Human Factors Psychology and the Master of Human Factors and Systems degree will be awarded when the student completes the master's degree program.

General Education Requirements

For a full description of Embry-Riddle's General Education guidelines, please see the Academic Programs section of this catalog.

These minimum requirements are applicable to all degree programs.

Course*	Credits
Communication Theory and Skills	9
Computer Science	3
HU/SS 300-400 Level	3
Lower-Level Humanities	3
Lower-Level Social Sciences	6
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 those listed below, assuming prerequisites are met. Courses from other institutions are acceptable if they fall into these broad categories.

Communication Theory and Skills
COM 122, 219, 221, 222, 351, 360, 364, 410, 411, 412
HU 143, 319, 351, 355, 375, 420

Mathematics
MA 111, 112, 140, 142, 145, 222, 241, 242, 243

Computer Science
CS 118, CS 120, BA 120

Physical and Life Sciences
PS 101-109, 142, 302, 304, 308, 309

Humanities
LOWER-LEVEL:
HU 140s series
UPPER-LEVEL:
HU 300-400 level

Social Sciences
LOWER-LEVEL:
PSY 101 (required) and 3 credits from the following: EC 200-211, SS 110-130, 204, 210
UPPER-LEVEL:
SS 302-361

Core Requirements**

College Success

UNIV 101

Total Credits **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.

COM 360, 364, 410, 411, 415, 460
HU 375, 415, 420

Total Credits **3**

Computer Science

Six credit hours from CS courses listed below. These courses are in addition to those taken as General Education.

CEC 220, 222
CS 118, 125, 223
EGR 115, 120
IT All courses in the curriculum may be used
SE 300

Total Credits **6**

Psychology and Human Factors

Course		Title	Credits
HF	300	Human Factors I: Principles and Fundamentals	3
HF	302	Human Factors II: Analytic Methods and Techniques	4
HF	305	Human Factors III: Test and Evaluation	4
HF	310	Human Computer Interaction	3
HF	312	Ergonomics and Bioengineering	3
HF	400	Human Factors IV: System Design	4
HF	412	Simulating Humans in Complex Systems	3
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
Total Credits			**41**

Aviation

Course		Title	Credits
AS	120	Principles of Aeronautical Science -OR-	
SP	110	Introduction to Space Flight -OR- FAA Private Pilot Certificate -OR-	
WX	201	Meteorology I	3
Total Credits			**3**

Practicum

Course		Title	Credits
HF	490	Practicum in Human Factors Psychology	3
Total Core Credits			**57**

Specified Electives

Take two courses from each of the following two groups of courses and any one additional course from either group (15 credit hours total).

Group I: Applied Systems in Human Factors

Course		Title	Credits
HF	315	Automation and Systems Issues in Aviation	3
HF	325	Human Factors and System Safety	3
HF	326	Human Performance in Extreme Environments	3
HF	330	Human Factors in Space	3
HF	335	Human Factors in Air Traffic Control	3
HF	340	Human Factors and Product Liability	3
HF	410	Human Factors in Crew Station Design	3
HF	415	Human Factors in Simulation Systems	3
HF	422	Applied Ergonomic Design, Analysis, and Evaluation	3
HF	440	Aerospace Physiology	3

Group II: Psychological Foundations of Human Factors

Course		Title	Credits
PSY	320	Aviation Psychology	3
PSY	340	Industrial-Organizational Psychology	3
PSY	345	Training and Development	3
PSY	350	Social Psychology	3
PSY	365	Abnormal Psychology	3
PSY	400	Introduction to Cognitive Science	3

(Other courses with approval of advisor.)

Total Specified Undergraduate Elective Credits **15**

Open Elective Credits **12**

Total Elective Credits **27**

UNDERGRADUATE SENIOR YEAR

Course		Title	Credits
HFS	500	Systems Concepts (Fall)	3
		One Additional Graduate Course (Spring)	3
Total Credits at End of Senior Year			**126**

GRADUATE-LEVEL STUDIES

Two graduate-level HFS courses are taken in the senior year as described above. Twenty-seven credits remain.

Course	Title	Credits
HFS 510	Research Design and Analysis I	3
HFS 610	Research Design and Analysis II	3
HFS 615	Sensation and Perception	3
HFS 700	Thesis	6
HFS	Graduate Elective***	12
Total Credits		**27**
TOTAL DEGREE CREDITS		**153**

Suggested Program 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.

FRESHMAN YEAR

Course	Title	Credits
	Communication Theory and Skills*	6
	Computer Science*	3
HF 300	Human Factors I: Principles and Fundamentals	3
	HU/PSY/SS 300-400 level*	3
	Lower-Level Humanities*	3
	Mathematics*	6
	Physical and Life Sciences*	3
PSY 101	Intro to Psychology*	3
UNIV101	College Success	1
Total Credits		**31**

SOPHOMORE YEAR

Course	Title	Credits
	Advanced Communication**	3
	Communication Theory and Skills*	3
	Computer Science**	3
	Lower-Level Social Sciences*	3
	Physical and Life Sciences*	3
HF 302	Human Factors II: Analytic Methods and Techniques	4
PSY 312	Research Analysis in Psychology	4
PSY 335	Physiological Psychology	3
AS 120	Principles of Aeronautical Science -OR-	
SP 110	Introduction to Space Flight -OR-	
	FAA Private Pilot Certificate -OR-	
WX 201	Meteorology I**	3
Total Credits		**29**

JUNIOR YEAR

Course	Title	Credits
	Computer Science**	3
HF 305	Human Factors III: Test and Evaluation	4
HF 312	Ergonomics and Biomechanics	3
HF/PSY	Specified Electives	9
PSY 305	Research Design	4
PSY 310	Sensation and Perception	3
PSY 315	Cognitive Psychology	3
	Open Electives	3
Total Credits		**32**

SUMMER TERM

Course	Title	Credits
HF 490	Practicum in Human Factors Technology	3

Students must spend the term performing a co-op engaged in a human factors engineering activity (analysis, design, or test).

SENIOR YEAR

Course	Title	Credits
HF 310	Human Computer Interaction	3
HF 400	Human Factors IV: System Design	4
HF 412	Simulating Humans in Complex Systems	3
HFS 500	Systems Concepts	3
HFS 620	Memory and Cognition	3
HF/PSY	Specified Electives	6
	Open Electives	9
Total Credits		**31**

GRADUATE-LEVEL STUDIES

Course	Title	Credits
HFS 510	Research Design and Analysis I	3
HFS 610	Research Design and Analysis II	3
HFS 615	Sensation and Perception	3
HFS 700	Thesis	6
HFS	Graduate Elective***	12
Total Credits		**27**
TOTAL DEGREE CREDITS		**153**

* General Education Requirement

** Degree Core Requirement

*** Please refer to the graduate section of this catalog for a listing of available graduate-level electives.

‡ All Psychology and Human Factors courses must be passed with a "C" or better to count toward degree completion.

Human Factors and Systems (MSHFS)

Master of Science

Introduction

The Department of Human Factors and Systems offers graduate instruction leading to the Master of Science degree in Human Factors and Systems with two distinct tracks in Human Factors and in Systems. These programs are 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 environments.

The Human Factors track will develop a graduate with the capacity to design, conduct, and apply human factors research in support of the design of simple and complex systems. It will develop a student's ability to work as a human factors professional in aviation and aerospace environments based on their academic preparation and to actively participate in human factors projects at the graduate level. A variety of research, consulting, and internship arrangements are included in the program.

This track is based on the scientist-practitioner model of the American Psychological Association (APA) and adheres to guidelines established by the committee for Education and Training of APA's Division 21 (Applied Experimental and Engineering Psychology). The program has been designed to meet the accreditation requirements of the Education Committee of the Human Factors and Ergonomics Society, as well as the International Ergonomics Association.

Students receive education in the content and techniques of human factors, including statistical and quantitative procedures, experimental design, survey methods, computer techniques, and other research methodologies.

The Systems track provides a systemic focus to the transformation of an operational need into a defined system configuration through the iterative process of functional analysis, synthesis, optimization, and design integration.

History indicates that a properly coordinated and functioning system that has a minimum of undesirable side effects cannot be achieved unless the system designer is sensitive to operational feasibility during the early stages of system development and assumes the responsibility for a user-centered life cycle. Therefore, a major focus of the Systems Track is an appreciation of the total life cycle of the system, including design, development, testing, production, operations, sustaining support, and disposal.

The track addresses considerations of human factors, reliability, maintainability, logistic support, safety, producibility, economic, and related factors as they apply to system design, integration, and evaluation. The goal of the track is to produce graduates who understand the proper balance between operational, behavioral, economic, and logistic factors.

Finally, the Systems track produces graduates who can move easily across disciplines. The graduates will understand the relative capabilities and limitations of each and thus know where trade-offs can effectively be made. This interdisciplinary prerequisite also requires that the graduate be able to use the tools and techniques of the various disciplines in both traditional and nontraditional applications.

* A five-year Human Factors and Systems program is available. Please see the undergraduate section of this catalog for details.

Degree Requirements

HUMAN FACTORS TRACK

Core Courses			Credits
HFS	500	Systems Concepts, Theory, and Tools	3
HFS	510	Research Design and Analysis I	3
HFS	600	Human Factors in Systems	3
HFS	610	Research Design and Analysis II	3
HFS	615	Sensation and Perception	3
HFS	620	Memory and Cognition	3

Electives*			Credits
BA	511	Operations Research	3
HFS	515	Ergonomics	3
HFS	520	Team Resource Management	3
HFS	521	Simulating Humans in Complex Systems	3
HFS	526	Aerospace Physiology	3
HFS	527	Drugs in Aviation and Society	3
HFS	528	Discrete Event Simulation I.	3
HFS	530	Systems Psychology	3
HFS	535	Applied Ergonomic Design, Analysis, & Evaluation	3
HFS	590	Graduate Seminar	3
HFS	625	Applied Testing and Selection	3
HFS	630	Cognitive Systems	3
HFS	635	Human Computer Interaction	3
HFS	640	Aviation/Aerospace Psychology	3
HFS	645	Underpinnings of Human Factors and Ergonomics	3
HFS	650	Human Factors of Aviation/Aerospace Applications.	3
HFS	696	Internship in Human Factors and Systems (highly recommended)	3
HFS	699	Special Topics in Human Factors and Systems	3
MSA	611	Aviation/Aerospace System Safety	3
MSA	612	Aviation/Aerospace Industrial Safety Management	3
MSE	500	Software Engineering Discipline	3

* Electives are selected with the consent of the student's graduate advisor. Other elective courses may be selected with the approval of the graduate advisor. A total of four electives must be fulfilled for degree completion.

Option I

HFS	700	Thesis	6
		-OR-	

Option II

HFS	515	Ergonomics	3
		-AND-	
HFS	611	Work Physiology	3
		-AND-	
Comprehensive Exam			0
Total Required			**36**

SYSTEMS TRACK

Core Courses			Credits
HFS	500	Systems Concepts, Theory, and Tools	3
HFS	505	System Engineering I	3
HFS	510	Research Design and Analysis I	3
HFS	600	Human Factors in Systems	3
HFS	605	System Engineering II	3
HFS	610	Research Design and Analysis II	3

Electives*			Credits
BA	511	Operations Research	3
BA	520	Organizational Behavior, Theory, and Applications in Aviation	3
BA	521	Global Information and Technology Management	3
HFS	515	Ergonomics	3
HFS	520	Team Resource Management	3
HFS	521	Simulating Humans in Complex Systems	3
HFS	526	Aerospace Physiology	3
HFS	527	Drugs in Aviation and Society	3
HFS	528	Discrete Event Simulation I.	3
HFS	530	Systems Psychology	3
HFS	535	Applied Ergonomic Design, Analysis, & Evaluation	3
HFS	590	Graduate Seminar	3
HFS	625	Applied Testing and Selection	3
HFS	635	Human Computer Interaction	3
HFS	640	Aviation/Aerospace Psychology	3
HFS	645	Underpinnings of Human Factors and Ergonomics	3
HFS	650	Human Factors of Aviation/Aerospace Applications.	3
HFS	696	Internship in Human Factors and Systems (highly recommended)	3
HFS	699	Special Topics in Human Factors and Systems	3
MSA	611	Aviation/Aerospace System Safety	3
MSA	612	Aviation/Aerospace Industrial Safety Management	3
MSA	641	Production & Procurement Management in the Aviation/Aerospace Industry	3

MSA 643 Management of Research & Development in the Aviation/ Aerospace Industry 3
MSE 500 Software Engineering Discipline 3
MSE 520 Formal Methods for Software Engineering 3
MSE 540 Simulation and Software Engineering. . . . 3
MSE 545 Specification and Design of Real-Time Systems 3

* Electives are selected with the consent of the student's graduate advisor. Other elective courses may be selected with the approval of the graduate advisor. A total of four electives must be fulfilled for degree completion.

Option I

HFS 700 Thesis 6

-OR-

Option II

HFS 515 Ergonomics 3

-AND-

HFS 611 Work Physiology 3

-AND-

Comprehensive Exam

Total Required **36**

Interdisciplinary Studies

Bachelor of Science

Program Plan of Study and Requirements

A unique interdisciplinary degree program offers students an opportunity to design a program of study that serves their needs and aspirations. This flexible degree, designed in response to appeals from corporate leaders, nurtures worldly thinkers who understand the intersections between technologies and humans.

Interdisciplinary Studies requires coursework in general education, a core curriculum, three minors, and open electives. General education provides a broad foundation of study, upon which the core expands. Core courses aim to enhance communication and analytical abilities and to help students gain an understanding of history, art, and literature, all of which shape an awareness of what it means to be human. Courses in the core also prepare students to discover meaningful connections among their three minors. The element of choice in Interdisciplinary Studies, primarily lodged in the selection of minor courses of study, allows them to explore the University's offerings in search of a configuration that will help them attain future goals. In the capstone experience, each student engages in a cooperative education or internship experience, or writes a senior thesis.

The flexibility of the Interdisciplinary Studies program allows students to design their own degree programs, by building on their individual strengths and interests. Depending on their choices, graduates can be prepared for careers in aviation and aerospace and related fields, business, the military, graduate studies, or law school. The Interdisciplinary Studies program seeks to graduate students with an entrepreneurial spirit who will cross boundaries, make creative connections, be flexible in a changing career environment, and become leaders in their chosen fields.

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's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Courses	Credits
Communication Theory and Skills*	9
Computer Science	3
Lower-Level Humanities*	3
Mathematics	6
Physical and Life Sciences	6
Lower-Level Social Sciences*	6
HU/SS 300-400 level*	3
Total Credits	**36**

*Embry-Riddle courses in Communication Theory and Skills, Humanities, and Social 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.

Communication Theory and Skills
COM 122, 219, 221, 222

Humanities
LOWER-LEVEL:
HU 140-146
UPPER-LEVEL:
300-400 level

Social Sciences
LOWER-LEVEL:
EC 200, 210, 211 (EC 200 is not acceptable together with EC 210 or EC 211 or their equivalent.)
PSY 101
SS 110, 120, 130
UPPER-LEVEL:
SS 302, 311, 321 325, 326, 331, 333, 334, 336, 337, 340, 353, 363

Core Requirements/Categories

Aviation Foundation

One course selected from the following:

Course		Title	Credits
AS	120	Introduction to Aeronautical Science	3
		-OR-	
SP	110	Introduction to Space Flight	3
		-OR-	
SS	130	History of Aviation	3
		-OR-	
		Private Pilot Certificate	
Total Credits			**3**

Humanities Survey

One course selected from the following:

Course		Title	Credits
HU	140	Western Humanities	3
		-OR-	
HU	141	Western Humanities II	3

(Must be taken in addition to HU 140's series course for General Education)

Total Credits **3**

Management Foundation

One course selected from the following:

Course		Title	Credits
BA	201	Principles of Management	3
		-OR-	
BA	335	International Business	3
Total Credits			**3**

Interdisciplinary Research and Skills

One course selected from the following:

Course		Title	Credits
HU	335	Technology and Modern Civilization	3
		-OR-	
HU	338	Traversing the Borders	3
Total Credits			**3**

International Perspectives

Two courses selected from the following:

Course		Title	Credits
SS	321	U.S. Military History 1900-Present	3
SS	325	International Studies	3
SS	326	Russian-U.S. Relations	3
SS	333	U.S.-Asian Relations	3
SS	334	Contemporary Africa and the World	3
SS	336	The Modern Middle East in World Affairs	3
SS	337	Globalization and World Politics	
SS	340	U.S. Foreign Policy	3
SS	363	Inter-American Relations	3
Total Credits			**6**

Philosophical Perspectives

One course selected from the following:

Course		Title	Credits
HU	330	Values and Ethics	3
		-OR-	
HU	341	World Philosophy	3
		-OR-	
HU	345	Comparative Religions	3
Total Credits			**3**

Upper-Level Literature

One course selected from the following:

Course		Title	Credits
HU	300	World Literature	3
		-OR-	
HU	305	Modern Literature	3
		-OR-	
HU	310	American Literature	3
Total Credits			**3**

Upper-Level Communication

One course selected from the following:

Course	Title	Credits
COM 225	Science and Technology Communication	3
COM 322	Aviation and Aerospace Communication	3
COM 350	Environmental Communication	3
COM 360	Media Relations I	3
COM 412	Advanced Technical Writing	3
COM 415	Nonverbal Communication	3
HU 420	Applied Cross-Cultural Communication	3
Total Credits		**3**

Capstone Experience

Course	Title	Credits
CE 396/397	Cooperative Education	
	-OR-	
HU 475	Senior Thesis	
Total Credits		**3**
Total Credits Required		**30**

Minors

Students must select three minor fields of study. Required credits in each minor vary, depending on the minors chosen. See Minor Courses of Study in this catalog.

Total Credits	**45/54**
Open Electives	**0-9**
TOTAL DEGREE CREDITS	**120**

Space Physics

Bachelor of Science

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 Space Physics program focuses on Space Science with emphasis on solar system physics, planetary science, and astrophysics. The program shares its facilities and coursework with the highly successful Engineering Physics program, the largest of its kind in the United States.

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 120 credit hours. 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 in MA 241, MA 242, MA 243, PS 208, PS 215, and PS 219.

General Education Requirements

For a full description of Embry-Riddle's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

* 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 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 Space Physics vertical outline.

COMMUNICATION THEORY AND SKILLS
COM 122, 219, 221, 222, 360

HUMANITIES
LOWER-LEVEL:
HU 140-146
UPPER-LEVEL:
HU 300-400 level

SOCIAL SCIENCES
LOWER-LEVEL:
EC 200
PSY 101, SS 110, 120, 130, 204, 210
UPPER-LEVEL:
HF 300
PSY 350
SS 302, 305, 310, 320, 325, 331, 335, 340, 350, 352, 360

TECHNICAL ELECTIVES
AE/AEL/CEC/CIV/CS/CC/EGR/EL/EP/ES/ME/SE/MA/PS 300-400 level

Students may take other HU/SS courses with the approval of the department chair/program coordinator.

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills*	6
		Lower-Level Humanities*	3
		Lower-Level Social Sciences*	3
EP	101	Current Topics in Space Sciences	1
MA	241	Calculus & Analytic Geometry I	4
MA	242	Calculus & Analytic Geometry II	4
PS	140	Chemistry for Engineers	4
PS	141	Chemistry for Engineers Laboratory	1
PS	215	Physics I	3
PS	216	Physics Laboratory I	1
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
		Communication Theory and Skills*	3
		Upper-Level Humanities*	3
EGR	115	Introduction to Computing for Engineers	3
MA	243	Calculus & Analytic Geometry III	
MA	345	Differential Equations and Matrix Methods	4
PS	208	Physics II	3
PS	219	Physics III	3
PS	220	Physics Laboratory III	1
		Open Electives	6
Total Credits			**30**

JUNIOR YEAR

Course		Title	Credits
		Technical Elective	3
EP	393	Spaceflight Dynamics	2
EP	400	Thermodynamics and Statistical Mechanics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
MA	442	Mathematical Methods for Engineering & Physics II	3
		Upper-Level Social Sciences*	3
PS	303	Modern Physics	3
PS	305	Modern Physics Laboratory	1
PS	320	Classical Mechanics	3
PS	401	Astrophysics	3
		Open Elective	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
		Technical Electives	6
EP	410	Space Physics	3
EP	420	Planetary Science	3
EP	440	Engineering Electricity and Magnetism	3
EP	455	Quantum Physics	3
PS	400	Senior Physics Laboratory	3
PS	405	Atomic/Nuclear Physics	3
PS	408	Astrophysics II	3
		Open Elective	3
Total Credits			**30**

TOTAL DEGREE CREDITS **120**

College of Aviation

Dr. Tim Brady, Dean

The College of Aviation integrates into one unit 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 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 Aviation Building, a strikingly beautiful state-of-the-art facility that opened in 2002, houses the academic departments, classrooms, and laboratories, including the Air Traffic Simulation laboratory, which provides 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) FTDs.

Each of these devices exactly simulates the aircraft, including the flying qualities, sounds, etc., 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, security systems, 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.

Academic degree programs offered through the College of Aviation include the following undergraduate degrees:

- Aeronautical Science (Professional Pilot)
- Aeronautics
- Aviation Maintenance Science
- Applied Meteorology
- Air Traffic Management
- Homeland Security
- Safety Science
- Unmanned Aircraft Systems Science

In addition, the College offers the Master of Science degree in Aeronautics with specializations in Air Traffic Management, Aviation/Aerospace Education Technology, Aviation/Aerospace Management, Aviation/Aerospace Operations, or Aviation/Aerospace Safety Systems.

The College of Aviation has an enrollment of approximately 2,200 students, many of whom are in the Aeronautical Science degree, which has the largest enrollment of any similar undergraduate degree program in the nation. The College has a fleet of 65 aircraft, including the Cessna C-172, Piper PA-28R Arrow, and the new Diamond DA 42 Twin Star. The entire C-172 and Diamond DA 42 Twin Star 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. This is the only all-glass cockpit, all ADS-B fleet in collegiate aviation.

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, and safety and security professionals of the new century.

Aeronautical Science (Professional Pilot)

Bachelor of Science

Specialties: Airline Pilot, Commercial Pilot, Military 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 and knowledge 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. Unmanned aerial vehicles are becoming an important part of aviation. Aeronautical Science students will have the opportunity to learn about UAVs, fly them, and incorporate them into the U.S. airspace. 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 in multi-crewmember jet transport aircraft. Critical-thinking and problem-solving skills are developed via computer simulations in aircraft performance, navigation, and aircraft systems operation. Effective resource management, human factors, 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 transport aircraft.

Students pursuing the Aeronautical Science degree will select one of three specializations after matriculation. Students entering under this catalog may select from the Airline Pilot, Commercial Pilot, or Military Pilot specialization. Please see the section concerning the restrictions imposed by the Aviation Transportation and Security Act. All students must complete the general education courses, the Aeronautical Science core courses, the flight core courses, and the courses required to complete one specialization in order to complete the requirements for the Aeronautical Science degree.

Bachelor of Science Degree in Aeronautical Science

Course	Title	Credits
General Education		39
Aeronautical Science Core		51
Flight Core		4
Specialty Courses		26
TOTAL DEGREE CREDITS		**120**

General Education Requirements

Course		Title	Credits
		Communication Theory and Skills*	9
		Lower-Level Humanities*	3
		Lower-Level Social Sciences*	6
		Upper-Level Humanities -OR- Social Sciences*	3
		Computer Science Elective*	3
		Management Elective*	3
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I with Laboratory	3
PS	104	Technical Physics II with Laboratory	3
Total Credits			**39**

Aeronautical Science Core Courses

Course		Title	Credits
ASC	101	Aeronautical Science Success	1
AS	121	Private Pilot Operations	5
AS	221	Instrument Pilot Operations	3
AS	309	Aerodynamics	3
AS	310	Aircraft Performance	3
AS	311	Aircraft Engines-Turbine	3
AS	321	Commercial Pilot Operations	3
AS	340	Instructional Design in Aviation	
		-OR-	
FA	417	Flight Instructor Rating**	3
AS	350	Domestic and International Navigation	3
AS	356	Systems and Components	3
AS	357	Flight Physiology	3
AS	387	Crew Resource Management	3
AS	408	Flight Safety	3
AS	435	Electronic Flight Management System	3
AS	472	Operational Applications in Aeronautical Science	3
WX	201	Survey of Meteorology	3
WX	301	Aviation Weather	3
Total Credits			**51**

Flight Core Courses**

SINGLE-ENGINE FLIGHT TRACK

Course		Title	Credits
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

-OR-

MULTI-ENGINE FLIGHT TRACK

Course		Title	Credits
FA	121	Private Single Flight	1
FA	122	Private Multi Flight with Laboratory	1
FA	222	Instrument Multi Flight	1
FA	322	Commercial Multi Flight	1
Total Credits			**4**

Airline Pilot Specialty

Course		Title	Credits
AS	254	Aviation Legislation	
		-OR-	
AS	405	Aviation Law	3
AS	380	Pilot Career Planning and Interviewing	1
AS	402	Airline Operations	
		-OR-	
AS	410	Airline Dispatch Operations	3
AS	411	Jet Transport Systems	3
AS	420	Flight Technique Analysis	3
BA	315	Airline Management	3
FA	420	Airline Flight Crew Techniques and Procedures	2
		Electives	8
Total Credits			**26**

Commercial Pilot Specialty

Course		Title	Credits
AS	254	Aviation Legislation	
		-OR-	
AS	405	Aviation Law	3
AS	380	Pilot Career Planning and Interviewing	1
BA/AES		300/400 level	3
		Minor	9-18
		Electives	1-10
Total Credits			**26**

Military Pilot Specialty

Course		Title	Credits
AS	220	Unmanned Aircraft Systems	3
		-OR-	
AS	420	Flight Technique Analysis	
SS	311	U.S. Military History 1775-1900	
		-OR-	
SS	321	U.S. Military History 1900-Present	
		-OR-	
SS	340	American Foreign Policy	3
		ROTC	16
		Electives	4
Total Credits			**26**
TOTAL DEGREE CREDITS			**120**

Aeronautical Science Notes

*Embry-Riddle courses in the general education categories of Communication Theory and Skills, Computer Science, Humanities, Social Sciences, and Management 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 Aeronautical Science vertical outline.

Communication Theory and Skills:
COM 122, 219, and 221, 222, or 410

Computer Science:
CS 120 or CS 117 or 118

Humanities/Social Sciences:
LOWER-LEVEL:
HU 140, 141, 142, 143, 144, 145, 146
LOWER-LEVEL:
PSY 101 and EC 200, SS 110, 120, 130, 204 or 210 (Military Pilot Specialty may take only PSY 101 and SS 110, 120, or 130.)
UPPER-LEVEL:
HU/SS 300-400 level or PSY 350

Management:
BA 201

**Flight:

Students have a choice of either the Single-Engine Flight Track or Multi-Engine Flight Track. Both result in certification as a Commercial Pilot with Multi-Engine and Instrument ratings. The Single-Engine Flight Track is selected by most students. In this track, single-engine aircraft and flight training devices are used for the majority of training. Students who select this track do so primarily because it will allow certification as a flight instructor sooner, allowing for the opportunity to flight instruct part-time while completing their degree. The Single-Engine Track also provides an opportunity to complete the required flight education with reduced flight fees when compared to the Multi-Engine Flight Track.

The Multi-Engine Flight Track emphasizes multi-engine aircraft operations. This track is selected by students who do not necessarily desire to attain their flight instructor certificate and prefer to complete their flight education with more multi-engine flight time. Students who are in the Multi-Engine Flight Track who wish to attain their Certified Flight Instructor certificate must complete their single-engine add-on to their commercial multi certificate before they can be certified to instruct in single-engine aircraft.

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 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, including those for single-engine commercial, certified flight instructor airplane and instrument, and/or they may enroll in the Airline Flight Crew Simulation course.

Refer to page 46 for credit for flight training at other institutions.

Cooperative Education credits may be used as open electives.

Aircraft Dispatcher Certification Program

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 Aeronautical Science courses and the applicable prerequisites.

Course		Title	Credits
AS	221	Instrument Pilot Operations	3
AS	310	Aircraft Performance	3
AS	321	Commercial Pilot Operations	3
AS	410	Airline Dispatch Operations*	3
AT	200	Air Traffic Management I	3
WX	201	Survey of Meteorology	3
WX	301	Aviation Weather	3
Total Credits			**21**

* AS 410 serves as the capstone course for the Aircraft Dispatcher program. Students cannot enroll in this class until they have completed and passed all other required Aeronautical Science 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 100 percent attendance throughout each course, and obtain a grade of at least 70 percent. For more information, contact the Aeronautical Science Department.

Pilot Advancement Certification Program

For those individuals already possessing a four-year degree who are interested in furthering their flight training beyond the Private Pilot level, Embry-Riddle offers a certificate program designed to deliver advanced levels of flight certification. The courses associated with this program are tailored to meet individual needs that build upon previously garnered flight experiences. (military, FBO, etc.). This certificate program does not require enrollment as a full-time degree-seeking student. The students enrolled in this program attend Aeronautical Science academic courses and train in the same flight courses as our regular four-year degree students. At the successful completion of this program, the student attains, as a minimum, an FAA commercial pilot certificate with an airplane single-engine and/or multi-engine land rating(s). Further pilot advancement training is available based on the individual student's needs. Advanced flight training and/or FAA certification includes upset training, hypoxia training, spatial disorientation training, flight instructor certificate, instrument flight instructor certificate, multi-engine flight instructor certificate, and training as a flight crewmember in a jet transport aircraft.

The training acquired in this program will advance the student's knowledge and ability to serve as a professional pilot.

Certification Requirements

The Pilot Advancement Certificate program provides a choice of either the Single-Engine Flight Track or Multi-Engine Flight Track. Both result in certification as a commercial pilot with multi-engine and instrument ratings. Graduation from the program is based on the successful completion of one of the two following Aeronautical Science ground and flight course sequences:

Single-Engine Flight Track

Course		Title	Credits
AS	221	Instrument Pilot Operations	3
AS	321	Commercial Pilot Operations	3
FA	221	Instrument Single Flight	1
FA	321	Commercial Single Flight	1
FA	323	Commercial Multi Add On	1
Total Credits			**9**

-OR-

Multi-Engine Flight Track

Course		Title	Credits
AS	221	Instrument Pilot Operations	3
AS	321	Commercial Pilot Operations	3
FA	122	Private Multi Flight with Laboratory	1
FA	222	Instrument Multi Flight	1
FA	322	Commercial Multi Flight	1
Total Credits			**9**

Students wanting to enter the Pilot Advancement Certificate Program who do not have a private pilot certificate will have to enroll as a regular degree-seeking student in AS 121 and FA 121.

Note: 9 credit hours are the minimum number of hours required for certification completion.

Advanced Flight Training Track

This supplemental track is designed for students with appreciable flight training and/or flight experience to them opportunities to advance as a professional pilot. Completion of the Single-Engine Flight Track or Multi-Engine Flight Track or equivalent experience is required to enter the Advanced Flight Training Track.

Advanced Flight Training Track

Course		Title	Credits
FA	215	Upset Training with Laboratory	1
FA	326	Commercial Single Add On Flight	1
FA	370	Advanced Multi-Engine Instrument Flight	1
FA	417	Flight Instructor Rating with Laboratory	3
FA	418	Airline Transport Pilot Proficiency Development	1
FA	420	Airline Flight Crew Techniques and Procedures with Laboratory	2
FA	460	Multi-Engine Flight Instructor Rating with Laboratory	2
FA	199-499	Special Topics in Flight	0-2
		-OR-	
AS	199-399	Special Topics in Aeronautical Science	1-3
Total Credits			**9/15**

Aeronautics

Bachelor of Science

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-six 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, Cooperative Education, Electronics, Flight,
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 may be used to fill Area of Concentration, Professional Development, or Open Elective 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.

Curriculum

Course Title **Credits**

Aviation Area of Concentration 36
Advanced standing credit and/or non-duplicating credit from AMS, AS, AT, CEA, FA, HS, SF, SIM, SP, or WX courses.
Communication Theory and Skills* 9
Computer Science Elective 3
Humanities/Social Sciences* 12
Lower-Level Humanities Elective 3
Lower-Level Social Sciences Elective
(PSY 101 and/or Lower-Level SS) 6
Upper-Level HU or SS Elective 3
Mathematics** 6
College Algebra or Higher-Level Mathematics 3
MA 112 College Mathematics for Aviation II -OR-
MA 222 Business Statistics -OR-
Higher-Level Mathematics 3
Physical Sciences** 6
Physical and Life Sciences Elective
One course must include a laboratory.
Program Support 12
AS 254 Aviation Legislation 3
AS 405 Aviation Law 3
BA 201 Principles of Management -OR-
BA 210 Financial Accounting 3
EC 200 An Economic Survey -OR-
EC 210 Microeconomics -OR-
EC 211 Macroeconomics 3
Professional Development Electives 21
Select from Upper-Division (300-400) courses in AMS, AS, AT, BA, CEA, CS, EC, FA, HS, IT, LET, SF, SIM, SP, WX
Open Electives 15

TOTAL DEGREE CREDITS 120

* Embry-Riddle courses in the general education categories of Communication Theory and Skills, Humanities, and Social 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 Aeronautics vertical outline. Other courses may also be used with permission of the undergraduate program coordinator.

Communication Theory and Skills
COM 122, 219, 221, 222, 410, 415

Humanities/Social Sciences:
LOWER-LEVEL:
HU 140, 141, 142, 143, 144, 145, 146
LOWER-LEVEL:
PSY 101, SS 110, 120, 130, 204 or 210
UPPER-LEVEL:
HU/SS 300-400 level or HF 300, PSY 350

Dependent on the amount of upper-level Aviation Area of Concentration credit applied, some of the open or Communication/Humanities/Social Sciences electives in the B.S. degree may have to be 300-400 level courses to satisfy the graduation requirement of 39 credits of upper-level courses.

** Students need to ascertain Mathematics and Physical Sciences pre/corequisites that are required for other courses. For example, PS 103/4 and MA 112 are required for many upper-division AS and WX courses.

Master of Science in Aeronautics (MSA)

Introduction

The Master of Science in Aeronautics (MSA) degree program is designed to provide the aviation/aerospace professional with a rigorous academic approach to a generalist education oriented degree. It provides an unequaled opportunity for flight crewmembers, air traffic control personnel, flight operations specialists, industry technical representatives, and aviation educators to enhance their knowledge and pursue additional career opportunities.

Entry into the MSA program requires possession of an undergraduate foundation, with a minimum GPA of 3.0, in the areas of college-level mathematics, introduction to computers, economics, and behavioral science.

The MSA program consist of 36 credits. Students must complete the Advanced Aviation/Aerospace Science Core consisting of 12 credits and then complete the 12 credits that make up the selected specialization in one of five areas: Air Traffic Management, Aviation/Aerospace Education Technology, Aviation/Aerospace Management, Aviation/Aerospace Operations, Aviation/Safety Management Systems or Aviation Meteorology. Students must also complete 12 credits of coursework that includes either a Thesis (6 credits), or a Graduate Capstone Course (GCP) (3 credits) and either 6 or 9 credits in elective courses to complete the 12 hours of credit depending on the option selected. A comprehensive examination (0 credits) plus 12 credits in elective courses is an option for students under special circumstances and with approval by the Program Coordinator. MSA students can also complete courses leading to a multiple specialization. The multiple specializations must be declared prior to the completion of the degree program. **Students wishing to complete multiple specializations must have 12 unduplicated credits in each of the specializations and a minimum of 39 credit hours.**

Degree Requirements

Air Traffic Management Specialization

Track 1: For students with no ATC experience or education.

Required Undergraduate Foundation (18 Credits)

Course	Title	Credits
AS 132	Basic Aeronautics I	3
AT 200	Air Traffic Management I	3
AT 302	Air Traffic Management II	3
AT 305	Air Traffic Management III	3
AT 401	Air Traffic Management IV	3
WX 201	Survey of Meteorology	3
Total Required		**15**

MSA Core Requirements (12 Credits)

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/Control Systems	3
Total Required		**12**

Specialization Requirements (12 Credits)

Course	Title	Credits
BA 520	Organizational Behavior, Theory, and Applications in Aviation	3
MSA 508	Advanced Airport Modeling	3
MSA 515	Aviation/Aerospace Simulation Systems	3
MSA 520	Air Traffic Management-VFR Tower	3
MSA 608	Aviation/Aerospace Accident Investigation and Safety Systems	3
MSA 615	Applied Aviation Research Methods	3
MSA 616	Air Traffic Management Leadership and Critical Decision Making	3
MSA 617	Air Traffic Management V	3
MSA 618	Air Traffic Management VI	3
MSA 627	Air Traffic Management in the NAS	3
MSA 636	Advanced Aviation/Aerospace Planning Systems	3
MSA 696	Graduate Internship in Aeronautical Science	1-3
Total Required		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**
TOTAL DEGREE REQUIREMENTS		**54**

Air Traffic Management Specialization

Track 2: For students with an Embry-Riddle undergraduate degree in Air Traffic Management.

MSA Core Requirements (12 Credits)

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/Control Systems	3
Total Required		**12**

Specialization Requirements (12 Credits)

Course	Title	Credits
BA 520	Organizational Behavior, Theory, and Applications in Aviation	3
MSA 508	Advanced Airport Modeling	3
MSA 515	Aviation/Aerospace Simulation Systems	3
MSA 608	Aviation/Aerospace Investigation and Safety Programs	3
MSA 615	Applied Aviation Research Methods	3
MSA 616	Air Traffic Management Leadership and Critical Decision Making	3
MSA 627	Air Traffic Management in the NAS	3
MSA 636	Advanced Aviation/Aerospace Planning Systems	3
MSA 696	Graduate Internship in Aeronautical Science	1-3
Total Required		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**
TOTAL DEGREE REQUIREMENTS		**36**

Course substitutions with approval of MSA Program Coordinator.

Aviation/Aerospace Education Technology Specialization

MSA Core Requirements (12 Credits)

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/ Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/ Control Systems	3
Total Required		**12**

Specialization Requirements (12 Credits)

Course	Title	Credits
MSA 514	Computer-Based Instruction	3
MSA 515	Aviation/Aerospace Simulation Systems	3
MSA 518	Online Learning Environment	3
MSA 550	Aviation Education Foundations	3
MSA 614	Advanced Aviation/Aerospace Curriculum Development	3
MSA 654	Adult Teaching and Learning Techniques	3
MSA 663	Memory and Cognition	3
Total Required		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**

TOTAL DEGREE REQUIREMENTS **36**

Aviation/Aerospace Management Specialization

MSA Core Requirements (12 Credits)

Total Required **12**

Specialization Requirements (12 Credits)

Course	Title	Credits
BA 511	Operations Research	3
BA 521	Global Information and Technology Management	3
BA 607	Human Resource Development	3
BA 632	Seminar in Aviation Labor Relations	3
BA 645	Airport Operations and Management	3
MSA 508	Advanced Airport Modeling	3
MSA 603	Aircraft and Spacecraft Development	3
MSA 609	Aircraft Maintenance Management	3
MSA 611	Aviation/Aerospace System Safety	3
MSA 612	Safety Program Management	3
MSA 615	Applied Aviation Research Methods	3
MSA 616	Air Traffic Management Leadership and Critical Decision Making	3
MSA 627	Air Traffic Management in the NAS	3
MSA 636	Advanced Aviation/Aerospace Planning Systems	3
MSA 641	Production and Procurement Management in the Aviation/ Aerospace Industry	3
MSA 643	Management of Research and Development for the Aviation/ Aerospace Industry	3
MSA 644	Integrated Logistics Support in Aviation/Aerospace	3
Total Required		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**

TOTAL DEGREE REQUIREMENTS **36**
(At least 18 credits must be MAS courses)

Aviation/Aerospace Operations Specialization

Advanced Aviation/Aerospace Science Core

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/ Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/ Control Systems	3
Total Required		**12**

Specialization Requirement (12 Credits)

Course	Title	Credits
BA 511	Operations Research	3
BA 520	Organizational Behavior, Theory, and Applications in Aviation	3
MSA 508	Advanced Airport Modeling	3
MSA 515	Aviation/Aerospace Simulation Systems	3
MSA 516	Applications in Crew Resource Management	3
MSA 519	Terrorism and Homeland Security	3
MSA 603	Aircraft and Spacecraft Development	3
MSA 606	Aviation/Aerospace Communication/ Control Systems	3
MSA 608	Aviation/Aerospace Accident Investigation and Safety Systems	3
MSA 620	Air Carrier Operations	3
MSA 622	Corporate Aviation Operations	3
Total Required		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**
TOTAL DEGREE REQUIREMENTS		**36**

Aviation Safety Management Systems Specialization

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/ Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/ Control Systems	3
Total Required		**12**

Specialization Requirement (12 Credits)

Course	Title	Credits
MSA 508	Advanced Airport Modeling	3
MSA 519	Terrorism and Homeland Security	3
MSA 608	Aviation/Aerospace Accident Investigation and Safety Systems	3
MSA 611	Aviation/Aerospace System Safety	3
MSA 612	Safety Program Management	3
MSA 613	Airport Operations Safety	3
MSA 634	Aviation/Aerospace Psychology	3

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**
TOTAL DEGREE REQUIREMENTS		**36**

Aviation Meteorology Specialization

MSA Core Requirements (12 Credits)

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/ Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/ Control Systems	3
Total Required		**12**

Specialization Requirement (12 Credits)

Option 1: For students with no undergraduate Meteorology/Atmospheric Sciences degree (12 credits)

Required courses:

Course	Title	Credits
MSA 517	Advanced Meteorology	3
MSA 525	Advanced Aviation Meteorology	3
MSA 530	Research Seminar in Aviation Meteorology	3
WX 422	Statistical Applications for Meteorological Data Analysis	
	-OR-	
WX 480	Environmental Security	3
Total Credits		**12**

Option II: For students with undergraduate Meteorology/Atmospheric Sciences Degree (12 credits)

Required courses:

Course	Title	Credits
MSA 525	Advanced Aviation Meteorology	3
MSA 530	Research Seminar in Aviation Meteorology	3
	Electives*	6
Total Credits		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**
Total Degree Requirements		**36**

Professional Pilot Specialization

MSA Core Requirements (12 Credits)

Required Course:

Course	Title	Credits
MSA 662	Statistical Analysis for Aviation/Aerospace	3
MSA 670	Research Methods for Aviation/Aerospace	3

Core Courses (choose 2)

Course	Title	Credits
MSA 602	Air Transportation System	3
MSA 604	Human Factors in the Aviation/ Aerospace Industry	3
MSA 606	Aviation/Aerospace Communications/ Control Systems	3
Total Required		**12**

Specialization Requirement (12 Credits)

Required courses:

Course	Title	Credits
MSA 509	Advanced Aerodynamics	3
MSA 510	Advanced Aircraft Performance	3
MSA 516	Applications in Crew Resource Management	3
MSA 671	Professional Flight Crew Techniques and Procedures	3
MSA 620	Air Carrier Operations	3
	-OR-	
MSA 622	Corporate Aviation Operations	3
Total Credits		**12**

Electives (12 Credits)

Option I

Course	Title	Credits
MSA 691	Graduate Capstone Project	3
MSA/BA	Electives (500-600 Level)	9

Option II

Course	Title	Credits
MSA/BA	Electives (500-600 Level)	6
MSA 700	Thesis	6
Total Required		**12**
Total Degree Requirements		**36**

Open Electives Options

MSA 515	Aviation/Aerospace Simulation Systems	3
MSA 517	Advances Meteorology	3
MSA 608	Aviation/Aerospace Accident Investigation and Safety Systems	3
MSA 611	Aviation/Aerospace Safety System	3
MSA 613	Airport Operations Safety	3

*A combination of two selected elective courses in the WX 400 series that is offered for dual undergraduate/graduate credit, or a combination of one WX 400 elective course for dual undergraduate/graduate credit, and a course in another department that is offered for graduate credit. Examples of acceptable elective course areas are program/project management, human factors, air traffic management, safety science, and homeland security.

Required Undergraduate FAA Certification*

Course Title Credits

AS	121	Private Pilot Operations	5
AS	221	Instrument Pilot Operations	3
AS	321	Commercial Pilot Operations	3

-AND-

Single Engine Flight Track

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

-OR-

Multi Engine Flight Track

FA	121	Private Single Flight	1
FA	122	Private Multi Flight with Laboratory	1
FA	222	Instrument Muli Flight	1
FA	322	Commercial Multi Flight	1

*May be completed concurrently with MSA course work

See the Advance 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, and an explanation of the single-engine and multi-engine flight tracks

Air Traffic Management

Bachelor of Science

The Applied Aviation Sciences Department offers a Bachelor of Science degree in Air Traffic Management (ATM). This degree is designed for students whose goal is to become air traffic controllers or seek employment in a related industry. The academic courses are designed to provide exposure to procedures and operations consistent with those found in Federal Aviation Administration (FAA) air traffic control facilities. The ATM curriculum provides the knowledge and foundation designated by the FAA for eventual student entry into the FAA Academy where they will be integrated with graduates of other Collegiate Training Initiative (CTI) schools for additional air traffic control training.

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 as approved by the Applied Aviation Sciences Department.

General Education Requirements

Course Title	Credits
Communication Theory & Skills	9
Computer Science	3
Lower-Level Humanities*	3
Mathematics	6
Physical and Life Sciences	6
Lower-Level Social Sciences*	6
HU/SS 300-400 level*	3
Total Credits	**36**

* 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.

Communication Theory and Skills
    COM 122, 219, 221, 222, 410

Humanities
    HU 140, 141, 142, 143, 144, 145

Social Sciences
    Lower-Level
    SS 110, 120, 130, 204, 210
    Upper-Level
    SS 310, 325, 350, 351, 352

Physical Sciences
    PS 101, 102, 103, 104, 105, 106, 107, 108, 111, 112, 142, 208, 215, 219, 240, 301, 302, 303, 304, 306, 308, 309, 310, 312, 313, 320, 400, 401, 403, 405, 408, 410, 411, 412, 414 (1 laboratory)

Mathematics
    MA 111, 112, 140, 142, 241; MA 145, 241

Students enrolled in the Army, Navy, or Air Force ROTC programs may substitute MY, NSC, or AF courses for open elective courses.

Suggested Program 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.

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills	6
		Computer Science Elective*	3
		Physical Sciences with Laboratory	3
		Lower-Level Humanities	3
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
WX	201	Survey of Meteorology	3
		Open Elective	6
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
		Communication Theory and Skills	3
		Physical Sciences*	3
		Lower-Level Humanities	3
AT	200	Air Traffic Management I	3
AT	302	Air Traffic Management II	3
BA	201	Principles of Management	3
EC	200	An Economic Survey	3
PSY	101	Introduction to Psychology	3
SF	201	Introduction to Health, Occupational Safety, and Transportation	
		-OR-	
SF	210	Introduction to Aerospace Safety	3
SF	320	Human Factors in Aviation Safety	3
Total Credits			**30**

JUNIOR YEAR

Course		Title	Credits
		300-400 Level Elective HU/SS	3
		Upper-Level Open Elective	6
AT	305	Air Traffic Management III	3
AT	315	VFR Control Tower	3
AT	401	Air Traffic Management IV	3
BA	314	Human Resource Management	3
SF	462	Health, Safety, and Aviation Law	3
WX	301	Aviation Weather	3
		Open Elective	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
AT	405	Air Traffic Management V	3
AT	406	Non Radar Air Traffic Control	3
Required courses necessary to complete one minor course of study approved by the Applied Aviation Sciences Department			15-24
Open Electives to meet the requirement of 40 hours of upper-level courses and 120 total hours to complete the degree.			9-18
TOTAL DEGREE CREDITS			**120**

Applied Meteorology

Bachelor of Science

The Applied Aviation Sciences Department offers a Bachelor of Science degree in Applied Meteorology. This program offers students with a passion for weather the opportunity to study, observe, and explore atmospheric phenomena ranging from global climate to tornadoes in our new state-of-the-art Weather Center and computer-equipped classrooms. Besides mastering the essentials of meteorology, students will acquire the communication skills necessary to translate information about complex atmospheric features into the practical language of operational decision makers. The program aims to produce graduates with the necessary knowledge, analytical skills, and operational expertise to add value to any decision impacted by the weather. Graduates will be competitive for jobs ranging from the aviation and aerospace industry to radio and television to business and government/military operations of the 21st century.

Degree Requirements

The Bachelor of Science degree in Applied Meteorology requires successful completion of a minimum of 120 credit hours and can be attained in eight semesters. Students pursuing the Applied Meteorology degree will select one of five areas of concentration (AOC) from Flight Weather, Media Weather, Commercial Weather, Meteorological Computer Applications, or Research, generally by the end of their fourth semester. All students must complete the general education courses, Applied Meteorology core courses, and the required courses for one AOC in order to graduate with a Bachelor of Science in Applied Meteorology. A student wishing to become eligible for employment with the U.S. government as a meteorologist must complete the Research or Meteorological Computer Applications AOC in order to meet U.S. Office of Personnel Management Qualification Standards. All students entering the Applied Meteorology program must take a math placement test or show suitable advanced placement. Because many courses have prerequisites or corequisites, students in the Research and Meteorological Computer Applications AOCs should prepare to begin the required calculus sequence as soon as they are eligible.

Bachelor of Science Degree in Applied Meteorology

Course Title	Credits
General Education	36/37
Applied Meteorology Core	47
Area of Concentration	29/32
Open Electives	3/8
Total Degree Credits Required	**120**

General Education Requirements

Course Title	Credits
Communication Theory and Skills	9
Computer Science Elective	3
Lower-Level Humanities (HU)	3
Lower-Level Social Sciences (SS)	6
Upper-Level HU/SS Elective	3
Mathematics (see specific AOC)	6/7
Physics (see specific AOC)	6
Total Credits	**36/37**

Applied Meteorology Core

Course	Title	Credits
CE AAS	Co-op/Internship or Approved Electives	6
PS 105	General Chemistry	4
UNIV 101	College Success	1
WX 201	Survey of Meteorology	3
WX 261	Applied Climatology	3
WX 270	Weather Information Systems	3
WX 353	Thermodynamics of the Atmosphere	3
WX 354	Dynamics of the Atmosphere	3
WX 356	Synoptic Meteorology	3
WX 365	Satellite & Radar Weather Interpretation	3
WX 390	Atmospheric Physics	3
WX 422	Statistical Applications for Meteorological Data Analysis	3
WX 427	Forecasting Techniques	3
WX 456	Advanced Weather Analysis	3
WX 457	Weather Operations Seminar	3
Total Credits		**47**

Flight Weather Area of Concentration

Course	Title	Credits
AS 121	Private Pilot Operations	5
AS 221	Instrument Pilot Operations*	3
AS 309	Aerodynamics	3
AS 310	Aircraft Performance*	3
AS 321	Commercial Pilot Operations*	3
AS 410	Air Dispatch Operations*	3
AT 200	Air Traffic Management I*	3
WX 301	Aviation Weather	3
WX 364	Weather for Aircrews	3
Total Credits		**29**

* Indicates courses in the Aircraft Dispatcher Certification Program.

Media Weather Area of Concentration

Course	Title	Credits
AS 120	Principles of Aviation Science	3
COM 225	Science & Technology Communications	3
COM 260	Introduction to Media	3
COM 265	Introduction to News Writing	3
COM 320	Communications Law & Ethics -OR-	
HU 330	Values and Ethics	3
COM 360	Media Relations I	3
WX 280	Introduction to TV Weathercasting	3
WX 361	Global Climate Change	3
WX 380	Advanced TV Weathercasting	3
WX 475	Field Production and Weathercast Video Editing	3
Total Credits		**30**

Commercial Weather Area of Concentration

Course	Title	Credits
AS 120	Principles of Aviation Science	3
BA 220	Marketing	3
BA 221	Advanced Computer Based Systems	3
BA 325	Social Responsibility and Ethics Management	3
EC 210	Microeconomics	3
EC 420	Economics of Air Transportation	3
WX 361	Global Climate Change	3
	Applied Meteorology Electives	3
	Business Electives	6
Total Credits		**30**

Meteorological Computer Applications Area of Concentration

Course	Title	Credits
AS 120	Principles of Aviation Sciences	3
CS 225	Computer Science II	4
MA 242	Calculus and Analytical Geometry II	4
MA 243	Calculus and Analytical Geometry III	4
MA 345	Differential Equations and Matrix Methods	4
PS 250	Physics III for Engineers	3
PS 253	Physics Laboratory for Engineers	1
SE 300	Software Engineering Practices	4
CS/SE/CEC	Upper-Level Electives	6
Total Credits		**33**

Research Area of Concentration

Course	Title	Credits
AS 120	Principles of Aviation Science	3
CS 225	Computer Science II	4
MA 242	Calculus and Analytic Geometry II	4
MA 243	Calculus and Analytic Geometry III	4
MA 345	Differential Equations and Matrix Methods	4
PS 250	Physics for Engineers III	3

PS	253	Physics Laboratory for Engineers	1
WX	420	Advanced Atmospheric Thermodynamics	3
WX	490	Advanced Dynamic Meteorology I	3
WX	491	Advanced Dynamic Meteorology II	3
Total Credits			**32**

Suggested Program of Study

A word about math and physics requirements: meteorology is an application of math and physics to the sea of air in which we live. Students who wish to pursue graduate studies in the atmospheric sciences or who want to work for the federal government or who are on U.S. Air Force ROTC scholarship should enroll in the Research or Meteorology Computer Applications AOCs and complete the math sequence MA 242, MA 243, and MA 345 by their junior year. Those students should also enroll in the physics sequence PS 150, PS 160, and PS 250. Students pursuing other AOCs should complete MA 111 and MA 112, and PS 103 and PS 104 with labs. Students who are undecided about their future should begin with MA 140 and PS 150.

Flight Weather Area of Concentration

Students interested in providing weather services to the aviation/aerospace industry should follow this course of study. The mix of courses will enhance the student's ability to communicate with people who build, fly, and control airplanes and flight activities. Courses designated with (*) are required for the Aircraft Dispatcher Certification Program.

FRESHMAN YEAR

Course		Title	Credits
AS	121	Private Pilot Operations	5
COM	122	English Composition and Literature	3
COM	219	Speech	3
HU	14X	Lower-Level Humanities	3
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I	3
PS	103L	Technical Physics I Laboratory	0
SS		Lower-Level Social Sciences Elective	3
UNIV	101	College Success	1
WX	201	Survey of Meteorology	3
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
AS	221	Instrument Pilot Operations	3
COM	221	Technical Report Writing	3
SS		Social Sciences Elective	3
PS	104	Technical Physics II	3
PS	104L	Technical Physics II Laboratory	0
PS	105	General Chemistry	4
WX	261	Applied Climatology	3
WX	270	Weather Information Systems	3
WX	301	Aviation Weather	3
WX	353	Thermodynamics of the Atmosphere	3
WX	354	Dynamics of the Atmosphere	3
Total Credits			**31**

JUNIOR YEAR

Course		Title	Credits
AS	309	Basic Aerodynamics	3
AS	321	Commercial Pilot Operations	3
AT	300	Air Traffic Management	3
EGR	115	Introduction to Computing for Engineers	3
HU/SS		Upper-Level Humanities or Social Sciences Elective	3
WX	356	Synoptic Meteorology	3
WX	365	Satellite and Radar Weather Interpretation	3
WX	390	Atmospheric Physics	3
WX	422	Statistical Application for Meteorology	3
		Open Electives	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
AS	310	Aircraft Performance*	3
AS	410	Air Dispatch Operations*	3
CE AAS		Co-op/Internship	6
WX	364	Weather for Aircrews	3
WX	427	Forecasting Techniques	3
WX	456	Advanced Weather Analysis	3
WX	457	Weather Operations Seminar	3
		Open Electives	6
Total Credits			**30**

Media Weather Area of Concentration

Students interested in journalism, radio, and television will combine meteorology with studies in verbal and written communications. Internships may be conducted with newspapers, radio stations, or network/cable television channels.

FRESHMAN YEAR

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
COM	122	English Composition and Literature	3
COM	219	Speech	3
HU	14X	Lower-Level Humanities	3
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I	3
PS	103L	Technical Physics I Laboratory	0
SS		Lower-Level Social Sciences Elective	3
UNIV	101	College Success	1
WX	201	Survey of Meteorology	3
WX	261	Applied Climatology	3
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
COM	221	Technical Report Writing	3
COM	260	Introduction to Media	3
SS		Social Sciences Elective	3
EGR	115	Introduction to Computing for Engineers	3
PS	104	Technical Physics II	3
PS	104L	Technical Physics II Laboratory	0
PS	105	General Chemistry	4
WX	270	Weather Information Systems	3
WX	353	Thermodynamics of the Atmosphere	3
WX	361	Global Climate Change	3
WX	365	Satellite and Radar Weather Interpretation	3
Total Credits			**31**

JUNIOR YEAR

Course		Title	Credits
COM	265	Introduction to News Writing	3
COM	320	Mass Communication Law and Ethics	3
COM	360	Media Relations I	3
SS		Social Sciences Elective	3
WX	280	Introduction to TV Weathercasting	3
WX	354	Dynamics of the Atmosphere	3
WX	356	Synoptic Meteorology	3
WX	390	Atmospheric Physics	3
		Open Electives	4
Total Credits			**28**

SENIOR YEAR

Course		Title	Credits
CE	AAS	Co-op/Internship	6
COM	225	Science and Technology Communications	3
COM	350	Environmental Communications	3
WX	380	Advanced TV Weathercasting	3
WX	422	Statistical Applications for Meteorology	3
WX	427	Forecasting Techniques	3
WX	456	Advanced Weather Analysis	3
WX	457	Weather Operations Seminar	3
WX	475	Field Production and Weathercast Video Editing	3
		Open Elective	3
Total Credits			**30**

Commercial Weather Area of Concentration

To meet the growing demand for meteorologists by the private sector, students who select this option will be prepared to provide meteorological expertise to a wide range of weather-dependent industries. By selecting appropriate courses in this highly flexible AOC, students can also complete a minor in Business Administration.

FRESHMAN YEAR

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
COM	122	English Composition and Literature	3
COM	219	Speech	3
HU	14X	Lower-Level Humanities	3
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I	3
PS	103L	Technical Physics I Laboratory	0
SS		Lower-Level Social Sciences Elective	3
UNIV	101	College Success	1
WX	201	Survey of Meteorology	3
WX	261	Applied Climatology	3
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
BA	221	Advanced Computer Based Systems	3
COM	221	Technical Report Writing	3
EC	210	Microeconomics	3
EGR	115	Intro to Computing for Engineers	3
PS	104	Technical Physics II	3
PS	104L	Technical Physics II Laboratory	0
PS	105	General Chemistry	4
SS		Social Sciences Elective	3
WX	270	Weather Information Systems	3
WX	353	Thermodynamics of the Atmosphere	3
WX	365	Satellite and Radar Weather Interpretation	3
Total Credits			**31**

JUNIOR YEAR

Course		Title	Credits
BA	220	Marketing	3
HU/SS		Upper-Level Humanities -OR- Social Sciences Elective	3
WX	354	Dynamics of the Atmosphere	3
WX	356	Synoptic Meteorology	3
WX	361	Global Climate Change	3
WX	390	Atmospheric Physics	3
WX	422	Statistical Applications for Meteorology	3
		Applied Meteorology Electives	3
		Business Elective	3
		Open Electives	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
BA	325	Social Responsibility and Ethics in Management	3
CE		AAS Co-op/Internship	6
EC	420	Economics of Air Transportation	3
WX	427	Forecasting Techniques	3
WX	456	Advanced Weather Analysis	3
WX	457	Weather Operations Seminar	3
		Business Elective	3
Total Credits			**28**

Meteorological Computer Applications Area of Concentration

Students wishing to pursue a career in developing applications in meteorology should choose the Meteorological Computer Applications Area of Concentration. The math, physics, and core Meteorology courses are the same as in the Research Area of Concentration. A minor in Computer Science is incorporated into this AOC. Students who choose the Meteorological Computer Applications Area of Concentration should follow the suggested four-year plan outlined below:

FRESHMAN YEAR

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
COM	122	English Composition and Literature	3
MA	142	Trigonometry	3
MA	241	Calculus and Analytical Geometry	4
MA	242	Calculus and Analytical Geometry II	4
PS	105	General Chemistry	4
PS	150	Physics I	3
UNIV	101	College Success Seminar	1
WX	201	Survey of Meteorology	3
WX	261	Applied Climatology	3
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
COM	219	Speech	3
COM	221	Technical Report Writing	3
EGR	115	Intro to Computing for Engineers	3
HU	14X	Lower-Level Humanities	3
MA	243	Calculus and Analytical Geometry III	4
PS	160	Physics for Engineers II	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
WX	353	Thermodynamics of the Atmosphere	3
WX	354	Dynamics of the Atmosphere	3
Total Credits			**29**

JUNIOR YEAR

Course		Title	Credits
CE		Applied Aviation Science Co-op/Internship	6
CS	225	Computer Science II	4
MA	345	Differential Equations and Matrix Methods	4
SE	300	Software Engineering Practices	4
SS		Social Sciences Elective	3
WX	270	Weather Information Systems	3
WX	356	Synoptic Meteorology	3
WX	365	Satellite and Radar Weather Interpretation	3
Total Credits			**30**

SENIOR YEAR

Course	Title	Credits
HU/SS	Upper-Level Elective	3
SS	Lower-Level Elective	3
WX 390	Atmospheric Physics	3
WX 422	Statistical Applications for Meteorology	3
WX 427	Forecasting Techniques	3
WX 456	Advanced Weather Analysis	3
WX 457	Weather Operations Seminar	3
CS/SE/CEC	Upper-Level Electives	6
	Open Electives	3
Total Credits		**30**
TOTAL DEGREE CREDITS		**120**

Research Area of Concentration

Students wishing to go to graduate school in Meteorology, or wishing to become eligible for Meteorology employment with the U.S. government, or who are on ROTC Meteorology scholarships should choose the Research Area of Concentration. Students who choose the Research Area of Concentration should follow the four-year plan outlined below:

FRESHMAN YEAR

Course	Title	Credits
AS 120	Principles of Aeronautical Science	3
COM 122	English Composition and Literature	3
MA 142	Trigonometry	3
MA 241	Calculus and Analytical Geometry	4
MA 242	Calculus and Analytical Geometry II	4
PS 105	General Chemistry	4
PS 150	Physics for Engineers I	3
UNIV 101	College Success Seminar	1
WX 201	Survey of Meteorology	3
WX 261	Applied Climatology	3
Total Credits		**31**

SOPHOMORE YEAR

Course	Title	Credits
COM 219	Speech	3
COM 221	Technical Report Writing	3
EGR 115	Introduction to Computing for Engineers	3
HU 14X	Lower-Level Humanities	3
MA 243	Calculus and Analytical Geometry III	4
PS 160	Physics for Engineers II	3
PS 250	Physics for Engineers III	3
PS 253	Physics Laboratory for Engineers	1
SS	Social Sciences Elective	3
WX 353	Thermodynamics of the Atmosphere	3
WX 354	Dynamics of the Atmosphere	3
Total Credits		**32**

JUNIOR YEAR

Course	Title	Credits
CE	Co-op/Internship	6
CS 225	Computer Science II	4
MA 345	Differential Equations and Matrix Methods	4
SS	Lower-Level Elective	3
WX 270	Weather Information Systems	3
WX 356	Synoptic Meteorology	3
WX 365	Satellite and Radar Weather Interpretation	3
WX 420	Advanced Atmospheric Thermodynamics	3
Total Credits		**29**

SENIOR YEAR

Course	Title	Credits
HU/SS	Upper-Level Elective	3
WX 390	Atmospheric Physics	3
WX 422	Statistical Applications for Meteorology	3
WX 427	Forecasting Techniques	3
WX 456	Advanced Weather Analysis	3
WX 457	Weather Operations Seminar	3
WX 490	Dynamic Meteorology I	3
WX 491	Dynamic Meteorology II	3
	Open Electives	4
Total Credits		**28**
TOTAL DEGREE CREDITS		**120**

Aviation Maintenance Science

Associate of 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 Core

Course	Title	Credits
COM 122	English Composition & Literature	3
COM 219	Speech	3
	-OR -	
COM 221	Technical Report Writing	3
CS 120	Introduction to Computing in Aviation	3
HU 140	Series (Lower-Level Humanities)	3
MA 111	College Mathematics for Aviation I	3
PSY 101	Introduction to Psychology	3
Total Credits		**18**

Aviation Maintenance Science Courses (leading to A&P certification)

Course	Title	Credits
AMS 115	Aviation Mathematics and Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Material and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants and Systems	4
AMS 365	Transport Category Aircraft Systems	3
AMS 366	Transport Category Aircraft Electrical and Instrument Systems	3
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
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 Course of Study

SEMESTER 1

Course	Title	Credits
AMS 115	Aviation Mathematics and Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Materials and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
Total Credits		**12**

SEMESTER 2

Course	Title	Credits
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
Total Credits		**12**

SEMESTER 3

Course	Title	Credits
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 365	Transport Category Aircraft Systems	3
AMS 366	Transport Category Aircraft Electrical and Instrument Systems	3
Total Credits		**12**

SEMESTER 4

Course	Title	Credits
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants and Systems	4
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
COM 122	English Composition & Literature	3
Total Credits		**15**

SEMESTER 5

Course	Title	Credits
COM 219	Speech	3
CS 120	Introduction to Computing in Aviation	3
HU 140	Series Class	3
MA 111	College Math for Aviation I	3
PSY 101	Introduction to Psychology	3
Total Credits		**15**

TOTAL DEGREE CREDITS **66**

Aviation Maintenance Science

Bachelor of 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:

- Flight
- Maintenance Management
- Safety Science

The degree is composed of 132 credit hours for the AOCs in Flight, Maintenance Management, and Safety Science.

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 industrial and aviation-specific safety courses with the technical coursework that leads to FAA Airframe and Powerplant certifications. The AMS degree is accredited by Aviation Accreditation Board International (AABI, formerly Council on Aviation Accreditation), 3410 Skyway Drive, Auburn, AL 86830, telephone: (334) 844-2431.

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.

	Flight	Maintenance Management	Safety Science
General Education Core	36	36	36
Common Core	6	6	6
Area of Concentration	42*	42	42
A&P Technical Courses [1]	48	48	48
Open Electives	0	0	0
Total	132	132	132

[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. A student wanting to take the A&P technical courses as part of their bachelor of science degree, and be allowed to do their flight training off campus, can do so in the Aeronautics degree. The Program Coordinator for AMS or for Aeronautics can explain how this is done.

General Education Core

Course	Title	Credits
COM 122	English Composition & Literature	3
COM 219	Speech	3
COM 221	Technical Report Writing	3
CS 120	Introduction to Computing in Aviation	3
HU 140	Series (Lower-Level Humanities)	3
HU/SS	Upper-Level Humanities or Social Sciences	3
MA 111	College Mathematics for Aviation I	3
MA 112	College Mathematics for Aviation II	3
PS 103	Technical Physics I & Laboratory	3
PS 104	Technical Physics II & Laboratory	3
PSY 101	Introduction to Psychology	3
	Lower-Level Social Sciences Elective	3
Total Credits		**36**

Common Core Curriculum

Course	Title	Credits
BA 201	Principles of Management	3
SF 201	Introduction to Health, Occupational, and Transportation Safety	3
	-OR-	
SF 210	Introduction to Aerospace Safety	3
Total Credits		**6**

Aviation Maintenance Science Courses (leading to A&P certification)

Course	Title	Credits
AMS 115	Aviation Mathematics and Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Materials, and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants and Systems	4
AMS 365	Transport Category Aircraft Systems	3
AMS 366	Transport Category Aircraft Electrical and Instrument Systems	3
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
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.

Flight Area of Concentration

SINGLE TRACK

Course	Title	Credits
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

-OR-

MULTI-TRACK

Course	Title	Credits
FA 121	Private Single Flight	1
FA 122	Private Multi Flight With Lab	1
FA 222	Instrument Multi Flight	1
FA 322	Commercial Multi Flight	1
	-AND-	
AS 121	Private Pilot Operations	5
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
AS 387	Crew Resource Management	3
WX 201	Survey of Meteorology	3
WX 301	Aviation Weather	3
	-AND- any two of the following:	
AS 402	Airline Operations	3
AS 408	Flight Safety	3
AS 411	Jet Transportation Systems	3
AS 412	Corporate and Business Aviation	3
AS 435	Electronic Flight Management Systems	3
Total Credits		**42**

Suggested Course of Study

(Assumes Single Engine Flight Track)

SEMESTER 1

Course	Title	Credits
AMS 115	Maintenance Mathematics & Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Materials, and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
Total Credits		**12**

SEMESTER 2

Course	Title	Credits
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
Total Credits		**12**

SEMESTER 3

Course	Title	Credits
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 365	Air Transport Aircraft Systems	3
AMS 366	Air Transport Aircraft Electrical and Instrument Systems	3
COM 122	English Composition & Literature	3
Total Credits		**15**

SEMESTER 4

Course	Title	Credits
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants & Systems	4
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
	Humanities Lower Level (140 Series)	3
Total Credits		**15**

SEMESTER 5

Course	Title	Credits
AS 121	Private Pilot Operations	5
FA 121	Private Single Flight	1
MA 111	College Math for Aviation I	3
PSY 101	Introduction to Psychology	3
WX 201	Survey of Meteorology	3
Total Credits		**15**

SEMESTER 6

Course	Title	Credits
COM 219	Speech	3
CS 120	Introduction to Computing in Aviation	3
MA 112	College Math for Aviation II	3
PS 103	Technical Physics I and Laboratory	3
WX 301	Aviation Weather	3
Total Credits		**15**

SEMESTER 7

Course	Title	Credits
AS 221	Instrument Pilot Operations	3
AS 309	Aerodynamics	3
BA 201	Principles of Management	3
COM 221	Technical Report Writing	3
FA 221	Instrument Single Flight	1
PS 104	Technical Physics II and Laboratory	3
Total Credits		**16**

SEMESTER 8

Course		Title	Credits
AS	310	Aircraft Performance	3
AS	321	Commercial Pilot Operations	3
AS	350	Domestic and International Navigation	3
FA	321	Commercial Single Flight	1
SF	201	Introduction to Health, Occupational, & Transportation Safety	3
SS		Lower-Level Social Sciences (SS 110, 120, 130)	3
Total Credits			**16**

SEMESTER 9

Course		Title	Credits
AS	357	Flight Physiology	3
AS	387	Crew Resource Management	3
AS	411	Jet Transportation Systems	3
AS	412	Corporate and Business Aviation	3
FA	323	Commercial Multi Add On	1
		HU or SS Upper Level	3
Total Credits			**16**
TOTAL DEGREE CREDITS			**132**

Maintenance Management Area of Concentration

Course		Title	Credits
BA	210	Financial Accounting	3
BA	221	Advanced Computer Based Systems	3
BA	220	Marketing	3
BA	225	Business Law	3
BA	312	Managerial Accounting	3
BA	317	Organizational Behavior	3
BA	320	Business Information Systems	3
BA	324	Aviation Labor Relations	3
BA	325	Social Responsibility and Ethics in Management	3
BA	411	Logistics Management for Aviation/Aerospace	3
BA	419	Aviation Maintenance Management	3
BA	420	Management of Production and Operations	3
BA	424	Project Management in Aviation Operations	3
MA	222	Business Statistics	3
Total Credits			**42**

Suggested Course of Study

SEMESTER 1

Course	Title	Credits
AMS 115	Maintenance Mathematics & Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Materials, and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
Total Credits		**12**

SEMESTER 2

Course	Title	Credits
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
Total Credits		**12**

SEMESTER 3

Course	Title	Credits
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 365	Air Transport Aircraft Systems	3
AMS 366	Air Transport Aircraft Electrical and Instrument Systems	3
COM 122	English Composition & Literature	3
Total Credits		**15**

SEMESTER 4

Course	Title	Credits
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants and Systems	4
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
	Humanities Lower Level (140 Series)	3
Total Credit		**15**

SEMESTER 5

Course	Title	Credits
BA 201	Principles of Management	3
COM 219	Speech	3
CS 120	Introduction to Computing in Aviation	3
MA 111	College Math for Aviation I	3
	Lower-Level Social Sciences (SS 110, 120, 130)	3
Total Credits		**15**

SEMESTER 6

Course		Title	Credits
BA	210	Financial Accounting	3
COM	221	Technical Report Writing	3
MA	112	College Math for Aviation II	3
PSY	101	Introduction to Psychology	3
		Humanities/Social Sciences Upper Level	3
Total Credits			**15**

SEMESTER 7

Course		Title	Credits
BA	220	Marketing	3
BA	221	Advanced Computer Based Systems	3
BA	312	Managerial Accounting	3
MA	222	Business Statistics	3
PS	103	Technical Physics I and Laboratory	3
Total Credits			**15**

SEMESTER 8

Course		Title	Credits
BA	320	Business Information Systems	3
BA	419	Aviation Maintenance Management	3
BA	424	Project Management in Aviation Operations	3
PS	104	Technical Physics II and Lab	3
SF	201	Introduction to Health, Occupational, and Transportation Safety	3
Total Credits			**15**

SEMESTER 9

Course		Title	Credits
BA	225	Business Law	3
BA	317	Organizational Behavior	3
BA	324	Aviation Labor Relations	3
BA	325	Social Responsibility & Ethics in Management	3
BA	411	Logistics Management for Aviation/Aerospace	3
BA	420	Management of Production and Operations	3
Total Credits			**18**
TOTAL DEGREE CREDITS			**132**

Safety Science Area of Concentration

Course		Title	Credits
HF	300	Human Factors I: Principles and Fundamentals	3
SF	201	Introduction to Health, Occupational, and Transportation Safety	3
		-OR-	
SF	210	Introduction to Aerospace Safety	3
SF	205	Principles of Accident Investigation	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	365	Fire Protection	3
SF	445	Systems Safety in Aviation	3
SF	462	Health, Safety, and Aviation Law	3
Total Credits			**30**

Plus Aviation Focus or Occupational Safety Focus courses.

Aviation Focus Classes

Course		Title	Credits
SF	330	Aircraft Accident Investigation	3
SF	350	Air Crash & Emergency Management	3
SF	375	Propulsion Plant Investigation	3
SF	335	Mechanical & Structural Factors in Aviation	3
		-OR-	
SF	435	Aircraft Crash Survival Analysis	3
Total Credits			**12**

Occupational Safety Focus Classes

Course		Title	Credits
HS	210	Fundamentals of Transportation Security	3
SF	355	Industrial Hygiene and Toxiocology	3
SF	410	Design of Engineering Hazard Controls	3
SF	440	Design of Engineering Hazard Controls II	3
Total Credits			**12**
TOTAL CREDITS REQUIRED			**42**

Suggested Course of Study - Aviation Focus

SEMESTER 1

Course		Title	Credits
AMS	115	Maintenance Mathematics & Physics	2
AMS	116	Fundamentals of Electricity	4
AMS	117	Tools, Materials, and Processes	4
AMS	118	Aircraft Familiarization and Regulations	2
Total Credits			**12**

SEMESTER 2

Course	Title	Credits
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
Total Credits		**12**

SEMESTER 3

Course	Title	Credits
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 365	Air Transport Aircraft Systems	3
AMS 366	Air Transport Aircraft Electrical and Instrument Systems	3
COM 122	English Composition & Literature	3
Total Credits		**15**

SEMESTER 4

Course	Title	Credits
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants and Systems	4
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
	Humanities Lower-Level (140 Series)	3
Total Credits		**15**

SEMESTER 5

Course	Title	Credits
BA 201	Principles of Management	3
COM 219	Speech	3
CS 120	Introduction to Computing in Aviation	3
MA 111	College Math for Aviation I	3
	Lower-Level Social Sciences (SS 110, 120, 130)	3
Total Credits		**15**

SEMESTER 6

Course	Title	Credits
COM 221	Technical Report Writing	3
MA 112	College Math for Aviation II	3
PSY 101	Introduction to Psychology	3
SF 201	Introduction to Health, Occupational, and Transportation Safety	3
	Humanities/Social Sciences Upper-Level	3
Total Credits		**15**

SEMESTER 7

Course	Title	Credits
HF 300	Human Factors I, Principles and Fundamentals	3
SF 210	Introduction to Aerospace Safety	3
SF 205	Principles of Accident Investigation	3
SF 315	Environmental Compliance and Safety	3
PS 103	Technical Physics I and Lab	3
Total Credits		**15**

SEMESTER 8

Course	Title	Credits
PS 104	Technical Physics II and Lab	3
SF 316	Workers' Compensation, Insurance, and Risk Management	3
SF 320	Human Factors in Aviation Safety	3
SF 330	Aircraft Accident Investigation	3
SF 345	Safety Program Management	3
Total Credits		**15**

SEMESTER 9

Course	Title	Credits
SF 350	Air Crash and Emergency Management	3
SF 365	Fire Protection	3
SF 375	Propulsion Plant Investigation	3
SF 435	Aircraft Crash Survival Analysis	3
SF 445	Systems Safety in Aviation	3
SF 462	Health, Safety, and Aviation Law	3
Total Credits		**18**

TOTAL DEGREE CREDITS **132**

Homeland Security

Bachelor of Science

Bachelor of Science

The Applied Aviation Sciences Department 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 specialty coursework in emergency management, terrorism studies, or cyber security. 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 including international relations, psychology courses, safety, or business courses.

The Homeland Security degree is designed for students who have an interest in obtaining a strong foundation in many of the domains of modern homeland security, including terrorism studies, law and policy, emergency management, risk analysis, intelligence, physical and transportation 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 taking two minors or one minor and at least a 15 credit "coherent block of courses" (decided on with permission from the HS program coordinator), or through technical study in cyber security. Required senior practicum projects and internship 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, 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, etc.

Degree Requirements

The Bachelor of Science degree in Homeland Security requires successful completion of a minimum of 122 credit hours and is normally completed in eight semesters as outlined below. Students enrolling in the cyber security track should be aware that this is a technical degree and will require three semesters of calculus including, calculus I in their first semester and calculus II in their second. Students should be aware that several courses have prerequisites or corequisites and should check course descriptions to be sure such requirements are met. Students enrolled in the cyber track are exempt from the breadth area requirement.

- 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)

- Completing a second major (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

General Education	37
Homeland Security Core	46
Breadth Area	30
Program Support	9
Total Degree Credits	**122**

General Education

Course	Title	Credits
COM	Communication Theory & Skills	9
CS	Computer Science	3
HU	Lower-Level Humanities	3
HU/SS	Upper-Level Humanities/Social Sciences	3
MA	Mathematics	6
PS	Physical Science (lab must be included)	6
SS	Lower-Level Social Sciences	6
UNIV 101	College Success	1
Total Credits		**37**

Computer Science 3

Mathematics. 8

MA 111 and 112 -or- MA 140 and 142 -or- equivalent

Physical and Life Sciences 6

Social Sciences 6

PSY 101 or equivalent and one additional SS course

Homeland Security Core Courses

Course		Title	Credits
CE	396	Internship/Co-Op in Homeland Security*	3
HS	110	Introduction to Homeland Security	3
HS	210	Fundamentals of Transportation Security	3
HS	215	Introduction to Industrial Security	3
HS	280	Business Skills for the Homeland Security Professional	1
HS	310	Fundamentals of Emergency Management	3
HS	315	Critical Infrastructure and Risk Analysis	3
HS	320	Homeland Security Law and Policy	3
HS	325	Terrorism: Origins, Ideologies, and Goals	3
HS	350	Intelligence Systems & Structures in Homeland Security	3
HS	360	Strategic Planning & Decision Making in Homeland Security	3
HS	385	Homeland Security Technology & Systems	3
HS	405	Emerging Topics in Homeland Security	3
HS	410	Exercise Design and Evaluation in Homeland Security	3
HS	480	Environmental Security	3
		-OR-	
WX	480	Environmental Security	3
HS	490	Practicum in Homeland Security	3
Total Credits			**46**

*Students with a CGPA of 2.5 or higher may enroll in the cooperative education or internship experience at the equivalent of three or more credits to be taken during or after the sophmore year. Student must see advisor prior to enrollment, prerequisite for CE 396 is HS 280 or consent of advisor.

Program Support

Course		Title	Credits
SF	201	Introduction to Health, Occupational, & Transportation Safety	3
		-OR-	
SF	210	Introduction to Aerospace Safety	3
SF	315	Environmental Compliance and Safety	3
		-OR-	
SF	355	Industrial Hygiene and Toxicology	3
		-OR-	
SF	405	Applications in Industrial Hygiene	3
		-OR-	
SF	462	Health, Safety, and Aviation Law	3
MA	222	Business Statistics (or equivalent)	3
Total Credits			**9**

Breadth Area

All non-Cyber Security Track HS majors are required to complete coursework to compliment the HS core courses. Students are strongly encouraged to complete their breadth requirement by either a second major, or 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.

Total Credits **30**

Suggested Program of Study

FRESHMAN YEAR

Course	Title	Credits
COM	Communication, Theory, and Skills	3
CS	Computer Science	3
HS 110	Introduction to Homeland Security	3
HU	Lower-Level Humanities	3
MA 111	College Mathematics for Aviation I	
	-OR-	
MA 140	College Algebra	3
MA 112	College Mathematics for Aviation II	
	-OR-	
MA 142	Trigonometry	3
PS	Physical Science (lab must be included with one PS course)	6
SF 201	Introduction to Health, Occupational, and Transportation Safety	3
	-OR-	
SF 210	Introduction to Aerospace Safety	3
SS	Lower-Level Social Sciences	3
UNIV 101	College Success	1
Total Credits		**31**

SOPHOMORE YEAR

Course	Title	Credits
COM	Communication, Theory, and Skills	6
HS 210	Fundamentals of Transportation Security	3
HS 215	Introduction to Industrial Security	3
HS 280	Business Skills for the Homeland Security Professional	1
HS 325	Terrorism: Origins, Ideologies, and Goals	3
HS 350	Intelligence Systems and Structures in Homeland Security	3
HU/SS	Upper-Level Humanities/ Social Sciences	3
SF 315	Environmental Compliance and Safety	3
	-OR-	
SF 355	Industrial Hygiene and Toxicology	3
	-OR-	
SF 405	Applications in Industrial Hygiene	3
	-OR-	
SF 462	Health, Safety, and Aviation Law	3
SS	Lower-Level Social Sciences	3
MA 222	Business Statistics	3
Total Credits		**31**

JUNIOR YEAR

Course	Title	Credits
HS 310	Fundamentals of Emergency Management	3
HS 315	Critical Infrastructure and Risk Analysis	3
HS 320	Homeland Security Law and Policy	3
HS 360	Strategic Planning and Decision Making in Homeland Security	3
HS 410	Exercise Design and Evaluation	3
CE 396	Internship/Co-Op in Homeland Security	3
	Breadth Area	12
Total Credits		**30**

SENIOR YEAR

Course	Title	Credits
HS 385	Homeland Security Technology & Systems	3
HS 405	Emerging Issues in Homeland Security	3
HS 480	Environmental Security	3
	-OR-	
WX 480	Environmental Security	3
HS 490	Practicum in Homeland Security	3
	Breadth Area	18
Total Credits		**30**

Cyber Security Track

The Cyber Security Track is considered a technical track. As such, students majoring in Homeland Security and choosing the Cyber Security Track should therefore qualify as being in a technical degree program. Students will be able to explore many aspects of the digital world as they pertain to homeland security, network design, data mining and protection, and network management. The Cyber Security Track combines the core Homeland Security curriculum with solid preparation in programming, network design, data hiding/abstraction, network analysis, network security, software quality assurance, and telecommunications.

B.S. in Homeland Security with Cyber Security Track

General Education	39
Homeland Security Core	46
Cyber Security Track	28
Program Support	9
Total Degree Credits	**122**

General Education

Course	Title	Credits
COM	Communication Theory & Skills	9
CS	Computer Science	3
HU	Lower-Level Humanities	3
HU/SS	Upper-Level Humanities/Social Sciences	3
MA	Mathematics	8
PS	Physical Science (lab must be included)	6
SS	Lower-Level Social Sciences	6
UNIV 101	College Success	1
Total Credits		**39**

Embry-Riddle courses in the general education categories of Computer Science, Social Sciences, Mathematics, and Physical Science 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 Homeland Security vertical outline.

Computer Science 3
EGR 115 or equivalent

Mathematics 8
MA 241, 242 or equivalent

Physical and Life Sciences 6
PS 150, PS 160 or equivalent

Social Sciences 6
PSY 101 and one additional SS course

Homeland Security Core Courses

Course		Title	Credits
CE	396	Cooperative Education*	3
HS	110	Introduction to Homeland Security	3
HS	210	Fundamentals of Transportation Security	3
HS	215	Introduction to Industrial Security	3
HS	230	Terrorism: Origins, Ideologies, and Goals	3
HS	280	Business Skills for the Homeland Security Professional	1
HS	310	Fundamentals of Emergency Management	3
HS	315	Critical Infrastructure and Risk Analysis	3
HS	320	Homeland Security Law and Policy	3
HS	350	Intelligence Systems & Structures in Homeland Security	3
HS	360	Strategic Planning & Decision Making in Homeland Security	3
HS	385	Homeland Security Technology & Systems	3
HS	405	Emerging Topics in Homeland Security	3
HS	410	Exercise Design and Evaluation in Homeland Security	3
HS	480	Environmental Security	3
		-OR-	
WX	480	Environmental Security	3
HS	490	Practicum in Homeland Security*	3
Total Credits			**46**

*Students with a CGPA of 2.5 or higher may enroll in the cooperative education or internship experience at the equivalent of three or more credits be taken during or after the sophmore year. Student must see advisor prior to enrollment. Prerequisite for CE 396 is HS 280 or consent of advisor.

Cyber Security Track Courses

Course		Title	Credits
CEC	460	Telecommunications Systems	3
CS	225	Computer Science II	4
CS	303	Network Security	3
		-OR-	
IT	320	Network Configurations	3
MA	243	Calculus and Analytic Geometry III	4
MA	412	Probability and Statistics	3
		-OR-	
WX	422	Statistical Applications for Meteorological Data Analysis	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
SE	300	Software Engineering Practices	4
SE	420	Software Quality Assurance	3
Total Credits			**28**

Program Support

Course		Title	Credits
SF	201	Introduction to Health, Occupational, & Transportation Safety	3
		-OR-	
SF	210	Introduction to Aerospace Safety	3
WX	210	Introduction to Geographic Information Systems	3
WX	310	Advanced Geographic Information Systems	3
Total Credits			**9**

*Electives to be guided by advisor.

Total Degree Credits **122**

Suggested Program of Study

FRESHMAN YEAR

Course		Title	Credits
COM		Communication, Theory, and Skills	3
EGR	115	Introduction to Computing for Engineers	3
HS	110	Introduction to Homeland Security	3
HU		Lower-Level Humanities	3
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
SS		Lower-Level Social Sciences	3
UNIV	101	College Success	1
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
CS	225	Computer Science II	4
HS	210	Fundamentals of Transportation Security	3
HS	215	Introduction to Industrial Security	3
HS	280	Business Skills for the Homeland Security Professional	1
HS	325	Terrorism: Origins, Ideologies, and Goals	3
HS	350	Intelligence Systems & Structures in Homeland Security	3
MA	243	Calculus and Analytical Geometry III	4
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
SF	201	Introduction to Health, Occupational, and Transportation Safety	3
		-OR-	
SF	210	Introduction to Aerospace Safety	3
SS		Lower-Level Social Sciences	3
Total Credits			**31**

JUNIOR YEAR

Course		Title	Credits
CE	396	Internship/Co-Op in Homeland Security	3
COM		Communication Theory and Skills	3
CS	303	Network Security	3
		-OR-	
IT	320	Network Configurations	3
HS	310	Fundamentals of Emergency Management	3
HS	315	Critical Infrastructure and Risk Analysis	3
HS	320	Homeland Security Law and Policy	3
HS	360	Strategic Planning & Decision Making in Homeland Security	3
HS	410	Exercise Design and Evaluation in Homeland Security	3
SE	300	Network Engineering Practices	4
WX	210	Introduction to Geographic Information Systems	3
Total Credits			**31**

SENIOR YEAR

Course		Title	Credits
CEC	460	Telecommunications Systems	3
COM		Communication, Theory, and Skills	3
HS	385	Homeland Security Technology & Systems	3
HS	405	Emergent Topics in Homeland Security	3
HS	480	Environmental Security	
		-OR-	
WX	480	Environmental Security	3
HS	490	Practicum in Homeland Security	3
HU/SS		Upper-Level Humanities/ Social Sciences	3
SE	420	Software Quality Assurance	3
WX	310	Advanced Geographic Information Systems	3
MA	412	Probability and Statistics	
		-OR-	
WX	422	Statistical Applications for Meteorological Data	3
		Electives	9
Total Credits			**30**

Total Degree Credits **122**

Safety Science

Bachelor of Science

The Applied Aviation Sciences Department offers a Bachelor of Science degree in Safety Science 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 Science courses through two areas of concentration (AOCs), students can prepare to work in the aerospace industry as well as in non-aerospace industries.

The Safety Science degree is designed for students interested in obtaining a strong safety foundation. The goal of the degree is to prepare graduates who are skilled in providing safety expertise in a variety of aviation, aerospace, and other occupational settings. This program will produce safety professionals who are skilled in providing safety management expertise as well as technical guidance in compliance issues involving FAA, EPA, OSHA, DOT, and state health and workplace standards.

Degree Requirements

The Bachelor of Science degree in Safety Science requires successful completion of a minimum of 120 credit hours and is normally completed in eight semesters.

Students are required to complete 36 hours of General Education courses as well as 46 hours of a Safety Science core curriculum. The Transportation AOC and Occupational Safety AOC each require 24 hours of AOC-related safety courses with the final 14 hours available as open electives. There are numerous minor fields of study for the student to choose from in order to meet specific desires.

Students enrolled in the Air Force, Army, or Naval ROTC programs may substitute AF, MY, or NSC courses for open elective courses.

	Credits
General Education	36
Safety Science Core	46
Area of Concentration (Air Transportation/Occupational)	30/30
Open Electives (Air Transportation/Occupational)	8/8
Total Degree Credits	**120**

General Education

Course		Title	Credits
COM		Communications Skills (COM 122, 219, 221)	9
CS		Computer Science Elective	3
EC	200	An Economic Survey	3
HU		Humanities (HU 140-146)	3
HU/SS		Upper-Level Elective	3
MA		Math Sequence (MA 111, 112)	6
PS		Physics Sequence (PS 103/PS 104) (one laboratory required)	6
PSY	101	Introduction to Psychology	3
Total Credits			**36**

Safety Science Core

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
AT	200	Air Traffic Management I	3
BA	201	Principles of Management	3
MA	222	Business Statistics	3
PS	101	Basic Chemistry	3
SF	201	Introduction to Health, Occupational, and Transportation Safety	3
SF	210	Introduction to Aerospace Safety	3
SF	315	Environmental Compliance and Safety	3
SF	345	Safety Program Management	3

SF	365	Fire Protection	3
SF	410	Design of Engineering Hazard Controls	3
SF	445	System Safety in Aviation	3
SF	462	Health, Safety, and Aviation Law	3
SF	470	Applications of Safety Management Capstone	3
UNIV	101	College Success	1
WX	201	Survey of Meteorology	3
Total Credits			**46**

Transportation Safety (Air) Area of Concentration

Course		Title	Credits
SF	309	Aeronautics and Performance for Air Safety Investigators	3
SF	320	Human Factors in Aviation	3
SF	330	Aircraft Accident Investigation	3
SF	335	Mechanical and Structural Factors in Aviation	3
SF	341	Safety and Secutiry of Airport Ground Operations	3
SF	342	Investigation of Aircraft Systems and Components	3
SF	350	Air Crash and Emergency Management	3
SF	375	Propulsion Plant Investigation	3
SF	435	Aircraft Crash Survival Analysis and Design	3
WX	301	Aviation Weather	3
		Open Electives	8
Total Credits			**38**

TOTAL DEGREE CREDITS **120**

Suggested Program 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.

FRESHMAN YEAR

Course		Title	Credits
AAS	101	Applied Aviation Sciences College Success Seminar	1
AS	120	Principles of Aeronautical Science	3
COM	122	English Composition and Literature	3
CS	120	Introduction to Computing in Aviation	3
MA	111	College Math for Aviation I	3
MA	112	College Math for Aviation II	3
PS	103	Technical Physics I	3
PSY	101	Introduction to Psychology	3
SF	201	Introduction to Health, Occupational, and Transportation Safety	3
SF	210	Introduction to Aerospace Safety	3
WX	201	Survey of Meteorology	3
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
AT	200	Air Traffic Management I	3
BA	201	Principles of Management	3
COM	219	Speech	3
EC	200	An Economic Survey	3
HU	14x	Lower Level Humanities	3
PS	101	Basic Chemistry	3
PS	104	Technical Physics II	3
SF	309	Aeronautics and Performance for Air Safety Investigators	3
SF	315	Environmental Compliance and Safety	3
		Open Electives	3
Total Credits			**30**

JUNIOR YEAR

Course		Title	Credits
COM	221	Technical Report Writing	3
MA	222	Business Statistics	3
SF	320	Human Factors in Aviation	3
SF	330	Aircraft Accident Investigation	3
SF	342	Investigation of Aircraft Systems and Components	3
SF	345	Safety Program Management	3
SF	355	Industry Hygiene and Toxicology	3
SF	365	Fire Protection	3
WX	301	Aviation Weather	3
		Open Electives	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
HU/SS		Upper-Level Elective*	3
SF	335	Mechanical and Structural Factors in Aviation	3
SF	350	Aircraft Crash and Emergency Management	3
SF	375	Propulsion Plant Investigation	3
SF	410	Design of Engineering Hazard Controls	3
SF	435	Aircraft Crash Survival Analysis and Design	3
SF	445	System Safety in Aviation	3
SF	462	Health, Safety, and Aviation Law	3

SF	470	Applications of Safety Management Capstone	3
		Open Electives	2
Total Credits			**29**

*The recommended elective is HU 330 Values and Ethics.

Occupational Safety Area of Concentration

Course		Title	Credits
BA	420	Management of Production and Operations	3
HF	300	Human Factors I: Principles and Fundamentals	3
HS	310	Fundamentals Emergency Management	3
SF	205	Principles of Accident Investigation	3
SF	316	Workers' Compensation and Risk Management	3
SF	355	Industrial Hygiene and Toxicology	3
SF	405	Applications in Industrial Hygiene	3
SF	420	Analysis of Observational Data	3
SF	440	Design of Engineering Hazard Controls II	3
		Open Electives	11
Total Credits			**38**

TOTAL DEGREE CREDITS **120**

Suggested Program 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.

FRESHMAN YEAR

Course		Title	Credits
AAS	101	Applied Aviation Sciences College Success Seminar	1
AS	120	Principles of Aeronautical Science	3
COM	122	English Composition and Literature*	3
CS	120	Introduction to Computing in Aviation	3
MA	111	College Math for Aviation I	3
MA	112	College Math for Aviation II	3
PS	103	Technical Physics I	3
PS	103L	Technical Physics I Laboratory	3
PSY	101	Introduction to Psychology	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
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
BA	201	Principles of Management	3
COM	219	Speech	3
COM	221	Technical Report Writing	3
EC	200	An Economic Survey	3
HF	300	Human Factors I: Principles and Fundamentals	3
HU	14X	Lower-Level Humanities*	3
PS	101	Basic Chemistry	3
PS	104	Technical Physics II	3
SF	315	Environmental Compliance and Safety	3
WX	201	Survey of Meteorology	3
Total Credits			**30**

JUNIOR YEAR

Course		Title	Credits
AT	200	Air Traffic Management I	3
HS	310	Fundamentals Emergency Management	3
MA	222	Business Statistics	3
SF	316	Workers' Compensation, Insurance, and Risk Management	3
SF	345	Safety Program Management	3
SF	355	Industrial Hygiene and Toxicology	3
SF	365	Fire Protection	3
SF	462	Health, Safety, and Aviation Law	3
		Open Electives	6
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
BA	420	Management of Production and Operations	3
HU/SS		Upper-Level Elective*	3
SF	405	Applications in Industrial Hygiene	3
SF	410	Design and Engineering Hazard Controls	3
SF	420	Analysis of Observational Data	3
SF	440	Design and Engineering Hazard Controls II	3
SF	445	System Safety in Aviation	3
SF	470	Applications of Safety Management Capstone	3
		Open Electives	5
Total Credits			**29**

** The recommended elective is HU 330 Values and Ethics.

Unmanned Aircraft Systems Science

Bachelor of Science

The Unmanned Aircraft Systems (UAS) Science degree will provide the necessary expertise for graduates to seek employment as pilots/operators, observers, sensor operators, and operations administrators of unmanned aircraft systems. This degree will provide background in several UAS applications areas, including hazardous operations, surveillance and data collection, secure operations, long duration operations, highly-repetitive operations, and autonomous operations. In addition, graduates will be knowledgeable of the engineering aspects of the UAS, as well as the regulatory restrictions governing the operation of UAS in the United States and international airspace.

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 121 credit hours is required.

Students pursuing the Unmanned Aircraft Systems degree will select one of two specialty tracks after matriculation. Students entering under this catalog may select from the Pilot track or the Non-Pilot track. All students must complete the general education courses, the Aeronautical Science core courses, the Unmanned Aircraft System courses, Engineering courses, Air Traffic Control course, Human Factors course, and the courses required to complete one of the specialization tracks in order to complete the requirements for the Unmanned Aircraft System Science degree.

	Credits
General Education	36
Aeronautical Science Core	30
Engineering Core	13
Specialty Courses (Pilot Track)	42
-OR-	
Specialty Courses (Non-Pilot Track)	42
TOTAL DEGREE CREDITS	**121**

General Education

Course		Title	Credits
		Communications Skills	9
		Lower-Level Humanities	3
		Lower-Level Social Science	3
PSY	101	Introduction to Psychology	3
HU/SS		Upper-Level Elective	3
CS	118	Computer Science	3
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I w/ Laboratory	3
PS	104	Technical Physics II w/ Laboratory	3
Total Credits			**36**

Pilot Track

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills	3
		Lower-Level Humanities	3
AS	121	Private Pilot Operations	5
AS	220	Unmanned Aircraft Systems	3

AS	221	Instrument Pilot Operations	3
ASC	101	Aeronautical Science Success	1
FA	121	Private Single Flight	1
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I with Laboratory	3
WX	201	Survey of Meteorology	3
Total Credits			**31**

SOPHOMORE YEAR

Course		Title	Credits
		Lower-Level Social Science	3
AS	309	Aerodynamics	3
AS	310	Aircraft Performance	3
AS	321	Commercial Pilot Operations	3
BA	201	Principles of Management	3
CEC	220	Digital Circuit Design	3
CEC	222	Digital Circuit Design Laboratory	1
CS	118	Computer Science	3
FA	221	Instrument Single Flight	1
PS	104	Technical Physics II w/ Laboratory	3
PSY	101	Introduction to Psychology	3
Total Credits			**29**

JUNIOR YEAR

Course		Title	Credits
		Communication Theory and Skills	3
		Open Elective (300/400 Level)	3
AS	235	Unmanned Aircraft Systems Operations and Cross-Country Data Entry	3
AS	304	Operational Aspects of Unmanned Aircraft	3
AS	315	Unmanned Aircraft Systems Robotics	3
AS	350	Domestic and International Navigation	3
AT	200	Air Traffic Management I	3
CEC	300	Computing in Aerospace and Aviation	3
CS	223	Scientific Programming in C	3
		-OR-	
EGR	115	Introduction to Computing for Engineers	3
HF	300	Human Factors I: Principles and Fundamentals	3
Total Credits			**30**

SENIOR YEAR (PILOT TRACK)

Course		Title	Credits
		Communications Theories and Skills	3
		Human Factors Upper Level Electives	6
		Open Elective (300-400)	3
		Open Elective	2
		Upper Level HU/SS Elective	3
AS	403	Unmanned Sensing Systems	3
AS	435	Electronic Flight Management System	3
AS	473	UAS Flight Simulation	3
EE	311	Robotics Technologies for Unmanned Systems	3
		-OR-	
ME	311	Robotics Technologies for Unmanned Systems	3
FA	321	Commercial Single Flight	1
FA	323	Commercial Multi Flight	1
		-OR-	
FA	324	Commercial Multi Add	1
FA	326	Commercial Multi Instrument Flight	1
Total Credits			**31**

Non-Pilot Track

FRESHMAN YEAR

Course		Title	Credits
		Communication Theory and Skills	3
		Lower-Level Humanities	3
AS	121	Private Pilot Operations	5
AS	220	Unmanned Aircraft Systems	3
AS	221	Instrument Pilot Operations	3
ASC	101	Aeronautical Science Success	1
MA	111	College Mathematics for Aviation I	3
MA	112	College Mathematics for Aviation II	3
PS	103	Technical Physics I with Laboratory	3
WX	201	Survey of Meteorology	3
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
		Lower-Level Social Science	3
AS	309	Aerodynamics	3
AS	310	Aircraft Performance	3
AS	321	Commercial Pilot Operations	3
BA	201	Principles of Management	3
CEC	220	Digital Circuit Design	3
CEC	222	Digital Circuit Design Laboratory	1
CS	118	Computer Science	3
PS	104	Technical Physics II w/ Laboratory	3
PSY	101	Introduction to Psychology	3
Total Credits			**28**

JUNIOR YEAR

Course		Title	Credits
		Communication Theory and Skills	3
		Open Elective (300/400 Level)	3
AS	235	Unmanned Aircraft Systems Operations and Cross-Country Data Entry	3
AS	304	Operational Aspects of Unmanned Aircraft	3
AS	315	Unmanned Aircraft Systems Robotics	3
AS	350	Domestic and International Navigation	3
AT	200	Air Traffic Management I	3
CEC	300	Computing in Aerospace and Aviation	3

Course		Title	Credits
CS	223	Scientific Programming in C	3
		-OR-	
EGR	115	Introduction to Computing for Engineers	3
HF	300	Human Factors I: Principles and Fundamentals	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
		Communications Theories and Skills	3
		Human Factors Upper Level Electives	6
		Open Elective	3
		Upper Level HU/SS Elective	3
AS	403	Unmanned Sensing Systems	3
AS	435	Electronic Flight Management System	3
AS	473	UAS Flight Simulation	3
EE	311	Robotics Technologies for Unmanned Systems	3
		-OR-	
ME	311	Robotics Technologies for Unmanned Systems	3
CE	397/497*	Cooperative Education	6
		-OR-	
		Open Electives (Internship)	6
Total Credits			**33**

*The intent of this elective is to allow students to experience a UA related internship.

Embry-Riddle courses in the general education categories of Communications Theory and Skills, Humanities, and Social 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 Unmanned Aircraft Systems vertical outline.

Communication Theory and Skills:
COM 122, 219, and 221 or 222

Humanities/Social Sciences:
LOWER-LEVEL:
HU 140, 141, 142, 143, 144, 145, 146
LOWER-LEVEL
PSY 101 AND EC 200, SS 110, 120, or 130
UPPER LEVEL
HU/SS 300-400 LEVEL or PSY 350

Open Electives
UPPER LEVEL
300-400 LEVEL

It is strongly suggested that the following courses be taken during these electives: AT 302, AT 305, and HF 310

College of Business

Our aim is to provide a world-class business and management education in an aviation/aerospace context. That means we have assembled a community of faculty scholars with global reputations and reach. That means we have designed curricula at the graduate and undergraduate levels that set the standard in aviation/aerospace management education. That means 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 ACBPS (the Association of Collegiate Business Programs and Schools) for all our degree programs.

The College consists of two departments: the Department of Management, Marketing, and Operations and the Department of Economics, Finance, and Information Systems. Both departments are responsible for designing and delivering our undergraduate and graduate degrees. The Bachelor of Science in Business Administration combines a rigorous business/management core with depth of focus through the two majors in Management and Air Transportation. This degree program offers graduates the specialized knowledge desired in the aviation industry along with the management and business general knowledge valuable to employers in any industry.

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 residential MBA program of study combines common general management courses with specializations in Airline Management, Airport Management, Aviation Human Resources, Aviation Systems Management, and Finance. 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.

Business Administration

Bachelor of Science

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 with emphasis on specific aviation applications, the degree lets the student select a major in Management or Air Transportation. Students should declare their major at the beginning of their sophomore year. Students who wish to both Business majors must take all courses as required in the Air Transportation major as well as the Management major. In addition they must take 9 credit hours of specified electives which are any 300-400 BA/EC course not required in the Buisness core or either major, COM 415, or HF 300. 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 at the back of this catalog before registering for classes to ensure appropriate placement.

General Education Requirements

For a full description of Embry-Riddle Aeronautical University's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Course	Credits
General Education	36
Program Support	12
Business Core	36
Major	21
Open Electives	15
Total Degree Credits	**120**

General Education*

Communication Theory and Skills. 9
COM 122, 219, 222, -OR- 221

Mathematics. 6
MA 111 -OR- MA 120, MA 112 -OR- MA 220

Computer Science 3
BA 120
Physical and Life Sciences 6
(One course must include a laboratory.)
PS 101-109, PS 142, PS 302, PS 308, PS 309

Humanities. 3
Lower-Level
HU 140 Series

Social Sciences 6
Lower-Level
EC 210, EC 211

Humanities/Social Sciences 3
Upper-Level
HU 300-400 Level, HF 300, PSY 350, SS 302-360

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 those listed below, 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

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
BA	221	Advanced Computer Based Systems	3
MA	222	Business Statistics	3
MA	320	Decision Math	3
Total Credits			**12**

Business Core

Course		Title	Credits
BA	201	Principles of Management	3
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	225	Business Law	3
BA	312	Managerial Accounting	3
BA	317	Organizational Behavior	3
BA	320	Business Information Systems	3
BA	325	Social Responsibility and Ethics	3
BA	332	Corporate Finance	3
BA	335	International Business	3
BA	420	Management of Production and Operations	3
BA	436	Strategic Management	3
Total Credits			**36**

Management Major

Course		Title	Credits
BA	314	Human Resource Management	3
BA	326	Marketing Management	
		-OR-	
BA	327	Airline-Airport Operations	
		-OR-	
BA	334	Investment Analysis	3
BA	427	Management of the Multicultural Workforce	3
EC	315	Managerial Economics	3
		Specified Electives (from list below)	9
Total Credits			**21**

Courses Available as Management Electives:

BA	310	Airport Management	3
BA	315	Airline Management	3
BA	318	Entrepreneurial Small Business	3
BA	322	Aviation Insurance	3
BA	324	Aviation Labor Relations	3
BA	326	Marketing Management	3
BA	327	Airline-Airport Operations	3
BA	330	Professional Selling	3
BA	334	Investment Analysis	3
BA	336	Electronic Commerce	3
BA	340	International Accounting	3
BA	345	Business Law II	3
BA	405	General Aviation Marketing	3
BA	410	Management of Air Cargo	3
BA	411	Logistics Management for Aviation/Aerospace	3
BA	412	Airport Planning and Design	3
BA	418	Airport Administration and Finance	3
BA	419	Aviation Maintenance Management	3
BA	422	Life Cycle Analysis for Systems and Programs in Aviation/Aerospace	3
BA	424	Project Management in Aviation Operations	3
BA	425	Trends and Current Problems in Air Transportation	3
BA	426	International Aviation Management	3
BA	430	International Trade and Regulations	3
BA	450	Airline/Airport Marketing	3
COM	415	Non-Verbal Communications	3
EC	420	Economics of Air Transportation	3
BA/EC		300/400 Level Experimental Courses	3
HF	300	Human Factors I: Principles and Fundamentals	3

Air Transportation Major

Course		Title	Credits
BA	215	Transportation Principles	3
BA	310	Airport Management	3
BA	315	Airline Management	3
BA	426	International Aviation Management	3
BA		Specified Electives (from list below)	6
EC	420	Economics of Air Transportation	3
Total Credits			**21**

Courses Available as Air Transportation Electives:

BA	314	Human Resource Management	3
BA	318	Entrepreneurial Small Business	3
BA	322	Aviation Insurance	3
BA	324	Aviation Labor Relations	3
BA	326	Marketing Management	3
BA	327	Airline-Airport Operations	3

BA	330	Professional Selling	3
BA	334	Investment Analysis	3
BA	336	Electronic Commerce	3
BA	340	International Accounting	3
BA	345	Business Law II	3
BA	405	General Aviation Marketing	3
BA	410	Management of Air Cargo	3
BA	411	Logistics Management for Aviation/Aerospace	3
BA	412	Airport Planning and Design	3
BA	418	Airport Administration and Finance	3
BA	419	Aviation Maintenance Management	3
BA	422	Life Cycle Analysis for Systems and Programs in Aviation/Aerospace	3
BA	424	Project Management in Aviation Operations	3
BA	425	Trends and Current Problems in Air Transportation	3
BA	427	Management of the Multicultural Workplace	3
BA	430	International Trade and Regulations	3
BA	450	Airline/Airport Marketing	3
EC	315	Managerial Economics	3
BA/EC		300/400 Level Experimental Courses	3

Open Electives:

Students select a minor or complete open electives of their choice.

Total Credits **15**

TOTAL DEGREE REQUIREMENTS **120**

Suggested Program of Study

FRESHMAN YEAR

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
		Communication Theory and Skills	3
		Lower-Level Humanities	3
BA	120	Introduction to Computer-Based Systems	3
		Mathematics	6
BA	201	Principles of Management	3
BA	221	Advanced Computer-Based Systems	3
EC	210	Microeconomics	3
EC	211	Macroeconomics	3
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
		Communication Theory and Skills	6
		Physical and Life Sciences	3
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	320	Business Information Systems	3
MA	222	Business Statistics	3
MA	320	Decision Mathematics	3
		Open Elective	3
Management Major:			
BA	225	Business Law	3
Air Transportation Major:			
BA	215	Transportation Principles	3
Total Credits			**30**

JUNIOR YEAR

Course		Title	Credits
		Upper-Level Humanities -OR- Social Sciences*	3
		Physical Sciences	3
BA	312	Managerial Accounting	3
BA	317	Organizational Behavior	3
BA	332	Corporate Finance I	3
		Open Elective	3
Management Major:			
BA	314	Human Resource Management	3
BA	427	Management of the Multicultural Workforce	3
BA	326	Marketing Management -OR-	
BA	327	Airline-Airport Operations -OR-	3
BA	334	Investment Analysis	
EC	315	Managerial Economics	3
Air Transportation Major:			
BA	225	Business Law	3
BA	310	Airport Management	3
BA	315	Airline Management	3
EC	420	Economics of Air Transportation	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
BA	325	Social Responsibility and Ethics	3
BA	335	International Business	3
BA	420	Production and Operations	3
BA	436	Strategic Management	3
		Open Electives	9
Management Major:			
		Specified Electives	9
Air Transportation Major:			
BA	426	International Aviation Management	3
		Specified Electives	6
Total Credits			**30**

TOTAL DEGREE CREDITS **120**

* See general education in the introduction

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. Residential students may select from specializations in Airport Management, Airline Management, Aviation Human Resources, Aviation System Management, and Finance. 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. Students are allowed to select only one specialization, and not all specializations are offered at all campus locations or through every mode of delivery.

Degree Requirements

Master of Business Administration

Aviation Business Core

Course	Title	Credits
BA 511	Operations Research	3
BA 514	Strategic Marketing Management in Aviation	3
BA 517	Accounting for Decision Making	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
Total Core Hours		**21**

Specified Electives

Students must complete a combination of 12 hours from the courses listed below:

Course	Title	Credits
BA 590	Graduate Seminar	1-3
BA 603	Aerospace Production and Operations Management	3
BA 604	International Management and Aviation Policy	3
BA 607	Human Resource Development	3
BA 609	Airline Operations and Management	3
BA 610	Airline Optimization and Simulation Systems	3
BA 615	Investments	3
BA 616	Electronic Commerce	3
BA 618	Advanced Corporate Finance	3
BA 620	Organizational Theory	3
BA 625	Airline Marketing	3
BA 630	Aviation/Aerospace Systems Analysis	3
BA 632	Seminar in Aviation Labor Relations	3
BA 645	Airport Operations and Management	3
BA 646	Air-Cargo Logistics Management	3
BA 650	Airline/Airport Relations	3
BA 651	Strategic Airport Planning	3
BA 655	Aviation Law and Insurance	3
BA 696	Internship**	1-3
BA 699	Special Topics in Business Administration	1-3
BA 700	Thesis	6
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

Course	Title	Credits
BA 511	Operations Research	3
BA 514	Strategic Marketing Management in Aviation	3
BA 517	Accounting for Decision Making	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
Core Credits Required		**21**

Specialization Required Courses

Students must complete these six hours.

Course	Title	Credits
BA 645	Airport Operations and Management	3
BA 651	Strategic Airport Planning	3

Electives

Students must complete a combination of six hours from the courses listed below.

Course	Title	Credits
BA 590	Graduate Seminar	1-3
BA 603	Aerospace Production and Operations Management	3
BA 604	International Management and Aviation Policy	3
BA 607	Human Resource Development	3
BA 609	Airline Operations and Management	3
BA 610	Airline Optimization and Simulation Systems	3
BA 615	Investments	3
BA 616	Electronic Commerce	3
BA 618	Advanced Corporate Finance	3
BA 620	Organizational Theory	3
BA 625	Airline Marketing	3
BA 630	Aviation/Aerospace Systems Analysis	3
BA 646	Air Cargo and Logistics Management	3
BA 650	Airline/Airport Relations	3
BA 655	Aviation Law and Insurance	3
BA 696	Internship**	1-3
BA 699	Special Topics in Business Administration	1-3
BA 700	Thesis	6
MSA 508	Advanced Airport Planning	3
MSA 613	Airport Operations Safety	3
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 Airline Management

Aviation Business Core

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	517	Accounting for Decision Making	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
Core Credits Required			**21**

Specialization Required Courses

Students must complete these six hours.

Course		Title	Credits
BA	609	Airline Operations and Management	3
BA	650	Airline/Airport Relations	3

Electives

Students must complete a combination of six hours from the courses listed below.

Course		Title	Credits
BA	590	Graduate Seminar	1-3
BA	603	Aerospace Production and Operations Management	3
BA	604	International Management and Aviation Policy	3
BA	607	Human Resource Development	3
BA	610	Airline Optimization and Simulation Systems	3
BA	615	Investments	3
BA	616	Electronic Commerce	3
BA	618	Advanced Corporate Finance	3
BA	620	Organizational Theory	3
BA	625	Airline Marketing	3
BA	630	Aviation/Aerospace Systems Analysis	3
BA	632	Seminar in Aviation Labor Relations	3
BA	645	Airport Operations and Management	3
BA	646	Air Cargo and Logistics Management	3
BA	655	Aviation Law and Insurance	3
BA	696	Internship**	1-3
BA	699	Special Topics in Business Administration	1-3
BA	700	Thesis	6
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 Aviation Human Resources

Aviation Business Core

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	517	Accounting for Decision Making	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
Core Credits Required			**21**

Specialization Required Courses

Students must complete these six hours.

Course		Title	Credits
BA	607	Human Resources Development	3
BA	632	Seminar in Aviation Labor Relations	3

Electives

Students must complete a combination of six hours from the courses listed below.

Course		Title	Credits
BA	590	Graduate Seminar	1-3
BA	603	Aerospace Production and Operations Management	3
BA	604	International Management and Aviation Policy	3
BA	609	Airline Operations and Management	3
BA	615	Investments	3
BA	616	Electronic Commerce	3
BA	618	Advanced Corporate Finance	3
BA	625	Airline Marketing	3
BA	630	Aviation/Aerospace Systems Analysis	3
BA	645	Airport Operations and Management	3
BA	655	Aviation Law and Insurance	3
BA	696	Internship**	1-3
BA	699	Special Topics in Business Administration	1-3
BA	700	Thesis	6
MSA	516	Applications in Crew Resource Management	3
MSA	604	Human Factors in Aviation/Aerospace Applications	3
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 Aviation System Management

Aviation Business Core

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	517	Accounting for Decision Making	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
Core Credits Required			**21**

Specialization Required Courses

Students must complete these six hours.

Course		Title	Credits
BA	610	Airline Optimization and Simulation Systems	3
BA	630	Airline/Aerospace Systems Analysis	3

Electives

Students must complete a combination of six hours from the courses listed below.

BA 590 Graduate Seminar 1-3

Course		Title	Credits
BA	603	Aerospace Production and Operations Management	3
BA	604	International Management and Aviation Policy	3
BA	607	Human Resource Development	3
BA	609	Airline Operations and Management	3
BA	615	Investments	3
BA	616	Electronic Commerce	3
BA	618	Advanced Corporate Finance	3
BA	645	Airport Operations and Management	3
BA	655	Aviation Law and Insurance	3
BA	696	Internship**	1-3
BA	699	Special Topics in Business Administration	1-3
BA	700	Thesis	6
MSA	603	Aircraft and Spacecraft Development	3
MSA	609	Aircraft Maintenance Management	3
MSA	641	Production and Procurement Management in Aviation/Aerospace Industry	3
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 Finance

Aviation Business Core

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	517	Accounting for Decision Making	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
Core Credits Required			**21**

Specialization Required Courses

Students must complete these six hours.

Course		Title	Credits
BA	615	Investments	3
BA	618	Advanced Corporate Finance	3

Electives

Students must complete a combination of six hours from the courses listed below.

Course		Title	Credits
BA	590	Graduate Seminar	1-3
BA	603	Aerospace Production and Operations Management	3
BA	604	International Management and Aviation Policy	3
BA	607	Human Resource Development	3
BA	609	Airline Operations and Management	3
BA	610	Airline Optimization and Simulation Systems	3
BA	616	Electronic Commerce	3
BA	620	Organizational Theory	3
BA	625	Airline Marketing	3
BA	630	Aviation/Aerospace Systems Analysis	3
BA	632	Seminar in Aviation Labor Relations	3
BA	645	Airport Operations and Management	3
BA	646	Air Cargo & Logistics Management	3
BA	650	Airline/Airport Relations	3
BA	651	Strategic Airport Planning	3
BA	655	Aviation Law and Insurance	3
BA	696	Internship**	1-3
BA	699	Special Topics in Business Administration	1-3
BA	700	Thesis	6
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 in Aviation Management (MBA in AM)

Introduction

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 ther 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

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	517	Accounting for Decision Making	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
Core Credits Required			**21**

Aviation Management Courses*

Course		Title	Credits
BA	604	International Management and Aviation Policy	3
BA	609	Airline Operations and Management	3
BA	645	Airport Operations and Management	3
BA	646	Air Cargo & Logistics Management	3
Total Credits Required			**33**

* Students may petition the Program Coordinator for permission to substitute the required specified electives to declare a specialization as shown with the MBA program.

Bachelor of Science in Business Administration Accelerated MBA

Bachelor of Science in Business Administration
Master of Business Administration

Introduction

The accelerated 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 five-year 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 five-year programs 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.

General Education Requirements

For a full description of Embry-Riddle's General Education guidelines, please see the Academic Programs section of this catalog. These minimum requirements are applicable to all degree programs.

Course	Credits
General Education	36
Program Support	12
Business Core	36
Bachelor of Science in Business Administration Major	21
Open Electives	6
MBA Transition Courses	9
Graduate BA courses	24
TOTAL PROGRAM CREDITS	**144**

General Education*

Communication Theory and Skills 9
COM 122, 219, 222, -OR- 221

Mathematics 6
MA 111 -OR- MA 120, MA 112 -OR- MA 220

Computer Science......................3
BA 120 -OR- CS 120

Physical and Life Sciences...............6
(One course must include a laboratory.)
PS 101-109, PS 142, PS 302, PS 308, PS 309

Humanities 3
Lower-Level
HU 140 Series

Social Sciences.........................6
Lower-Level
EC 210, EC 211

Humanities/Social Sciences 3
Upper-Level
HU 300-400 Level, HF 300, PSY 350, SS 302-360

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 those listed below, 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

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
BA	221	Advanced Computer Based Systems	3
MA	222	Business Statistics	3
MA	320	Decision Math	3
Total Credits			**12**

Business Core

Course		Title	Credits
BA	201	Principles of Management	3
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	225	Business Law	3
BA	312	Managerial Accounting	3
BA	317	Organizational Behavior	3
BA	320	Business Information Systems	3
BA	325	Social Responsibility and Ethics	3
BA	332	Corporate Finance	3
BA	335	International Business	3
BA	420	Management of Production and Operations	3
BA	436	Strategic Management	3
Total Credits			**36**

Bachelor of Science in Business Administration Major Option

Required Major Credits.........................21
Open Electives................................6

MBA Transition Courses

Courses Available as MBA Transition Courses:

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	520	Organizational Behavior, Theory, and Applications in Aviation	3
Total Credits			**9**

GRADUATE LEVEL STUDIES

MBA Business Core* 12

*THE REMAINING 4 CLASSES BEYOND THE MBA TRANSITION COURSES.

Course		Title	Credits
BA	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
TOTAL CORE HOURS			**12**

MBA Specified Electives

Students must complete a combination of 12 hours from the courses listed below:

Course		Title	Credits
BA	590	Graduate Seminar	1-3
BA	603	Aerospace Production and Operations Management	3
BA	604	International Management and Aviation Policy	3
BA	607	Human Resource Development	3
BA	609	Airline Operations and Management	3
BA	610	Airline Optimization and Simulation Systems	3
BA	615	Investments	3
BA	616	Electronic Commerce	3
BA	618	Advanced Corporate Finance	3
BA	620	Organizational Theory	3
BA	625	Airline Marketing	3

BA	630	Aviation/Aerospace Systems Analysis	3
BA	632	Seminar in Aviation Labor Relations	3
BA	645	Airport Operations and Management	3
BA	646	Air-Cargo Logistics Management	3
BA	650	Airline/Airport Relations	3
BA	651	Strategic Airport Planning	3
BA	655	Aviation Law and Insurance	3
BA	696	Internship**	1-3
BA	699	Special Topics in Business Administration	1-3
BA	700	Thesis	6
Total MBA Specified Elective Credits			**12**

** Students may petition for an internship credit with prior approval of the Associate Dean or graduate program coordinator as appropriate.

TOTAL MBA DEGREE REQUIREMENTS **24**

Suggested Program of Study

FRESHMAN YEAR

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
		Communication Theory and Skills	3
		Lower-Level Humanities	3
BA	120	Introduction to Computer-Based Systems	3
		Mathematics	6
BA	201	Principles of Management	3
BA	221	Advanced Computer-Based Systems	3
EC	210	Microeconomics	3
EC	211	Macroeconomics	3
Total Credits			**30**

SOPHOMORE YEAR

Course		Title	Credits
		Communication Theory and Skills	6
		Physical and Life Sciences	3
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	225	Business Law	3
BA	317	Organizational Behavior	3
BA	320	Business Information Systems	3
MA	222	Business Statistics	3
MA	320	Decision Mathematics	3
Total Credits			**30**

JUNIOR YEAR

Course		Title	Credits
		Upper-Level Humanities -OR- Social Sciences*	3
		Physical Sciences	3
BA	312	Managerial Accounting	3
BA	325	Social Responsibility and Ethics	3
BA	332	Corporate Finance I	3
		BSBA Major Credits	12
		Open Elective	3
Total Credits			**30**

SENIOR YEAR

Course		Title	Credits
BA	335	International Business	3
BA	420	Production and Operations	3
BA	436	Strategic Management	3
		BSBA Major Credits	9
		Open Elective	3

MBA TRANSITION COURSES

Course		Title	Credits
BA	511	Operations Research	3
BA	514	Strategic Marketing Management in Aviation	3
BA	520	Organizational Behavior, Theory, and Applications in Aviation	3
Total Credits			**30**

The BSBA undergraduate degree is awarded once 120 hours and the MBA transition classes are successfully completed.

YEAR FIVE

MBA Business Core**	12
MBA Specified Electives	12
Total Graduate Credits	**24**

TOTAL PROGRAM CREDITS **144**

Master of Business Administration Five-Year Programs

Bachelor of Science in Interdiscipinary Studies/Master of Business Administration
Bachelor of Science in Communication/Master of Business Administration
Bachelor of Science in Human Factors/Master of Business Administration

Introduction

The five-year program options allow exceptional students to complete a baccalaureate degree (B.S.) in either Interdisciplinary Studies, Communication, or Human Factors, and a Master of Business Administration (MBA). The objective of these five-year 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.

Admission Requirements

Students interested in pursuing one of these five-year 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, before enrollment in the Business Administration graduate transition classes is allowed.

Students should review the undergraduate degree program sections for the recommended course of study and program requirements.

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.

Inerdisciplinary Studies/MBA

MATHEMATICS

Course		Title	Credits
MA	111	College Mathematics for Aviation I	3
MA	222	Business Statistics	3

SOCIAL SCIENCES

Course		Title	Credits
EC	210	Microeconomics	3
EC	211	Macroeconomics	3
		-OR-	
EC	200	An Economic Survey	3
		-And 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

	Credits
Minor requirements are based on the catalog of the declaring year; must earn a 2.0 GPA or higher in each minor	38-40

MINOR IN BUSINESS ADMINISTRATION

Course		Title	Credits
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	221	Advanced Computer Based Systems	3
BA	332	Corporate Finance	3

BUSINESS ADMINISTRATION TRANSITION

Nine credits are required from the list below.

Course		Title	Credits
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 (24 CREDIT HOURS)

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional courses that have not been completed.

Course		Title	Credits
BA	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 Aerospace Studies, any MBA transition courses used to meet graduation requirements will be noted as undergraduate courses for the purpose of graduation.

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 BA 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.

Communication/MBA

MATHEMATICS

Course		Title	Credits
MA	111	College Mathematics for Aviation I	3
MA	222	Business Statistics	3

SOCIAL SCIENCES

Course		Title	Credits
EC	210	Microeconomics	3
EC	211	Macroeconomics -OR-	
Lower-Level Social Sciences			3

MINOR IN BUSINESS ADMINISTRATION

Course		Title	Credits
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	221	Advanced Computer Based Systems	3
BA	332	Corporate Finance	3

OPEN ELECTIVES

One class MUST be:

Course		Title	Credits
BA	201	Principles of Management	3

BUSINESS ADMINISTRATION TRANSITION

Nine credits are required from the list below:

Course		Title	Credits
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 (24 CREDIT HOURS)

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

Course	Title	Credits
BA 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****

**There may be additional hours 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.

Human Factors/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 BS 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.

Human Factors/MBA

MATHEMATICS

Course	Title	Credits
MA 111	College Mathematics for Aviation I	3
MA 222	Business Statistics	3

SOCIAL SCIENCES

One class must be:

Course	Title	Credits
EC 210	Microeconomics	3
PSY 101	Introduction to Psychology	3

SPECIFIED ELECTIVES (15 CREDITS)

One course MUST be:

Course	Title	Credits
PSY 340	Industrial Organizational Psychology*	3

BUSINESS ADMINISTRATION COURSES

(In place of open elective courses)

Course	Title	Credits
BA 210	Financial Accounting	3
BA 220	Marketing	3
BA 332	Corporate Finance	3

BUSINESS ADMINISTRATION TRANSITION

Nine credits are required from the list below:

Course	Title	Credits
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 (24 CREDIT HOURS)

Students must fulfill the required MBA core classes listed below and any remaining courses from the transitional period that have not been completed:

Course	Title	Credits
BA 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		**150**

* 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.

College of Engineering

Dr. Maj Dean Mirmirani, Dean

The College of Engineering at Embry-Riddle offers Bachelor of Science degrees in Aerospace Engineering, Civil Engineering, Computer Engineering, Computer Science, Electrical Engineering, Mechanical Engineering, and Software Engineering. Each of these degree programs gives students the opportunity to acquire a depth of understanding while at the same time benefiting from aerospace strengths that are unique to each curriculum.

All undergraduate engineering programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700, http://www.abet.org).

Embry-Riddle's College of Engineering is one of the most highly regarded undergraduate engineering schools in the nation. Its Aerospace Engineering program, which is the largest in the country, has been ranked # 1 by *U.S. News & World Report* among those offered by primarily bachelor's and master's granting institutions.

In addition to its diverse undergraduate programs, the College of Engineering offers master's degrees in Aerospace Engineering, Electrical and Computer Engineering, Mechanical Engineering, and Software Engineering.

The College of Engineering has a vision to be recognized internationally for excellence in engineering education and leadership in aerospace and aviation research. The mission of the College of Engineering is:

- To educate and prepare our students for engineering careers and leadership roles in aerospace, aviation, and related disciplines.
- To support the advancement of engineering by promoting interdisciplinary applied research and by developing technology that serves the needs of the aerospace and aviation industry.
- To serve society and the engineering profession by fostering a global perspective and a culture of social responsibility and service.

The College of Engineering achieves its mission by emphasizing high-quality education through excellence in teaching; balancing coursework between theory and application; research; co-curricular and internship opportunities; and opportunities to study and conduct research abroad. Students are continually engaged and advised to strive for innovative, creative, and socially responsible solutions to real technological problems through research projects of their own as well as joint projects with faculty.

The state-of-the-art facilities provide students with valuable hands-on experience using cutting-edge technology in laboratories and activities devoted to design, composites, robotics, wind tunnel testing, autonomous systems, flight testing, real-time software, and other engineering pursuits. The College invites industry and academic experts to present seminars and workshops on technical, business, social, and global issues. These interactions provide a stimulating intellectual environment and enable students to stay abreast of current industry conditions and advancements. College of Engineering graduates are regarded as among the most knowledgeable and best-trained professionals entering today's engineering workforce.

Freshman Engineering

The Freshman Engineering Program is designed to prepare students for entry into the engineering degrees offered by the College of Engineering. The first-year curriculum allows engineering students to take coursework that is common to every engineering degree in the College, allowing students flexibility in choosing engineering degrees without affecting their progress toward graduation.

The Freshman Engineering Program is designed to introduce students to the interdisciplinary aspects of engineering. Engineering, mathematics, computing, and physics courses are integrated to prepare students to work in teams for solving aerospace-related problems that reach across the broad areas of engineering.

Students entering the Freshman Engineering Program should have demonstrated 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 entry into the Freshman Engineering Program by taking College Algebra (MA 140) and Trigonometry (MA 142) before taking Calculus and Analytic Geometry I (MA 241).

FRESHMAN YEAR

Course		Title	Credits
COM	122	English Composition and Literature I	3
COM	219	Speech*	3
EGR	101	Introduction to Engineering	2
EGR	115	Introduction to Computing for Engineers	3
HU	14X	Humanities	3
MA	241	Calculus I	4
MA	242	Calculus II	4
PS	150	Physics I	3
PS	160	Physics II	3
SS		Lower-Level Social Sciences Elective	3
UNIV		101 College Success	1
Total Credits			**32**

* COM 219 is required in every degree for graduation. However, students are advised to postpone COM 219 during the first year in favor of one of the following courses based on the field of interest of the student:

Aerospace Engineering, Civil Engineering, or Mechanical Engineering: EGR 120, Graphical Communications, 3 credits.

Computer Engineering or Software Engineering: CS 225, Computer Science II, 4 credits.

Electrical Engineering: CEC 220/2, Digital Circuit Design with lab, 4 credits.

Please refer to the specific Area of Concentration (AOC) in the Computer Science degree for specific science requirements.

General Education Electives For Engineers

Embry-Riddle courses in the general education categories of Humanities and Social Sciences may be chosen from those listed below, assuming prerequisite and other listed requirements are met. Courses from other institutions are acceptable if they fall into these categories and are at the level specified in the particular engineering program.

Humanities: Any HU course at the required level.
Social Sciences: Any SS, EC, or PSY course at the required level. HF 300 is also acceptable.
Exceptions: Language courses must not be the student's native language. EC 200 is not acceptable together with EC 210 or EC 211 or their equivalent. Registering in a Special Topics course must be approved by the appropriate engineering department **before** taking the course.

Aerospace Engineering

Bachelor of Science

The 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. The goal of the Aerospace Engineering program is to produce graduates who are ready for constructive roles in society, who qualify for entry-level engineering jobs in the aerospace industry or aviation-related fields, who qualify for admission to graduate programs in Aerospace Engineering (or related engineering fields), and who are prepared to continue learning throughout their lives.

In order to achieve these objectives, the following are the expected outcomes:

1. ***Engineering responsibilities and methodology.*** From their first semester onward, students will be made aware of what engineering is and what will be expected of them as engineers, including a commitment to continuing education and to engineering ethics. This will be accomplished through interdisciplinary team activities and design projects, workshops, and seminars, and the consistent assignment of open-ended problems throughout the curriculum.
2. ***Professional activity and development.*** Students will be encouraged throughout their Embry-Riddle careers to actively participate in professional organizations, to stay abreast of industry and government aeronautical/aerospace related activities and programs, and to continue their professional development.
3. ***Technical communication.*** Throughout the curriculum, wherever appropriate, student teams will make professional-quality verbal and written presentations.
4. ***General education.*** Students will satisfy the University's general education requirements to broaden the student's education, develop effective communication skills, and obtain awareness of social and ethical issues.
5. ***Basic science and mathematics.*** Students will demonstrate a knowledge of chemistry fundamentals (including oxidation/reduction, the essentials of physical chemistry, and the basics of organic compounds as related to composite materials), basic physics (mechanics, heat, sound, electricity, and optics), and mathematics (differential and integral calculus, differential equations, matrix algebra, and vector calculus) to use as tools in support of their studies of engineering topics and beyond.
6. ***Engineering mechanics.*** Students will demonstrate a knowledge of the fundamentals of classical engineering mechanics (as applied to rigid, elastic, and fluid media) to provide a foundation for the professional component of the curriculum as well as to become familiar with basic engineering problem-solving techniques, including team approaches.

7. ***Aerodynamics and aeronautics.*** Students will demonstrate a knowledge of topics in aerodynamics, to include a majority of the following: the aerospace environment; applications of mass, momentum, energy, and entropy principles to one- and two-dimensional flows; potential flow; viscous flow and boundary layers; aerodynamics of airfoils in incompressible and compressible flows; steady-state aircraft performance; static stability; propeller and rotary wing fundamentals; applications of the concept of panel methods; supersonic flow; and aerodynamic heating.
8. ***Thermal sciences.*** Students will demonstrate knowledge of a sequence of topics in thermodynamics, heat transfer, and propulsion so as to be able to assess the operational capabilities and analyze the performance of air-breathing and rocket engines.
9. ***Structures.*** Students will demonstrate a knowledge of topics in aerospace structures and materials, to include as a minimum the equilibrium of forces and moments in three dimensions; shear and bending moment diagrams; stresses and deflections due to elastic tension, compression, shear, and torsion on stable cross sections; compression and shear buckling; composite materials; basics of the finite element method; and vibration, fatigue, and fracture mechanics concepts.
10. ***Electronics.*** Students will demonstrate a knowledge of topics in electric circuits, analog and digital electronic fundamentals, electromechanical devices, and instrumentation fundamentals.
11. ***Astronautics.*** Students will demonstrate a knowledge of topics in orbital mechanics, gyroscopic motion, and control systems with aerospace applications.
12. ***Laboratories and data interpretation.*** Students will demonstrate an ability to perform laboratory work, including setting up and running an experiment, data collection, statistical processing of data and error analysis, in materials, structures, aerodynamics, power and energy systems, electronics, and instrumentation.
13. ***Design***. Students will carry out and defend the conceptual design of an aircraft or a spacecraft in an industry-like environment, in teams, using realistic constraints and considerations of cost, safety, manufacturability and maintainability, mission success, and the needs of the public. Students will likewise also carry out the detail design of an aircraft or a spacecraft system.
14. ***Support hardware and software.*** The program will be supported throughout by the use of modern equipment and the most relevant modern tools and techniques of engineering analysis, design, and production, including student experience with industry-level solid modeling (CAD/CAM), finite element, and computational fluid mechanics software.

To enter this program, students should have demonstrated competence in mathematics, physics, and chemistry in high school.

The Aerospace Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700; http://www.abet.org).

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.

First-Year Requirement

A student must attain a minimum cumulative grade point average of 2.5 in those courses prescribed by the College of Engineering Freshman Program (see the common Freshman Year outline in the College of Engineering introduction) before continuing the pursuit of an Aerospace Engineering degree.

Remaining on Track for AE

Aerospace Engineering students must complete MA 241, MA 242, PS 150, PS 160, and EGR 115 with a C or better within three attempts (including audits and withdrawals) before attending any ES courses. Failure to abide by the above requirements will prohibit the student from continuing in the Aerospace Engineering program. Students should be aware that many courses have prerequisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure required sequencing.

FRESHMAN YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32**

SOPHOMORE YEAR

Course		Title	Credits
COM	221	Technical Report Writing	3
COM	219	Speech -OR-	
EGR	120	Graphical Communications	3
ES	201	Statics	3
ES	202	Solid Mechanics	3
ES	204	Dynamics	3
ES	206	Fluid Mechanics	3
MA	243	Calculus and Analytic Geometry III	4
MA	345	Differential Equations and Matrix Methods	4
PS	105	General Chemistry I	4
PS	250	Physics III for Engineers**	3
PS	253	Physics Laboratory for Engineers**	1
Total Credits			**34**

JUNIOR YEAR (AERONAUTICS OPTION)

Course		Title	Credits
AE	301	Aerodynamics I	3
AE	302	Aerodynamics II	3
AE	313	Space Mechanics	3
AE	314	Experimental Aerodynamics I**	1
AE	315	Experimental Aerodynamics Laboratory**	1
AE	316	Aerospace Engineering Materials	3
AE	318	Aerospace Structures I	3
AE	413	Airplane Stability and Control	3
AE	418	Aerospace Structures II	3
EE	335	Electrical Engineering**	2
EE	336	Electrical Engineering Laboratory**	1
ES	305	Thermodynamics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
Total Credits			**32**

JUNIOR YEAR (ASTRONAUTICS OPTION)

Course		Title	Credits
AE	301	Aerodynamics I	3
AE	302	Aerodynamics II	3
AE	313	Space Mechanics	3
AE	314	Experimental Aerodynamics I**	1
AE	315	Experimental Aerodynamics Laboratory**	1
AE	316	Aerospace Engineering Materials	3
AE	318	Aerospace Structures I	3
AE	418	Aerospace Structures II	3
EE	335	Electrical Engineering I**	2
EE	336	Electrical Engineering Laboratory**	1
ES	305	Thermodynamics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
		Technical Elective	3
Total Credits			**32**

JUNIOR YEAR (AEROSPACE PROPULSION OPTION)

Course		Title	Credits
AE	301	Aerodynamics I	3
AE	302	Aerodynamics II	3
AE	313	Space Mechanics	3
AE	314	Experimental Aerodynamics I**	1
AE	315	Experimental Aerodynamics Laboratory**	1
AE	316	Aerospace Engineering Materials	3
AE	318	Aerospace Structures I	3
AE	413	Airplane Stability and Control	3
AE	418	Aerospace Structures II	3
EE	335	Electrical Engineering I	2
EE	336	Electrical Engineering Laboratory	1
ES	305	Thermodynamics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
Total Credits			**32**

SENIOR YEAR (AERONAUTICS OPTION)

Course		Title	Credits
AE	408	Turbine and Rocket Engines	3
AE	416	Aerospace Structures and Instrumentation**	1
AE	417	Aerospace Structures and Instrumentation Laboratory**	1
AE	420	Aircraft Preliminary Design	4
AE	421	Aircraft Detail Design	4
AE	432	Flight Dynamics and Control	3
ES	405	Electrical Engineering II	3
HU/SS		Lower-Level Elective	3
HU/SS		Upper-Level Elective	3
		Approved Upper-Level Technical Electives	6
Total Credits			**31**

SENIOR YEAR (ASTRONAUTICS OPTION)

Course		Title	Credits
AE	408	Turbine and Rocket Engines	3
AE	416	Aerospace Structures and Instrumentation	1
AE	417	Aerospace Structures and Instrumentation Laboratory	1
AE	426	Spacecraft Attitude Dynamics and Control	3
AE	427	Spacecraft Preliminary Design	4
AE	434	Spacecraft Control	3
AE	445	Spacecraft Detail Design	4
ES	405	Electrical Engineering II	3
HU/SS		Lower-Level Elective	3
HU/SS		Upper-Level Elective	3
		Approved Upper-Level Technical Electives	6
Total Credits			**31**

SENIOR YEAR (AEROSPACE PROPULSION OPTION)

Course		Title	Credits
AE	408	Turbine and Rocket Engines	3
AE	416	Aerospace Structures and Instrumentation	1
AE	417	Aerospace Structures and Instrumentation Laboratory	1
AE	432	Flight Dynamics and Control	3
AE	435	Air-Breathing Propulsion Preliminary Design	4
AE	440	Air-Breathing Propulsion Component Design	4
ES	405	Electrical Engineering	3
HU/SS		Lower-Level Elective	3
HU/SS		Upper-Level Elective	3
		Approved Upper-Level Technical Electives	6
Total Credits			**31**

TOTAL DEGREE CREDITS **129**

Technical Electives:

AE: 350, 395*, 399*, 401, 409, 411, 415, 425, 433, 495*, 499*, 5XXU
CEAE: With prior approval of the Aerospace Engineering Department
CEC: 300, 315, 330, 340, 460
CIV: 447
CS: 303, 344, 350
EGR: 305
EP: 320, 391, 394 (Astronautics option only)
ES: 315 (Astronautics option only), 395*, 399*, 403, 412, 495*, 499*
MA: 412, 432, 438, 442, 443, 5XXU
ME: 304/305** (was 300/L), 302, 303, 425
PS: 303, 320, 401 (Astronautics option only)
SE: 300
SYS: 301

Students may substitute upper-level AF, NSC, and MY courses or aeronautical certificates for the 6 credits of technical electives.

Students may take courses that are not listed above with prior approval of the Aerospace Engineering Department.

* Need approval of Aerospace Engineering Department Chair before enrolling.

** Lecture/Lab courses must be taken at the same time.

Accelerated Program in Aerospace Engineering

Bachelor of Science/Master of Aerospace Engineering

The accelerated program allows students with strong academic backgrounds to complete both B.S. and M.A.E. degrees in Aerospace Engineering. The goal of the program is to produce graduates who are prepared for careers in the aerospace industry and in research and development. The program augments the student's undergraduate background with graduate-level study and with course offerings in the areas of aerodynamics, structures, propulsion, and astronautics.

Degree Requirements

Students enrolled in the Bachelor of Science program in Aerospace Engineering may apply for entry into the accelerated program when they have completed about 90 hours of coursework. Students should have a CGPA of 3.20 (out of a possible 4.00) in AE/ES courses, at a minimum, for selection. For continued enrollment, a CGPA of 3.00 must be maintained. Each student is required to conduct an independent study in a topic of current interest in aerospace engineering under the guidance of an advisor, with a formal report due at the end. Three graduate credits are earned through this work.

FRESHMAN YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32**

SOPHOMORE YEAR

Course		Title	Credits
COM	221	Technical Report Writing	3
COM	219	Speech -OR-	
EGR	120	Graphical Communications	3
ES	201	Statics	3
ES	202	Solid Mechanics	3
ES	204	Dynamics	3
ES	206	Fluid Mechanics	3
MA	243	Calculus and Analytic Geometry III	4
MA	345	Differential Equations and Matrix Methods	4
PS	105	General Chemistry I	4
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
Total Credits			**34**

JUNIOR YEAR (AERONAUTICS AND PROPULSION OPTIONS)

Course		Title	Credits
AE	301	Aerodynamics I	3
AE	302	Aerodynamics II	3
AE	313	Space Mechanics	3
AE	314	Experimental Dynamics I	1
AE	315	Experimental Dynamics I Laboratory	1
AE	316	Aerospace Engineering Materials	3
AE	318	Aerospace Structures I	3
AE	413	Airplane Stability and Control	3
AE	418	Aerospace Structures II	3
EE	335	Electrical Engineering I	2
EE	336	Electrical Engineering I Laboratory	1
ES	305	Thermodynamics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
Total Credits			**32**

JUNIOR YEAR (ASTRONAUTICS OPTION)

Course		Title	Credits
AE	301	Aerodynamics I	3
AE	302	Aerodynamics II	3
AE	313	Space Mechanics	3
AE	314	Experimental Dynamics I	1
AE	315	Experimental Dynamics I Laboratory	1
AE	316	Aerospace Engineering Materials	3
AE	318	Aerospace Structures I	3
AE	418	Aerospace Structures II	3
EE	335	Electrical Engineering I	2
EE	336	Electrical Engineering I Laboratory	1

Course		Title	Credits
ES	305	Thermodynamics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
		Technical Elective	3
Total Credits			**32**

SENIOR YEAR (AERONAUTICS OPTION)

Course		Title	Credits
HU/SS		Lower-Level Elective	3
HU/SS		Upper-Level Elective	3
		Technical Electives†	6
AE	408	Turbine and Rocket Engines	3
AE	416	Aerospace Structures and Instrumentation Lab	1
AE	417	Aerospace Structures and Instrumentation Lab	1
AE	420	Aircraft Preliminary Design	4
AE	421	Aircraft Detail Design	4
AE	430	Control Systems Analysis and Design	3
ES	405	Electrical Engineering II	3
Total Credits			**31**

SENIOR YEAR (PROPULSION OPTION)

Course		Title	Credits
HU/SS		Lower-Level Elective	3
HU/SS		Upper-Level Elective	3
		Technical Electives†	6
AE	408	Turbine and Rocket Engines	3
AE	416	Aerospace Structures and Instrumentation	1
AE	417	Aerospace Structures and Instrumentation Laboratory	1
AE	430	Control Systems Analysis and Design	3
AE	435	Air-Breathing Propulsion Preliminary Design	4
AE	440	Air-Breathing Propulsion Component Design	4
ES	405	Electrical Engineering II	3
Total Credits			**31**

SENIOR YEAR (ASTRONAUTICS OPTION)

Course		Title	Credits
AE	408	Turbine and Rocket Engines	3
AE	416	Aerospace Structures and Instrumentation	1
AE	417	Aerospace Structures and Instrumentation Laboratory	1
AE	426	Spacecraft Attitude Dynamics and Control	3
AE	427	Spacecraft Preliminary Design	4
AE	430	Control Systems Analysis and Design	3
AE	445	Spacecraft Detail Design	4
ES	405	Electrical Engineering II	3
HU/SS		Lower-Level Elective	3
HU/SS		Upper-Level Elective	3
		Technical Elective†	3
Total Credits			**31**
TOTAL UNDERGRADUATE CREDITS			**129**

GRADUATE-LEVEL STUDY

Course		Title	Credits
AE	699	Special Topics in Aerospace Engineering	3
MA	502	Boundary Value Problems (or equivalent)	3
		Core Courses	6
		Electives†	9
Total Credits (at least nine hours 600-level)			**21**
TOTAL DEGREE CREDITS			**150**

†Technical Electives: Students may satisfy this requirement by selecting from the 500-level graduate courses listed in this section.

‡Electives: The following should be selected as electives at the graduate level. The elective list has been grouped into areas of concentration.

Areas of Concentration

Structures

This area includes Structural Analysis, Vibration, Nondestructive Testing, Composite Materials, Elasticity, Flight Dynamics, Controls, and Design Optimization.

Core Course for Structures Concentration

Course		Title	Credits
AE	502	Strength and Fatigue of Materials	3

Electives for Structures Concentration

AE	506	Airplane Dynamic Stability	3
AE	514	Introduction to the Finite Element Method	3
AE	518	Acoustic Emission Nondestructive Testing	3
AE	520	Perturbation Methods in Engineering	3
AE	522	Analysis of Aircraft Composite Materials	3
AE	612	Analysis of Aircraft Plate and Shell Structures	3
AE	616	Advanced Aircraft Structural Dynamics	3
AE	699	Special Topics in Aerospace Engineering	3

Aerodynamics and Propulsion

This area includes Aerodynamics, Propulsion, Computational Aero and Fluid Dynamics, Transition and Turbulence, Aeroacoustics, Heat Transfer, and Combustion.

Core Course for Aerodynamics and Propulsion Concentration

Course		Title	Credits
AE	504	Advanced Compressible Flow	3

Electives for Aerodynamics and Propulsion Concentration

AE	508	Heat Transfer	3
AE	512	Combustion I	3
AE	516	Computational Aeronautical Fluid Dynamics	3
AE	528	Advanced Incompressible Aerodynamics	3
AE	530	Aeroacoustics	3
AE	610	Advanced Computational Fluid Dynamics	3
AE	620	Boundary Layer Theory	3
AE	640	Turbine Engine Propulsion Systems	3
AE	648	Thermal Stresses in Aerospace Engineering	3
AE	699	Special Topics in Aerospace Engineering	3
AE	652	Turbulent Flows	3

Astronautics and Control

This area includes Space Vehicles, Space Power, and Systems Control.

Electives for Astronautics Concentration

AE 508 Heat Transfer
AE 524 Rocket Engine Propulsion Systems
AE 526 Engineering Optimization
AE 606 Finite Element Aerospace Applications
AE 620 Boundary Layer Theory
AE 646 Nonlinear Dynamical Systems and Chaos

A 3 credit hour graduate internship, AE 695, may be taken as an elective course.

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

Master of Science in Aerospace Engineering

Master of Aerospace Engineering

Introduction

The Master of Science in Aerospace Engineering (MSAE) and the Master of Aerospace Engineering (MAE) provide formal advanced study, preparing students for careers in the aerospace industry and in research and development. Both degree programs are planned to augment the individual student's engineering and science background with adequate depth in areas of aeroacoustics, nondestructive testing, aerodynamics, design and optimization, propulsion, aerospace structures, composites, computational fluid dynamics, or other areas of aerospace engineering. Candidates for both degree programs can select courses that prepare them for the aerospace engineering profession or that prepare them to continue on to doctoral studies.

Both degree programs require a minimum of 30 credit hours of graduate-level work.

Degree Requirements

MSAE (Thesis option)

3 hours	MA 502 or Equivalent
6 hours	Core courses
12 hours	Electives
9 hours	Thesis
30 hours	

MAE (Nonthesis option)

3 hours	MA 502 or equivalent
6 hours	Core courses
21 hours	Electives (at least six hours should be 600-level)
30 hours	

Areas of Concentration

Aerospace Structures

This area includes Structural Analysis, Vibration, Nondestructive Testing, Composite Materials, Elasticity, Flight Dynamics, Controls, and Design Optimization.

Core Courses for Structures Concentration

Course		Title	Credits
AE	502	Strength and Fatigue of Materials	3
AE	504	Advanced Compressible Flow	3

Electives for Structures Concentration

AE	506	Airplane Dynamic Stability	3
AE	510	Aircraft Structural Dynamics	3
AE	514	Introduction to the Finite Element Method	3
AE	518	Acoustic Emission Nondestructive Testing	3
AE	520	Perturbation Methods in Engineering	3
AE	522	Analysis of Aircraft Composite Materials	3
AE	526	Engineering Optimization	3
AE	606	Finite Element Aerospace Applications	3
AE	612	Analysis of Aircraft Plate and Shell Structures	3
AE	616	Advanced Aircraft Structural Dynamics	3
AE	646	Nonlinear Dynamical Systems and Chaos	3
AE	648	Thermal Stresses in Aerospace Engineering	3
AE	699	Special Topics in Aerospace Engineering*	3

* No more than 3 hours of AE 699 should be taken.

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

Course		Title	Credits
AE	502	Strength and Fatigue of Materials	3
AE	504	Advanced Compressible Flow	3

Electives for Aerodynamics and Propulsion Concentration

AE	508	Heat Transfer	
AE	512	Combustion	
AE	516	Computational Aeronautical Fluid Dynamics	
AE	524	Rocket Engine Propulsion Systems	
AE	528	Advanced Incompressible Aerodynamics	
AE	530	Aeroacoustics	
AE	610	Advanced Computational Fluid Dynamics	
AE	620	Boundary Layer Theory	
AE	640	Turbine Engine Propulsion Systems	
AE	652	Turbulent Flows	
AE	699	Special Topics in Aerospace Engineering*	3

* No more than 3 hours of AE 699 should be taken.

A 3 credit hour graduate internship, AE 695, may be taken as an elective course.

Civil Engineering

Bachelor of Science

The demand for civil engineers educated in the fields of airports, transportation, aviation and aerospace planning, and analysis and design is strong and is expected to grow rapidly in the future. Air and ground transportation systems have substantially expanded in the last few years and are expected to continue to grow at an increasing pace. Space utilization and exploration initiatives are certain to produce further demand for civil engineers with aerospace interests. 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, structural design, and materials science 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 objectives of the program are to produce graduates who:

- Are prepared for the challenges of contemporary civil engineering practice and have the ability to adapt to changes in the civil engineering profession.
- Have developed problem-solving skills, have acquired team-building abilities, and have demonstrated leadership talent.
- Are capable of participating in interdisciplinary projects, of applying their knowledge of engineering theory to actual problems, and have the skills to perform technical research.
- Have experienced the facilities, equipment, and academic environment necessary to encourage learning.
- Have developed a love of learning and a quest for understanding that will last throughout their professional careers.

As graduates of a program fully accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: (410) 347-7700, http://www.abet.org), students will have the necessary background to further their formal education through graduate school if desired.

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.

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.

Degree Requirements

The Bachelor of Science in Civil Engineering program requires successful completion of a minimum of 128 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 2.00 is needed for all required CIV, AE, EE, EGR, and ES courses, including engineering electives.

FIRST YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits 32

SECOND YEAR

Course		Title	Credits
CIV	140	Engineering Measurements	2
CIV	140L	Engineering Measurements Laboratory	0
CIV	370	Computational Methods in Civil Engineering	3
COM	221	Technical Report Writing	3
ES	201	Statics	3
ES	202	Solid Mechanics	3
ES	204	Dynamics	3
MA	243	Calculus and Analytical Geometry III	4
MA	345	Differential Equations	4
PS	105	General Chemistry with Laboratory	4
PS	250	Physics III	3
PS	253	Physics Laboratory for Engineers	1
Total Credits			**33**

THIRD YEAR

Course		Title	Credits
CIV		Structures Elective	3
CIV		Transportation Elective	3
CIV	304	Structural Analysis	3
CIV	307	Civil Engineering Materials I	4
CIV	307L	Civil Engineering Materials I Laboratory	0
CIV	311	Introduction to Transportation Engineering	3
CIV	316	Hydraulics	3
CIV	320	Soil Mechanics	4
CIV	320L	Soil Mechanics Laboratory	0
CIV	441	Civil Engineering Materials II	4
CIV	441L	Civil Engineering Materials II Laboratory	0
COM	219	Speech - OR-	
EGR	120	Graphical Communications	3
HU/SS		Lower-Level Elective	3
Total Credits			**33**

FOURTH YEAR

Course		Title	Credits
CIV		Geotechnical Elective	3
CIV		Civil Engineering Electives	6
CIV	460	Senior Design Project	3
CIV	490	The Civil Engineering Profession	1
HU/SS		Upper-Level Elective	3
EE	335	Electrical Engineering I	2
MA	412	Probability and Statistics	3
		Technical Electives	9
Total Credits			**30**

TOTAL DEGREE CREDITS **128**

Civil Transportation Electives

CIV 447, 457, 499

Civil Structures Electives

CIV 431, 432, 499

Civil Geotechnical Electives

CIV 421, 422, 424, 499

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.

Computer Engineering

Bachelor of Science

The Bachelor of Science in Computer Engineering degree gives the student the opportunity to acquire a broad background in computer design, including embedded control systems, real-time systems, telecommunication systems, and software engineering. The curriculum includes courses in general education, computer science, software engineering, and electrical engineering, and features a capstone senior design. The program's emphasis on real-time embedded control systems and hardware/software interfaces give program graduates employment opportunities beyond graduates of traditional computer engineering programs, including positions in the aerospace and defense industries.

The goal of the Computer Engineering program is to produce graduates who are successful practitioners of computer engineering. The detailed objectives of the program are that our graduates:

- Effectively analyze, design, and implement computer systems, including embedded, real-time, and safety-critical computer systems.
- Demonstrate professionalism in their work and grow professionally through continued learning and involvement in professional activities.
- Contribute to society by behaving ethically and responsibly.
- Communicate effectively in oral, written, and newly developing modes and media.
- Assume a variety of roles in teams of diverse membership.

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. The Computer Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700, http://www.abet.org).

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. 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 College Algebra (MA 140) and/or Trigonometry (MA 142) before taking Calculus and Analytic Geometry (MA 241). Students should check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

FIRST YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits	**32**

SECOND YEAR

Course	Title	Credits
CEC 220	Digital Circuit Design	3
CEC 222	Digital Circuit Design Laboratory	1
CEC 320	Microprocessor Systems	3
CEC 322	Microprocessor Systems Laboratory	1
COM 221	Technical Report Writing	3
CS 222	Introduction to Discrete Structures	3
CS 225	Computer Science II* (3 credits lecture, 1 credit lab)	4
	-OR-	
COM 219	Speech*	3
EE 223	Linear Circuit Analysis I	3
EE 224	Electrical Engineering Laboratory I	1
MA 243	Calculus and Analytic Geometry III	4
MA 345	Differential Equations and Matrix Methods	4
PS 250	Physics III for Engineers	3
PS 253	Physics Laboratory for Engineers	1
Total Credits		**34/33**

* Students in the Computer Engineering program are encouraged to take CS 225 during the first year, postponing COM 219 until the second year.

THIRD YEAR

Course	Title	Credits
CEC 300	Computing in Aerospace and Aviation	3
CEC 315	Signals and Systems	3
CEC 330	Digital System Design with Aerospace Applications	4
CEC 450	Real Time Systems	3
CS 420	Operating Systems	3
EC 225	Engineering Economics	3
EE 302	Electronic Devices and Circuits	3
EE 304	Electronic Circuits Laboratory	1
HU/SS	Humanities/Social Sciences Elective	3
MA 412	Probability and Statistics	3
SE 300	Software Engineering Practices (3 credits lecture, 1 credit lab)	4
Total Credits		**33**

FOURTH YEAR

Course	Title	Credits
CEC 420	Computer Systems Design I (2 credits lecture, 1 credit lab)	3
CEC 421	Computer Systems Design II (1 credit lecture, 2 credits lab)	3
CEC 460	Telecommunication Systems	3
CEC 470	Computer Architecture	3
CEC/EE	3/4 Elective* (3 credits lecture, 1 credit lab)	4
	HU/SS 3/4XX Humanities or Social Sciences Elective (upper division)	3
	Specified Electives**	9
Total Credits		**28**
TOTAL DEGREE CREDITS		**127**

*EE 401/402, CEC 410/411, EE 410/412, 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.

Computer Engineering/Master of Software Engineering

Bachelor of Science / Master of Software Engineering

This is a five-year program that allows exceptional students to complete both a B.S. in Computer Engineering and a Master of Software Engineering degree. The objectives of this five-year program, in addition to the objectives for the Computer Engineering program, are to produce professional software engineers with advanced knowledge and skill in:

- Fundamentals of computing (discrete mathematics, programming languages, operating systems, computer architecture, and so on)
- Software systems development for real-time embedded applications
- Use of personal and team software processes
- Understanding the breadth of software engineering's terminology, tools, and techniques
- Use of requirements engineering and software architecture and design
- Use of modern software development methodologies (for example, object-oriented analysis and design)
- Software development in real work environments

Degree Requirements

Students interested in pursuing this program must meet the following requirements:

- Maintain at least a 3.2 cumulative GPA throughout the academic program.
- Maintain at least a 3.0 cumulative GPA for the graduate credits.
- Complete a total of 151 credit hours (listed in a subsequent section). There will be 124 credit hours of undergraduate requirements (equivalent to the B.S. in Computer Engineering) and 27 credit hours of graduate requirements (equivalent to a Master of Software Engineering degree).
- The program includes a requirement for two summer internships in industry. Credit at the undergraduate and graduate level will be awarded for approved and successful work.

YEAR 1

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits	**32/33**

YEAR 2

Course	Title	Credits
CEC 220	Digital Circuit Design	3
CEC 222	Digital Circuit Design Laboratory	1
CEC 320	Microprocessor Systems	3
CEC 322	Microprocessor Systems Laboratory	1
COM 221	Technical Report Writing	3
CS 222	Introduction to Discrete Structures	3
CS 225	Computer Science II* (3 credits lecture, 1 credit lab)	4
	-OR-	
COM 219	Speech*	3
EE 223	Linear Circuit Analysis I	3
EE 224	Electrical Engineering Laboratory I	1
MA 243	Calculus and Analytic Geometry III	4
MA 345	Differential Equations and Matrix Methods	4
PS 250	Physics III for Engineers	3
PS 253	Physics Laboratory for Engineers	1
Total Credits		**34/33**

* Students in the Computer Engineering program are encouraged to take CS 225 during the first year, postponing COM 219 until the second year.

YEAR 3

Course		Title	Credits
CEC	300	Computing in Aerospace and Aviation	3
CEC	315	Signals and Systems	3
CEC	330	Digital System Design with Aerospace Applications	4
CEC	450	Real Time Systems	3
CS	420	Operating Systems	3
EC	225	Engineering Economics	3
EE	302	Electronic Devices and Circuits	3
EE	304	Electronics Circuits Laboratory	1
HU/SS		Humanities/Social Sciences Elective	3
MA	412	Probability and Statistics	3
SE	300	Software Engineering Practices (3 credits lecture, 1 credit lab)	4
Total Credits			**33**

SUMMER TERM (BETWEEN YEAR 3 AND YEAR 4)

Course		Title	Credits
CESE	4XX	Cooperative Education	3
Total Credits			**3**

The student must spend the term performing a co-op in a software industry and be engaged in a software engineering activity (such as analysis, design, code, or test).

YEAR 4

Course		Title	Credits
CEC	420	Computer Systems Design I (2 credits lecture, 1 credit lab)	3
CEC	421	Computer Systems Design II (1 credit lecture, 2 credits lab)	3
CEC	460	Telecommunication Systems	3
CEC	470	Computer Architecture	3
CEC/EE	3/4	Elective* (3 credits lecture, 1 credit lab)	4
HU/SS	3/4XX	Humanities or Social Sciences Elective (upper division)	3
SE	500	Software Engineering Concepts	3
SE	510	Software Project Management	3
SE	530	Software Requirements Engineering	3
Total Credits			**28**

FIVE-YEAR CE/MSE CURRICULUM

Summer Term (between YEAR 4 and YEAR 5)

Course		Title	Credits
SE	696	Graduate Internship in Software Engineering	3
Total Credits			**3**

The student must spend the term performing a co-op in a software industry and be engaged in a software engineering activity (for example, analysis, design, code, or test).

YEAR 5

Course		Title	Credits
SE	555	Object-Oriented Software Construction	3
SE	610	Software Architecture and Design	3
SE		Graduate Level Electives**	12
Total Credits			**18**
5 YEAR TOTAL			**151**

*CEC/EE 300/400 Level Elective

* EE 401/402, CEC 410/411, EE 410/412, other CEC/EE (300/400) with the approval of the program coordinator.

** Graduate-Level Electives

Course		Title	Credits
SE	505	Model-Based Verification of Software	3
SE	520	Formal Methods for Software Engineering	3
SE	535	GUI Design and Evaluation	3
SE	545	Specification and Design of Real-Time Systems	3
SE	625	Quality Engineering and Assurance	3
SE	565	Concurrent and Distributed Systems	3
SE	575	Software Safety	3
SE	655	Performance Analysis of Real-Time Systems	3
SE	585	Metrics and Statistical Methods of Software Engineering	3
SE	660	Formal Methods for Concurrent and Real-Time Systems	3

While other elective courses may be selected, the student's advisor and the program coordinator must approve the selection.

Computer Science

Bachelor of 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. 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. There are four Areas of Concentration (AOC) to chose from: Applied Mathematics, Business Administration, Homeland Security, and Human Factors. The courses in the Area of Concentration 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.

Applied Mathematics Area of Concentration

The Computer Science degree with an area of concentration in Applied Mathematics is designed to produce graduates who can operate at the intersection of applied mathematics, computer science, and a science application area. This degree program integrates computing, mathematical modeling, and visualization to solve complex problems that arise in the physical, natural, and behavioral sciences as well as engineering. Students will have a very strong core of computing, as well as an in-depth exposure to numerical methods, modeling, and visualization. This background is synthesized and applied to computational models that arise in such areas as atmospheric physics, structural dynamics, or computational fluid dynamics in the capstone course.

Because of the strong emphasis on applied mathematics, computing tools, and science applications, this program provides an excellent background for graduates to work in a variety of aviation/aerospace or homeland security industries.

Business Administration Area of Concentration

The Computer Science degree with an Area of Concentration in Business Administration is designed to produce graduates who can 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. Graduates of this program have an opportunity to pursue graduate studies in computing or management, or careers in the computing industry, management, or entrepreneurship.

Homeland Security Area of Concentration

The Computer Science degree with 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.

The Computer Science degree with Area of Concentration in Human Factors is designed to produce graduates who can 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 121 credit hours is required.

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 140, College Algebra, and MA 142, Trigonometry, prior to 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 is required to 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 at the back of this catalog before registering for classes to ensure requisite sequencing.

COMPUTER SCIENCE CORE

Course	Title	Credits
CEC 220	Digital Circuit Design	3
COM 122	English Composition & Literature	3
COM 219	Speech	3
COM 221	Technical Report Writing	3
CS 222	Introduction to Discrete Structures	3
CS 225	Computer Science II	4
CS 315	Data Structures and Analysis of Algorithms	3
CS 332	Organization of Programming Languages	3
CS 420	Operating Systems	3
EGR 101	Introduction to Engineering	2
EGR 115	Introduction to Computing for Engineers	3

HU	14X	Humanities	3
HU/SS		Upper-Level Electives	6
MA	241	Calculus and Analytical Geometry I	4
MA	242	Calculus and Analytical Geometry II	4
SE	300	Software Engineering Practices	4
UNIV	101	College Success	1
Total Credits			**55**

APPLIED MATHEMATICS AREA OF CONCENTRATION

Course		Title	Credits
CEC	300	Computing in Aerospace and Aviation	3
CS	317	Files and Database Systems	3
CS	344	C Programming and UNIX	3
CS	375	Algorithms	3
ES	312	Energy Transfer Fundamentals	3
HU/SS		Upper-Level Humanities	6
MA	243	Calculus III	4
MA	345	Differential Equations and Matrix Methods	4
MA	350	Partial Differential Equations	3
MA	412	Probability and Statistics	3
MA	432	Linear Algebra	3
MA	444	Scientific Visualization	3
MA	453	High Performance Scientific Computing	3
MA	488	Introduction to Numerical Fluids	3
MA	490	Capstone Project	3
PS	150	Physics for Engineers I	3
PS	160	Physics for Engineers II	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
WX	201	Survey of Meteorology	3
		Open Elective	3
Total Credits			**66**

BUSINESS ADMINISTRATION AREA OF CONCENTRATION

Course		Title	Credits
BA	201	Principles of Management	3
BA	210	Financial Accounting	3
BA	220	Marketing	3
BA	225	Business Law	3
BA	317	Organizational Behavior	3
BA	325	Social Responsibility and Ethics in Management	3
BA	406	Strategic Management of Technical Operations	3
BA	422	Life Cycle Analysis for Systems and Programs in Aviation/Aerospace	3
BA	436	Strategic Management	3
CEC	300	Computing in Aerospace and Aviation	3
CS	317	Files and Database Systems	3
CS	455	Artificial Intelligence	3
CS	490	Computer Science Capstone Design	3
EC	225	Engineering Economics	3
MA	222	Business Statistics	3
MA	245	Applied Differential Equations	3
MA	320	Decision Mathematics	3
PS		Science I*	3
PS		Science II*	3
PS		Science III* with Laboratory	4
SE	310	Analysis and Design of Software Systems	3
		Open Elective	3
Total Credits			**67**

HOMELAND SECURITY AREA OF CONCENTRATION

Course		Title	Credits
CEC	460	Telecommunication	3
CS	303	Computer Security	3
CS	317	Files and Database Systems	3
CS	344	C Programming in UNIX	3
CS/SE/CEC/HS		Upper-Level	3
HS	110	Introduction to Homeland Security	3
HS	210	Fundamentals of Transportation Security	3
		-OR-	
HS	215	Introduction to Industrial Security	3
HS	230	Terrorism: Origin, Ideologies, & Goals	3
HS	310	Fundamentals of Emergency Management	3
HS	315	Critical Infrastructure & Risk Analysis	3
HS	320	Homeland Security Law & Policy	3
HS	330	Business Skills in Homeland Security	1
HS	385	Homeland Security Technology and Systems	3
HS	490	Senior Project in Homeland Security	3
		-OR-	
CS	490	Computer Science Capstone Design	3
HU/SS		Upper-Level Elective	3
MA	245	Applied Differential Equations	3
MA	412	Probability and Statistics	3
PS	150	Physics I	3
PS	160	Physics II	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
SE	420	Software Quality Assurance	3
		Open Elective	3
Total Credits			**65**

HUMAN FACTORS AREA OF CONCENTRATION

Course	Title	Credits
CEC 300	Computing in Aerospace and Aviation	3
CS 490	Computer Science Capstone Design	3
HF 300	Human Factors I: Principles and Fundamentals	3
HF 302	Human Factors II: Analytic Methods and Techniques	4
HF 305	Human Factors III: Test and Evaluation	4
HF 310	Human-Computer Interaction	3
HF 400	Human Factors IV: System Design	4
HF/PSY	Human Factors or Psychology Elective	3
MA 222	Business Statistics	3
MA 245	Applied Differential Equations	3
MA 320	Decision Mathematics	3
PS	Science I*	3
PS	Science II*	3
PS	Science III* with Laboratory	4
PSY 101	Introduction to Psychology	3
PSY 312	Research Analysis in Psychology	4
PSY 322	Research Design	4
SE 310	Analysis and Design of Software Systems	3
SE 320	Software Construction	3
SE 420	Software Quality Assurance	3
Total Credits		**66**
Total Degree Credits		**121/122**

*Students may satisfy the science requirements by choosing one of the course sequences identified below.

- PS 150, PS 160, PS 250/253 -OR- PS 140/141
- PS 103/103L, PS 104/104L, PS 107/107L
- Other combinations of science topics may be approved by the program coordinator

Electrical Engineering

Bachelor of Science

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 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, 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. The objectives of the Electrical Engineering degree are to produce graduates who:

- Are prepared to be immediately productive as well-rounded electrical engineers in aerospace, aviation, and related fields;
- Understand the importance of life-long learning and pursue professional development including advanced degrees, professional society memberships and professional registration;
- Are able to systematically apply the fundamental principles of science and mathematics to solve engineering problems;
- Understand engineering design processes that will meet system and component requirements as well as comply with health and environmental regulations;
- Are effective at both oral and written communications;
- Work effectively within a team, in both supporting and leadership roles;
- Are able to apply their knowledge to real-world multidisciplinary challenges facing society;
- Are able to apply the latest tools and technology to engineering problems;
- Understand the impact of engineering solutions in a global, economic, environmental, political, social, and ethical context.

The Electrical Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700, http://www.abet.org).

Degree Requirements

The Bachelor of Science in Electrical Engineering requires the successful completion of a minimum of 129 credit hours.

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.

FRESHMAN YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32/33**

SOPHOMORE YEAR

Course		Title	Credits
CEC	220	Digital Circuit Design	3
		-AND-	
CEC	222	Digital Circuit Design Laboratory	1
		-OR-	
COM	219	Speech	3
CEC	320	Microprocessor Systems	3
CEC	322	Microprocessor Laboratory	1
COM	221	Technical Report Writing	3
CS	225	Computer Science II	4
EE	223	Linear Circuit Analysis	3
EE	224	Electrical Engineering Laboratory	1
MA	243	Calculus and Analytic Geometry III	4
MA	345	Differential Equations and Matrix Methods	4
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
SYS	301	Introduction to Systems Engineering	3
Total Credits			**33/34**

JUNIOR YEAR

Course		Title	Credits
CEC	315	Signals and Systems	3
EC	225	Engineering Economics	3
EE	300	Linear Circuits II	3
EE	301	Linear Circuits Laboratory	1
EE	302	Electronic Devices	3
EE	304	Electronic Devices Laboratory	1
SYS	302	System Engineering Design Considerations	3
SYS	303	Optimization in Systems Engineering	3
SYS	304	Systems Engineering in Management, Risk, and Decision Making	3
HU/SS		Lower-Level Humanities	3
MA	412	Probability and Statistics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
Total Credits			**32**

SENIOR YEAR

Course		Title	Credits
EE	308	Intro to Electrical Communications	3
EE	401	Control Systems Analysis & Design	3
EE	402	Control Systems Laboratory	1
EE		Open Technical Elective	3
EE		Upper-Level Technical Elective	6
HU/SS		Upper-Level Elective	3
SYS	403	Systems Engineering Life Cycle Costing	3
SYS	405	Aerospace Systems, Guidance, and Control	3
SYS	410	Space Systems and Mission Analysis	3
SYS	417	Senior Systems Engineering Project	3
Total Credits			**31**

TOTAL DEGREE CREDITS **129**

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 (Avionics I and II) with approved CEC/EE/MA/PS/SE 3/4 upper-level electives, and EE 420/421 (Avionics Senior Design) with an approved senior design sequence.

FRESHMAN YEAR

See common Freshman Year outline on page 170.

Total Credits **32/33**

SOPHOMORE YEAR

Course		Title	Credits
CEC	220	Digital Circuit Design	3
		-AND-	
CEC	222	Digital Circuit Design Laboratory	1
		-OR-	
COM	219	Speech	3
CEC	315	Signals and Systems	3
CS	225	Computer Science II	4
EE	223	Linear Circuits Analysis	3
EE	224	Electrical Engineering Laboratory I	1
HU/SS		Lower-Level	3
MA	243	Calculus III	4
MA	345	Differential Equations and Matrix Methods	4
PS	250	Physics III	3
PS	253	Physics Laboratory for Engineers	1
SYS	301	Introduction to Systems Engineering	3
Total Credits			**32/33**

JUNIOR YEAR

Course		Title	Credits
CEC	320	Microprocessor Systems	3
CEC	322	Microprocessor Systems Laboratory	1
COM	221	Technical Report Writing	3
EC	225	Engineering Economics	3
EE	300	Linear Circuit Analysis II	3
EE	302	Electronic Devices and Circuits	3
EE	304	Electronic Circuits Laboratory	1
EE	307	Avionics I	3
EE	308	Introduction to Electrical Communications	3
EE	340	Electric and Magnetic Fields	3
MA	412	Probability and Statistics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
Total Credits			**32**

SENIOR YEAR

Course		Title	Credits
CEC	410	Digital Signal Processing	3
CEC	411	Digital Signal Processing Laboratory	1
CEC	460	Telecommunication Systems	3
EE	310	Avionics II	3
EE	401	Control Systems Analysis and Design	3
EE	417	Digital Communications	3
EE	420	Avionics Preliminary Design	3
EE	421	Avionics Detail Design	3
EE	430	Introduction to Radio Frequency Circuits	3
EE	430L	Radio Frequency Circuits Laboratory	1
HU/SS		Upper-Level	3
		Open Elective	3
Total Credits			**32**
TOTAL DEGREE CREDITS			**129**

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.

FRESHMAN YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32/33**

SOPHOMORE YEAR

Course		Title	Credits
CEC	220	Digital Circuit Design	3
		-AND-	
CEC	222	Digital Circuit Design Laboratory	1
		-OR-	
COM	219	Speech	3
COM	221	Technical Report Writing	3
CS	225	Computer Science II	4
EE	223	Linear Circuits Analysis	3
EE	224	Electrical Engineering Laboratory I	1
HU/SS		Lower-Level	3
MA	243	Calculus III	4
MA	345	Differential Equations and Matrix Methods	4
PS	250	Physics III	3
PS	253	Physics Laboratory for Engineers	1
SYS	301	Introduction to Systems Engineering	3
Total Credits			**32/33**

JUNIOR YEAR

Course		Title	Credits
CEC	315	Signals and Systems	3
CEC	320	Microprocessor Systems	3
CEC	322	Microprocessor Systems Laboratory	1
EC	225	Engineering Economics	3
EE	300	Linear Circuit Analysis II	3
EE	302	Electronic Devices and Circuits	3
EE	304	Electronic Circuits Laboratory	1
EE	308	Introduction to Electrical Communications	3
EE	340	Electric and Magnetic Fields	3
EE	417	Digital Communications	3
MA	412	Probability and Statistics	3
MA	441	Mathematical Methods for Engineering & Physics I	3
Total Credits			**32**

SENIOR YEAR

Course		Title	Credits
CEC	410	Digital Signal Processing	3
CEC	411	Digital Signal Processing Laboratory	1
EE/CEC		Upper-Level Elective	3
EE/CEC/MA/PS		Upper-Level Technical Elective	3
EE	401	Control Systems Analysis and Design	3
EE	420	EE Preliminary Design	3
EE	421	EE Detail Design	3
EE	430	Introduction to Radio Frequency Circuits	3
EE	430L	Radio Frequency Circuits Laboratory	1
CEC	460	Telecommunication Systems	3
HU/SS		Upper-Level	3
		Open Elective	3
Total Credits			**32**
TOTAL DEGREE CREDITS			**129**

Master of Science in Electrical and Computer Engineering

Introduction

The Master of Science in Electrical and Computer Engineering prepares students for advanced careers in the aerospace industry and as well as other industries. 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 track. For those more interested in entering or returning to the workplace, there is a non-thesis track.

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)

15 credits	Core courses
6 credits	Electives
9 credits	Thesis
30 credits	

MSECE (Nonthesis option)

15 credits	Core courses
12 credits	Electives
3 credits	Project
30 credits	

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

Course		Title	Credits
EE	510	Linear Systems	3
EE	515	Random Signals	3
EE	525	Avionics and Radio Navigation	3
EE	620	Digital Communications	3
SYS	500	Systems Engineering	3

Electives for Electrical Engineering Concentration

AE	514	Introduction to the Finite Element Method	3
CEC	500	Engineering Project Management	3
CEC	510	Digital Signal Processing	3
CEC	600	Computer Systems Safety	3
CEC	610	State and Parameter Estimation	3
EE	500	Digital Control Systems	3
EE	505	Advanced Mechatronics	3
EE	625	Satellite-Based Communications and Navigations	3
EP	501	Numerical Methods for Engineers and Scientists	3
EP	505	Advanced Spacecraft Dynamics and Control	3
HFS	505	Systems Engineering I	3
HFS	605	Systems Engineering II	3
HFS	635	Human-Computer Interaction	3
ME	503	Unmanned and Autonomous Vehicle Systems	3
SE	505	Model-Based Software Verification	3
SE	530	Software Requirements Engineering	3
SE	545	Specification and Design for Real-Time Systems	3
SE	610	Software Systems Architecture and Design	3
SE	625	Software Quality Engineering and Assurance	3
SE	655	Performance Analysis of Real-Time Systems	3

*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

Course		Title	Credits
CEC	500	Engineering Project Management	3
CEC	600	Computer Systems Safety	3
EE	510	Linear Systems	3
EE	515	Random Signals	3
SYS	500	Systems Engineering	3

Electives for Computer Engineering Concentration

AE	514	Introduction to the Finite Element Method	3
CEC	510	Digital Signal Processing	3
EE	500	Digital Control Systems	3
EE	505	Advanced Mechatronics	3
EE	525	Avionics and Radio Navigation	3
EE	620	Digital Communications	3
EE	625	Satellite-Based Communication and Navigation	3
EP	501	Numerical Methods for Engineers and Scientists	3
EP	505	Advanced Spacecraft Dynamics and Control	3
HFS	505	Systems Engineering I	3
HFS	605	Systems Engineering II	3
HFS	635	Human-Computer Interaction	3
ME	503	Unmanned and Autonomous Vehicle Systems	3
SE	505	Model-Based Software Verification	3
SE	530	Software Requirements Engineering	3
SE	545	Specification and Design for Real-Time Systems	3
SE	610	Software Systems Architecture and Design	3
SE	625	Software Quality Engineering and Assurance	3
SE	655	Performance Analysis of Real-Time Systems	3

*Other electives may be approved by the degree program coordinator

Mechanical Engineering

Bachelor of Science

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 year 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 his or her major field of study.

The Mechanical Engineering program offers two areas of emphasis, or tracks, in High Performance Vehicle and Robotic 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 Vehicle 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 objective of the Mechanical Engineering degree is to produce graduates who:

- Are prepared to be immediately productive as well-rounded mechanical engineers in aerospace, aviation, and related fields.
- Are able to systematically apply the fundamental principles of science and mathematics to solve engineering problems.
- Are effective at both oral and written communications.
- Work effectively within a team, in both supporting and leadership roles.
- Have exceptional backgrounds in engineering design that meet system, component, or process requirements and comply with health and environmental requirements.
- Are able to apply their knowledge to real-world multidisciplinary challenges facing society.
- Are able to apply the latest tools and technology to engineering problems.
- Understand the impact of engineering solutions in a global, economic, environmental, political, social, and ethical context.
- Understand the importance of life-long learning and pursue professional development, including advanced degrees and professional registration.

The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700, 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.

FRESHMAN YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32**

SOPHOMORE YEAR

Course		Title	Credits
COM	221	Technical Report Writing	3
COM	219	Speech -OR-	
EGR	120	Engineering Graphics	3
ES	201	Statics	3
ES	202	Solid Mechanics	3
ES	204	Dynamics	3
ES	206	Fluid Mechanics	3
MA	243	Calculus III	4
MA	345	Differential Equations & Matrix Methods	4
PS	105	General Chemistry	4
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
Total Credits			**34**

JUNIOR YEAR

Course		Title	Credits
EE	335	Electrical Engineering	2
EE	336	Electrical Engineering Laboratory	1
ES	305	Thermodynamics	3
ES	320	Engineering Materials	2
ES	321	Engineering Materials Laboratory	1
MA	412	Probability and Statistics -OR-	
MA	438	Numerical Analysis I	3
ME	304	Introduction to Machine Design	3
ME	305	Machine Design Laboratory	1
ME	303	Vehicle Dynamics (HPV) -OR-	
ME	306	Robotic Mechanisms (RS) -OR-	3
ME	307	Energy Conversion and Storage	3
ME	3/4XX	Mechanical Engineering Elective*	3
ME	400	Vibrations and Acoustics	3
ME	401	Advanced Fluid Dynamics	3
ME	410	Advanced Machine Design	2
Total Credits			**30**

SENIOR YEAR (HIGH PERFORMANCE VEHICLES)

Course		Title	Credits
EC	225	Engineering Economics	3
EE	401	Control Systems	3
ES	403	Heat Transfer	3
HU		Upper-Level Humanities	3
ME	405	Vehicle Power Systems	3
ME	409	Vehicle Aerodynamics	3
ME	413	Preliminary Design of High Performance Vehicles w/Laboratory	4
ME	423	Senior Design of High Performance Vehicles	3
ME/EE/AE Technical Elective*			6
Total Credits			**31**

SENIOR YEAR (ROBOTICS SYSTEMS)

Course		Title	Credits
EC	225	Engineering Economics	3
EE	401	Control Systems	3
ES	403	Heat Transfer	3
HU		Upper-Level Humanities	3
ME	402	Robot Arms	3
ME	404	Mechatronics	3
ME	407	Preliminary Robotic Systems Design with Laboratory	4
ME	427	Senior Robotic Systems Design	3
AE/EE/CEC/CS/ME/SE Technical Elective*			6
Total Credits			**31**

SENIOR YEAR (CLEAN ENERGY)

Course		Title	Credits
EC	225	Engineering Economics	3
EE	401	Control Systems	3
ES	403	Heat Transfer	3
HU		Upper-Level Humanities	3
ME	408	Clean Thermal Power System	3
ME	411	Clean Kinetic Power Systems	3
ME	414	Preliminary Design in Clean Energy with Laboratory	4
ME	419	Senior Design in Clean Energy	3
AE/EE/CEC/CS/ME/SE Technical Elective*			6
Total Credits			**31**

TOTAL DEGREE CREDITS **127**

Accelerated Master of Science Option in Mechanical Engineering

For exceptional students enrolled in the Bachelor of Science degree program, the Mechanical Engineering Department offers the opportunity to pursue an accelerated 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 nine Electro-Mechanical Systems Electives 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 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 MSME 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 listed in this catalog; the Master of Science degree will be conferred upon completion of all master's degree requirements listed in this catalog.

Technical electives must be chosen from among the list of nine Electro-Mechanical Systems Electives specified by the MSME program, listed below.

Course		Title	Credits
CEC	510	Digital Signal Processing	3
EE	500	Digital Control Systems	3
EE	505	Advanced Mechatronics	3
ME	500	Clean Energy Systems	3
ME	503	Unmanned and Autonomous Vehicle Systems	3
ME	506	Design for Manufacturing and Assembly	3
ME	508	Hydrogen and Hybrid Vehicle Systems	3
ME	510	Micro-Electrical Mechanical Systems	3
SYS	500	Systems Engineering	3

* Students declaring the accelerated MS option are required to choose courses from the above list to replace up to 9 hours of technical electives, ME 3/4XX Mechanical Engineering Elective (3) at the junior level; and ME/EE/AE technical electives (6) at the senior level.

Master of Science in Mechanical Engineering

Master of Science

The Master of Science in Mechanical Engineering (MSME) program provides students with advanced study in engineering with a specialization in Electro-Mechanical Systems. Students are prepared to design and implement electro-mechanical systems to fulfill the needs of a wide range of industries, including aerospace, aviation, automotive, and energy systems. Both thesis and non-thesis options are available, and each requires completion of 30 credits hours.
In either option, the concentration area in Electro-Mechanical Systems requires students to complete 15 credit hours from a list of core courses. These core courses address both the theory and practical implementation of electro-mechanical systems. Students are permitted to choose general electives offered within the College of Engineering and the College of Arts and Sciences that support the educational and/or research goals of the student, pending approval from the ME graduate program coordinator.

Degree Requirements

The Master of Science degree in Mechanical Engineering (MSME) provides students with advanced study in the concentration of Electro-Mechanical Systems. Students may choose to participate in a thesis or non-thesis program, each requiring 30 total 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.

Thesis Option:

Course	Title	Credits
	Electro-Mechanical Systems Electives	15
	General Electives	3
	Mathematics Elective	3
ME 700	Graduate Thesis	9
Total Credits		**30**

Non-Thesis Option:

Course	Title	Credits
	Electro-Mechanical Systems Electives	15
	General Electives	12
	Mathematics Elective	3
Total Credits		**30**

ELECTRO-MECHANICAL SYSTEMS ELECTIVES

Course	Title	Credits
EE 500	Digital Control Systems	3
EE 505	Advanced Mechatronics	3
CEC 510	Digital Signal Processing	3
ME 500	Clean Energy Systems	3
ME 503	Unmanned and Autonomous Vehicle Systems	3
ME 506	Design for Manufacturing and Assembly	3
ME 508	Hydrogen and Hybrid Vehicle Systems	3
ME 510	Micro-Electrical Mechanical Systems	3
SYS 500	Systems Engineering	3
Total Credits		**15**

GENERAL ELECTIVES

General Electives can be courses chosen from the Electro-Mechanical Systems electives above, and from appropriate graduate courses offered by the College of Engineering and the College of Arts and Sciences with program coordinator approval. Students may also obtain general elective credit for completing the graduate internship, ME 696 (3 credits).

MATHEMATICS ELECTIVE

Course	Title	Credits
MA 500	Level or higher	3
Total Credits		**3**

Software Engineering

Bachelor of Science

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. The objectives of the Software Engineering program are that our graduates:

- Effectively analyze, design, and implement software systems, including embedded, real-time, and safety-critical systems.
- Demonstrate professionalism in their work and grow professionally through continued learning and involvement in professional activities.
- Contribute to society by behaving ethically and responsibly.
- Communicate effectively in oral, written, and newly developing modes and media.
- Successfully assume a variety of roles in teams of diverse membership.

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.

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.

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 140, College Algebra, and MA 142, Trigonometry, prior to taking MA 241. For those students who have not taken physics in high school, it is recommended that PS 103, Technical Physics I, 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.

The Software Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Telephone: (410) 347-7700, http://www.abet.org).

FIRST YEAR

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32/33**

SECOND YEAR

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
CEC	220	Digital Circuit Design	3
CEC	222	Digital Circuit Design Laboratory	1
CEC	320	Microprocessor Systems	3
CEC	322	Microprocessor Systems Laboratory	1
COM	221	Technical Report Writing	3
CS	222	Introduction to Discrete Structures	3
CS	225	Computer Science II* (3 credits lecture, 1 credit lab)	4
		-OR-	
COM	219	Speech*	3
CS	315	Data Structures and Algorithms	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
SE	300	Software Engineering Practices (3 credits lecture, 1 credit lab)	4
Total Credits			**32/31**

* Students in the Software Engineering program are encouraged to take CS 225 during the first year, postponing COM 219 until the second year.

THIRD YEAR

Course		Title	Credits
CEC	450	Real-Time Systems	3
CEC	470	Computer Architecture	3
CS	317	Files and Database Systems	3
CS	332	Organization of Programming Languages	3
CS	420	Operating Systems	3
EC	225	Engineering Economics	3
HU/SS	XXX	Humanities/Social Sciences Elective	3
MA		Math Elective (300/400 level)**	3
MA	412	Probability and Statistics	3
SE	310	Analysis & Design of Software Systems	3
SE	320	Software Construction	3
Total Credits			**33**

FOURTH YEAR

Course		Title	Credits
CEC/CS/SE 3/4XX		Elective	3
HU/SS		Upper Level Humanities/Social Science Elective	3
SE	410	Formal Software Modeling	3
SE	420	Software Quality Assurance & Testing	3
SE	450	Software Team Project I (2 credits lecture, 1 credit lab)	3
SE	451	Software Team Project II (1 credit lecture, 2 credits lab)	3
		Open Elective	3
		Specified Electives***	9
Total Credits			**30**

TOTAL DEGREE CREDITS **127**

** 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.

Software Engineering/Master of Software Engineering

Bachelor of Science
Master of Software Engineering

This is a five-year program that allows exceptional students to complete both the Bachelor of Science in Software Engineering (BSSE) and the Master of Software Engineering (MSE) degrees.

The objective of this five-year program is to produce professional software engineers with advanced knowledge and skill in:

- Fundamentals of computing (discrete mathematics, programming languages, operating systems, computer architecture, and so on)
- Software systems development for real-time embedded applications
- Use of personal and team software processes
- Understanding the breadth of software engineering terminology, tools, and techniques
- Use of requirements engineering and software architecture and design
- Use of modern software development methodologies (such as object-oriented analysis and design)
- Software development in real work environments.

Students interested in pursuing this program must meet the following requirements:

- Maintain at least a 3.2 cumulative GPA throughout the academic program.
- Maintain at least a 3.0 cumulative GPA for the graduate credits.
- Complete a total of 151 credit hours (listed in a subsequent section). There will be 124 credit hours of undergraduate requirements (equivalent to the B.S. in Software Engineering) and 27 credit hours of graduate requirements (equivalent to a Master of Software Engineering degree).
- The program includes a requirement for two summer internships in industry. Credit at the undergraduate and graduate level will be awarded for approved and successful work.

YEAR 1

See the common Freshman Year outline in the College of Engineering introduction.

Total Credits **32/33**

YEAR 2

Course		Title	Credits
AS	120	Principles of Aeronautical Science	3
CEC	220	Digital Circuit Design	3
CEC	222	Digital Circuit Design Laboratory	1
CEC	320	Microprocessor Systems	3
CEC	322	Microprocessor Systems Laboratory	1
COM	221	Technical Report Writing	3
CS	222	Introduction to Discrete Structures	3
CS	225	Computer Science II* (3 credits lecture, 1 credit lab)	4
		-OR-	
COM	219	Speech	3
CS	315	Data Structures and Algorithms	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
SE	300	Software Engineering Practices (3 credits lecture, 1 credit lab)	4
Total Credits			**32/31**

* Students in the Software Engineering program are encouraged to take CS 225 during the first year, postponing COM 219 until the second year.

YEAR 3

Course	Title	Credits
CEC 450	Real-Time Systems	3
CEC 470	Computer Architecture	3
CS 317	Files and Database Systems	3
CS 332	Organization of Programming Languages	3
CS 420	Operating Systems	3
EC 225	Engineering Economics	3
HU/SS	Humanities/Social Sciences Elective	3
MA	Math Elective (300/400 level)*	3
MA 412	Probability and Statistics	3
SE 310	Analysis and Design of Software Systems	3
SE 320	Software Construction	3
Total Credits		**33**

* Math elective to be selected from an approved list of courses maintained by the program coordinator.

SUMMER TERM (BETWEEN YEAR 3 AND YEAR 4)

Course	Title	Credits
CESE 4XX	Cooperative Education	3
Total Credits		**3**

The student must spend the term performing a co-op in a software industry and be engaged in a software engineering activity such as analysis, design, code, or test.

YEAR 4

Course	Title	Credits
CEC/CS/SE 3/4XX	Elective	6
HU/SS	Upper Level Humanities/Social Sciences Elective	3
SE 500	Software Engineering Concepts	3
SE 530	Software Requirements Engineering	3
SE 625	Quality Engineering and Assurance	3
	Open Elective	3
SE 410	Formal Software Modeling	3
SE 450	Software Team Project I (2 credits lecture, 1 credit lab)	3
SE 451	Software Team Project II (1 credit lecture, 2 credits lab)	3
Total Credits		**30**

SUMMER TERM (BETWEEN YEAR 4 AND YEAR 5)

Course	Title	Credits
SE 696	Graduate Internship in Software Engineering	3
Total Credits		**3**

The student must spend the term performing a co-op in a software industry and be engaged in a software engineering activity such as analysis, design, code, or test.

YEAR 5

Course	Title	Credits
SE 510	Software Project Management	3
SE 610	Software Architecture and Design	3
SE	Graduate-Level Electives**	12
Total Credits		**18**
5 Year Total		**151**

GRADUATE-LEVEL ELECTIVES

Course	Title	Credits
SE 505	Model-Based Verification of Software	3
SE 520	Formal Methods for Software Engineering	3
SE 535	GUI Design and Evaluation	3
SE 545	Specification and Design of Real-Time Systems	3
SE 565	Concurrent and Distributed Systems	3
SE 575	Software Safety	3
SE 655	Performance Analysis of Real-Time Systems	3
SE 585	Metrics and Statistical Methods of Software Engineering	3
SE 660	Formal Methods for Concurrent and Real-Time Systems	3

While other elective courses may be selected, the student's advisor and the program coordinator must approve the selection.

*Master of Software Engineering (MSE)**

Master of Software Engineering

Introduction

The Master of Software Engineering (MSE) 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 cutting-edge of modern software development. Software engineers who complete the program can rapidly assume positions of substantial responsibility in a software development organization.

The MSE 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.

A special emphasis is on real-time embedded software systems encountered in such applications as the FAA air traffic control computer system, aircraft avionics, NASA's space station, and others. In addition, the MSE curriculum takes full notice of the Software Engineering Institute's (SEI) capability maturity model (CMM) by incorporating the key practices throughout the coursework.

The curriculum is structured into two groups of courses: core (18 credits) and specified electives (12 credits). As part of the core, each MSE student must complete a "capstone experience," which entails a major project that involves applications of the theory, practices, and technology studied in the other core courses. Typically students will take SE 697 to satisfy the capstone experience. In special cases, the capstone experience can be satisfied by completing a Graduate Research Project (SE 690). In such cases and 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.

* A five-year Computer Engineering/Master of Software Engineering program and a five-year Software Engineering/Master of Software Engineering program are available. See the undergraduate catalog for details.

Degree Requirements

Students must complete 18 credit hours of core courses.

Course		Title	Credits
SE	500	Software Engineering Discipline	3
SE	510	Software Project Management	3
SE	530	Software Requirements Engineering	3
SE	555	Object-Oriented Softwar Construction	3
SE	610	Software Systems Architecture and Design	3
SE	697	Software Engineering Practicum	
		-OR-	
SE	690	Graduate Research Project	3
		Specified Electives	12
Total Credits			**30**

Students must complete 12 credit hours from the following list of courses:

Course		Title	Credits
SE	505	Model-Based Verification of Software	3
SE	520	Formal Methods for Software Engineering	3
SE	535	Graphical User Interface Design and Evaluation	3
SE	565	Concurrent and Distributed Systems	3
SE	545	Specification and Design of Real-Time Systems	3
SE	550	Current Trends in Software Engineering	3
SE	575	Software Safety	3
SE	580	Software Process Definition and Modeling	3
SE	585	Metrics and Statistical Methods for Software Engineering	3
SE	590	Graduate Seminar	3
SE	625	Software Quality Engineering and Assurance	3
SE	655	Performance Analysis of Real-Time Systems	3
SE	660	Formal Methods for Concurrent and Real-Time Systems	3
SE	699	Special Topics in Software Engineering	3

Note: Other electives may be authorized based on the student's background, program of study, performance during the MSE, and approval of the MSE program coordinator.

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.

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. Students are encouraged to declare a minor by the beginning of their senior year. Designed to include a minimum number of required courses, minors provide students, whenever possible, with flexibility in fulfilling program requirements. No more than two substitutions (six hours) are permitted in any one minor or in any combination of multiple minors. A student who seeks three minors could have two substitutions in one minor, or one substitution in two of the three minors.

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
- Students must earn a 2.00 GPA or higher in the minor to complete that program of study successfully
- Some minor courses of study are not open to students 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 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
Aerospace Life Sciences
Air Traffic Control
Applied Mathematics
Applied Meteorology
Asian Studies
Astronomy
Aviation Law
Aviation Maintenance Science Airframe
Aviation Maintenance Science Powerplant
Aviation Safety
Avionics Line Maintenance
Business Administration
Communication
Computational Mathematics
Computer Aided Design/ Computer Aided Manufacturing
Computer Science
Environmental Studies
Flight
Flight Test and Simulation
High Performance Vehicles
Homeland Security
Human Factors
Humanities
Industrial Safety
International Relations
Physics
Psychology
Space Studies
Terrorism Studies
Unmanned Aircraft Systems Science

Minor in 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 this minor can come from courses required for the student's degree. A minor in Aeronautical Studies can be earned by successfully completing six of the following:

Course	Title	Credits
AS 254	Aviation Legislation	3
AS 309	Aerodynamics	3
AS 310	Aircraft Performance	3
AS 311	Aircraft Engines - Turbine	3
AS 350	Domestic and International Navigation	3
AS 356	Aircraft Systems and Components	3
AS 357	Flight Physiology	3
AS 402	Airline Operations	3
AS 405	Aviation Law	3
AS 408	Flight Safety	3
AS 410	Airline Dispatch Operations	3
AS 411	Jet Transport Systems	3
AS 420	Flight Technique Analysis	3
Total Credits Required		18

Minor in 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, four must be earned with Elements of Biological Science (PS 107, 3 credits) and Biological Science Laboratory (PS 107L, 1 credit). The remaining 12 credits can be earned with any combination of other courses from the listing below:

Course	Title	Credits
AS 357	Flight Physiology	3
HF 321	Drugs in Society and Aerospace	3
HF 326	Human Performance in Extreme Environments	3
PS 107	Elements of Biological Science	3
PS 107L	Biological Science Laboratory	1
PS 142	Environmental Sciences	3
PS 309	Principles of Ecology	3
PSY 310	Sensation and Perception	3
PSY 335	Physiological Psychology	3
SF 315	Environmental Compliance	3
SF 355	Industrial Hygiene and Toxicology	3
Total Credits Required		16

Minor in Air Traffic Control

The Air Traffic Control (ATC) minor provides the fundamental traffic controller knowledge and technical competency through a mix of classroom instruction, computer-based instruction, and realistic ATC laboratory simulations. Embry-Riddle has a formal partnership agreement with the FAA that designates the University as an FAA-approved air traffic control training school. This partnership ensures that the learning objectives and the standards of student achievement are relevant to the needs of the FAA. To qualify for the ATC minor, students must successfully complete the required prerequisites, listed below.

Course	Title	Credits
AT 200	Air Traffic Management I	3
AT 302	Air Traffic Management II	3
AT 305	Air Traffic Management III	3
AT 315	VFR Tower	3
AT 401	Air Traffic Management IV	3
AT 405	Air Traffic Management V	3
WX 201	Survey of Meteorology	3
Total Credits Required		21

Minor in Applied Mathematics

Students may earn a minor in Applied Mathematics by completing the following:

Course	Title	Credits
MA 241	Calculus and Analytical Geometry I	4
MA 242	Calculus and Analytical Geometry II	4
MA 243	Calculus and Analytic Geometry III	4
MA 245	Applied Differential Equation	3

Course		Title	Credits
		-OR-	
MA	345	Differential Equations and Matrix Methods	4
MA		Electives (approved by department chair)	5-6
Total Credits Required			**21**

Minor in 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, WX 201 and WX 301 (WX 352 in older catalogs), 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.

Course		Title	Credits
WX	201	Survey of Meteorology	3
WX	301	Aviation Weather	3
Recommended Electives for flight students:			
WX	261	Applied Climatology	3
WX	363	Thunderstorms	3
WX	364	Weather for Aircrews	3
WX	365	Satellite and Radar Weather Interpretation	3
		Or any combination of WX courses	9
Total Credits Required			**15**

Minor in 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 I:

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.

Course		Title	Credits
One of the following is required:			
SS	110	World History	3
HU	145	Themes in Humanities	3
All of the following are required:			
LCH	101	Mandarin Chinese	3
LCH	102	Mandarin Chinese II	3
LCH	201	Mandarin Chinese III	3
		-OR-	
HU	199	Special Topics in Humanities	3
Choose two of the following:			
HU	300	World Literature	3
SS	325	International Studies	3
SS	333	U.S.-Asian Relations	3
HU	399	Special Topics in Humanities	3
Total Credits Required			**18**

Minor in Astronomy

Students may earn a minor in Astronomy by successfully completing one of the following two options:

Option 1:

Course		Title	Credits
PS	215	Physics I	3
PS	216	Physics I Laboratory	1
PS	208	Physics II	3
PS	219	Physics III	3
PS	220	Physics III Laboratory	1
PS	301	Astronomy	3
PS	303	Modern Physics	3
PS	305	Modern Physics Laboratory	1
EP	425	Observational Astronomy	3
PS	401	Astrophysics	3
		-OR-	
EP	420	Planetary Science	3
Total Credits Required			**24**

Option 2:

Course		Title	Credits
EP	425	Observational Astronomy	3

PS	150	Physics I for Engineers	3
PS	160	Physics II for Engineers	3
PS	250	Physics III for Engineers	3
PS	253	Physics Laboratory for Engineers	1
PS	301	Astronomy	3
PS	303	Modern Physics	3
PS	305	Modern Physics Laboratory	1
PS	401	Astrophysics	3
		-OR-	
EP	420	Planetary Science	3
Total Credits Required			**23**

Minor in 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:

Course		Title	Credits
AS	405	Aviation Law	3
AS	414	Aviation and the Administrative Law Process	3

AND any three of the following:

AS	254	Aviation Legislature	3
AS	312	Ethics in the Aviation Environment	3
BA	225	Business Law	3
BA	322	Aviation Insurance	3
SF	462	Health, Safety, and Aviation Law	3
Total Credits Required			**15**

Minor in 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 Powerplant minor, or has the FAA Mechanic's Certificate with powerplant rating, only the 18 credits of airframe-specific courses will be needed to complete this minor.

Course	Title	Credits
AMS 115	Aviation Mathematics and Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Materials, and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
AMS 261	Aircraft Metallic Structures	3
AMS 262	Aircraft Composite Structures	3
AMS 263	General Aviation Aircraft Systems	3
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
AMS 365	Transport Category Aircraft Systems	3
AMS 366	Transport Category Aircraft Electrical and Instrument Systems	3
Total Credits Required		**30**

Minor in 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 airframe rating, only the 18 credits of powerplant-specific courses will be needed to complete this minor.

Students may earn a minor in Aviation Maintenance Science Powerplant by successfully completing the following:

Course	Title	Credits
AMS 115	Aviation Mathematics and Physics	2
AMS 116	Fundamentals of Electricity	4
AMS 117	Tools, Materials, and Processes	4
AMS 118	Aircraft Familiarization and Regulations	2
AMS 271	Aircraft Reciprocating Powerplants and Systems	3
AMS 272	Powerplant Electrical and Instrument Systems	3
AMS 273	Propeller Systems	2
AMS 274	Aircraft Turbine Powerplants and Systems	4
AMS 375	Repair Station Operations	3
AMS 376	Powerplant Line Maintenance	3
Total Credits Required		**30**

Minor in 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.

Course	Title	Credits
SF 210	Introduction to Aerospace Safety*	
	-OR-	
SF 201	Introduction to Health, Occupational, and Transportation Safety*	3
SF 320	Human Factors in Aviation Safety	3
Total Credits		**6**

AND any three of the following:

Course	Title	Credits
SF 330	Aircraft Accident Investigation	3
SF 335	Mechanical and Structural Factors in Aviation Safety	3
SF 341	Safety and Security of Airport Ground Operations	3
SF 345	Safety Program Management	3
SF 350	Aircraft Crash and Emergency Management	3
SF 375	Propulsion Plant Investigation	3
SF 435	Aircraft Crash Survival Analysis and Design	3
SF 445	System Safety in Aviation	3
SF 399/499	Special Topics in Aviation Safety	3
Total Credits Required		**15**

*AS 408 may be substituted for SF 210/SF 201 in this minor.

NOTE: SF 330, SF 341, and SF 345 can be used for either the Aviation Safety minor OR the Industrial Safety minor, but NOT both.

Minor in 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:

Course	Title	Credits
AMS 116	Fundamentals of Electricity	4
AMS 264	General Aviation Aircraft Electrical and Instrument Systems	3
AMS 366	Transport Category Aircraft Electrical Instrument Systems	3

Course	Title	Credits
AMS 380	Radio Communication Theory and Application	2
AMS 384	General Aviation Avionics Systems Integration	4
AMS 388	Air Transport Avionics Systems	6
Total Credits Required		**22**

Minor in 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 College of Business.

Course	Title	Credits
BA 201	Principles of Management	3
BA 210	Financial Accounting	3
BA 220	Marketing	3
BA 332	Corporate Finance I	3
EC 200	An Economic Survey	
	-OR-	
EC 210	Microeconomics	3
	Specified Elective*	3
Total Credits Required		**18**

*Any Upper-Level BA/EC not required.

Minor in Communication

The minor in Communication encourages an appreciation of communication as the basis of shared meaning, provides interpersonal competencies that benefit graduates in any workplace, and offers advanced coursework in Communication required in high-skill, high-wage jobs. Students may earn a minor in Communication by successfully completing 18 credit hours, comprising six credits of 18 required coursework and 12 credits chosen from specified electives, as seen below.

Course	Title	Credits
COM 225	Science and Technology Communication	3
COM 265	Introduction to News Writing	3
Total Credits		**6**

Specified Electives

Course	Title	Credits
COM 230	Digital Photography	3
COM 260	Introduction to Media	3
COM 268	Introduction to Sports Writing	3
COM 320	Mass Communication Law and Ethics	3
COM 322	Aviation and Aerospace Communication	3
COM 350	Environmental Communication	3
COM 360	Media Relations I	3
COM 364	Visual Design	3
COM 410	Advanced Professional Writing	3
COM 411	Web Design Workshop	3
COM 412	Advanced Technical Writing	3
COM 415	Nonverbal Communication	3
COM 460	Media Relations II	3
HU 319	Advanced Speech	3
HU 375	Nature of Language	3
HU 420	Applied Cross-Cultural Communication	3
Total Credits		**12**
TOTAL CREDITS REQUIRED		**18**

Minor in 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:

Course	Title	Credits
MA 241	Calculus and Analytical Geometry I	4
MA 242	Calculus and Analytical Geometry II	4
MA 245	Applied Differential Equations	3
	-OR-	
MA 345	Differential Equations and Matrix Methods	4
MA 432	Linear Algebra	3
MA 438	Numerical Analysis I	3
MA 444	Scientific Visualization	
	-OR-	
MA 453	High Performance Scientific Computing	3
Total Credits Required		**20/21**

Minor in Computer Aided Design/ Computer Aided Manufacturing

Students may earn a minor in Computer Aided Design/Computer Aided Manufacturing by successfully completing the following:

Course		Title	Credits
EGR	120	Graphical Communications	3
EGR	305	Advanced CATIA	3
		-OR-	
CS	335	Introduction to Computer Graphics	3
ME	304	Introduction to Machine Design	3
ME	424	Automation and Rapid Prototyping	3
ME	428	Design for Manufacturing and Assembly	3
Total Credits Required			**15**

Minor in Computer Science

Students may earn a minor in Computer Science by successfully completing the following:

Course		Title	Credits
CS	225	Computer Science II	4
EGR	115	Introduction to Computing for Engineers	3
SE	300	Software Engineering Practices*	4
XX	300-400	CS/SE/CEC Electives**	6
Total Credits Required			**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/SE/CEC electives, students may take any computer-related course approved by the CS minor program coordinator.

Minor in Environmental Studies

This course sequence is an interdisciplinary program designed to provide a fundamental knowledge of the natural environment and the dimensions of human impacts. It provides in-depth analysis of the relationship between the environment, culture, and law. Furthermore, it supplies knowledge about major environmental issues surrounding technology and technical careers. Not open to AES-Environment students.

Course		Title	Credits
COM	350	Environmental Communication	
		-OR-	
SS	360	Environmental Law	3
PS	107	Elements of Biological Science	3
PS	101	Basic Chemistry	
		-OR-	
PS	105	General Chemistry I	
		-OR-	
PS	108	Contemporary Chemistry	
		-OR-	
PS	140	Chemistry for Engineers	3/4
PS	142	Introduction to Environmental Science	3
PS	304	Environmental Science	
		-OR-	
PS	309	Principles of Ecology	3
Total Credits Required			**15-16**

Minor in 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.

Course		Title	Credits
AS	121	Private Pilot Operations	5
AS	221	Instrument Pilot Operations	3
AS	321	Commercial Pilot Operations	3
		Upper-Level AS Course	3
		-AND-	
SINGLE-ENGINE FLIGHT TRACK*			
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
		-OR-	
MULTI-ENGINE FLIGHT TRACK*			
FA	121	Private Single Flight	1

FA	122	Private Multi Flight with Laboratory	1
FA	222	Instrument Multi Flight	1
FA	322	Commercial Multi Flight	1
Total Credits Required			**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, and an explanation of the single-engine and multi-engine flight tracks.

Minor in Flight Test and Simulation

The minor in Flight Test and Simulation is an interdisciplinary minor that draws on many different major fields of study with the commonality of aviation as a focal point. This minor has been designed to be available to almost all University majors by the selection of the proper coursework. Typical major fields of study include but are not limited to Aerospace Engineering, Aeronautical Science, Human Factors, and Engineering Physics. Students may earn a minor in Flight Test and Simulation by completing 15 credits.

All of the following are required:

Course		Title	Credits
SIM	200	Aviation Simulation Systems	3
SIM	300	Flight Dynamic Algorithms*	3
		-OR-	
HF	310	Human Computer Interaction	
		-OR-	
AS	340	Instructional Design in Aviation	3
SIM	410	Flight Test and Simulation**	3
Total Credits			**9**

* AE 413 is acceptable for Aerospace Engineering students.

**AE 415 is acceptable for Aerospace Engineering students.

Two of the following courses are required:

SIM	400	Instrumentation for Flight Test	3
SIM	402	Introduction to Flight Testing	3
SIM	404	Fly-By-Wire Aircraft Simulation and Design*	3
SIM	405	Simulation Visual Systems	3
SIM	406	Aviation Simulation Systems Integration	3
HF	415	Human Factors and Simulation Systems	3
Total Credits Required			**15**

*AE 432 is acceptable for Aerospace Engineering students.

Minor in High Performance Vehicles

This minor introduces students to High Performance Vehicles. The following topics are covered: suspension design, aerodynamics of race cars, advanced drive systems (such as hybrid electric drives, fuel cells, and high-power engines), and vehicle dynamics and safety systems. Special topics courses on research and student projects related to the minor may be available. This minor is not available to students in the High Performance Vehicle Track of Mechanical Engineering.

Course		Title	Credits
ME	303	Vehicle Dynamics	3
ME	304	Introduction to Machine Design	3
		-OR-	
AE	316	Aerospace Engineering Materials	3
ME	400	Vibrations and Acoustics	3
		-OR-	
ME	405	Vehicle Power Systems	3
ME	409	Vehicle Aerodynamics	3
AE	430	Control Systems Analysis and Design	3
Total Credits Required			**15**

Minor in 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 aerospace studies. This minor requires 15 credit hours of the following courses:

Course		Title	Credits
HS	110	Introduction to Homeland Security	3
HS	210	Fundamentals of Transportation Security	3
HS	215	Introduction to Industrial Security	3
		-AND-	
HS	320	Homeland Security Law and Policy	3
		-OR-	
HS	325	Terrorism: Origins, Ideologies, and Goals	3
One of the following is required			
HS	310	Fundamentals of Emergency Management	3
HS	315	Critical Infrastructure and Risk Analysis	3
HS	350	Intelligence Systems & Structures in Homeland Security	3
HS	360	Strategic Planning & Decision Making in Homeland Security	3
Total Credits			**15**

Minor in 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, 399, or 499 (Special Topics in Human Factors Psychology) 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.

Specified Courses:

Course		Title	Credits
PSY	101	Introduction to Psychology	3
HF	300	Human Factors I: Principles and Fundamentals	3

Three of the following courses are also required:

Course		Title	Credits
HF	310	Human Computer Interaction	3
HF	312	Ergonomics and Bioengineering	3
HF	315	Automation and Systems Issues in Aviation	3
HF	325	Human Factors and System Safety	3
HF	326	Human Performance in Extreme Environments	3
HF	330	Human Factors in Space	3
HF	335	Human Factors in Air Traffic Control	3
HF	340	Human Factors and Product Liability	3
HF	410	Human Factors in Crew Station Design	3
HF	412	Simulating Humans in Complex Systems	3
HF	415	Human Factors in Simulation Systems	3
HF	422	Applied Ergonomic Design, Analysis, and Evaluation	3
HF	440	Aerospace Physiology	3
SF	320	Human Factors in Aviation Safety	3
Total Credits Required			**15**

Minor in 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.

Course		Title	Credits
HU	300	World Literature	3
HU	302	Contemporary Issues in Science	3
HU	305	Modern Literature	3
HU	310	American Literature	3
HU	316	Studies in Music	3
HU	325	Exploring Film	3
HU	330	Values and Ethics	3
HU	335	Technology and Modern Civilization	3
HU	338	Traversing the Borders: Interdisciplinary Explorations	3
HU	341	World Philosophy	3
HU	345	Comparative Religions	3
HU	355	Creative Writing	3
Total Credits Required			**18**

HU 395/495, experimental courses in the humanities, and 399/499, Special Topics in Humanities, may be included in the minor with advance permission of the department chair.

Minor in Industrial 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

Course		Title	Credits
SF	201	Introduction to Health, Occupational, and Transportation Safety	3
SF	355	Industrial Hygiene and Toxicology	3
SF	410	Design of Engineering Hazard Controls	3

AND any two of the following:

Course		Title	Credits
SF	315	Environmental Compliance and Safety	3
SF	320	Human Factors in Aviation Safety	3
SF	330	Aircraft Accident Investigation	3
SF	341	Safety and Security of Airport Ground Operations	3
SF	345	Safety Program Management	3
SF	365	Fire Protection	3
SF	399/499	Special Topics in Safety	3
Total Credits Required			**15**

NOTE: SF 330, SF 341, and SF 345 can be used for either the Aviation Safety minor OR Industrial Safety minor, but NOT both.

Minor in International Relations

The minor in International Relations 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 Relations by successfully completing 15 credit hours composed of one lower-level Social Sciences option, the required keystone course, and 9 credits chosen from specified electives, as seen below.

One of the following is required:

Course		Title	Credits
EC	200	An Economic Survey	3
EC	211	Macroeconomics	3
SS	110	World History	3
SS	120	U.S. History	3
SS	130	History of Aviation in America	3

Required Keystone Course:

Course		Title	Credits
SS	337	Globalization and World Politics	3

Specified Electives (choose three):

Course		Title	Credits
BA	335	International Business	3
SS	311	U.S. Military History 1775-1900	3
SS	321	U.S. Military History 1900-Present	3
SS	325	International Studies	3
SS	326	Russian-U.S. Relations	3
SS	331	Current Issues in America	3
SS	333	U.S.-Asian Relations	3
SS	334	Contemporary Africa and the World	3
SS	336	The Modern Middle East in World Affairs	3
SS	340	U.S. Foreign Policy	3
SS	353	Early U.S. Foreign Policy	3
SS	363	Inter-American Relations	3
Total Credits Required			**15**

Minor in Physics

Students may earn a minor in Physics by completing the list below. Engineering Physics or Space Physics students are not eligible.

Course		Title	Credits
PS	150	Physics for Engineers I	3
		-OR-	
PS	215	Physics I	3
PS	160	Physics for Engineers II	3
		-OR-	
PS	208	Physics II	3
PS	250	Physics III for Engineers	3
		-OR-	
PS	219	Physics III	3
PS	253	Physics Laboratory for Engineers	1
		-OR-	
PS	220	Physics III Laboratory	1
PS	303	Modern Physics	3
PS	305	Modern Physics Laboratory	1
		Upper-Level Elective*	3
Total Credits Required			**17**

* Choose one elective from EP 320, EP 400, EP 440, PS 320, PS 400

Minor in Psychology

Three credits of HF 299, 399, or 499 (Special Topics in Human Factors Psychology) or PSY 299, 399, or 499 (Special Topics in Psychology) 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

Course		Title	Credits
PSY	101	Introduction to Psychology	3
PSY	350	Social Psychology	3
		-AND-	
HF	300	Human Factors I: Principles and Fundamentals	3

Two of the following courses are also required:

BA	317	Organizational Behavior	3
HU	361	Interpersonal Communication	3
HU	363	Communication and Society	3
PSY	310	Sensation and Perception	3
PSY	315	Cognitive Psychology	3
PSY	320	Aviation Psychology	3
PSY	335	Physiological Psychology	3
PSY	340	Industrial-Organizational Psychology	3
PSY	345	Training and Development	3
PSY	365	Abnormal Psychology	3
PSY	400	Introduction to Cognitive Science	3
SS	310	Personality Development	3
SS	350	Psychology of Relationships	3
Total Credits Required			**15**

Three credits of HF 299, 399, or 499 or PSY 299, 399, or 499 (Special Topics in Psychology) may be substituted with advance permission of the department chair.

Minor in 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.

Twelve credits selected from:

Course		Title	Credits
SP	110	Introduction to Space Flight	3
SP	200	Planetary and Space Exploration	3
SP	210	Space Transportation System	3
SP	215	Space Station Systems and Operations	3
SP	220	Life Support Systems	3
SP	300	Satellite and Spacecraft Systems	3
SP	340	Russian Space Operations and Technology	3
SP	400	Introduction to Space Navigation	3
SP	299/399/499	Spec. Topics in Space Studies	3

In addition, all students must complete:

SP	425	Selected Topics in Space and Aerospace	3
Total Credits Required			**15**

Minor in Terrorism Studies

The AOC in Terrorism will build on Terrorism: Origins, Ideologies, and Goals as well as on Critical Infrastructure and Risk Analysis by providing a deeper exploration of the roots, motivations, mechanisms, and operations of terrorist cells and groups. Courses will examine critical aspects of terrorism and counter-terrorism concepts, strategies, and operational outcomes. Terrorism and Emergency Management (also used in the Emergency Management AOC), will acquaint students with ways in which the discipline of emergency management adjusts to prepare, respond, mitigate, and recover from terrorism, and will provide a conceptual bridge between this AOC and the AOC in Emergency Management. Asymmetric Terrorism exposes the student to ways and means by which terrorists (and counter-terrorist activity) leverage technology and critical thinking to achieve objectives and

Counter-Terrorism Strategy & Policy exposes students to high-level strategic concepts involving counter-terrorist policy and activities and involves in-depth examinations of U.S. strategic plans and policies to achieve homeland security objectives. Students in this AOC will develop a senior project in terrorism.

Course		Title	Credits
HS	375	Studies in Transportation Sector Infrastructure and Protection	3
HS	380	Asymmetric Terrorism: Cyberspace, Technology, and Innovation	3
HS	408	Terrorism and Emergency Management	3
HS	425	Counter Terrorism Strategy and Policy	3
HS	435	International Crime and Criminal Justice	3
Total Credits			**15**

Minor in Unmanned Aircraft Systems Science

Students may earn a minor in Unmanned Aircraft Systems Applications by successfully completing the following. This minor is open to US citizens only.

Course		Title	Credits
AS	220	Unmanned Aircraft Systems	3
AS	235	Unmanned Aircraft Systems Operations and Cross-Country Data Entry	3
AS	304	Operational Aspects of Unmanned Aircraft	3
AS	315	Unmanned Aircraft Systems Robotics	3
AS	403	Unmanned Sensing Systems	3
Total Credits Required			**15**

Embry-Riddle Language Institute (ERLI)

The Embry-Riddle Language Institute (ERLI) is an intensive English program providing English-language instruction and cultural orientation to nonnative speakers of English. Most of our students plan to attend Embry-Riddle, but we also welcome others who just want to improve their English-language ability. If you desire to become more proficient in listening, speaking, reading, and writing the English language, this intensive English program is for you.

Students benefit from a computer laboratory with up-to-date language-learning software and TOEFL (Test of English as a Foreign Language) preparation software. Additionally, students who wish to attend Embry-Riddle can be granted conditional acceptance pending completion of our program or a passing TOEFL score, assuming they meet all other University admission requirements. Eligible students are also able to earn a part-time recommendation after successful completion of a semester at ERLI, which allows them to begin their University studies while continuing their English-language studies. Embry-Riddle Language Institute students have full access to all Embry-Riddle facilities.

For more information, contact:
Embry-Riddle Language Institute
Doolittle Annex
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-6192
(386) 226-6165 (fax)
erli@erau.edu
www.erli.us

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:

- Twelve credit hours of Honors in general education; at least nine credit hours of Honors in the major. The Honors Program does not automatically add credit hours to any major.
- Honors seminars no larger than 20 students.
- Honors faculty.
- Guest speakers who spend time with students in Honors seminars.
- Honors housing for freshman students.
- Priority registration for classes.
- Research opportunities.
- Co-op and internship opportunities.
- Summer study-abroad opportunities.

International Programs

Recognizing the unquestionable benefits of international exposure in today's increasing globalization, Embry-Riddle offers its students a wealth of opportunities to study abroad in more than 50 destinations spanning five continents worldwide. Whether it's as short as a one-month summer venture or a two-year dual-degree program, we feel these programs provide students with the experience that will greatly enhance not only their academic and professional lives but also their personal lives.

Motivated students in good academic standing (participation requires a minimum GPA of 2.5 for summer programs and 3.0 for exchange programs except under special circumstances) from the residential campuses have the unique opportunity to take courses through our partner schools that will be directly applicable to their degree programs at Embry-Riddle. Foreign language classes are an essential part of every program, and students at all levels of language experience from absolute beginners to native speakers are encouraged to take part. In fact, all of our summer programs are designed to accommodate students who have had no prior foreign language experience. We offer many opportunities to take classes taught in English abroad, including specialized semester-long programs. For a longer exchange commitment, we offer dual degree opportunities during which students may obtain both an Embry-Riddle undergraduate degree and a master-level degree from a foreign institution, simultaneously. Qualified exchange program participants could also have the opportunity to be placed in paid internships with companies or research labs abroad.

Summer Study Abroad

Embry-Riddle offers four- to six- week summer programs at half-price tuition, providing an additional incentive for students to explore other continents and advance their education. Living expenses in many of our destinations can be substantially lower than in the United States, allowing students to save even more. Students who qualify for financial aid will receive an equivalent amount when enrolled in one of our international programs; there may also be additional scholarship and grant opportunities available to students who choose to study abroad.

Cooperative Education

The Cooperative Education/Internship program offers qualified students an opportunity to gain valuable 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, and, 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 current openings and requirements, is available from Career Services and on the Career Services Website. There is a co-op/internship fee which is equal to the cost of one credit hour based on the student's catalog start date.

Reserve Officer Training Corps

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.

Air Force Reserve Officer Training Corps

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 while completing their college degrees. The Air Force ROTC program is focused on preparing cadets to become leaders in today's high-tech Air Force.

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 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). As students attend class, they learn more about the Air Force and the historical development of airpower. 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.

Finances

Textbooks for all Air Force ROTC courses are free. Students who have contracted with Air Force ROTC receive a tax-free subsistence allowance during the academic year of $300-$500 per month, depending on their academic year.

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 $900, and a tax-free subsistence allowance of $300-$500 per month (see Finances). 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 $5,000 in each subsequent year. All high school four-year Air Force ROTC scholarship recipients will receive a minimum university assurance of $7,500 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 seven-month application period (May 1 to December 1 of their senior year). Application forms for the scholarship are available online at http://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 minimum requirements:

- Be a U.S. citizen
- Be less than 31 years old as of December 31 of the year you will commission
- Meet military and physical standards
- Have a minimum cumulative and term GPA of 2.50

For more information, contact:

AFROTC Detachment 157
Embry-Riddle Aeronautical University
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-3900
(386) 226-6880
http://det157.db.erau.edu

Army Reserve Officer Training Corps

Army Reserve Officer Training Corps (ROTC) is open to both men and women, freshmen through seniors, and 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, leadership problem-solving, 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 toward open elective requirements in degree programs. All uniforms, military textbooks, and equipment are issued to Basic Military Science freshman/sophomore 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 basic camp or using past military experience for credit.

Basic Military Science

The Basic Military Science courses are offered during the freshman and sophomore years. These courses cover 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.

Advanced Military Science

The Advanced Military Science courses are normally taken during the junior and senior years. 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 a five-week National Leadership Development Assessment Course (LDAC) held at Ft. Lewis, Wash., during the summer after the junior year.

Leaders Training Course

A summer training program is offered for students without previous ROTC or military training who will be academic juniors. A five-week course at Fort Knox, Ky., during the summer after the sophomore year 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 the Leadership Training Course.

Benefits

All contracted military science students receive a monthly stipend of $300-$500 per month.

Four-year, three-year, and two-year scholarships are available to those who qualify. The higher the student's GPA and SAT/ACT scores, the better their 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. Army Green to Gold Scholarship winners may be eligible for these incentives as well.

All applicants must meet the following requirements:

- Be a U.S. citizen,
- Be under 31 years of age prior to commissioning,
- Meet required medical and physical standards,
- Have a minimum cumulative academic GPA of 2.50,
- Have a minimum SAT score of 920 or an ACT composite score of 19.

Scholarship Benefits Include:

- Full tuition per 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:

- Successful completion of the Basic Course Leader's Training Camp 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.

You must have a GT score of 110 or higher and a cumulative grade point average of 2.50 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 2.50 on a 4.00 grading scale. All applicants must meet other eligibility requirements. An SAT score totaling 920 or an ACT composite score of 19 is required for three and four-year Green to Gold scholarships.

For further information contact:

Embry-Riddle Army ROTC
600 S. Clyde Morris Blvd.
ROTC Building, Second Floor
Daytona Beach, FL 32114-3900
(386) 226-6470/6437
(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. MSII level students must be enrolled in the course to participate. Physical training is normally conducted Monday, through Thursday from 5:45 a.m. to 7 a.m.

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, and uniforms, a stipend for textbooks each semester, and a monthly subsistence allowance starting at $250 per month for first-year candidates and up to $400 for senior students during the academic year for four-year scholarship recipients. 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 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 Tweeddale Scholarship Program

The Professor of Naval Science recommends two Tweeddale scholarships per year to outstanding Embry-Riddle students in a technical major. The scholarship's focus is to give students an opportunity to earn a commission in the U.S. Navy and possibly serve as a nuclear propulsion officer. The scholarship pays the student the same benefits as the four-year scholarship.

Eligibility requirements: Candidates must be a U.S. citizen pursuing a science or technical major and may not have previously been non-selected for or dis-enrolled from any officer accession program. Candidates must have completed at least one semester but less than four semesters of coursework and have at least one term of math or science complete at the time of application. Further, they must have a cumulative GPA of 3.0 or higher, score at least a C in all coursework, and have a B or better in calculus.

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 ranging from three and a half years to two years. 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 students are required to complete training of approximately four to six weeks during each of the three 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.

Aviation Maintenance Science

Airframe and Powerplant Technician Certification Program

The Airframe and Powerplant Technician Certification Program provides the student the necessary training leading toward for the Federal Aviation Administration's (FAA) Airframe and Powerplant Technician Certification. The 16-month program, offered only at the Daytona Beach Campus, presents a carefully selected blend of theory and practical applications.

Students perform repairs and overhaul engines and accessories, including those used in the Embry-Riddle pilot-training fleet. The curriculum, facilities, equipment, and instructional staff are fully approved under the Code of Federal Regulations (CFR) Title 14 Part 147. Embry-Riddle holds Air Agency Certificate No. NX4T404M and FAA Repair Station Certificate No. NX42404M.

Avionics Line Maintenance Specialization Program

The Avionics Line Maintenance program provides the student the necessary training to successfully obtain the FCC General Radiotelephone Operators License (GROL) as well as advanced avionics training using current industry standards and procedures. Students will cover basic wiring and electronics concepts, system installations, and advanced avionics line maintenance troubleshooting.

Sources of Information

For general academic and admissions information regarding the Aviation Maintenance Science programs:

Aviation Maintenance Science Dept.
Embry-Riddle Aeronautical university
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114
(386) 226-7617 - or - (877) 904-3746
(386) 226-6778 (fax)
http://www.embryriddle.edu/amt

UNDERGRADUATE COURSE DESCRIPTIONS

Embry-Riddle Aeronautical University course offerings are listed in alphabetical order, according to the course designations below.

AE	Aerospace Engineering
AF	Air Force Aerospace Studies
AMS	Aviation Maintenance Science
AS	Aeronautical Science
AT	Air Traffic Control
AVT	Avionics Technology
BA	Business Administration
CE	Cooperative Education
CEC	Computer Engineering
CIV	Civil Engineering
COM	Communication
CS	Computer Science
EC	Economics
EE	Electrical Engineering
EGR	Engineering
EP	Engineering Physics
ES	Engineering Science
FA	Flight-Academic
HF	Human Factors
HON	Honors
HS	Homeland Sec urity
HU	Humanities
IT	Information Technology
LCH	Languages
MA	Mathematics
ME	Mechanical Engineering
MSL	Military Science and Leadership
NSC	Naval Science
PE	Physical Education
PS	Physical Science
PSY	Psychology
SE	Software Engineering
SF	Safety Science
SIM	Simulation
SP	Space Studies
SS	Social Sciences
SYS	Systems Engineering
UNIV	College Success
WX	Applied Meteorology

Courses numbered 001–099 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 95 designate time-limited offerings, such as those taught by a visiting lecturer. 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.

The following courses are not necessarily offered every term, nor are they offered at all campus locations.

Aerospace Engineering

A grade of C or better is required in MA 241, MA 242, PS 150, PS 160, and PS 250 for entry into all AE courses. A passing grade in all prerequisite courses or department consent is required for entry into all AE courses.

AE 301

Aerodynamics I (3,0)

3 Credits

The atmosphere. Incompressible and compressible one-dimensional flow. Airspeed measurement. Two-dimensional potential flow. Circulation theory of lift. Thin airfoil theory. Viscous flow. Boundary layers. Finite wing theory. Drag in incompressible flow. Wing-body interactions.

Prerequisites: *ES 204, ES 206.*

Corequisite: *ES 305.*

AE 302

Aerodynamics II (3,0)

3 Credits

Laminar and turbulent flows, transition point, determination of skin friction drag on an airfoil. Obtaining equations for streamline, for particle path, and for streakline in a flow field. Compressible flow, shock waves, thermodynamics of gas flow. Reversible and irreversible processes. Changes in pressure, density, and temperature across shock waves. Isentropic duct flow and flow through a nozzle. Static performance and maneuvers in flight. Propeller theory.

Prerequisite: *AE 301.*

AE 313

Space Mechanics (3,0)

3 Credits

This course presents the 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 three-dimensional vector dynamics, the motion and stability of rigid and semi-rigid spacecraft are studied as are the means for controlling spacecraft orientation.

Prerequisite: *ES 204.*

AE 314

Experimental Aerodynamics (1, 0)

1 Credit

This course supports the Experimental Aerodynamics lab by providing lectures based in practice and theory. Topics include wind tunnel design, instrumentation, scaling effects, tunnel wall corrections, 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.

Prerequisite: *COM 221.*

Corequisite: *AE 301.*

AE 315

Experimental Aerodynamics Laboratory (0,3)

1 Credit

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. Specific experiments depend on apparatus availability and instructor preference. The Experimental Aerodynamics Lab, AE 315, must be taken during the same semester as AE 314.

Prerequisite: *COM 221.*

Corequisite: *AE 301.*

AE 316

Aerospace Engineering Materials (3,0)

3 Credits

Structure, properties, and processing of engineering materials. Crystal structure, defects, imperfections, and strengthening mechanisms. Mechanical properties, fracture mechanics, fatigue and creep, and material failures. Phase diagrams and transformations. Degradation of materials. Characteristics of ferrous and nonferrous metals and alloys, ceramics, polymers, and composite materials. Emphasis on materials and processes used in the aerospace industry.

Prerequisites: *ES 202, PS 105/PS 105L or PS 140/141.*

AE 318

Aerospace Structures I (3,0)

3 Credits

Methods of stress analysis of statically determinate lightweight structural systems. Applications include space structures and semimonocoque structures. Inertia force and load factor computation. Topics in applied elasticity. Three-dimensional beam bending.

Shear flow. Materials considerations. Finite element modeling and computer-aided analysis.

Prerequisite: *ES 202.*

AE 350

Project Engineering (3,0)

3 Credits

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.

Prerequisite: *Junior class standing or consent of the instructor.*

AE 408

Turbine and Rocket Engines (3,0)

3 Credits

A study of gas turbine and rocket engines. Topics include control volumes, conservation equations, combustion processes, efficiencies, fuel consumption, nozzle flow, diffusers, ideal and real ramjets, gas turbine engines, performance of rocket vehicles, and solid and liquid propellant rocket motors.

Prerequisite: *AE 302.*

AE 409

Aircraft Composite Structures (3,1.5)

3 Credits

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: *ES 202, AE 316.*

AE 413

Airplane Stability and Control (3,0)

3 Credits

Development of longitudinal, lateral, and directional stability and control equations. Control surface design. Control effectiveness and size requirements. Dynamic control theory. Handling characteristics and maneuvering stability of aircraft.

Corequisite: *AE 302.*

AE 415

In-Flight Laboratory (3,1.5)

3 Credits

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 validations.

Prerequisite: *AE 413.*

AE 416

Aerospace Structures and Instrumentation (1,0)

1 Credit

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 design are utilized. The Structures and Instrumentation Laboratory, AE 417, must be taken during the same semester as AE 416.

Prerequisites: *AE 316, COM 221, EE 335/336.*

AE 417

Aerospace Structures and Instrumentation Laboratory (0,3)

1 Credit

Principles of modern aerospace vehicle 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. The Structures and Instrumentation Laboratory, AE 417, must be taken during the same semester as AE 416.

Prerequisites: *AE 316, COM 221, EE 335/336.*

AE 418

Aerospace Structures II (3,0)

3 Credits

Continuation of AE 318. 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.

Prerequisite: *AE 318.*

AE 420

Aircraft Preliminary Design (3,3)

4 Credits

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:** AE 302, AE 314, AE 315.*

***Corequisite:** AE 413.*

AE 421

Aircraft Detail Design (3,3)

4 Credits

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. Carries the design of an airplane from the general layout to the design of its detail parts and the design of necessary tools.

***Prerequisites:** AE 316, AE 418, AE 420.*

AE 425

Aircraft Acoustics and Noise Control (3,0)

3 Credits

Sound wave characteristics, levels, and directivity. Hearing and psychological effects of noise. Noise control criteria and regulations. Instrumentation. Noise sources. Acoustics of walls, barriers, and enclosures. Acoustical materials and structures. Noise characteristics of jet and propeller aircraft, including helicopters.

***Prerequisite:** AE 301.*

AE 426

Spacecraft Attitude Dynamics (3,0)

3 Credits

Fundamentals of spacecraft attitude dynamics. Three-dimensional rigid-body kinematics. Stability and dynamics of symmetric and tri-inertial bodies. Attitude, nutation, and spin-control maneuvers for spin-stabilized spacecraft. Effects of energy dissipation. Momentum-biased spacecraft dynamics. Stability, modeling, and simulation of spin-stabilized and momentum-biased spacecraft. Elements of three-axis stabilized spacecraft. Effects of gravity gradient, solar radiation pressure, atmospheric drag, and magnetic torque on spacecraft attitude.

***Prerequisite:** AE 313.*

AE 427

Spacecraft Preliminary Design (3,3)

4 Credits

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.

***Corequisite:** AE 426.*

AE 432

Flight Dynamics and Control (3,0)

3 Credits

Aircraft equations of motion. State variable representation of the equations of motion. Longitudinal motion (stick fixed) and lateral motion (stick fixed). Aircraft response to atmospheric inputs. Automatic control theory. Application of classical and modern control theory to aircraft autopilot design.

***Prerequisite:** AE 413.*

AE 433

Aerodynamics of the Helicopter (3,0)

3 Credits

The development of rotating-wing aircraft and the helicopter. Hovering theory and vertical flight performance analysis. Auto-rotation, physical concepts of blade motion and control, aerodynamics and performance of forward flight. Blade stall, stability, and vibration problems. Design problems.

***Prerequisites:** AE 302, MA 441.*

AE 434

Spacecraft Control (3,0)

3 Credits

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.

***Corequisite:** AE 426.*

AE 435

Air-Breathing Propulsion Preliminary Design (3,3)

4 Credits

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. Corequisite: AE 408 or permission of the instructor.

AE 440

Air-Breathing Propulsion Detail Design (3,3)

4 Credits

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.

Prerequisite: *AE 435 or permission of the instructor.*

AE 445

Spacecraft Detail Design (3,3)

4 Credits

Principles of spacecraft detail and subsystem design, analysis, modeling, manufacture, and test are covered and incorporated into projects to give actual experience in the detail design and integration of spacecraft subsystems and systems. Integration of multiple subsystems into a single functional model is a key component of the course.

Prerequisites: *AE 318, AE 426, AE 427.*

Corequisite: *AE 434.*

AE 399, 499

Special Topics in Aerospace Engineering

1-6 Credits

Individual independent or directed studies of selected topics in aerospace engineering.

Prerequisites: *Consent of the instructor and the department chair. May be repeated with a change of content.*

Air Force Aerospace Studies

AF 101

The Foundation of the U.S. Air Force (General Military Course) (1,0)

1 Credit

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.

Corequisite: *AF 101L.*

AF 102

The Foundation of the U.S. Air Force (General Military Course) (1,0)

1 Credit

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. Corequisite: AF 102L.

AF 101L/AF 102L

Leadership Laboratory (0,2)

0 Credit

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.

AF 201

The Evolution of USAF Air and Space Power (General Military Course) (1,0)

1 Credit

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.

AF 202

The Evolution of USAF Air and Space Power (General Military Course) (1,0)

1 Credit

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.
Corequisite: AF 202L.

AF 201L/AF 202L

Leadership Laboratory (0,2)
0 Credit
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.

AF 301

Air Force Leadership Studies (Professional Officer Course) (3,0)
3 Credits
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.

AF 302

Air Force Leadership Studies (Professional Officer Course) (3,0)
3 Credits
Continuation of AF 301. A weekly Leadership Laboratory is mandatory.
Corequisite: AF 302L.

AF 301L/AF 302L

Leadership Laboratory (0,2)
0 Credit
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.

Prerequisites: *Completion of the General Military Course or Two-Year Program selection and/or approval of the professor of Aerospace Studies.*

AF 401

Preparation for Active Duty (Professional Officer Course) (3,0)
3 Credits
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.
Corequisite: AF 401L.

AF 402

Preparation for Active Duty (Professional Officer Course) (3,0)
3 Credits
Continuation of AF 401. A weekly Leadership Laboratory is mandatory.
Corequisite: AF 402L.

AF 401L/AF 402L

Leadership Laboratory (0,2)
0 Credit
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.

Prerequisites: *Completion of the General Military Course or Two-Year Program selection and/or approval of the professor of Aerospace Studies.*

AF 403L/AF 404L

Leadership Laboratory (0,2)
0 Credit
Mandatory. Provides advanced leadership experiences in officer-type activities. Includes a mandatory physical fitness program.

Prerequisite: *Completion of the POC. These courses are graded Pass/Fail.*

Aviation Maintenance Science

AMS 115

Aviation Mathematics and Physics (5.5, 0)
2 Credits

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 (4.75,4)
4 Credits

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 (4.25,4.25)
4 Credits

An introduction to the tools, hardware, and materials used in aircraft maintenance and repair. Various methods of nondestructive testing are studied and performed. Principles of corrosion control are studied and applied. Understand the information found in aircraft drawings, blueprints, charts, and graphs.

AMS 118

Aircraft Familiarization and Regulations (5,1.75)
2 Credits

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, and 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 (6.5,5.5)
3 Credits

A study of aircraft structural characteristics and methods of fabrication with an emphasis on aluminum sheet metal applications. Explains metal-working 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.

Prerequisites: *AMS 115, AMS 117, AMS 118.*

AMS 262

Aircraft Composite Structures (3.3,3.25)
3 Credits

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.

Prerequisites: *AMS 117, AMS 118*

AMS 263

General Aviation Aircraft Systems (4,4)
3 Credits

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.

Prerequisites: *AMS 116, AMS 117, AMS 118.*

AMS 264

General Aviation Aircraft Electrical and Instrument Systems (6,4.5)
3 Credits

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.

Prerequisite: *AMS 116.*

AMS 271

Aircraft Reciprocating Powerplant and Systems (6.5,5.5)

3 Credits

AMS 271 is a study of the 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.

Prerequisite: *AMS 115, AMS 117, AMS 118.*

AMS 272

Powerplant Electrical and Instrument Systems (4,3)

3 Credits

A study of various electrical and instrumentation systems used 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.

Prerequisite: *AMS 116.*

AMS 273

Propeller Systems (3.5,2)

2 Credits

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.

Prerequsites: *AMS 115, AMS 116, AMS 117, AMS 118.*

AMS 274

Aircraft Turbines Powerplants and Systems (6.5,7)

4 Credits

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 271, AMS 272.*

AMS 365

Transport Category Aircraft Systems (4,4)

3 Credits

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, AMS 118, AMS 263, AMS 265.*

AMS 366

Transport Category Aircraft Electrical and Instrument Systems (6,5.25)

3 Credits

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, AMS 264.*

AMS 375

Repair Station Operations (4,4)

3 Credits

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.

Prerequisite: *AMS 271.*

AMS 376

Powerplant Line Maintenance (4,4.5)

3 Credits

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, AMS 272.*

AMS 380

Radio Communication Theory and Application (10,0) ("A" Term Only Each Semester)

2 Credits

This course is designed to increase previously learned electronics theory obtained during the course of study toward the A&P certificate or formal basic electronic theory classes. Upon completion of this course the student will be able to pass the FCC General Radio Telephone Examination (Elements 1 & 3).

Prerequisites: *AMS 116, AMS 264, AMS 366, or A&P Certificate.*

AMS 384

General Aviation Avionics Systems Integration (10,0) ("A" Term Only Each Semester)

4 Credits

This course is a study of aviation electronic equipment with hands-on wiring and system testing. Emphasis will be placed on avionics system installation and the block diagrams of individual appliances. Complete wiring of an Allied Signal Silver Crown avionics suite and a GPS unit is a requirement of the class. Upon completion of this course, the student will be able to understand the operation, testing, and troubleshooting of general aviation avionics systems and wiring concepts.

Prerequisites: *AMS 116, AMS 264, AMS 366, or A&P Certificate.*

AMS 388

Air Transport Avionics Systems Line Maintenance (15,15) ("B" Term Only Each Semester)

6 Credits

This course is an advanced course in aircraft wiring and air transport avionics systems with hands-on wiring and testing. This is the capstone course of the AMS 380 to 388 series and will concentrate on corporate and airline maintenance and troubleshooting. Included in this effort will be the use of advanced ramp test equipment and wiring concepts.

Prerequisites: *AMS 116, AMS 264, AMS 366, or A&P Certificate.*

Aeronautical Science

AS 120

Principles of Aeronautical Science (3,0)

3 Credits

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 (5,0)

5 Credits

This course develops 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.

Corequisite: *ASC 101 (Aeronautical Science students).*

AS 220

Unmanned Aircraft Systems (3,0)

3 Credits

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.

AS 221

Instrument Pilot Operations (3,0)

3 Credits

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.

Prerequisite: *AS 121.*

AS 235

Unmanned Aircraft Systems Operation and Cross-Country Data Entry (3,0)

3 Credits

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.

Prerequisite: *AS-220.*

AS 254

Aviation Legislation (3,0)

3 Credits

This course examines the evolution of federal civil aviation regulations in the United States. It provides an overview of the past and present problems prompting regulation of the industry, the resultant safety legislation, airport development funding legislation, and international aviation legislation.

AS 304

Operational Aspects of Unmanned Aircraft Systems (3,0)

3 Credits

This course will prepare the student to differentiate the applicable needs of civil aviation for UAS. It will examine each of the particular needs and address how to implement UASs to fill that need within the constraints of the current national airspace and federal aviation regulation restrictions. Particular attention will be given to skill sets and tools used to mitigate restrictions, and to create a flight operation that can successfully employ UASs.

Prerequisite: *AS 220; Junior standing*

AS 309

Aerodynamics (3,0)

3 Credits

Incompressible flow airfoil theory, wing theory. Calculation of stall speed, drag, and basic performance criteria. Configuration changes, high and low speed conditions. Special flight conditions. Introduction to compressible flow.

Corequisite: PS 104.

AS 310

Aircraft Performance (3,0)

3 Credits

Aerodynamic performance of aircraft powered by reciprocating, turboprop, or jet turbine engines. Stability and control, weight and balance, and operating data.

Prerequisite: *AS 309.*

Corequisite: *AS 311.*

AS 311

Aircraft Engines - Turbine (3,0)

3 Credits

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; representative engines. This course is not available for students who have received credit for the AMS turbines course.

Corequisite: *PS 104.*

AS 312

Ethics in the Aviation Environment (3,0)

3 Credits

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: *Junior standing.*

AS 315

Unmanned Aircraft Systems Robotics (3,0)

3 Credits

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; Junior standing.*

AS 321

Commercial Pilot Operations (3,0)

3 Credits

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.

Prerequisite: *AS 221.*

AS 340

Instructional Design in Aviation (3,0)

3 Credits

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.

Prerequisite: *Commercial Pilot Certificate with Instrument Rating.*

AS 350

Domestic and International Navigation (3,0)

3 Credits

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 used 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.

Prerequisite: *AS 221 or Instrument Rating.*

Corequisite: *AS 310.*

AS 356

Aircraft Systems and Components (3,0)

3 Credits

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 courses.

Prerequisite: *PS 104.*

AS 357

Flight Physiology (3,0)

3 Credits

Aeromedical information. 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.

Prerequisite: *Sophomore standing.*

AS 358

Advanced Avionics (3,0)

3 Credits

The student will be taught the electronic characteristics of communications, navigation, and surveillance equipment both on the ground and in the aircraft. This will include historical information leading to the current systems. Systems and concepts taught will include ADF, VOR, INS, IRS, GPS, ILS, VHF and UHF communications, SATCOM, ACARS, TCAS, EGPWS, transponders (Mode A, C, and S), ADS and ADS-B, TLS, free flight, and weather radar. Since this area is very dynamic, new systems will be introduced as they are designed and perfected.

Prerequisites: *PS 104 and AS 221 or Instrument Rating.*

AS 380

Pilot Career Planning and Interviewing Techniques (1,0)

1 Credit

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.

Prerequisite: *Junior standing.*

AS 387

Crew Resource Management (3,0)

3 Credits

A capstone course designed to develop a detailed understanding of the organizational behavior, interpersonal relationships skills, and other critical behavioral dynamics of professional flight crews. The course builds upon the knowledge of crew resource management (CRM) acquired during the student's private, instrument, and commercial pilot certification training. 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.

Prerequisites: *AS 350 and PSY 101.*

AS 402

Airline Operations (3,0)

3 Credits

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.

AS 403

Unmanned Sensing Systems (3,0)

3 Credits

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; AS XX, PS 104.*

AS 405

Aviation Law (3,0)

3 Credits

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.

Prerequisite: *Junior standing.*

AS 408

Flight Safety (3,0)

3 Credits

This capstone course is designed to assist the student in developing an attitude and philosophy for accident prevention. The course includes ideal and practical personal and organizational safety procedures and goals; safety philosophies; aircraft accident reports; human factors; principles of accident investigation, accident prevention programs, and accident statistics; current events; and NTSB special studies.

Prerequisite: *Aeronautical Science Senior standing or the permission of the instructor.*

AS 410

Airline Dispatch Operations (3,0)

3 Credits

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.

Prerequisite: *AS 310.*

Corequisites: *AT 300, WX 301. (AT 300 and WX 301 are only applicable to students in the Dispatcher Program.)*

AS 411

Jet Transport Systems (3,0)

3 Credits

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 the B-747-400. Air carrier procedures are examined from a crew member's operational perspective.

Prerequisite: *AS 356 or permission of the instructor.*

AS 412

Corporate and Business Aviation (3,0)

3 Credits

Operation of a corporate flight department. Value of management mobility. Aircraft and equipment evaluation, maintenance, flight operations, administration, and fiscal considerations.

AS 414

Aviation and the Administrative Law Process (3,0)

3 Credits

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.

Prerequisite: *AS 254 or permission of the instructor.*

AS 420

Flight Technique Analysis (3,0)

3 Credits

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, AS 435.*

AS 435

Electronic Flight Management Systems (3,0)

3 Credits

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, AS 350.*

AS 471

All-Attitude Flight and Upset Recovery

1 Credit

Introduction to aerobatic and upset-recovery maneuvering using flight simulation software running on desktop computers. Course content is drawn selectively from three related areas: light aircraft upset maneuvering; air transport upset maneuvering; and analysis of loss of control accidents.

Prerequisite: *AS 309, Pilot Certificate with Instrument Rating.*

AS 472

Operational Applications in Aeronautical Science (3,0)

3 Credits

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. Life-long learning skills are promoted through the use of team exercises that require students to explore the regulatory and ethical requirements of professional pilots.

Prerequisites: *AS 350, AS 387. Must be taken during the last two semesters before graduation.*

AS 473

UAS Flight Simulation

3 Credits

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 235*

AS 199-499

Special Topics in Aeronautical Science

1-3 Credits

Individual independent or directed studies of selected topics in general aviation.

Prerequisites: *Consent of the instructor and approval of department and program chairs. May be repeated with a change of subject. Special topics courses involving flight training are offered in selected areas for the purpose of gaining proficiency in required pilot operations for various certificates and ratings.*

ASC 101

Aeronautical Science Student Success Seminar (1,0)

1 Credit

This course helps students assess and develop the personal, interpersonal, intellectual, and social skills necessary to succeed in a flight-related college degree program. Topics include time management, study skills, principles of learning, goal clarification, and college resources. Practical applications will emphasize strategies for coping with challenges unique to students in a flight-related degree program.

Corequisite: *AS 121 or approval of the instructor.*

Air Traffic Control

AT 200

Air Traffic Management I (3,0)

3 Credits

AT 200 is the entry-level course in the Air Traffic Management (ATM) degree sequence. It is also the first of the courses required in the FAA's Collegiate Training Initiative (CTI) program the FAA is using to meet ATC staffing requirements. This course provides students with a fundamental knowledge of the U.S. air traffic control system and develops content knowledge in the following areas: the Federal Aviation Administration, its mission, organization, and operation; the air traffic control career; navigational aids, current and future; airspace; communications; federal aviation regulations; ATC procedures; control tower operations; nonradar operations; radar operations; pilots' environment; and future air traffic control systems. The course also provides essential information that is useful for pilots and other aviation professionals.

AT 302

Air Traffic Management II (3,0)

3 Credits

Air Traffic Management II gives the student an introduction to the manuals, procedures, maps, charts, and regulations used by pilots and air traffic controllers in the National Airspace System (NAS). Included is an examination of FAA Orders, the Aeronautical Information Manual (AIM), and Federal Air Regulations (FARs). Students will also acquire basic knowledge about SIDs, STARs, en route IFR charts, and instrument approaches. Search and rescue, special operations, NOTAMS, and teamwork in the ATC environment are also studied in this course.

Prerequisite: *AT 200.*

AT 305

Air Traffic Management III (3,0)

3 Credits

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 200, AT 302.*

AT 310

ATCT For Pilots

3 Credits

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.

Prerequisite: *Private pilot*

AT 315

Air Traffic Management - VFR Tower (2.5,1)

3 Credits

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 intrafacility 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 200, AT 302, AT 305.*

AT 401

Air Traffic Management IV (2,3)

3 Credits

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 200, AT 302, AT 305.*

AT 405

Air Traffic Management V (2,3)

3 Credits

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 200, AT 302, AT 305, AT 401.*

AT 406

Air Traffic Management VI

3 Credits

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 200, AT 302, AT 305, AT 401, AT 405.*

AT 415

Air Traffic Management - Advanced ATC 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 200, AT 302, AT 305, AT 315.*

Avionics Technology

AVT 301

Introduction to Avionics (3,0)

3 Credits

A survey course designed to provide a basic knowledge of electronics with application to avionics for the non-avionics major.

AVT 330

Simulation Maintenance Technician (2,3)
3 Credits

This course is an introduction to simulator types, FAA regulations germane to simulators, and actual operation of different types of simulators. Types of display devices, computer languages, support systems, inspection techniques, and troubleshooting procedures will be offered in the classroom and laboratory environment.

Corequisite: *AEL 311, AEL 312, or permission of the department chair.*

Business Administration

BA 101

Introduction to Business Programs and Careers (3,0)
1 Credit

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 (3,0)
3 Credits

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 (3,0)
3 Credits

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 210

Financial Accounting (3,0)
3 Credits

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.

BA 215

Transportation Principles (3,0)
3 Credits

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.

Prerequisite: *BA 201.*

BA 220

Marketing (3,0)
3 Credits

Marketing theory; marketing management, sales management; market research. Public and customer relations, advertising, distribution.

Prerequisite: *BA 201.*

BA 221

Advanced Computer-Based Systems (3,0)
3 Credits

This course is a continuation of BA 120 or IT 109. It covers advanced concepts of spreadsheet use, database management systems, and Internet usage. Students perform macro and command language programming in applications packages. In addition, the course provides the basics of Web-based design to support management activities.

Prerequisite: *BA 120 or CS 120.*

BA 225

Business Law (3,0)
3 Credits

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.

Prerequisite: *BA 201.*

BA 310

Airport Management (3,0)

3 Credits

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, AS 120 or AS 121.*

BA 312

Managerial Accounting (3,0)

3 Credits

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.

Prerequisite: *BA 210.*

BA 314

Human Resource Management (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 315

Airline Management (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 317

Organizational Behavior (3,0)

3 Credits

This course introduces students to the fundamental concepts of organizational behavior with an emphasis on research, theory, and practice. The student is presented with basic concepts shaping individual behavior such as values, personality, perception, learning, and motivation; basic concepts shaping group/team behavior such as leadership, communication, power, politics, conflict, and negotiation; basic concepts shaping organizational structure such as work design, human resources policies, and culture as well as issues related to organizational change, stress, ethics, and diversity.

Prerequisite: *BA 201.*

BA 318

Entrepreneurial Small Business (3,0)

3 Credits

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.

Prerequisite: *BA 201 or permission of the instructor.*

BA 320

Business Information Systems (3,0)

3 Credits

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.

Prerequisite: *BA 221.*

BA 321

Aviation/Aerospace Systems Analysis Methods (3,0)

3 Credits

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.

Prerequisite: *BA 320.*

BA 322

Aviation Insurance (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 324

Aviation Labor Relations (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 325

Social Responsibility and Ethics in Management (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 326

Marketing Management (3,0)

3 Credits

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.

Prerequisite: *BA 220.*

BA 327

Airline-Airport Operations (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 330

Professional Selling (3,0)

3 Credits

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.

BA 332

Corporate Finance I (3,0)

3 Credits

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.

Prerequisite: *BA 210.*

BA 334

Investment Analysis (3,0)

3 Credits

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, 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, a survey of investment companies, asset allocation, concept of efficient markets, equity and bond portfolio management, portfolio performance evaluation, fiduciary responsibility and ethical conduct in the investment profession, and corporate governance. The course is taught from the viewpoint of an individual rather than an institutional investor. The course uses current economic and capital market information for a practical application of the course materials.

Prerequisite: *BA 332 or EC 225 or permission of the instructor.*

BA 335

International Business (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 336

Electronic Commerce (3,0)

3 Credits

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.

BA 340

International Accounting (3,0)

3 Credits

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.

Prerequisite: *BA 210.*

BA 345

Business Law II (3,0)

3 credits

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 405

General Aviation Marketing (3,0)

3 Credits

Marketing and management concepts applicable to FBOs and other general aviation enterprises. Travel analysis is performed to determine the need for a business aircraft.

Prerequisite: *BA 326.*

BA 410

Management of Air Cargo (3,0)

3 Credits

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.

Prerequisite: *BA 215.*

BA 411

Logistics Management for Aviation/Aerospace (3,0)

3 Credits

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, MA 222.*

BA 412

Airport Planning and Design (3,0)

3 Credits

The principles of airport master planning and system planning are studied. Fundamental principles of airport planning and design are covered, including activity forecasting, capacity and delay analysis, site selection, airfield and terminal design, environmental mitigation and abatement, and financial planning.

Prerequisites: *BA 310, MA 222.*

BA 418

Airport Administration and Finance (3,0)

3 Credits

This course is 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, BA 332.*

BA 419

Aviation Maintenance Management (3,0)

3 Credits

Comprehensive examination of organizational maintenance policies, programs, and procedures. Emphasis on maintenance planning; forecasting and cost control; reliability and safety; and flight schedule performance.

Prerequisites: *BA 201, MA 222.*

BA 420

Management of Production and Operations (3,0)

3 Credits

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.

Prerequisite: *MA 320 or permission of the instructor.*

BA 422

Life Cycle Analysis for Systems and Programs in Aviation/Aerospace (3,0)

3 Credits

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, MA 222.*

BA 424

Project Management in Aviation Operations (3,0)

3 Credits

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.

Prerequisite: *MA 320.*

BA 425

Trends and Current Problems in Air Transportation (3,0)

3 Credits

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.

Prerequisite: *BA 201.*

BA 426

International Aviation Management (3,0)

3 Credits

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.

Prerequisite: *BA 335.*

BA 427

Management of the Multicultural Workforce (3,0)

3 Credits

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, BA 314, BA 335.*

BA 430

International Trade and Regulations (3,0)

3 Credits

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 225.*

BA 434

Corporate Finance II (3,0)

3 Credits

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.

Prerequisite: BA 332

BA 436

Strategic Management (3,0)

3 Credits

This business capstone course examines strategic management principles involving strategy, formulation, implementation, evaluation, and organization analysis. Case analysis employing strategic management principles is used to examine and solve organization problems. Total quality management concepts are studied for improvement of organizational effectiveness.

Prerequisite: *Graduating senior standing.*

BA 450

Airline/Airport Marketing (3,0)

3 Credits

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.

Prerequisite: *BA 220.*

BA 299-499

Special Topics in Management

1-4 Credits

Individual independent or directed studies of selected topics in management.

Prerequisites: *Consent of the instructor and approval of the department chair. May be repeated with change of content.*

Cooperative Education

CE 396, 397

1-6 Credits

Aeronautics (A), Aerospace Engineering (AE), Aerospace Studies (AR), Aeronautical Science (AS), Aircraft Engineering Technology (ET), Applied Aviation Sciences (AAS), Aviation Business Administration (ABA), Aviation Environmental Science (AES), Aviation Maintenance Science (AMS), Air Traffic Management (ATM), Applied Meterology (AMET), Aviation Management (AM), Avionics (AV), Civil Engineering (CIV), Computer Engineering (CEC), Communications (COM), Computer Science (CS), Electrical Engineering (EE), Engineering Physics (EP), Flight (FL), Homeland Security (HS), Human Factors (HF), Interdisciplinary Studies (IS), Maintenance Technology (MT), Mechanical Engineering (ME), Safety Science (SF), Software Engineering (SE), Space Physics (SPS)Space Studies (SP). Provides practical learning experience in full-time or part-time employment related to the student's degree program and career goals. Course title and level are based on the work assignment.

Prerequisites: *Approval by the department chair and cooperative education administrator.*

NOTE: Cooperative Education and internship experiences are designed as academically based experiential education. A student enrolled in a University-approved co-op/internship professional activity and registered for 6 credit hours will be considered full-time by all University departments

other than Financial Aid. The Financial Aid Office will consider a 6-hour co-op/internship as half-time enrollment and will process financial aid accordingly. They will report enrollment to the outside agencies as half-time, thus keeping them out of repayment on their student loans.

CE 496, 497

1-6 Credits

Continuation of CE 396 and 397.

Computer Engineering

CEC 220

Digital Circuit Design (3,0)

3 Credits

Introduction to logic design and interfacing digital circuits. Boolean algebra, combinatorial logic circuits, digital multiplexers, circuit minimization techniques, flip-flop storage elements, shift registers, counting devices, and sequential logic circuits.
Corequisite: CEC 222.

CEC 222

Digital Circuit Laboratory (0,3)

1 Credit

Laboratory experiments in the measurement and verification of digital circuits. Discrete and integrated logic circuit design analysis and measurements.
Corequisite: CEC 220.

CEC 300

Computing in Aerospace and Aviation (3,0)

3 Credits

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.

Prerequisites: *EGR 115 and Junior standing.*

CEC 315

Signals and Systems (3,0)

3 Credits

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.

Prerequisite: *EGR 115.*

Corequisite: *MA 345.*

CEC 320

Microprocessor Systems (3,0)

3 Credits

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 and experience in programming in a high-level language.*

Corequisite: *CEC 322.*

CEC 322

Microprocessor Systems Laboratory (0,3)

1 Credit

Hands-on experience with a microprocessor is provided through weekly experiments involving hardware and software techniques.
Corequisite: CEC 320.

CEC 330

Digital Systems Design with Aerospace Applications (3,3)

4 Credits

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 410

Digital Signal Processing (3,0)

3 Credits

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.

Prerequisite: *CEC 315.*

Corequisite: *CEC 411.*

CEC 411

Digital Signal Processing Laboratory (0,3)

1 Credit

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.

Corequisite: *CEC 410.*

CEC 420

Computer Systems Design I (2,3)

3 Credits

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.

Prerequisites: *Computer Engineering major, Senior status.*

CEC 421

Computer Systems Design II (1,6)

3 Credits

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.

CEC 440

Autonomous Vehicle Design (3,0)

3 Credits

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.

Prerequisite: *CEC 320.*

CEC 450

Real-Time Systems (3,0)

3 Credits

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: *CEC 320, CS 225.*

Corequisite: *CS 420.*

CEC 460
Telecommunications Systems (3,0)
3 Credits

Techniques and applications in telecommunications. Types of data communication versus line discipline methodology. Hardware requirements and constraints. Speed versus quality. Security and encoding algorithms.

Prerequisite: *CEC 320 or permission of the instructor.*

CEC 470
Computer Architecture (3,0)
3 Credits

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.

Prerequisite: *CEC 320.*

CEC 299-499
Special Topics in Computer Engineering
1-6 Credits

Directed studies of selected topics in computer engineering.

Prerequisites: *Consent of the instructor and department chair.*

Civil Engineering

CIV 140
Engineering Measurements (1,3)
2 Credits

Introduction to data collection and analysis. Principles of surveying and mapping, with emphasis on modern methods. Laboratory methods.

Corequisite: *CIV 140L.*

CIV 140L
Engineering Measurements Laboratory (0,3)
0 Credits

Field practice in surveying and mapping. Use of modern measurement instrumentation. Development of teamwork and surveying project management skills.

CIV 304
Structural Analysis (3,0)
3 Credits

Analysis of statically determinate and indeterminate structures using statics, kinematics, virtual work, strain energy, force, and displacement methods. Structural laboratory testing.

Prerequisite: *ES 201.*

CIV 307
Civil Engineering Materials I (3,3)
4 Credits

Properties of engineering materials: steel, concrete, soil, asphalt, polymers, composites. Relationship between structure and behavior. Standard methods of testing and inspecting. Laboratory methods.

Prerequisites: *COM 221, ES 202.*

Corequisite: *CIV 307L.*

CIV 307L
Civil Engineering Materials I Laboratory (0,3)
0 Credits

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 (3,0)
3 Credits

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.

Prerequisite: *PS 150.*

CIV 316
Hydraulics (3,0)
3 Credits

Open channel and pipe flows. Hydraulic structures. Groundwater hydrology and stormwater management.

Prerequisite: *ES 204.*

CIV 320
Soil Mechanics (3,3)
4 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: *COM 221, ES 202.*

Corequisite: *CIV 320L.*

CIV 320L

Soil Mechanics Laboratory (0,3)

0 Credits

Modern soil testing and analysis methods. Preparation of samples. Testing of soils for engineering behavioral properties, including permeability, settlement, bearing capacity, and lateral pressures.

CIV 330

Computer Applications in Transportation (1,3)

2 Credits

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.

Prerequisite: *CIV 311.*

CIV 340

Construction Engineering (3,0)

3 Credits

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 (3,0)

3 Credits

U.S. space exploration policies in the 21st century. Construction in zero- or low-weight environments. Development of lunar and planetary resources. Controlled ecological life support systems. Lunar concrete.

CIV 370

Computational Methods in Civil Engineering (3,0)

3 Credits

Numerical techniques for solving civil engineering problems. Applications of statistical methods. Matrix operations. Spreadsheet development.

Prerequisite: *EGR 115.*

CIV 421

Geotechnical and Foundation Engineering (3,0)

3 Credits

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.

Prerequisite: *CIV 320.*

CIV 422

Design of Pavement Structures (3,0)

3 Credits

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.

Prerequisite: *CIV 320.*

CIV 424

Rehabilitation of Pavement Structures (3,0)

3 Credits

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.

Prerequisite: *CIV 320.*

CIV 431

Reinforced Concrete Design (3,0)

3 Credits

Properties of concrete, its constituents, and reinforcement steels. Design of beams, columns, beam-columns, and slabs. Cracking and deterioration. Torsion and shear reinforcement. Anchorage and bond detailing. Application of the concrete design code.

Prerequisites: *CIV 304, ES 202.*

CIV 432

Structural Steel Design (3,0)

3 Credits

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, ES 202.*

CIV 441

Civil Engineering Materials II (3,3)
4 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.

Prerequisite: *CIV 307.*

Corequisite: *CIV 441L.*

CIV 441L

Civil Engineering Materials II Laboratory (0,3)
0 Credits

Advanced testing methodology for concrete, concrete mixtures, bituminous materials, and pavements.

CIV 447

Airport Design I (3,0)
3 Credits

Fundamental principles of airport layout and preliminary design. Airport site selection, runway length and orientation, air traffic control, capacity, and delay.

Prerequisite: *CIV 311.*

CIV 457

Airport Design II (3,0)
3 Credits

Airport terminal passenger and vehicle processing systems. Lighting and signing systems, pavement marking, baggage handling, communication systems, and security systems.

Prerequisite: *CIV 447.*

CIV 460

Senior Design Project (3,0)
3 Credits

Detailed and complete design of a civil engineering facility. Progress reports and presentation. Interdisciplinary group cooperation is emphasized.

Prerequisite: *Senior standing.*

CIV 490

The Civil Engineering Profession (1,0)
1 Credit

Current problems in engineering, professional duties and responsibilities, opportunities for professional development, ethics, and professionalism.

Prerequisite: *Graduating Senior status.*

CIV 499

Directed Design Project (Variable)
1-3 Credits

Directed design project. Individual investigation of current design problem. Offered by special arrangement only.

Prerequisite: *Permission of Civil Engineering program coordinator.*

CIV 199-399

Special Topics in Civil Engineering (Variable)
1-3 Credits

Directed studies of special topics in Civil Engineering. Offered by arrangement only.

Prerequisites: *Consent of the instructor and Civil Engineering program coordinator.*

Communication

COM 008

Academic English for Non-Native Speakers of English (4,0)
4 Credits

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 018

Advanced Academic English for Non-Native Speakers of English (4,0)
4 Credits

A developmental course designed to help advanced-level non-native speakers of English develop their English language proficiency. The emphasis is on writing and reading in an academic setting and on preparation for degree-credit bearing communication courses. (Credit not applicable to any degree.) Students cannot withdraw from the course. The course must be passed with a grade of C or better.

Prerequisite: *ESL Placement Test or COM 008.*

COM 020

Fundamentals of Communication (3,0)
3 Credits

Designed to improve the student's reading and writing abilities through focusing on critical thinking. All three skills are approached as facets of each other and as processes that the student learns to control and take responsibility for. The fundamentals of grammar, punctuation, and sentence structure are strengthened when students write and revise multi-paragraph expository essays. A grade of C is required to pass this course, and it may not be dropped. (Credit is not applicable to any degree.)

COM 122

English Composition and Literature (3,0)
3 Credits

This course focuses on principles of writing in response to readings in the humanities, social sciences, and other interdisciplinary fields. Students develop their communicative, evaluative, critical thinking, and research writing abilities through the close examination of key texts across those disciplines. A grade of C or better is required to pass this course.

Prerequisite: *Satisfactory completion of basic skills requirements.*

COM 219

Speech (3,0)
3 Credits

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.

Prerequisite: *COM 122.*

COM 221

Technical Report Writing (3,0)
3 Credits

Preparation of formal and informal technical reports, abstracts, resumes, and business correspondence. Major emphasis placed on the long technical paper and the acquisition of advanced writing skills.

Prerequisite: *Any course from the HU 140 series.*

COM 222

Business Communication (3,0)
3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

COM 225

Science and Technology Communication (3,0)
3 Credits

This course introduces the practices of communicating news and issues in science and technology to a variety of publics through magazine-style writing and public speaking. Guest speakers will present research questions, methodologies, and issues in the sciences. Coursework also includes readings from successful science and technology communicators, illustrating various solutions to writing about complex subjects. Special topics include identifying science and technological stories, evaluating sources and information, and communicating findings clearly, comprehensibly, and accurately for publication and speaking engagements.

Prerequisite: *COM 221.*

COM 230

Digital Photography (3,0)
3 Credits

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.

Prerequisite: *Sophomore standing or permission of the program coordinator.*

COM 260

Introduction to Media (3,0)
3 Credits

The structure of, professional opportunities in, and social issues arising from, media industries. Required of all Communication students. Must be taken within the first year of entering the program.

Prerequisite: *COM 122.*

COM 265

Introduction to News Writing (3,0)

3 Credits

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.

Prerequisite: *COM 122 or permission of the instructor.*

COM 268

Sports Writing (3,0)

3 Credits

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.

Prerequisite: *COM 122.*

COM 320

Mass Communication Law and Ethics (3,0)

3 Credits

This course is based on case studies introducing students to the legal and ethical environments underpinning First Amendment rights in the United States from the nation's founding to the present. Topics in law include intents of the framers, prior restraint, libel, privacy, hate speech, freedom of information laws, shield laws, and copyright. Topics in ethics concentrate on models for decision-making in difficult situations. Practices of journalists, media relations practitioners, and Internet communicators will be examined. Topics in ethics concentrate on models for decision-making in difficult situations.

Prerequisite: *COM 221.*

COM 322

Aviation and Aerospace Communication (3,0)

3 Credits

This course introduces the practices of communicating news and issues in aviation and aerospace to a variety of publics through magazine-style writing and public speaking. Students will learn how to recognize the news value of contemporary aviation issues, to gain an understanding of those issues through research and interviews with experts, and to write about and discuss the issues. Coursework also includes readings from respected aviation writers that illustrate aviation's economic and social impact on society. Special topics include safety, airport security and congestion, emerging legal issues, and international aviation trends.

Prerequisite: *COM 221.*

COM 350

Environmental Communication (3,0)

3 Credits

This course centers on national and regional environmental issues, including planning, regulation, and crises. Topics include responses to climate change, endangered species, wetlands preservation, coastal development, and hazardous materials regulation. Field trips and guest speakers will be included. Students learn how to research and write articles and stories for nature and environmental magazines as well as general-audience media.

Prerequisite: *COM 221 or COM 225.*

COM 360

Media Relations I (3,0)

3 Credits

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.

Prerequisite: *COM 219.*

COM 364

Visual Design (3,0)

3 Credits

This course presents principles of visual design applying to print and electronic publications, including unity, emphasis, balance, line, shape, value, color, and texture. Special topics include ethics, typography, semiotics, and layout. Students analyze existing graphical artifacts and create print and electronic projects focused on communicating science and technology, using professional design software.

Prerequisites: *COM 221, COM 222, or an equivalent professional writing course; COM 265.*

COM 410

Advanced Professional Writing (3,0)

3 Credits

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, COM 221, COM 265.*

COM 411

Web Design Workshop (3,0)

3 Credits

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.

Prerequisite: *COM 221, COM 222, or an equivalent professional writing course.*

COM 412

Advanced Technical Writing (3,0)

3 Credits

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.

Prerequisite: *COM 221.*

COM 415

Non-Verbal Communication (3,0)

3 Credits

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.

Prerequisite: *COM 219, equivalent Speech Communications course. (Also offered as HU 415. Students receive either Communication or Humanities credit, but not both.)*

COM 460

Media Relations II (3,0)

3 Credits

Mastery of writing and speaking genres in media relations with an emphasis on crisis communication.

Prerequisites: *COM 265, COM 360.*

Computer Science

CS 118

Fundamentals of Computer Programming (3,0)

3 Credits

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 (3,0)

3 Credits

This course provides an introduction to computer organization and applications, with an emphasis on 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. This course has a closed laboratory associated with it.

CS 125

Computer Science I (3,3)

4 Credits

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: *Experience in programming in a high-level language, and proficiency in high school pre-Calculus mathematics.*

CS 222

Introduction to Discrete Structures (3,0)

3 Credits

An introduction to the fundamental algebraic, logical, and combinatorial concepts of mathematics that provide a foundation for the study of computer science.

Prerequisites: *Experience in programming in a high-level language, pre-Calculus mathematics.*

CS 223

Scientific Programming in C (3,0)

3 Credits

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.

Prerequisite: *MA 112 or MA 241 or permission of the instructor.*

CS 225

Computer Science II (3,3)

4 Credits

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.

Prerequisite: *EGR 115.*

CS 303

Network Security (3,0)

3 Credits

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 Information Security minor or a technical elective for students majoring in Computer Science or Computer Engineering.

Prerequisites: *CS 222 or MA 242 or consent of the instructor. CS 225 or consent of the instructor. Junior status or consent of the instructor.*

CS 315

Data Structures and Analysis of Algorithms (3,0)

3 Credits

This course emphasizes the design, implementation, and analysis of algorithms dealing with searching, sorting, graphs, trees, and disk files.

Prerequisites: *CS 222, CS 225.*

CS 317

Files and Database Systems (3,0)

3 Credits

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 222, CS 225.*

CS 332

Organization of Programming Languages (3,0)

3 Credits

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, CS 225.*

CS 335

Introduction to Computer Graphics (3,0)

3 Credits

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 and proficiency in an implementation language.*

CS 344

C Programming and UNIX (3,0)

3 Credits

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.

Prerequisite: *CS 225 or equivalent experience in programming.*

CS 350

Computer Modeling and Simulation (3,0)

3 Credits

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.

Prerequisites: *MA 222 or MA 412, a proficiency in computer programming, and Junior/Senior standing.*

CS 420

Operating Systems (3,0)

3 Credits

Development, structure, and functions of operating systems; demand service models; development of concurrent models.

Prerequisites: *CS 225 and Junior standing.*

CS 455

Artificial Intelligence (3,0)

3 Credits

This course introduces students to the basic concepts of artificial intelligence with emphasis on knowledge engineering. Students gain experience, through individual and group exercises, in the various phases of system development: planning, requirements and specification, design, implementation, and testing. Students study and apply commercial tools to the development of knowledge-base systems in the aerospace and aviation domain.

Prerequisite: *CS 222 or permission of the instructor.*

CS 490

Computer Science Capstone Design (3,0)

3 Credits

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.

Prerequisite: *SE 300.*

CS 299-499

Special Topics in Computer Science

1-6 Credits

Individual independent or directed studies of selected topics in computer science.

Prerequisites: *Consent of the instructor and the department chair.*

Economics

Standing is based on credit hours earned toward the student's declared degree program.

EC 200

An Economic Survey (3,0)

3 Credits

An introduction to macro and microeconomic principles, problems, and policies with a view to current economic problems.

EC 210

Microeconomics (3,0)

3 Credits

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 (3,0)

3 Credits

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 (3,0)
3 Credits
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 315

Managerial Economics (3,0)
3 Credits
An analytical approach to the manager's role in understanding pricing, costing, production, and forecasting. Concentrates on simple quantitative models to explain the firm's position in the market and how the manager can react to and control this information. Aviation topics commonly discussed include airport privatization and employee ownership of airlines.

Prerequisite: *EC 210.*

EC 420

Economics of Air Transportation (3,0)
3 Credits
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.

Prerequisite: *EC 210.*

EC 299-499

Special Topics in Economics
1-4 Credits
Individual independent or directed studies of combinations of selected topics in economics.

Prerequisites: *Consent of the instructor and the department chair.*

Electrical Engineering

EE 223

Linear Circuits Analysis I (3,0)
3 Credits
Volt-ampere characteristics for passive circuit elements, resistive network circuit theory, and simplification. Kirchoff's current and voltage laws. Introduction to linear network theorems and transformations. Transient response of RC, RL, and RLC circuits. Steady state and impedance circuit analysis for sinusoidal sources.

Corequisites: *MA 345, PS 250.*

EE 224

Electrical Engineering Laboratory I (0,3)
1 Credit
Problem sessions, electrical instrumentation and measurement, verification of theory presented in EE 223, working knowledge of electronic test equipment.

Corequisite: *EE 223.*

EE 300

Linear Circuit Analysis II (3,0)
3 Credits
Continuation of EE 223. Study of the Laplace and Fourier transforms, Fourier analysis, complex plane, resonance and coupled circuits, Bode Diagrams, and two-port networks.

Prerequisite: *EE 223.*

Corequisite: *MA 441 or permission of the instructor.*

EE 301

Electrical Engineering Laboratory II (0,3)
1 Credit
Problem sessions, analysis, and simulation of analog and digital circuits using computer-aided design and analysis tools.

Corequisite: *EE 300.*

EE 302

Electronic Devices and Circuits (3,0)
3 Credits
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.

Prerequisite: *EE 223 or permission of the instructor.*

Corequisite: *EE 304.*

EE 303

Signals and Filters (3,0)
3 Credits
Mathematics for filtering and spectral analysis of continuous and discrete systems. Solutions to filter-

ing approximations via Butterworth, Chebyshev, elliptic, and others. Introductions to Z-transforms and digital filter design methods.

Prerequisites: *EE 300 and MA 441 or permission of the instructor.*

EE 304

Electronic Circuits Laboratory (0,3)

1 Credit

Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits. Corequisite: EE 302.

EE 306

Introduction to Electrical Systems (2,0)

2 Credits

Direct current electricity; circuits, resistance, DC machinery. AC current; transformers, three-phase circuits, AC machinery, commercial applications, building codes.

EE 307

Avionics I (3,3)

4 Credits

Provides the first part of a comprehensive and rigorous study of avionics systems. A laboratory is provided to give the student the opportunity to gain hands-on experience. The course covers avionics systems from the basic physics of avionics to the latest technology.

Prerequisites: *EE 223, EE 224, MA 345, PS 250, PS 253.*

EE 308

Introduction to Electrical Communications (3,0)

3 Credits

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.

EE 310

Avionics II

3 Credits

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

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 335

Electrical Engineering I (2,0)

2 Credits

Introduction of the fundamentals of electrical engineering. Circuit theory and variables. Voltage-current relationship for passive elements. Circuit analysis and network solutions. Phasors and frequency-domain analysis. Transient analysis of first and second order systems. Equivalent circuits and power. The Electrical Engineering Lab, EE 336, must be taken during the same semester as EE 335.

Prerequisites: *COM 221, MA 345, PS 250, PS 253.*

EE 336

Electrical Engineering Laboratory I (0,3)

1 Credit

Laboratory experiments and techniques in electrical engineering. The Electrical Engineering Lab EE 336 must be taken during the same semester as EE 335.

EE 340

Electric and Magnetic Fields (3,0)

3 Credits

Electrostatics and magnetostatics. 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: *MA 441, PS 250.*

EE 401

Control Systems Analysis and Design (3,0)

3 Credits

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.

Prerequisite: *MA 345.*

EE 402

Control Systems Laboratory (0,3)

1 Credit

Laboratory experiments involving the principles of operation and design of linear control systems. Experiments to support theory introduced in EE 401. Corequisite: EE 401.

EE 417

Digital Communications (3,0)

3 Credits

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 intersymbol 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.

EE 420

Avionics Preliminary Design (3,0)

3 Credits

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.

Prerequisite: *Senior standing.*

EE 421

Avionics Detail Design (3,0)

3 Credits

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.

Prerequisite: *EE 420 or EE 428 (Prescott only).*

EE 422

Wired and Fiber Optic Communications (3,0)

3 Credits

This course applies the foundations laid down by EE 310 and EE 417 to wired and fiber optic communications. The course discusses the characteristics of theoretical and real transmission lines. The similarities of electrical transmission lines and fiber optic transmission are studied. Methods of establishing networks using electrical transmission lines are discussed as well as the impairments encountered by such networks. Fiber optic networks are introduced, building on the foundation set down by the electrical transmission line networks.

EE 430

Introduction to Radio Frequency Circuits (3,0)

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.

Prerequisite: *EE 302.*

Corequisite: *EE 430L.*

EE 430L

Radio Frequency Circuits Laboratory (0,3)

1 Credit

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.

EE 475

Senior Telecommunications Project (2,3)

3 Credits

The capstone course for the telecommunications track. This course will entail a design project involving a broad spectrum of tasks including system design, software, hardware, text, and evaluation. The students will plan the project using the latest computer tools and monitor the progress. Group and interdisciplinary efforts are encouraged.

EE 299-499

Special Topics in Electrical Engineering

1-6 Credits

Directed studies of selected topics in electrical engineering.

Prerequisites: *Consent of the instructor and department chair.*

Engineering

EGR 101

Introduction to Engineering (1,2)

2 Credits

An introduction to the interdisciplinary aspects of the engineering of aerospace systems. This is a project-based course demonstrating how aerospace engineering, electrical engineering, computer engineering, civil engineering, and software engineering are combined to produce results. 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 (2,0)

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 (3,0)

3 Credits

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.

Prerequisite: *Pre-Calculus or permission of the instructor.*

EGR 120

Graphical Communications (2,2)

3 Credits

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.

Prerequisite: *Enrollment in an engineering program.*

EGR 305

3D-CADD and Engineering Documentation (3,0)

3 Credits

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, knowledgware, parametric design, part and assembly design, modification, document release and control, final drawings, and changes.

Prerequisites: *EGR 120, ES 201, ES 204.*

Engineering Physics

A grade of C or better is required in MA 241, MA 242, PS 140, PS 141, PS 215, and PS 216 for entry into all EP and ES courses.

EP 101

Current Topics in Space Sciences (1,0)

1 Credit

A survey seminar intended to explore contemporary topics encountered in the exploration of the upper atmosphere and near space environment.

EP 320

Electro-Optical Engineering (3,0)

3 Credits

Geometrical optics of mirrors, thin and thick lenses, prisms, and systems. Ray tracing with optical CAD. Fiber optics applications. Physical optics including interference, diffraction, and polarization. Phaser methods. Engineering considerations in choice of different types of detectors. Space systems applications. Image processing. Emphasis on design.

Prerequisites: *EGR 115, PS 303.*

Corequisites: *MA 345, PS 305.*

EP 340

Introduction to Space Systems Design (2,1.5)
2 Credits

An introduction to space mission analysis and design process, mission characterization, evaluation, and requirements definition. Introduction to computer-aided design (CAD). Numerical modeling and simulation of engineering systems, the finite element method, the finite difference method.

Prerequisite: *ES 202.*

EP 391

Microcomputers and Electronic Instrumentation (2,3)
3 Credits

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. In the laboratory portion of the course the student will explore the design of pertinent regulated power supplies, amplifiers, logic circuits, filters, stepper motors, servo motors, and A-to-D and D-to-A converters. This work will serve as the basis for design project assignments to produce one or two working instruments that are interfaced to a microcomputer.

Prerequisites: *EGR 115, PS 219, PS 220, or instructor's waiver.*

Corequisite: *MA 345.*

EP 393

Spaceflight Dynamics (2,0)
2 Credits

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, and interplanetary transfer. Fundamentals of ascent flight mechanics, launch vehicle selection, fundamentals of entry flight mechanics, and the associated thermal control problem.

Prerequisite: *EGR 115.*

EP 394

Space Systems Engineering (3,0)
3 Credits

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.

Prerequisite: *AE 313 or EP 393 or consent of the instructor.*

EP 400

Thermodynamics and Statistical Mechanics (3,0)
3 Credits

Basic thermodynamics, entropy, kinetic theory, distribution of molecular velocities, Maxwell-Boltzmann statistics, Bose-Einstein statistics, Fermi-Dirac statistics, microcanonical ensemble, canonical ensemble.

Prerequisite: *PS 303.*

EP 410

Space Physics (3,0)
3 Credits

Origin, evolution, and structure of neutral and ionized terrestrial atmosphere. Effect of sun's electromagnetic radiation on ozone shield. Photoionization and thermal structure of the neutral atmosphere as well as the ionosphere and magnetosphere. Solar disturbances and their effects on satellite orbit decay and on long-distance communication. Studies of composition, thermodynamics, and physical processes of the near-Earth space environment. Rocket and satellite monitoring and remote sensing. Numerical and instrument design projects.

Prerequisite: *PS 320.*

Corequisite: *EP 440.*

EP 420

Planetary Science (3,0)
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.

Prerequisite: *PS 303.*

EP 425

Observational Astronomy (2,3)

3 Credits

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, PS 305, and either PS 301 or PS 401.*

EP 430

Spacecraft Instrumentation (3,0)

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 315, CEC 320.*

Corequisite: *EP 391, EP 394.*

EP 440

Engineering Electricity and Magnetism (3,0)

3 Credits

Solutions of electrostatics problems using Poisson's equation and Laplace's equation, electrostatic energy, electric current, magnetic field, electromagnetic induction, physics of plasmas, Maxwell's equations, and application of Maxwell's equations (reflection, refraction, waveguides, antenna radiation). Students will write some simple computer programs.

Prerequisites: *EGR 115, MA 442, PS 303, PS 305, PS 320, or instructor consent.*

EP 455

Quantum Physics (3,0)

3 Credits

The Schrodinger equation in one and three dimensions and its solutions for step potentials, the harmonic oscillator, and the hydrogen atom. Operators and their matrix representations: Dirac bracket formalism, angular momentum and spin, and spin-orbit interaction. Identical particles and exchange symmetries. Time-independent and time-dependent perturbation theory and approximation methods: transition rates, Fermi's rule, scattering theory. Classical and quantum statistical distributions.

Prerequisite: *EP 440 or instructor consent.*

EP 496

Space Systems Design I (1,3)

2 Credits

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 (2,4)

3 Credits

This is a required course in the Engineering Physics program. It is the second of a two-semester sequence and completes senior design project requirements of this program. Continuation and completion of EP 496.

Prerequisite: *EP 496.*

EP 199-499

Special Topics in Engineering Physics

1-4 Credits

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

A grade of C or better is required in MA 241, MA 242, and either PS 150 or PS 215 and PS 216 for entry into all ES courses. A passing grade in all prerequisite courses or department consent is required for entry into all ES courses.

ES 201

Statics (3,0)
3 Credits

A vector treatment of the concepts and characteristics of forces and couples. Distributed forces. Center of mass, centroid. Equilibrium of particles and rigid bodies. Trusses and frames. Internal forces. Shear and moment distribution in beams. Area moments of inertia.

Prerequisites: *PS 150 or PS 215, EGR 120 or EGR 111, or consent of the instructor. Corequisite: MA 243.*

ES 202

Solid Mechanics (3,0)
3 Credits

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.

Prerequisite: *ES 201.*

ES 204

Dynamics (3,0)
3 Credits

A vector treatment of the kinematics and kinetics of particles and rigid bodies. Acceleration, work, energy, power, impulse, and momentum.

Prerequisite: *ES 201.*

Corequisite: *MA 345.*

ES 206

Fluid Mechanics (3,0)
3 Credits

Physical characteristics of the fluid state. Fluid statics. Kinematics of fluid motion. Flow of an incompressible ideal fluid. Impulse-momentum principles. Similitude and dimensional analysis, fluid measurements.

Prerequisite: *ES 201, PS 160, or PS 208.*

ES 305

Thermodynamics (3,0)
3 Credits

A study of the concepts of heat and work and their transformation as governed by the first and second laws of thermodynamics. Properties of pure substances. Ideal gas behavior and relationships. Reversible processes and temperature-entropy diagrams. Conventional power cycles. Properties of ideal gas mixtures. Combustion.

Prerequisite: *ES 206 or consent of the instructor.*

ES 320

Engineering Materials Science (2,0)
2 Credits

Materials used in aeronautical engineering applications. Properties of materials and their measurements. Metals and their structures. Characteristics of metallic phases. Equilibrium diagrams. Processing of metals and alloys. Plastics, their structures, and characteristics. Ceramics and their characteristics. Composite materials. Corrosion. The Engineering Materials Science Lab ES 321 must be taken during the same semester as ES 320.

Prerequisites: *COM 221, ES 202, and PS 105 or PS 140 or consent of the instructor.*

Corequisite: *ES 321.*

ES 321

Engineering Materials Science Laboratory (0,3)
1 Credit

Laboratory experiments and techniques in materials science, composites, and solid mechanics. The Engineering Materials Science Lab must be taken during the same semester as ES 320.

ES 403

Heat Transfer (3,0)
3 Credits

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 206 or permission of the instructor, ES 305, MA 345.*

ES 405

Electrical Engineering II (3,0)
3 Credits

Diode, transistor, and operational amplifier circuit analysis. System block diagrams, feedback, and transfer functions. Digital and analog computer principles. Boolean algebra, logic gates, and microprocessors. Rotating electrical machines, transformers, and other electro-mechanical energy conversion devices.

Prerequisites: *EE 335, EE 336.*

ES 299-499

Special Topics in Engineering Science

1-6 Credits

Individual independent or directed studies of selected topics in engineering science.

Prerequisites: *Consent of the instructor and department chair. May be repeated with change of content.*

Flight-Academic

FA 121

Private Single Flight (1,0)

1 Credit

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.

Corequisite: *AS 121. NOTE: The FAA requires AS 121 to be completed at Embry-Riddle with a "C" or higher. Students who transfer credit for AS 121 will be required to complete additional ground training in FA 121 to meet the FAA requirement.*

FA 122

Private Multi Flight with Laboratory (1, 0)

1 Credit

The student will receive training in the maneuvers and procedures necessary to meet the standards contained in the FAA Multi-Engine 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 the addition of a Multi-Engine Rating for the Private Pilot Certificate.

Prerequisite: *Private Pilot Certificate with an Airplane Single-Engine Land Rating (FA 121).*

Corequisite: *FA 122L.*

FA 215

Upset Training

1 Credit

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.

FA 221

Instrument Single Flight (1,0)

1 Credit

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.

Prerequisite: *Private Pilot Certificate with an Airplane Single-Engine Land Rating (FA 121).*

Corequisite: *AS 221. NOTE: The FAA requires AS 221 to be completed at Embry-Riddle with a "C" or higher. Students who transfer credit for AS 221 will be required to complete additional ground training in FA 221 to meet the FAA requirement.*

FA 222

Instrument Multi Flight (1,0)

1 Credit

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.

Prerequisite: *Private Pilot Certificate with an Airplane Multi-Engine Land Rating (FA 122).*

Corequisite: *AS 221. NOTE: The FAA requires AS 221 to be completed at Embry-Riddle with a "C" or higher. Students who transfer credit for AS 221 will be required to complete additional ground training in FA 222 to meet the FAA requirement.*

FA 321

Commercial Single Flight (1,0)

1 Credit

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.

Prerequisite: *Private Pilot Certificate with Airplane Single-Engine Land and Instrument Airplane Ratings (FA 221).*

Corequisite: *AS 321. NOTE: The FAA requires AS 321 to be completed at Embry-Riddle with a "C" or higher. Students who transfer credit for AS 321 will be required to complete additional ground training in FA 321 to meet the FAA requirement.*

FA 322

Commercial Multi-Flight (1,0)

1 Credit

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 an Airplane Multi Engine Land Rating.

Prerequisite: *Private Pilot Certificate with Airplane Multi-Engine Land and Instrument Airplane Ratings (FA 222).*

Corequisite: *AS 321. NOTE: The FAA requires AS 321 to be completed at Embry-Riddle with a "C" or higher. Students who transfer credit for AS 321 will be required to complete additional ground training in FA 322 to meet the FAA requirement.*

FA 323

Commercial Multi-Add On (1,0)

1 Credit

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.

Prerequisite: *Commercial Pilot Certificate with Airplane Single Engine Land and Instrument Airplane Ratings (FA 321).*

FA 324

Commercial Multi Instrument Flight (1,0)

1 Credit

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.

FA 326

Commercial Single Add On Flight (1,0)

1 Credit

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.

Prerequisite: *Commercial Pilot Certificate with Airplane Multi Engine Land and Instrument Airplane Ratings (FA 322).*

FA 370

Advanced Multi-Engine Instrument Flight

1 Credit

Introduction to autopilot and flight director operations to further develop instrument piloting skills to the ATP level. In addition, the student is introduced to advanced cross-country operations, with emphasis on precision flying skills and the use of automated flight management systems in an IFR environment.

Prerequisite: *Commercial Pilot Certificate with a Multi-Engine Class Rating and Instrument Airplane Rating (FA 322 or FA 323).*

FA 417

Flight Instructor Rating

3 Credits

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, 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.

Prerequisite: *FAA Commercial Pilot Certificate with Single-Engine and Instrument Rating (FA 321 or FA 326).*

FA 418

Airline Transport Pilot Proficiency Development

1 Credit

Certified Commercial and Instrument rated multi-engine 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.

Prerequisites: *FAA Commercial Pilot Certificate with Airplane-Single-Engine and Multi-Engine Land and Instrument- Airplane ratings.*

FA 420

Airline Flight Crew Techniques and Procedures

2 Credits

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.

Prerequisites: *Commercial Pilot Certificate with Multi-Engine/Instrument Airplane Rating, AS 387, AS 435.*

Corequisite: *AS 420.*

FA 460

Multi-Engine Flight Instructor Rating

2 Credits

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.

Prerequisites: *FA 417 or FAA Commercial Pilot Certificate with Airplane Multi-Engine Land and Instrument Airplane Ratings and an FAA Flight Instructor Certificate with an Instrument Airplane Rating.*

FA 199-499

Special Topics in Flight

0-2 Credits

Flight training in selected areas for the purpose of gaining proficiency in required pilot operations for various certificates and ratings.

Prerequisites: *Approval of chief flight instructor and department chair.*

Human Factors

HF 300

Human Factors I: Principles & Fundamentals (3,0)

3 Credits

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.

Prerequisite: *PSY 101.*

HF 302

Human Factors II: Analytic Methods and Techniques (3,0)

4 Credits

Covers a variety of engineering and behavioral analytic methods and techniques critical to the study of work performance. Provides required tools needed to accomplish workload analysis as a requisite to a systems design or a redesign of an existing system.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 305

Human Factors III: Test and Evaluation (3,0)

4 Credits

Studies quantitative means of modeling, analyzing, and predicting the performance of human-machine systems. Topics include queuing models, system simulation, model validation, data collection, quantitative analysis of system performance, and system design evaluation.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 310

Human-Computer Interaction (3,0)

3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 312

Ergonomics and Bioengineering (3,0)

3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 315

Automation and Systems Issues in Aviation (3,0)

3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 325

Human Factors and System Safety (3,0)

3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 326

Human Performance in Extreme Environments (3,0)

3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 330

Human Factors in Space (3,0)

3 Credits

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.

Prerequisite: *HF 200 or HF 210 or HF 300.*

HF 335

Human Factors in Air Traffic Control (3,0)

3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 340

Human Factors and Product Liability (3,0)

3 Credits

This course will provide the student with an understanding of the legalities and liabilities of product manufacturing. Topics to be covered will include what is required of a manufacturer when designing a product for human use, what can go wrong, the role of expert witnesses in a product liability case, a review of specific case studies, and a discussion of awards to plaintiffs.

HF 400

Human Factors IV: System Design (3,0)
4 Credits

Application of human factors concepts to system design. Develops human factors influence on system dynamics, structure, and control as well as impact on reliability and maintainability. Emphasizes the design of control-display integration, cockpit configuration, maintainability, and reliability. Emphasizes the significant human factors contributions to the design of state-of-the-art aerodynamic and space systems.

Prerequisites: *HF 302 and HF 305.*

HF 410

Human Factors Engineering: Crew Station Design (3,0)
3 Credits

In-depth treatment of human factors principles applicable to the design of crew command centers for aerodynamic aviation/aerospace systems.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 412

Simulating Humans in Complex Systems (3,0)
3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300. Familiarity with a programming language or macro programming such as Microsoft Access or Excel is encouraged but not required.*

HF 415

Human Factors in Simulation Systems (3,0)
3 Credits

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.

Prerequisite: *HF 201 or HF 210 or HF 300.*

HF 422

Applied Ergonomic Design, Analysis, and Evaluation (3,0)
3 Credits

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 CATIA's human modeling and ergonomics workbench. Students will learn to verify how well an existing design accommodates 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. Students are introduced to the statistical tools used in the corroboration of ergonomic design and verification.

HF 440

Aerospace Physiology (3,0)
3 Credits

This course emphasizes the adaptability of 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, and muscular and sensory neuroscience. The impact of the special aerospace environment on human capability will be discussed, such as acceleration, hypo and hyperbaric environments, and microgravity and spatial disorientation. This course brings together the operational demands of physiology, medicine, and behavioral science. The student will also 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 on Earth or in space. 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.

Prerequisite: *PS 107 or equivalent.*

HF 490

Practicum in Human Factors Psychology (3,0)

3 Credits

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.

Prerequisites: *Approval of advisor and department chair.*

HF 299-499

Special Topics in Human Factors Psychology (3,0)

1-6 Credits

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.

Prerequisites: *Approval of advisor and department chair.*

Honors

HON 150

Honors Seminar I (3,0)

3 Credits

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 250

Honors Seminar II (3,0)

3 Credits

This course is open only to students enrolled in the Honors program, and will satisfy 3 credits of the lower-level Social Sciences requirement in general education. The course focuses on material pertinent to one or more disciplines in the broad arena of the Social Sciences. Specific emphases will vary by instructor. 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.

HON 350

Honors Seminar III (3,0)

3 Credits

Honors Seminar III will satisfy either the Humanities or the Social Sciences upper-level elective requirement in general education. Building on the previous two Honors seminars, it will require students to further develop their ability to locate and assess primary and secondary research materials, to present effective verbal and written presentations that display more sophisticated research and presentational sensibilities, and to engage in discussion that is rooted in close reading of assigned and unassigned material. Whatever the specific course topic, the seminar will be an interdisciplinary exploration of the subject, will emphasize student participation in focused class discussion, and will foster further development of research, critical thinking, and oral and written communication abilities. Topics vary by instructor.

Homeland Security

HS 110

Introduction to Homeland Security (3,0)

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, maritime, surface, and cargo security.

HS 210

Fundamentals of Transportation Security (3,0)

3 Credits

The primary focus of this course is on security in all modes of public transportation. Students will study the governmental organizations responsible for the security of people and property while being transported by air, rail, marine, or on the highways, as well as the federal regulations governing security in these modes of transportation. Specific subjects discussed include the federal regulations governing all modes of transportation, the role of safety and security program managers, airport security, air carrier security, foreign and indirect air carrier security, cargo security, transportation of dangerous goods, and the role of security-oriented technology.

Prerequisite: *HS 110.*

HS 215

Introduction to Industrial Security (3,0)

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.

Prerequisite: *HS 110.*

HS 280

Business Skills for the Homeland Security Professional (3,0)

1 Credit

The main objective of this course is to better prepare graduates in Homeland Security to effectively enter the workforce. Students will learn how to prepare a resume and cover letter, practice interviewing, learn about how their personality matches job descriptions, search for internships, and will develop a Web page that describes themselves, their professional aspirations, skills, etc. The Homeland Security program will then aggregate each of the student's Web pages into a Web site that can be distributed to constituents, agencies, organizations, and businesses interested in hiring a B.S.-prepared student in Homeland Security.

Prerequisites: *HS 110, Sophomore standing.*

HS 306

Aviation Security

3 Credits

Although terrorism has been a known phenomenon for centuries, it has become the most frequent form of conflict. In fact, terrorism against the aviation industry has made aviation facilities the preferred target of terrorist. This course will cover specific facets of aviation-related airport and air carrier security to include physical and procedural controls, regulations of the Department of Homeland Security, the Transportation Security Administration, and ICAO, as well as international treaties. The history and background of threats directed at the aviation industry will be explored. The course will also discuss the current threat against civil aviation, security countermeasures, and new technology.

Prerequisites: *HS 210 or permission from the instructor.*

HS 310

Fundamentals of Emergency Management (3,0)

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, HS 210, HS 215, or permission of the instructor.*

HS 315

Critical Infrastructure and Risk Analysis (3,0)

3 Credits

This course will primarily focus on definitions, structures, and the process of risk analysis as applied to critical infrastructure and key asset. Risk analysis, threat, and vulnerability models will be examined, both individually and as part of risk assessment studies. Students will complete a class project utilizing vulnerability and risk assessment methodologies. Specific subjects introduced include risk and vulnerability basics, fundamentals of security surveys, concepts of mitigation, preparedness, response, and recovery, continuity of business planning, cost-benefit analysis, and documentation. The role of risk in the overall mission of the Department of Homeland Security will be covered, to include the National Infrastructure Protection Plan (NIPP). Successful completion of a FEMA online certification on the NIPP is also required.

Prerequisites: *HS 110, HS 210, HS 215, or permission of the instructor.*

HS 320

Homeland Security Law and Policy (3,0)

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, HS 210, HS 215, or permission of the instructor.*

HS 325

Terrorism: Origins, Ideologies, and Goals (3,0)

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.”

Prerequisite: *HS 110.*

HS 350

Intelligence Systems & 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 US. In addition, students will explore the history and development of the IC in the US, major legislative acts that led to the development of intelligence as a major function of US national security strategy.

Prerequisites *– HS 110, HS 210, HS 215, or cons instructor*

HS 360

Strategic Planning & 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 US. 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, HS 210, HS 215, or cons instructor.*

HS 370

Emergency Management Strategy & Policy (3,0)

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 230, HS 310, HS 315, or permission of the instructor.*

HS 375

Studies in Transportation Sector Infrastructure and Protection (3,0)

3 Credits

HS 375 will explore 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 210, HS 310, HS 315, or permission of the instructor.*

HS 380

Asymmetric Terrorism: Cyberspace, Technology, and Innovation (3,0)

3 Credits

This course will examine the concept and elements of asymmetric terrorism. Specific contexts examined will include cyber-terrorism, leveraging of technology to advance terrorist agendas, and the importance of innovation and critical thinking in both terrorist and counter-terrorism policy and practice. The principle of asymmetric thinking will be discussed, especially as it applies to terrorist aims and methodologies. Specific examples of the use of cyberspace, technological advances, and innovative techniques will be discussed and analyzed. Terrorist utilization of these areas as a force multiplier will be discussed in light of present and future capabilities.

Prerequisites: *HS 230, HS 315, or permission of the instructor.*

HS 385

Homeland Security Technology and Systems (3,0)

3 Credits

The purpose of this course is to increase the understanding of the fundamentals and basic operating principles of current security systems in use by homeland security agencies, professionals, and industries. Students will learn how various imaging, detection, scanning, or identification systems operate and will develop a deeper understanding of the strengths and weaknesses of each system. Students will have the opportunity to study a given system in depth and to report on ways in which that system could be improved or applied more efficiently in a homeland security context. Subject areas will include, but are not limited to, X-rays, T-rays, metal detectors, biometrics, smart cards, RFID, smart videos, and puffers.

Prerequisites: *PS 104, HS 110 or permission of the instructor.*

HS 405

Emerging Issues in Homeland Security (3,0)

3 Credits

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.

Prerequisites: *Permission of the instructor; 12 hours of HS courses.*

HS 410

Exercise Design and Evaluation in Homeland Security (3,0)

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, HS 315, or permission of the instructor.*

HS 411

Terrorism, Insurgency & Irregular Warfare(3,0)

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, or permission of instructor.*

HS 412

Aviation and Transportation Security: 9/11 and Beyond (3,0)

3 Credits

This course will explore and define the progression of aviation security initiatives since Sept. 11, 2001, by an in-depth look at the history of aviation safety and security regulations before the World Trade Center terrorist attacks of 9/11. The student will be exposed to the current laws, rules, and regulations governing both national and international aviation security and learn how these laws have changed as the terrorist threat to transportation systems in general, and aviation specifically, has expanded and changed in the 21st century. In addition, the organization, function, and interaction of the various governmental and nongovernmental agencies that regulate aviation security, both at home and abroad, will be explored. Specific emphasis will be placed on such issues as the carriage of cargo on commercial aircraft, transportation of HAZMAT by air, determining future threats to the aviation transportation system, and identifying potential countermeasures or controls that could be implemented.

Prerequisites: *HS 210, HS 306, or permission of the instructor.*

HS 417

Transportation Security Issues at Sea and on Land (3,0)

3 Credits

This course will explore the issues regarding security for the maritime, mass transit, highway, railway, and pipeline modes of transportation. Topics including the history of security initiatives, the global impact of transportation modal disruption, and the role of the private sector in transportation security will be explored. Additionally, an in-depth examination will be made into the governmental and nongovernmental agencies that control or impact transportation security, in these modes, both nationally and internationally. Specific emphasis will be placed on interagency cooperation, communication challenges, cargo container security, intermodal transportation security issues, concerns for transportation of HAZMAT, and the threats and countermeasures regarding cargo security in the maritime, rail, and highway environments.

Prerequisites: *HS 210, HS 310, HS 315, or permission of the instructor.*

HS 425

Counter Terrorism Strategy and Policy (3,0)

3 Credits

This course will address strategic-level plans and policies to combat and defeat terrorism. The relationship between terrorism and counter-terrorist (CT) strategies will be discussed. Both international and U.S. domestic CT concepts and strategies will be explored. The evolution and efficacy of current U.S. strategies involving CT will be examined. U.S. policy documents, to include Presidential Decision Directives 39, 62, and 63, will be examined and analyzed in the context of organizational structure and activities in the CT arena. Specific CT initiatives, to include National Guard WMD Civil Support Teams, infrastructure protection, and deterrence measures will be discussed.

Prerequisites: *HS 230, HS 310, HS 315, or permission of the instructor.*

HS 435

International Crime & 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, HS 325, HS 350, or cons instr.*

HS 480

Environmental Security (3,0)

3 Credits

Students will learn how environmental issues may give rise to sociopolitical 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:** WX 201, HS 110 or permission of the instructor.*

HS 490

Practicum in Homeland Security (3,0)

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.

***Prerequisites:** Senior standing, HS 310, HS 315, HS 410, or permisson of the instructor.*

HS 491

Thesis in Homeland Security (3,0)

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.

***Prerequisites:** Junior standing, HS 310, HS 315, HS 350, HS 360, or permission of the instructor.*

HS 299, 399, 499

Special Topics in Homeland Security (3,0)

1-3 Credits

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.

Humanities

Note: Foreign language courses are listed under the Language discipline (L).

The Humanities 140 Series

The HU 140 series constitutes an integral component of the University's General Education Program. This series offers students a variety of choices, with each course fulfilling a lower-level requirement in the humanities. Courses in the HU 140 series emphasize writing, reading, and appreciation skills and are designed to expose students to the complexity of human emotions and experiences. Students also explore the framework of historical and cultural contexts in which artistic and creative expressions have arisen.

In selecting a course from the HU 140 series, students have opportunities to concentrate their studies on one form of cultural expression, such as music, literature, or the visual arts. Others may opt for a course that provides a chronological examination of a cultural expression or a thematic approach to several disciplines in the humanities.

HU 140

Western Humanities I: Antiquity and the Middle Ages (3,0)
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.
Prerequisite: *COM 122.*

HU 141

Western Humanities II: Renaissance to Postmodern (3,0)
3 Credits
A continuation of COM 122 with interdisciplinary emphasis. Traces the evolution of the Western humanistic tradition from the Renaissance to the Postmodern using examples from art, architecture, music, philosophy, and literature. Emphasizes writing, reading, and appreciation skills.
Prerequisite: *COM 122.*

HU 142

Studies in Literature (3,0)
3 Credits
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.
Prerequisite: *COM 122.*

HU 143

Introduction to Rhetoric (3,0)
3 Credits
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.
Prerequisite: *COM 122.*

HU 144

Studies in Art (3,0)
3 Credits
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.
Prerequisite: *COM 122.*

HU 145

Themes in the Humanities (3,0)
3 Credits
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.
Prerequisite: *COM 122.*

HU 146

Music Appreciation and Criticism (3,0)
3 Credits
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.
Prerequisite: *COM 122.*

HU 300

World Literature (3,0)
3 Credits
Major works and literary trends in world literature. Course content varies by instructor and is listed in the Schedule of Courses.
Prerequisite: *Any course from the HU 140 series.*

HU 302

Contemporary Issues in Science (3,0)
3 Credits
This course bridges science and the humanities, examining how different disciplines approach problems of common interest. Students study selected

contemporary issues such as stem cell use in medicine, evolution vs. intelligent design, imminent worldwide crises, DNA engineering, responses to climate change, and possible problems associated with autonomous machines and artificial intelligence. As they examine their own assumptions while participating in debates that encourage appreciation of other viewpoints, students demonstrate understanding of course topics in class discussion and formal papers. The course is team-taught by a Physical Sciences professor and a Communication professor, and will include guest experts on selected topics.

Prerequisite: *COM 221.*

HU 305

Modern Literature (3,0)

3 Credits

The mainstreams of literature of this century. Course content varies by instructor and is listed in the Schedule of Courses.

Prerequisite: *Any course from the HU 140 series.*

HU 310

American Literature (3,0)

3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

HU 316

Studies in Music (3,0)

3 Credits

Musical works, musical instruments, and the important developments in the technology of making the music of a specific style, a group of related styles, or a historical sequence. Social and intellectual context of the music studied. Course content varies from semester to semester and is listed in the Schedule of Courses.

Prerequisite: *One lower-level Humanities course, or Junior standing, or permission of the instructor.*

HU 319

Advanced Speech (3,0)

3 Credits

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.

Prerequisite: *COM 219.*

HU 325

Exploring Film (3,0)

3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

HU 330

Values and Ethics (3,0)

3 Credits

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 devaluating 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.

Prerequisite: *Any course from the HU 140 series.*

HU 335

Technology and Modern Civilization (3,0)

3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

HU 338

Traversing the Borders: Interdisciplinary Explorations (3,0)

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.

HU 341

World Philosophy (3,0)
3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

HU 345

Comparative Religions (3,0)
3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

HU 355

Creative Writing (3,0)
3 Credits

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.

Prerequisite: *Any course from the HU 140 series.*

HU 375

The Nature of Language (3,0)
3 Credits

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.

Prerequisite: *COM 221 or COM 222.*

HU 415

Non-Verbal Communication (3,0)
3 Credits

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.

Prerequisites: *COM 219, equivalent Speech Communications course. (Also offered as COM 415. Students receive either Communication or Humanities credit, but not both.)*

HU 420

Applied Cross-Cultural Communication (3,0)
3 Credits

An examination of the challenges to communicating across the variety of subcultures 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 subcultural differences will be considered.

Prerequisites: *COM 219, COM 221.*

HU 475

Senior Thesis
3 Credits

As the culmination of the student's experience in the interdisciplinary Aerospace Studies major, senior thesis requires the student to complete documented research under the guidance of the course instructor, involving subject matter that is demonstrably tied to at least two of the student's three chosen minor fields of study. A series of seminar discussions or extended individual consultations with the course instructor may accompany the guided writing of the thesis. Additional faculty may be interviewed or consulted during the thesis project.

HU 299, 399, 499

Special Topics in Humanities

1-6 Credits

Individual independent or directed studies of selected topics in the humanities.

Prerequisites: *Consent of the instructor and approval of the department chair.*

Information Technology

IT 210

Web Page Authoring and Design (3,0)

3 Credits

This course will address the organization of the Internet, addressing, routing, DNS, and use of Internet applications. It will review such applications as FTP, telnet, and advanced Web searching methodology. This course covers Web page authoring and design techniques using both HTML and WYSIWYG authoring software. Students will study, create, and refine Web pages online as well as create Web graphics. Lastly, legal and ethical issues related to the Internet and emerging technologies are discussed.

Prerequisite: *BA 120, or BA 221 or CS 120 or CS 223, or approval.*

IT 220

Introduction to Networking (3,0)

3 Credits

Introduction to networking covers each of the seven layers of the OSI reference model, MAC and IP addressing, identification of IP class addressing schemes including subnet masks, network wiring standards, and TCP/IP network layer protocols.

Prerequisite: *BA 120 or BA 221 or CS 120 or approval.*

IT 310

Web Site Management (3,0)

3 Credits

The course addresses effective Web site design including page layout, user interface design, graphic design, content flow, and site structure. Additionally, students will learn the optimal use of keywords and search engine positioning to maximize page exposure. Web site management including security and Intranet management will be discussed. The use of design standards and templates will teach students to emphasize site consistency. Students will design and create a major Web site with multiple pages and cross-linked structure.

Prerequisite: *IT 210.*

IT 320

Network Configurations (3,0)

3 Credits

Introduces the four router elements, configuration vehicles, user and privileged mode commands, configuring IP addresses, and monitoring/troubleshooting of router functions. More advanced topics include LAN switching theory, VLANs, LAN switched design, Novell IPX, and threaded case studies.

Prerequisite: *IT 220.*

IT 330

Programming for the Web (3,0)

3 Credits

This course introduces programming the Common Gateway Interface for Web pages using scripting languages. The emphasis is on the fundamentals of programming and creating interfaces to handle HTML form data. Students will create basic scripting programs with Web interfaces, learn to adapt existing code, and process data flows from online forms with basic database structures.

Prerequisite: *CS 118 or CS 223 or IT 210 or programming experience in a high-level language.*

IT 340

WAN Theory and Design (3,0)

3 Credits

WAN theory and design covers WAN technology, PPP, frame relay, and ISDN. It further discusses network troubleshooting, national SCANS skills, and threaded case studies.

Prerequisite: *IT 320.*

Languages

LCH 101

Mandarin Chinese I (3,0)

3 Credits

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 (3,0)
3 Credits

A continuation of Mandarin Chinese I.

Prerequisite: *Satisfactory completion of Mandarin Chinese I or consent of the instructor.*

LCH 201

Mandarin Chinese III (3,0)
3 Credits

A continuation of LCH 102 with emphasis on communicative abilities in listening, speaking, reading, and writing.

Prerequisite: *Satisfactory completion of Mandarin Chinese II or consent of the instructor.*

LCH 202

Mandarin Chinese IV (3,0)
3 Credits

A continuation of LCH 201.

Prerequisite: *Satisfactory completion of Mandarin Chinese III or consent of the instructor.*

LCH 399, 499

Special Topics in Chinese Language
1-6 Credits

Upper-level study abroad course or directed studies of selected topics in Chinese language.

Prerequisites: *Consent of the instructor and approval of department chair.*

Mathematics

MA 004

Beginning Algebra (4,1)
4 Credits

Fundamentals and theory of algebra including exponents, radicals, factoring, linear equations, rational expressions, quadratic equations, polynomial arithmetic, and solutions to applied problems. One hour lab session per week. (Credit not applicable to any degree.) Required of all students who placed in this course.

MA 006

Intermediate Algebra (3,1)
3 Credits

An intermediate-level algebra course. Topics include fundamental concepts of algebra; linear equations and inequalities; polynomials; rational expressions; exponents and radicals; quadratic equations; functions and graphing; systems of linear equations and inequalities. One-hour lab session per week. (Credit not applicable to any degree.)

Prerequisite: *MA 004 or placement.*

MA 111

College Mathematics for Aviation I (3,0)
3 Credits

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.

Prerequisite: *MA 006 or placement.*

MA 112

College Mathematics for Aviation II (3,0)
3 Credits

Basic calculus designed for the student of aviation. Differentiation and integration of algebraic functions; applications to velocity, acceleration, area, curve sketching, and computation of extreme values.

Prerequisite: *MA 111.*

MA 120

Quantitative Methods I (3,0)
3 Credits

An algebra methods course with applications to business and economics. Operations, relations, functions, modeling, and problem solving; systems of linear equations and inequalities.

Prerequisite: *MA 006 or placement.*

MA 140

College Algebra (3,0)
3 Credits

Fundamentals of exponents, radicals, linear, quadratic, and absolute value equations, inequalities, and complex numbers. Introduction to functions, curve sketching, elementary theory of equations, sequences and series, matrix algebra, and systems of equations.

Prerequisite: *MA 006 or placement.*

MA 142

Trigonometry (3,0)
3 Credits

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.

Prerequisite: *MA 006 or placement.*

Corequisite: *MA 140.*

MA 143

Precalculus Essentials (3,0)

3 Credits

A precalculus course with an emphasis on functions and their graphs, including polynomial, rational, exponential, logarithmic, and trigonometric; radian measure; trigonometric identities and equations; vectors, parametric and polar curves; sequences and series; binomial theorem.

Prerequisite: *MA 006 or placement.*

MA 145

College Algebra and Trigonometry (5,0)

5 Credits

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.

Prerequisite: *MA 006 or placement.*

MA 220

Quantitative Methods II (3,0)

3 Credits

An introduction to the methods and concepts of calculus with applications to business and economics; marginal functions, graphing, extreme values, and area problems. A brief introduction to descriptive statistics.

Prerequisite: *MA 111 or MA 120.*

MA 222

Business Statistics (3,0)

3 Credits

Measures of central tendency and dispersion; histograms; algebra of probability; sample spaces; dependent events; Bayes' Theorem with applications; binomial, Poisson, normal distributions, and their interrelationships; sampling distributions; hypothesis testing; confidence intervals.

Prerequisite: *MA 111 or MA 140.*

MA 241

Calculus and Analytical Geometry I (4,0)

4 Credits

Graphs and functions; limits and continuity; differentiation and integration of algebraic and elementary trigonometric functions; applications of first and second derivatives.

Prerequisite: *MA 140 or MA 145 or equivalent.*

Corequisite: *MA 142.*

MA 242

Calculus and Analytical Geometry II (4,0)

4 Credits

Differentiation and integration of transcendental functions; special integration techniques; polar coordinates; applications of the definite integral; numerical methods.

Prerequisite: *MA 241.*

MA 243

Calculus and Analytic Geometry III (4,0)

4 Credits

Solid analytic geometry; vector functions in three dimensions; elements of infinite series; partial differentiation; directional derivative and gradient; multiple integrals.

Prerequisite: *MA 242.*

MA 245

Applied Differential Equations (3,0)

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: *CS 210, MA 242. (Not for Bachelor of Science degree in Aerospace Engineering credit.)*

MA 270

Computational Mathematics Seminar

1 Credit (can be repeated 2 times)

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.

Corequisite: *MA 241 or permission of the instructor*

MA 320

Decision Mathematics (3,0)

3 Credits

The mathematical concepts and applications in mathematical model building and problem solving. Included are mathematical areas that are basic to decision theory.

Prerequisite: *MA 211 or MA 222. (Not open to engineering students.)*

MA 345

Differential Equations and Matrix Methods (4,0)

4 Credits

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; applications to physics and engineering.

Prerequisite: *MA 243.*

MA 348

Numerical Analysis I (3,0)

3 Credits

Floating point arithmetic, error analysis, algorithms in interpolation, integration, differentiation, matrix algebra, approximation and solution of equations, use of numerical software packages.

Prerequisites: *EGR 115, MA 245 or MA 345.*

MA 350

Partial Differential Equations (3,0)

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.

Prerequisite: *MA 345.*

MA 412

Probability and Statistics (3,0)

3 Credits

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.

Prerequisite: *MA 242.*

MA 432

Linear Algebra (3,0)

3 Credits

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.

Prerequisite: *MA 245 or MA 345.*

MA 441

Mathematical Methods for Engineering & Physics I (3,0)

3 Credits

Line and surface integrals; vector fields with the study of Green, Gauss, and Stokes Theorems; applications of vector field theory; Fourier series.

Prerequisite: *MA 345.*

MA 442

Mathematical Methods for Engineering and Physics II (3,0)

3 Credits

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.

Prerequisite: *MA 441.*

MA 443

Complex Variables (3,0)

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.

Prerequisite: *MA 441.*

MA 444

Scientific Visualization (3,0)

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: *CS 315 and CS 344.*

MA 453

High Performance Scientific Computing (3,0)
3 Credits

This course is an introduction to parallel computing in computational mathematics and sciences with practical applications. We start with an overview of parallel computing and study the problem of program efficiency on parallel computers. Then we introduce two major programming paradigms: shared memory and message passing. The last third of the course will focus on applications of parallel computing in the sciences (Engineering, Physics, Mathematics, etc.).

Prerequisites: *MA 432.*

MA 488

Numerical Methods in Fluids (3,0)
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; primative 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.

Prerequisites: *MA 350 and WX 201.*

Corequisite: *ES 312.*

MA 490

Capstone Project (1,6)
3 Credits

This course is focused on the development of a functioning software product as it applies to a computational problem in the area of aviation and aerospace. Also, material on business practices, professional practices, and ethics is included. Students, working in teams, are involved in management and planning, analysis and specification, design, implementation, and testing of a software system. Project work is assessed using modern industrial software standards and review techniques. Laboratory work includes team building, project reports, walk-throughs and inspections, design activities, process analysis, and acceptance tests.

Prerequisites: *SE 300, MA 444 or MA 453.*

MA 299, 399, 499

Special Topics in Mathematics
1-6 Credits

Individual independent or directed studies of selected topics in mathematics.

Prerequisites: *Consent of the instructor and approval of the department chair.*

Mechanical Engineering

ME 200

Machine Shop Laboratory (0,3)
1 Credit

Introduction to machine shop techniques including familiarization with riveting, sheet metal forming, welding, and machining.

ME 302

Introduction to Robotics (3,0)
3 Credits

This course is an introduction to robotics with emphasis on the mathematical tools for kinematics and dynamics of robot arms. Topics include the geometry and mathematical representation of rigid body motion; forward and inverse kinematics of articulated mechanical arms; trajectory generation, splines, interpolation; manipulator dynamics; position sensing and actuation; and topics in manipulator control. Coursework includes weekly problem sets and computational laboratories (using the Matlab numerical programming environment), a mid-term examination, and a final examination.

Prerequisite: *ES 204.*

Corequisites: *AE 430 or EE 401/402.*

ME 303

Vehicle Dynamics (3,0)
3 Credits

This course covers design considerations for high-performance vehicles such as competition automobiles and high-speed mass transit vehicles. Considered are propulsion, aerodynamics, stability, down force enhancement systems, braking, and handling. Engines for various vehicles are compared, such as the conventional internal combustion engine, the rotary or Wankel, for competition applications and long-life requirements such as traction engines for rail applications. Also investigated are crash safety issues for both mass transit and competition. Guided vehicles such as mass transit trains and the Intelligent Transportation System (ITS) are investigated. Future technologies such as magnetically levitated and very high-speed mass transit systems are analyzed.

Prerequisites: *ES 202, ES 204, and ES 305, or consent of the instructor.*

ME 304

Introduction to Machine Design (3,0)

3 Credits

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, ES 204.*

ME 305

Machine Design Laboratory (0,3)

1 Credit

A companion laboratory to ME 304.

Corequisite: *ME 304.*

ME 306

Robotic Mechanisms (3,0)

3 Credits

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.

Prerequisite: *ES 204.*

ME 307

Energy Conversion and Storage

3 Credits

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 335*

ME 311

Robotics Technologies for Unmanned Systems

3 Credits

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 400

Vibration & Acoustics (3,0)

3 Credits

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, ES 202, and ES 204, or approval of the instructor.*

ME 401

Advanced Fluid Dynamics (3,0)

3 Credits

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.

Prerequisite: *ES 206.*

ME 402

Robotic Arms (3,0)

3 Credits

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.

Prerequisite: *ES 204.*

ME 404

Mechatronics (3,0)

3 Credits

This course includes the application of microprocessors to robotic systems with control. This course emphasizes the integration of aerospace, mechanical, electrical, and computer systems in robotics. Design and integration of microcontrollers, actuators, motors, power systems, and sensors are studied with significant group-oriented design experiments. High-level graphical programming is introduced. Simple autonomous algorithms such as line tracking, edge detection, and path planning are examined with and without feedback control.

Prerequisites: *EE 401, ME 306.*

ME 405

Vehicle Power Systems (3,0)

3 Credits

Modern analytical approach to the design and performance analysis of advanced internal combustion engines. Study of thermodynamics, fluid flow, combustion, and heat transfer. Engines for various vehicles are compared (such as the conventional internal combustion engine, the rotary or Wankel), for competition applications and long-life requirements such as traction engines for rail applications. Fuels and combustion, exhaust flows, emission and air pollution, fuel cell systems, and hybrid vehicles. Ideas from aerospace technologies are implemented, such as jet engines and gas turbines for powering vehicles, and mass transit. Also, future technologies such as magnetically levitated and very high-speed mass transit systems are analyzed. Application of course techniques to engine research projects.

Prerequisite: *ES 305.*

ME 406

Robotics II (3,0)

3 Credits

This course studies the applications and design of robotic systems. Particular emphasis is placed on aviation and space applications of robotics. Typical robotic motion is investigated as well as the requirements for control systems for the needed accuracy, repeatability, and stability. Sensors such as position, force, and acceleration are explored and the signal conditioning circuits and analog-to-digital conversion required for interfacing these sensors. Activating devices such as electric motors, linear actuators, and other motion devices are analyzed. Systems are modeled and control laws are developed. Software for computer-generated control laws are studied.

Prerequisite: *ME 302.*

ME 407

Preliminary Design of Robotic Systems with Laboratory (3,3)

4 Credits

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, 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 306, ME 400.*

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 turbomachinery 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/Corequisites:ES *305, MA 345*

ME 409

Vehicle Aerodynamics (3,0)

3 Credits

Aerodynamic forces on land vehicles. Design requirements for lift, drag, stability, and safety for passengers. Cars, high-performance vehicles, commercial, and motorcycles. Noise control, heating, ventilation, and air conditioning. Engines for various vehicles are compared (such as the conventional internal combustion engine, the rotary or Wankel), for competition applications and long-life requirements such as traction engines for rail applications. Fuels and combustion, exhaust flows, emission and air pollution, fuel cell systems, and hybrid vehicles. Ideas from aerospace technologies are implemented, such as jet engines for powering vehicles and the use of computational fluid dynamics codes to predict the aerodynamic performance of such vehicles. Also, future technologies such as magnetically levitated and very high-speed mass transit systems are analyzed.

Prerequisites: *ES 201, ES 204, ES 206, ES 305.*

ME 410

Advanced Machine Design (2,0)

2 Credits

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, 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/Corequisites:ES *305, MA 345*

ME 413

Preliminary Design of High Performance Vehicles with Laboratory (3,3)

4 Credits

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 303, ME 400.*

ME 414

Preliminary Design in Clean Energy

3 Credits

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 400*

ME 415

Modeling and Numerical Simulations of Energy and Environmental Systems (3,0)

3 Credits

The course introduces students to the basic methods of numerical modeling for typical physical problems encountered in solid mechanics, thermal/fluid sciences, energy, and environmental systems. Students will learn how to formulate a model in terms of an analgebraic or differential equation. Problems that can be solved analytically will be chosen initially and solutions will be obtained by appropriate discrete methods. Basic concepts in numerical methods, such as convergence, stability, and accuracy, will be introduced. Various computational tools will then be applied to more complex problems, with emphasis on finite element and finite difference methods, finite volume techniques, boundary element methods, and gridless Lagrangian methods. Methods of modeling convective nonlineariaties, such as upwind differencing and the Simpler method, will be introduced. Discussion of structural mechanics, internal/external fluid flows, and conduction and convection heat transfer. Steady state, transient, and eigenvalue problems will be addressed with emphasis on aerospace power and environmental systems.

ME 417

Advanced Propulsion (3,0)

3 Credits

Jet engines are analyzed in depth using the fundamental principles developed in AE 408 and by extensive computer programs. Parametric engine cycle analysis will investigate both ideal and engines with losses. The performance of a particular actual jet engine will be analyzed to determine how its performance is affected by operational conditions (altitude, throttle positions). In addition to the turbojet, turbofan, turboprop, and turboshaft family of jet engines, the scramjet will be analyzed.

Prerequisite: *AE 408.*

ME 419

Senior Design in Clean Energy

3 Credits

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 400*

ME 423

Senior Design of High Performance Vehicles (3,0)

3 Credits

This is a continuation of the preliminary design course and is the capstone course for the degree.

ME 426

Propulsion III (2,0)

2 Credits

Engines to provide the propulsion for general aviation aircraft are analyzed. While the standard Otto Cycle engines using avgas have served general aviation well, the fuel crisis and the environmental issues around the over 14,000 suburban airports in the United States have resulted in numerous proposals for new engines. The course will study the various options: electrical, diesel, rotary, turboprop, turbofan, as well as modifications to the conventional spark-ignition engine.

Prerequisites: *AE 408, ES 305.*

ME 427

Senior Design of Robotic Systems (3,0)

3 Credits

This is a continuation of the preliminary design course and is the capstone course for the degree.

ME 430L

Control Systems Laboratory (0,3)

1 Credit

A companion laboratory for AE 430.

ME 199-499

Special Topics in Mechanical Engineering

1-3 Credits

Individual independent or directed studies of selected topics in Mechanical Engineering.

Prerequisite: *Consent of the instructor or the department chair.*

Military Science Army ROTC

MSL 101

Basic Military Science I (1,0)

1 Credit

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.

Corequisite: MY 103 Laboratory.

MSL 101L

Basic Military Science I Laboratory (0,1.5)

0 Credit

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 (1,0)

1 Credit

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.

Corequisite: *MY 104 Laboratory.*

MSL 102L

Basic Military Science II Laboratory (0,1.5)
0 Credit

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 201

Basic Military Leadership I (1,0)
2 Credits

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.

Corequisite: *MY 203 Laboratory.*

MSL 201L

Basic Military Leadership I Laboratory (0,1.5)
0 Credit

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 (1,0)
2 Credits

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.

Corequisite: *MY 204 Laboratory.*

MSL 202L

Basic Military Leadership II Laboratory (0,1.5)
0 Credit

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 301

Officership I (3,0)
3 Credits

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.

Prerequisites: *Completed basic military science (or given constructive credit) and be a contracted Army ROTC cadet.*

Corequisite: *MY 303 Laboratory.*

MSL 301L

Officership I Laboratory (0,2.5)
0 Credit

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 (3,0)

3 Credits

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.

Prerequisite: *MY 303.*

Corequisite: *MY 304 Laboratory.*

MSL 302L

Officership II Laboratory (0,2.5)

0 Credit

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 drownproofing. The Army Physical Fitness Test (APFT) is administered to assess the state of physical development.

MSL 401

Advanced Military Leadership I (3,0)

3 Credits

A study of military professionalism with emphasis on command and staff relationships, organizational functions, and duties of various staff officers who assist in the leadership of the organization. A study of personnel and logistical systems and the role they play in helping the organization optimize operations and improve life in the Army community. Training in staff briefings will be used as an introduction to military procedures. This course includes lecture, laboratory, and physical readiness training.

Corequisite: *MY 403 Laboratory.*

MSL 401L

Advanced Military Leadership I Laboratory (0,2.5)

0 Credit

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.

MSL 402

Advanced Military Leadership II (3,0)

3 Credits

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.

Corequisite: *MY 404 Laboratory.*

MSL 402L

Advanced Military Leadership II Laboratory (0,2.5)

0 Credit

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 199-499

Special Topics in Military Science (3,0)

1-3 Credits

Individual independent or directed studies of selected topics in general military science.

Prerequisites: *Consent of the instructor and approval of professor of military science.*

Naval Science

NSC 100

Naval Science Lab

0 Credit

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 (2,0)

2 Credits

Introduction to the naval service with emphasis on the mission, organization, regulations, and components of the Navy and Marine Corps. Must be completed during the freshman year. Required for all midshipmen.

NSC 102

Seapower and Maritime Affairs (3,0)

3 Credits

This course provides an understanding of the significance of sea power throughout history from the Phoenicians to 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. Midshipmen with the exception of Nurse Corps options are required to take this course in the spring of the first year. Nurse Corps option midshipmen may take the course during their second year.

NSC 201

Principles of Naval Leadership and Management (3,0)

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.

Prerequisite: *NSC 100.*

NSC 202

Navigation (3,0)

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. Midshipmen with the exception of Nurse Corps and Marine Corps options are required to take this course.

Corequisite: *NSC 202L.*

NSC 202L

Navigation Laboratory

1 Credit

Laboratory work in piloting and celestial navigation to complement Naval Science 202. One hour per week. Required for all Navy option midshipmen. Not required for Nurse Corps and Marine Corps option midshipmen. (Fall term only.)

NSC 301

Naval Engineering (3,0)

3 Credits

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 or higher and PS 103. Required for Navy option midshipmen; not required for Nurse Corps and Marine Corps option midshipmen.*

NSC 302

Naval Weapons Systems (3,0)

3 Credits

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 Nurse Corps or Marine Corps option midshipmen.

NSC 310

Evolution of Warfare (3,0)

3 Credits

Survey of military history emphasizing principles of warfare, strategy and tactics, and significant military leaders and organizations. May be taken in the

Sophomore or Junior year. Required for all Marine Corps option midshipmen. Not required for Navy option or Nurse Corps midshipmen.

NSC 311

Amphibious Warfare (3,0)
3 Credits
The history of amphibious warfare emphasizing doctrine and techniques. May be taken in the junior or senior year. Required for all Marine Corps midshipmen.

NSC 401

Naval Operations & Seamanship (3,0)
3 Credits
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. Midshipmen with the exception of Nurse Corps and Marine Corps options are required to take this course. (Spring term only.)

Corequisite: *NSC 401L.*

NSC 401L

Naval Operations and Seamanship Laboratory
1 Credit
Laboratory work in maneuvering board (vector analysis) and communications, and conflict resolution to complement NSC 401. One hour per week. Required for all Navy option midshipmen. Not required for Nurse Corps and Marine Corps option midshipmen.

NSC 402

Principles of Naval Management II/ Leadership and Ethics (3,0)
3 Credits
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. Required for all midshipmen.

Physical Education

PE 110

Lifetime Fitness and 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 101

Basic Chemistry (3,1.5)
3 Credits
Elementary chemical theory. Covers basic atomic theory, elements, compounds, and mixtures, calculation of weight and weight volume relationships, and basic descriptive chemistry. One 1.5-hour laboratory session per week. (Cannot be used for credit in chemistry toward a degree in Aerospace Engineering.) Passing grade required for Lab. Students who take PS 108 may not also take PS 101.

Prerequisite: *MA 111 or corequisite: MA 140.*

PS 102

Explorations in Physics (3,0)
3 Credits
Survey course in elementary physics. Stress will be placed on basic concepts, principles, and history of the development of physics. Presentations will include selected topics in mechanics, heat, light, sound, electricity and magnetism, and modern physics. (Cannot be used for credit in physics toward degrees in Computer Science, Engineering Physics, Civil, Aerospace, or Electrical Engineering, or Aeronautical Science.)

Prerequisite: *MA 111.*

PS 103

Technical Physics I (3,0)
3 Credits
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.)

Prerequisite: *MA 111 or MA 140.*

Corequisites: *MA 112 or MA 241; PS 103L.*

PS 103L

Technical Physics I Laboratory (0,1)

0 Credit

Techniques for data analysis and laboratory methods in the context of experiments dealing with Newton's laws, energy, and rotational motion. This laboratory is designed to complement PS 103.

Corequisite: *PS 103.*

PS 104

Technical Physics II (3,0)

3 Credits

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, MA 112, or MA 241.*

Corequisite: *PS 104L.*

PS 104L

Technical Physics II Laboratory (0,1)

0 Credit

Techniques for data analysis and laboratory methods in the context of experiments dealing with oscillatory motion, sound, heat, fluids, and electricity. This laboratory is designed to complement PS 104.

Corequisite: *PS 104.*

PS 105

General Chemistry I (3,3)

4 Credits

Fundamental principles of chemistry that include nomenclature, stoichiometry, atomic structure, periodic relationships, chemical bonding, geometry of molecules, properties of gases, solutions, and an introduction to organic chemistry. Laboratory includes both descriptive and quantitative work. Students who have not taken high school chemistry are strongly urged to take PS 101 first.

Prerequisites: *High school chemistry, MA 111 or MA 120 or MA 140 or their equivalents.*

PS 107

Elements of Biological Science (3,0)

3 Credits

An introductory science course in general biology. Emphasis is placed on human anatomy, and on the chemical and biological foundations of human physiology. Provides background material that supports life science applications courses. Required for the minor in Aerospace Life Sciences.

PS 107L

Biological Science Laboratory (0,3)

1 Credit

Students will perform fundamental experiments to supplement discussions of selected topics in PS 107 (Elements of Biological Science). Experiments will include use of the compound microscope to examine living and non-living cells and tissues, studies of DNA and chromosomes during mitosis and meiosis, and other types of biologically important compounds, and cell structure and transformation. Students will also measure their own pulse rate, blood pressure, and respiratory capacity.

Corequisite: *PS 107.*

PS 140

Chemistry for Engineers (4,0)

4 Credits

Chemical stoichiometry, states of matter, solutions, thermodynamics, rate of reaction, equilibrium, oxidation-reduction, corrosion, organic compounds, and polymers.

Prerequisite: *High school chemistry or PS 101.*

Corequisite: *PS 141.*

PS 141

Chemistry for Engineers Laboratory (0,3)

1 Credit

One three-hour laboratory session per week, with experiments paralleling the material of PS 140.

Corequisite: *PS 140.*

PS 142

Introduction to Environmental Science (3,0)

3 Credits

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.

PS 150

Physics for Engineers I (3,0)
3 Credits

Vectors and scalar quantities, geometrical optics, kinematics, Newton's Laws of Motion, work, work-energy, conservation of energy, conservation of momentum, center of mass and its motion.

Corequisite: *MA 241.*

PS 160

Physics for Engineers II (3,0)
3 Credits

Special theory of relativity, rotational motion, simple harmonic motion, waves, fluids, heat, kinetic theory, and thermodynamics.

Prerequisite: *PS 150.*

Corequisite: *MA 242.*

PS 208

Physics II (3,0)
3 Credits

Fluids, temperature, heat, first and second laws of thermodynamics, wave motion, and acoustics.

Prerequisites: *MA 242, PS 215, PS 216.*

Corequisite: *MA 243.*

PS 210

Physics II Laboratory (0,1)
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.

Corequisite: *PS 208*

PS 215

Physics I (3,0)
3 Credits

Estimations, order of magnitude analysis, Newton's Law, gravitation, kinematics, work and energy, momentum, rotation, and harmonic motion.

Prerequisite: *MA 241.*

Corequisites: *MA 242, PS 216.*

PS 216

Physics I Laboratory (0,3)
1 Credit

One three-hour laboratory session per week, with experiments chosen primarily from mechanics.

Corequisite: *PS 215.*

PS 219

Physics III (3,0)
3 Credits

Static electricity, Gauss's Law, potential, Ohm's Law, direct current circuits, magnetic fields, induced electromotive force, inductance, EM waves, the nature of light, images formed by mirrors and lenses and optical instruments.

Prerequisites: *MA 243, PS 208.*

Corequisite: *PS 220.*

PS 220

Physics III Laboratory (0,3)
1 Credit

One three-hour laboratory session per week with experiments chosen primarily from thermodynamics, electricity and magnetism, and geometric optics.

Prerequisites: *MA 243 and PS 208.*

Corequisite: *PS 219.*

PS 250

Physics III for Engineers (3,0)
3 Credits

Gravitational fields, electric fields and magnetic fields, Gauss's law, electric potential, linear accelerators, cyclotrons, capacitors, Ohm's law, Kirchoff's laws, Ampere's law, Faraday's law, Lenz's law, Maxwell equations, and selected topics from modern physics.

Prerequisites: *MA 242, PS 160.*

PS 253

Physics Laboratory for Engineers (0,3)
1 Credit

One three-hour session per week. Experiments will vary from semester to semester, but will be chosen from laboratory report writing workshop, error analysis, damped harmonic oscillations, spectrometers, optics, fiber optics, atomic physics, thermodynamics, and R-C circuit theory.

Corequisite: *PS 250.*

PS 290

Physics Laboratory Practicum (0,1)
0 Credit

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.

Prerequisite: *COM 219.*

PS 301

Astronomy (3,0)
3 Credits

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.

Prerequisite: *PS 102 or PS 103 or PS 150 or PS 215.*

PS 302

Evolution of Scientific Thought (3,0)
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 SS 302. Students receive either Social Sciences elective credit or Physical Sciences elective credit, but not both.)

Prerequisites: *Either HU 140 or HU 141 or HU 142 and either PS 101 or PS 102 or PS 103 or PS 150 or PS 215.*

PS 303

Modern Physics (3,0)
3 Credits

Modern concepts in physics including optics. Topics include refraction, diffraction, and scattering of electromagnetic radiation, special relativity, wave-particle duality, the uncertainty principle, quantum theory of atomic structure, X-rays, lasers, and nuclear reactions.

Prerequisite: *PS 219.*

PS 305

Modern Physics Laboratory (0,3)
1 Credit

Experiments in atomic and nuclear physics, including spectroscopy, nuclear particle analysis, X-ray analysis, and laser applications.

Prerequisite: *PS 220.*

Corequisite: *PS 303.*

PS 320

Classical Mechanics (3,0)
3 Credits

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, PS 219.*

Corequisite: *PS 303.*

PS 335

Nanomaterials and Nanoscience (3,0)
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; the large number of applications that employ nanomaterials; and nanotoxicology.

Prerequisites: *PS 105 or PS 140; PS 219 or PS 250; MA 242.*

PS 400

Senior Physics Laboratory I (2,3)
3 Credits

Study of geometrical and physical optics including plane waves, mirrors, lenses, emission and absorption line spectroscopy, diffraction gratings, lasers, and interferometers.

Prerequisite: *PS 305.*

PS 401

Astrophysics (3,0)
3 Credits

Study of the basic physical processes operating in the astronomical environment, stellar structure and evolution, the interstellar medium, galaxies, and cosmology. Astrophysical concepts are emphasized, thus underlining the common features operating in many astronomical systems.

Prerequisites: *MA 345, PS 303.*

PS 405

Atomic/Nuclear Physics (3,0)
3 Credits

Multi-electron atoms, X-rays and gamma rays, radiative transitions in the atom and the nucleus. Basic properties of nuclei, systematics of nuclear stability, dynamics of nuclear reactions, nuclear models, and nuclear forces. Introduction to particle physics and its applications to cosmic rays, stellar energy, and the formation of the elements.

Prerequisite: *EP 440.*

PS 408
Astrophysics II (3,0)
3 Credits
Radiative transfer in astrophysical environments; stellar atmospheres, stellar interiors, and gaseous nebulae. Emission and absorption processes. Interaction of radiation with matter.

Prerequisite: *MA 345, PS 401, or permission of the instructor.*

PS 410
Senior Physics Laboratory IIa (2,3)
3 Credits
Binary stars, spectroscopic binaries, proper motion, galaxy rotation curves, image processing.

Prerequisites: *PS 400, PS 401.*

PS 199, 299, 399, 499
Special Topics in Physical Science
1-4 Credits
Individual independent or directed study of topics in the fields of the physical sciences impinging on aerospace development or practices that are of current or anticipated interest.

Prerequisites: *Consent of the instructor and approval of the department chair.*

Psychology

PSY 101
Introduction to Psychology (3,0)
3 Credits
A survey of the biopsychosocial continuum and the intrapsychic, interpersonal, and organizational factors affecting human behavior. A primary feature of the course is its focus on the scientific method as the route to psychological knowledge. Students study the rationalist, empiricist, and experimental foundations of the scientific method and how these foundations can be critiqued. Topics include sensation, perception, learning, memory, personality, psychopathology, physiological psychology, and social processes. Emphasis is placed on the application of the basic principles of psychology to engineering, aviation, public policy, and business.

PSY 310
Sensation and Perception (2,1)
3 Credits
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.

Prerequisite: *PSY 101.*

PSY 312
Research Analysis in Psychology (3,2)
4 Credits
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, corelational 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, PSY 101.*

PSY 315
Cognitive Psychology (3,0)
3 Credits
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.

Prerequisite: *PSY 101.*

PSY 320
Aviation Psychology (3,0)
3 Credits
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.

Prerequisite: *PSY 101.*

PSY 322

Research Design (3,1)

4 Credits

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.

Prerequisite: *PSY 30X.*

PSY 335

Physiological Psychology (2,1)

3 Credits

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.

Prerequisite: *PSY 101.*

PSY 340

Industrial-Organizational Psychology (3,0)

3 Credits

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 intrapersonal behavior, such as motivation, job stress, and job satisfaction.

Prerequisite: *PSY 101.*

PSY 345

Training and Development (3,0)

3 Credits

A review of the principles and techniques applicable to training and training development.

Prerequisite: *PSY 101.*

PSY 350

Social Psychology (3,0)

3 Credits

This course examines the interactional forces between groups and the individual in society. Since the major focus of the course is on social interactions, such diverse topics as group dynamics, interpersonal relationships, prejudice, discrimination, and antisocial behavior will be considered. Special attention is given to the topic of stress in the aviation environment.

Prerequisite: *PSY 101.*

PSY 365

Abnormal Psychology (3,0)

3 Credits

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.

Prerequisite: *PSY 101.*

PSY 400

Introduction to Cognitive Science (3,0)

3 Credits

An introduction to the science of the mind from the perspective of cognitive psychology, linguistics, neuroscience, philosophy, and artificial intelligence. The focus is on the similarities and differences in the approach taken by researchers in these different fields in their study of cognitive mechanisms. Issues to be addressed: What does it mean to be able to think? What kind of computational architecture is most appropriate to describe cognitive mechanisms? Is the mind an emergent property of the brain? What kind of hardware is required for thinking to occur? Can a computer have a mind?

Prerequisite: *PSY 315.*

Software Engineering

SE 300

Software Engineering Practices (3,3)
4 Credits

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.

Prerequisite: *CS 225.*

SE 310

Analysis and Design of Software Systems (3,0)
3 Credits

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: *CS 315, SE 300.*

SE 320

Software Construction (3,0)
3 Credits

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: *CS 315, SE 300.*

SE 410

Formal Software Modeling (3,0)
3 Credits

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 (for example, 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, SE 300.*

SE 420

Software Quality Assurance (3,0)
3 Credits

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.

Prerequisite: *SE 300.*

SE 450

Software Team Project I (2,3)
3 Credits

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: *Senior standing, SE 310, SE 320.*

SE 451

Software Team Project II (1,6)

3 Credits

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).

Prerequisites: *SE 410 and SE 450.*

Corequisite: *SE 420.*

SE 299, 399, 499

Special Topics in Software Engineering

1-6 Credits

Individual independent or directed studies of selected topics in software engineering.

Prerequisites: *Consent of the instructor and the department chair.*

Safety Science

SF 201

Introduction to Health, Occupational, and Transportation Safety (3,0)

3 Credits

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 (3,0)

3 Credits

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.

SF 210

Introduction to Aerospace Safety (3,0)

3 Credits

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 309

Aeronautics & Performance for Air Safety Investigators

3 Credits

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, SF 210*

SF 315

Environmental Compliance and Safety

3 Credits

This course examines matters associated with health and safety relating to the environment, including air and water quality and sanitation. The course concentrates on hazardous materials, their storage, handling, and transportation by air, rail, marine, and highway. Additional study includes waste management and cleanup as well as a detailed study of environmental laws, regulations, and the protection of workers involved in activities associated with hazardous materials.

SF 316

Workers' Compensation, Insurance, and Risk Management (3,0)

3 Credits

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.

SF 320

Human Factors in Aviation Safety (3,0)

3 Credits

An examination of the major human causative agent in aircraft accidents: the human being. Emphasis is placed on the psychology and physiologic factors that enhance accident probability. Included is a detailed analysis of ergonomics (human engineering) and its influence.

SF 325

Human Factors and Ergonomics I (3,0)

3 Credits

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 (3,0)

3 Credits

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 followup work designed to avoid similar or related aircraft accidents.

Prerequisite: *SF 201 or SF 210 or approval.*

SF 335

Mechanical and Structural Factors in Aviation Safety (3,0)

3 Credits

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.

Prerequisite: *SF 330.*

SF 341

Safety and Security of Airport Ground Operations

3 credits

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

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, PS 104*

SF 345

Safety Program Management (3,0)

3 Credits

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.

Prerequisite: *SF 201 or SF 210 or approval.*

SF 350

Aircraft Crash and Emergency Management (3,0)

3 Credits

Theories, practices, and techniques used in the response phase of aircraft crashes and emergencies are explored. Designed as a real-world introduction to the field of emergency response at the Code of Federal Regulation (CFR) agency level, the airport response and administration levels, and related and associated entities involved in aircraft mishaps.

SF 355

Industrial Hygiene and Toxicology (3,0)

3 Credits

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.

Prerequisite: *SF 201 or approval.*

SF 365

Fire Protection (3,0)

3 Credits

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.

SF 375

Propulsion Plant Investigation (3,0)

3 Credits

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.

Prerequisite: *SF 330.*

SF 380

Internship I (3,0)

3 Credits

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 201, SF 315, SF 355, SF 410, or approval.*

SF 405

Applications in Industrial Hygiene (3,0)

3 Credits

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.

Prerequisite: *SF 355 or approval.*

SF 410

Design of Engineering Hazard Controls (3,0)

3 Credits

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.

Prerequisite: *SF 201 or approval.*

SF 420

Analysis of Observational Data (3,0)

3 Credits

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.

Prerequisite: *MA 222.*

SF 435

Aircraft Crash Survival Analysis and Design (3,0)

3 Credits

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.

Prerequisite: *SF 335 or approval.*

SF 440

Design of Engineering Hazard Controls II (3,0)

3 Credits

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.

Prerequisite: *SF 201 or approval.*

SF 445

System Safety in Aviation (3,0)

3 Credits

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.

SF 450

Internship II (3,0)

3 Credits

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.

Prerequisite: *SF 380.*

SF 462

Health, Safety, and Aviation Law (3,0)

3 Credits

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.

SF 470

Applications of Safety Management Capstone

3 Credits

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, SF 462*

Corequisite: *SF 445*

SF 475

Senior Project (3,0)

3 Credits

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 299-499
Special Topics in Aviation Safety
1-3 Credits

Individual independent or directed studies of selected topics in aviation or non-aviation safety topics.

Prerequisites: *Approval of program chair and department chair, consent of the instructor, and 12 hours of SF courses.*

Simulation

SIM 200
Aviation Simulation Systems (3,0)
3 Credits

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 proprioceptive, 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 derivates will be discussed at length.

Prerequisite: *MA 345.*

Corequisite: *AE 302.*

SIM 400
Instrumentation for Flight Test (3,0)
3 Credits

Advanced instrumentation setups for aircraft flight testing. The following aircraft quality transducers will be discussed theoretically: accelerometers, rate gyros, strapdown 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.

Pre/Corequisites: *SIM 300, MA 345, or AE 413.*

SIM 402
Introduction to Flight Testing (3,0)
3 Credits

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 or equivalent, SIM 200.*

SIM 404
Fly-By-Wire Aircraft Simulation and Design (3,0)
3 Credits

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, MA 345.*

SIM 405
Simulation Visual Systems (3,0)
3 Credits

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 department's global database.

Prerequisite: *SIM 200.*

SIM 406

Aviation Simulation Systems Integration (3,0)

3 Credits

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.

Prerequisite: *At least one of the following: AE 413, AS 340, HF 310, SIM 300.*

SIM 412

Operational Applications in Simulation

4 Credits

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.

Prerequisite: *SIM 200*

Space Studies

SP 110

Introduction to Space Flight (3,0)

3 Credits

A survey of the major aspects of space flight. Topics covered include the history of space flight, space shuttle operations, and present and future commercial, industrial, and military applications in space.

SP 200

Planetary and Space Exploration (3,0)

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 (3,0)

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 (3,0)

3 Credits

This course is designed to provide a brief study of the space station's flight operations, its supporting elements, and planned systems. The survey study will include commercial applications, logistical support, and maintenance and servicing design concepts at the introductory level.

SP 300

Satellite and Spacecraft Systems (3,0)

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.

Prerequisite: *MA 112 or equivalent.*

SP 340

Russian Space Operations and Technology (3,0)

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 400

Introduction to Space Navigation (3,0)

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 or equivalent.*

SP 425

Selected Topics in Space and Aerospace (3,0)

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 and any two SP courses or equivalent.*

SP 299, 399, 499

Special Topics in Space Studies

1-3 Credits

Individual independent or directed studies of selected topics in space studies related topics.

Prerequisites: *Consent of the instructor and approval of department or program chair. May be repeated with a change of subject.*

Social Sciences

SS 110

World History (3,0)

3 Credits

Designed primarily as a survey of the development and evolution of Western civilization from l500 to the present. Emphasis is placed on the effect of Western influence on the world.

SS 120

U.S. History (3,0)

3 Credits

From 1865 to the present. Reconstruction, the age of big business, the United States as a world power. World War I, World War II, the Great Depression and its aftermath.

SS 130

History of Aviation in America (3,0)

3 Credits

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 302

Evolution of Scientific Thought (3,0)

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: *Any course from the HU 140 series and either PS 101 or PS 102 or PS 103 or PS 150 and PS 215.*

SS 310

Personality Development (3,0)

3 Credits

A survey of selected theories of human nature and functioning from the beginning of modern psychology to present developments, including psychodynamic, cognitive, behavioral, biological, humanistic, and other types. Various concepts of personality and the associated methodologies for gathering and validating knowledge are explored. Theories are applied to normal issues in personal, professional, and relational life, and theory-related skills are taught for self-awareness, problem solving, habit change, and emotional and interpersonal competence.

SS 311

U.S. Military History 1775-1900 (3,0)

3 Credits

Military history with emphasis on military policy, organization, and technology as they relate to U.S. political, social, and economic developments from 1775 to 1900.

Prerequisite: *SS 110 or SS 120 or permission of the instructor.*

SS 320

Government of the U.S. (3,0)

3 Credits

Basic issues of American democracy, constitutional principles, and the executive, legislative, and judicial branches of government.

Prerequisite: *SS 110 or SS 120 or permission of the instructor.*

SS 321

U.S. Military History 1900-Present (3,0)

3 Credits

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: *SS 110 or SS 120 or permission of the instructor.*

SS 325

International Studies (3,0)

3 Credits

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: *SS 110 or SS 120 or permission of the instructor.*

SS 326

Russian-U.S. Relations (3,0)

3 Credits

This course explores the development of Russian-American economic and political relations, emphasizing the era of the 20th century.

Prerequisite: *SS 110 or SS 120 or permission of the instructor.*

SS 331

Current Issues in America (3,0)

3 Credits

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: *SS 110 or SS 120 or permission of the instructor.*

SS 333

U.S.-Asian Relations (3,0)

3 Credits

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 developmental history course or Junior standing.*

SS 334

Contemporary Africa and the World (3,0)

3 Credits

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: *SS 110 or SS 120 or permission of professor.*

SS 336

The Modern Middle East in World Affairs (3,0)

3 Credits

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: *SS 110 or SS 120 or permission of professor.*

SS 337

Globalization and World Politics (3,0)

3 Credits

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; transborder issues and the role of the state; multinational corporations; labor and the terms of international trade; issues of environmental degradation; international organizations and non-governmental organizations in global affairs; terrorism, global crime and international security; human rights, democracy, and cultural nationalism; and technology and global communication.

Prerequisite: *SS 110 or SS 120 or permission of the instructor.*

SS 340

U.S. Foreign Policy (3,0)

3 Credits

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 and the role each plays in policy formulation. Emphasis is on the period since World War II.

Prerequisite: *SS 110 or SS 120 or permission of the instructor.*

SS 350

Psychology of Relationships (3,0)

3 Credits

Empirical, theoretical, and practical knowledge of the components of intimate relationships, involving friendship, romance, marriage, divorce, and non-traditional relationships, and embedded in lifespan development. Disciplines include social, behavioral, clinical, family, and biological psychology, as well as , sociology, anthropology, sociobiology, and neuroscience. Consideration of how relationships knowledge is gathered and interpreted, along with the social and political consequences of such knowledge for relationship descriptions, prescriptions, and power. Development of self-awareness and interpersonal skills through writing, experiential exercise, improvisational drama, and communication games.

SS 353

Early U.S. Diplomacy (3,0)

3 Credits

This course explores the cultural, economic, political. and social aspects of U.S. foreign policy from the Colonial Era through World War I.

Prerequisite: *SS 110, SS 120, or SS 130.*

SS 363

Inter-American Relations (3,0)

3 Credits

This course explores the development of U.S. political and economic relations with Latin America from their beginning in the 19th century to the present.

Prerequisite: *SS 110 or SS 120 or SS 130 or Junior standing.*

SS 299, 399, 499

Special Topics in the Social Sciences

1-6 Credits

Individual independent or directed study of selected topics in the areas of history, sociology, psychology, and human culture in general.

Prerequisites: *Consent of the instructor and approval of the department chair.*

Systems Engineering

SYS 301

Introduction to Systems Engineering (3,0)

3 Credits

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.

Prerequisite: *MA 243.*

SYS 302

System Engineering Design Considerations (3,0)

3 Credits

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.

Prerequisite: *SYS 301.*

SYS 303

Optimization in Systems Engineering (3,0)

3 Credits

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.

Prerequisite: *SYS 301.*

SYS 304

Systems Engineering in Management, Risk, and Decision Making (3,0)

3 Credits

An understanding of the decision-making process usually requires simplification of the complexity facing the systems engineer and associated decision-making. This course examines methods such as modeling and simulation (M&S) for identifying/generating alternatives, evaluating their outcomes in terms of risk and benefit, and ultimately providing management authority with options and recommendations on such alternatives to support effective decision-making. Topics include both technical and economic evaluation models and methods. The course also emphasizes the importance of program controls (for example, PERT) and system configuration control.

Prerequisites: *EC 225, SYS 301.*

SYS 403

Systems Engineering Life Cycle Costing (3,0)

3 Credits

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.

Prerequisite: *SYS 304.*

SYS 405

Aerospace Systems Guidance and Control (3,0)

3 Credits

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.

Prerequisite: *EE 401 or equivalent control systems course.*

SYS 410

Space Systems and Mission Analysis (3,0)

3 Credits

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).

Prerequisite: *SYS 403 or permission of the instructor.*

SYS 417

Senior Systems Engineering Project (3,0)

3 Credits

This is the capstone course for the Systems Engineering track. The project will involve setting system characteristics, specifications, interfaces, and so on, and planning and scheduling the design process. Complete analysis is required from performance, costs, and reliability. Although an electrical component is dominant, other disciplines such as software, mechanical, and fluid will be involved. The course requires the completion of a detailed project document package.

Prerequisite: *SYS 403 or permission of the instructor.*

SYS 299, 399, 499

Special Topics in Systems Engineering

1-6 Credits

Individual, independent or directed studies of selected topics in systems engineering.

Prerequisites: *Concent of the instructor and the department chair.*

College Success

UNIV 101

College Success (2,0)

1 Credit

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.

Applied Meteorology

WX 201

Survey of Meteorology (3,0)

3 Credits

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, weather observations and data, energy and energy transfer in the atmosphere, seasonal and daily controls on temperature, atmospheric moisture, fog, clouds, atmospheric stability, precipitation, icing, atmospheric pressure, winds, local and regional circulations, the general circulation pattern, jet streams, turbulence, air masses, fronts, mid-latitude cyclones, thunderstorms, tropical cyclones, and climate change.

Prerequisite: *MA 006 or math equivalent.*

WX 210

Introduction to Geographic Information Systems (3,0)

3 Credits

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.

WX 215

Physical Geography (2,1)

3 Credits

Students will acquire a thorough comprehension of various physical and chemical forces that sculpt the landscape. From alluvial fans and distinct dune formations of the arid and semi-arid West to the karst terrain of the humid East, these features reveal a rich history of climatological conditions. A greater understanding of weathering processes and the resultant landforms should lead to a heightened appreciation of geophysical properties and products.

Prerequisite: *WX 201.*

WX 261

Applied Climatology (2,1)

3 Credits

An in-depth survey of the varied climates of the world and the associated biomes, the weather systems that contribute to those climates, and their cumulative influence on people and places. Included is a historical perspective of how climate is changing, the radiative forcing mechanisms that are involved, and the paleoclimate data used for analysis. Climate controls, including latitude, altitude, continentality, ocean currents, and land/water differences, are analyzed. Emphasis is placed on developing a broad-based working knowledge of the impacts present-day climate variability has on society.

Prerequisite: *WX 201.*

WX 270

Weather Information Systems (3,0)

3 Credits

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.

Prerequisite: *WX 201.*

WX 280

Introduction to TV Weathercasting (2,1)

3 Credits

This course introduces the student to the world of broadcast meteorology. Using the most modern of facilities in our state-of-the-art building, students will learn to prepare and present TV presentations. A local on-camera meteorologist will help instruct, critique, and assist other faculty in making weather come alive on the University's local cable network.

Prerequisites: *WX 201 and COM 219.*

WX 301

Aviation Weather (2,1)

3 Credits

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.

Prerequisite: *WX 201.*

WX 310

Advanced Geographic Information Systems (2,1)

3 Credits

Advanced GIS is designed to further develop the concepts and principles learned in WX 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.

Prerequisite: *WX 210 or permission of the Instructor.*

WX 353

Thermodynamics of the Atmosphere (3,0)

3 Credits

A course for those requiring an in-depth understanding of the physical processes governing the atmosphere. Includes discussion and quantitative treatment of meteorological conventions, atmospheric state and structure, radiation, heat/energy transfer, boundary layer structure and fluxes, moisture, stability, cloud formation, and precipitation.

Prerequisites: *PS 104 or PS 160 and WX 201.*

WX 354

Dynamics of the Atmosphere (3,0)

3 Credits

A course for those requiring an in-depth understanding of the dynamic processes governing the atmosphere. Includes discussion and quantitative treatment of atmospheric forces, the equations of motion, local and global winds, air masses and fronts, middle latitude cyclones, quasi-geostrophic theory, thunderstorms, and hurricanes.

Prerequisites: *PS 104 or PS 160 and WX 353.*

WX 356

Synoptic Meteorology (2,1)

3 Credits

This course uses observations and analyses of both current and historical weather systems to explain atmospheric structures and behavior on the synoptic scale. An important component of this course is the introduction of sophisticated computer graphics software as the primary data-retrieval and analysis tools for the students. Individual and team lab exercises provide practice in applying principles and techniques learned in lecture sessions. Topics include pressure, temperature, and moisture field analyses, frontal structure, thermal wind, temperature advection, jet streams, divergence, vorticity, and vertical motion fields within the context of examining mid-latitude cyclones and anticyclones. Numerical model data as well as surface and upper-air observations are used to examine and diagnose synoptic scale motions. Satellite imagery is also used when applicable.

Prerequisite: *WX 353.*

Corequisite: *WX 354.*

WX 361

Global Climate Change (2,1)

3 Credits

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.

Prerequisite: *WX 201, WX 261*

WX 363

Thunderstorms (3,0)

3 Credits

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.

Prerequisite: *WX 301 or WX 353.*

WX 364

Weather for Aircrews (3,0)

3 Credits

Making use of the Weather Center and the Internet, students collect and study weather data from around the world. Emphasis is placed on decoding information contained in the remarks section of weather observations and on the differences between North American weather charts and those produced in other parts of the world. Students investigate the flying conditions and aviation environment over the seven continents. The proper operation of airborne weather radar is studied. Students identify weather hazards by using ground-based weather radar and satellite imagery.

Prerequisite: *WX 301.*

WX 365

Satellite and Radar Weather Interpretation (3,0)

3 Credits

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, midlatitude 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.

Prerequisite: *WX 301 or WX 353.*

WX 370

Planetary Atmospheres (3,0)

3 Credits

The primary purpose of this course is for students to understand weather on other planets. All of the planets in our solar system have very different atmospheres and weather. The same concepts of the causes of weather on Earth can be applied to other planets to explain what causes weather on other planets. This course can be used to satisfy a requirement in the Space Studies minor.

Prerequisite: *WX 301 or WX 353.*

WX 380

Advanced TV Weathercasting (2,1)

3 Credits

This course builds on the student meteorologist's radio and television weathercasting abilities and introduces the additional skills required for entry-level employment in the fields of radio and television weathercasting. The student will develop techniques for live in-studio and remote reporting of severe weather events and natural disasters. Additionally, the student will gain valuable experience writing, preparing, and delivering scientific and environmental reports and acquiring techniques for remote broadcasting.

Prerequisites: *WX 280, WX 356.*

WX 390

Atmospheric Physics (3,0)

3 Credits

Topics covered include elements of Earth-Sun geometry, radiative transfer, photochemistry, and remote sensing of the atmosphere. Additionally, properties of aerosols and clouds, cloud nucleation, precipitation processes, and atmospheric electricity will be discussed.

Prerequisites: *MA 112 or MA 242, PS 105, WX 353.*

WX 420

Advanced Atmospheric Thermodynamics (3,0)

3 Credits

This course provides an application of physics and calculus to the study of atmospheric thermodynamics. The course covers such topics as hydrostatics, conservation of energy, the Ideal Gas Law, temperature relationship to kinetic energy, specific heats, enthalpy, and entropy. Additionally, water and its transformations, the thermodynamics of dry, moist, and saturated air, and thermodynamic diagrams are covered.

Prerequisites: *MA 242, PS 160, WX 353.*

WX 422

Statistical Applications for Meteorological Data Analysis (2,1)

3 Credits

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.

Prerequisite: *Any course in computer programming (CS 118, or CS 223, or EGR 115 etc.) or permission of the instructor.*

WX 427

Forecasting Techniques (2,1)

3 Credits

An advanced course in meteorology that includes applications to a variety of forecast problems, from large-scale, multi-day “traditional” forecasting, to short-term, “tailored” forecasts for weather-sensitive operations. The course is basically divided into two parts: 1) a study of the various phases of the forecasting process, and 2) a look at weather forecasting from a business process point of view. The first part of the course examines meteorological collection platforms and how they are evolving, the importance of data assimilation in operational numerical analysis and forecast systems, characteristics of numerical models run at the National Centers for Environmental Prediction, model post-processing (including an introduction to Model Output Statistics), and product tailoring for different user communities. A set of city-pair forecast exercises allows the students to apply the knowledge gained during this segment before moving on to the second portion of the course. In the second part of the course, the students are introduced to weather forecasting from the business process perspective. This part of the course examines the relationship between the provider of meteorological information and the user of that information. Within the provider-user relationship, we explore concepts such as the provider’s knowledge of meteorology and the user’s operation, the user’s knowledge of meteorology, how weather/climate impacts his/her operations, and his/her understanding of the provider’s capabilities. These principles are used to illustrate how different types of users (e.g., general public, business, the military) employ tailored weather forecast products and integrate them into their decision-making processes. The exercises introduced here give the students, now working in teams, experience in preparing different types of forecasts, varying from synoptic-scale, national forecasts, to local forecasts for a hypothetical weather-sensitive customer. The capstone for this portion of the course is a visit to the 45th Weather Squadron at Cape Canaveral Air Force Station to get a first-hand look at weather operations there, and how their tailored weather decision guidance is integrated into the decision-making process for space launches.

Prerequisites: *COM 221, WX 353, WX 354, WX 356, and WX 365.*

WX 456

Advanced Weather Analysis (2,1)

3 Credits

This course builds on the concepts learned in WX 356 (Synoptic Meteorology) by using the governing meteorological equations to explain what is causing the current weather, thereby integrating atmospheric dynamics principles into weather analysis and forecasting. The computer graphics programs introduced in WX 356 are used as primary analysis tools for the students. Individual and team lab exercises provide practice in applying principles and techniques learned in lecture sessions. Topics may include analysis and prediction of clouds, precipitation, flight hazards, and convective weather using conventional and model-based analyses. Diagnoses of vertical motion fields, atmospheric soundings, and spatial/temporal cross sections are also used to examine atmospheric stability, environments favorable for deep moist convection, and possibly mesoscale systems. Satellite imagery is also used when applicable. The student is expected to retrieve raw data from Internet sources and the department's computer system.

Prerequisites: *COM 221, WX 356.*

Corequisite: *WX 365.*

WX 457

Weather Operations Seminar (2,1)

3 Credits

This course simulates a number of industry/agency operational weather environments. The student will acquire and evaluate the significance that weather impact variables have on all phases of the operational environment. Real-time as well as preprogrammed scenarios are used to give the student the opportunity to become knowledgeable in the methodologies employed by decision-makers in flight and marine planning/operations, multimedia productions, and agribusiness operations.

Prerequisites: *WX 356 and Senior standing.*

WX 475

Field Production and Weathercast Video Editing (2,1)

3 Credits

In this course, students will learn the skills of shooting and editing in short, medium, and long formats with industry-standard hardware and software. This will include production of weather segments for multi-platform broadcast. Additionally, students will gain experience in electronic field production and electronic news gathering (EFP/ENG). This experience will include live remote broadcasting for severe weather events. Topics and exercises include the role of the assignment editor, field producer, audio technician, videographer, on-air talent, and editor. Working closely with the professor and with state-of-the-art equipment, students produce and edit a variety of projects including, but not limited to, television series episodes, documentaries, live remote reports, short-turnaround reports, crime and crash scene documentation, and short-form videos. Occasionally professional speakers and outside team field production work are included.

Prerequisite: *COM 225 or COM 265 or WX 280*

WX 480

Environmental Security (3,0)

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.

Prerequisite: *HS 201, WX 201 or permission of the instructor.*

WX 490

Advanced Dynamic Meteorology I (3,0)

3 Credits

This is the first course in atmospheric dynamics that uses calculus. The focus of this course is on the full development of the momentum equation on a rotating earth and the subsequent applications of this equation to atmospheric flows. Applications will include the concepts of geostrophic balance and the geostrophic wind, gradient balance and the gradient wind, hydrostatic balance, the hypsometric equation, and thermal wind balance. Synoptic examples will be examined to illustrate these concepts.

Prerequisites: *MA 243, WX 354, and WX 420.*

WX 491

Advanced Dynamic Meteorology II (3,0)

3 Credits

This is the second course in atmospheric dynamics that uses calculus. The dynamical set of equations and expressions that govern atmospheric phenomenon will be developed and applied. These equations and expressions will include the primitive set of equations, a kinematic description of the atmosphere, the absolute and barotropic vorticity equation, and the quasi-geostrophic set of equations. Applications will include the use of these equations to better understand Rossby wave dynamics and the cyclogenesis process.

Prerequisite: *WX 490.*

WX 299-499

Special Topics in Meteorology

1-6 Credits

Individual independent or directed studies of selected topics in applied meteorology.

Prerequisites: *Consent of the instructor and approval of the program coordinator.*

Graduate Course Descriptions

Embry-Riddle course offerings are listed in alphabetical order, according to the following course designations:

AE	Master of Aerospace Engineering/Master of Science in Aerospace Engineering
BA	Master of Business Administration
CEC	Computer Engineering
EE	Electrical Engineering
EP	Engineering Physics
HFS	Master of Science in Human Factors and Systems
MA	Mathematics
ME	Master of Science in Mechanical Engineering
MSA	Master of Aeronautical Science
SE	Software Engineering
SYS	Systems Engineering

The following courses are not necessarily offered every term, nor are they necessarily offered at all campus locations.

AE - Aerospace Engineering

AE 502

Strength and Fatigue of Materials

3 Credits

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.

Prerequisite: *Consent of the department.*

AE 504

Advanced Compressible Flow

3 Credits

Classification and solution of compressible flow problems, basic conservation laws, and fundamental theorems of compressible flows. Wave phenomena; normal and oblique shocks. Method of characteristics and wave interactions. Perturbation theories and similarity rules. Linearized supersonic flow, axisymmetric flow wing theory, and wave drag. Nonlinear theories of transonic and supersonic flows.

Prerequisite: *Consent of the department.*

AE 506

Airplane Dynamic Stability

3 Credits

Small-disturbance theory and linearized solutions of the general equations of motions. Aerodynamic derivatives, derivative analysis, aerodynamic transfer functions. Dynamic stability of uncontrolled longitudinal and lateral motions. Computer solution of dynamic stability problems. Inverse problems. Automatic stability and control. An introduction to automatic flight controls and feedback control system analysis.

Prerequisite: *Consent of the department.*

AE 508

Heat Transfer

3 Credits

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.

Prerequisite: *Consent of the department.*

AE 510

Aircraft Structural Dynamics

3 Credits

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.

Prerequisite: *Consent of the department.*

AE 512

Combustion

3 Credits

Equilibrium and kinetics of combustion processes. Law of mass action, Arrhenius reaction rate law, heat of reaction, and adiabatic flame temperature. Conservation equations of reacting flows. Applications of conservation equations.

Prerequisite: *Consent of the department.*

AE 514

Introduction to the Finite Element Method

3 Credits

Basic equations of the theory of elasticity. Energy principles. Formulation and assembly of stiffness matrices and load vectors for elastic solids. Modeling considerations. Solution methods Computer implementation of finite element and stress analysis procedures. Interpretation of computer solutions. Design applications.

AE 516

Computational Aeronautical Fluid Dynamics

3 Credits

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.*

AE 518

Acoustic Emission Nondestructive Testing

3 Credits

Fundamentals of acoustic emission testing. Macroscopic origins. Wave propagation. Acoustic emission sensors and their calibration. Source location. Applications. Survey of commercial acoustic emission sensors and systems. Current research.

AE 520

Perturbation Methods in Engineering

3 Credits

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 522

Analysis of Aircraft Composite Materials

3 Credits

Fiber materials, tapes cloths, resin systems. Theory of elastic anisotropic materials. Elastic constants for multi-ply composites. Matrix formulation. Computer analysis. Strength and theory of failure. Sources and use of experimental data. Design considerations.

Prerequisite: *Graduate standing.*

AE 524

Rocket Engine Propulsion Systems

3 Credits

Analysis of combustion and expansion processes. Thrust nozzle performance analysis and design techniques. Characteristics of liquid propellants and liquid propellant rocket motors. Characteristics of solid propellants and interior ballistics of solid propellant rocket motors. Cooling techniques. Thrust vector control methods.

Prerequisite: *Graduate standing.*

AE 526

Engineering Optimization

3 Credits

Numerical optimization methods are presented and applied to the solution of engineering problems. Constrained problems and Kuhn-Tucker conditions. Optimization model construction. Sequential unconstrained optimization. Direct methods for constrained problems. Structural optimization. Genetic algorithms and the method of simulated annealing and their applications in research and engineering problems. Case studies in mechanical and aerospace engineering.

AE 528

Advanced Incompressible Aerodynamics

3 Credits

Kinematics and dynamics, thin airfoil theory, finite wing theory, bluff body flow, the Panel Method, numerical techniques, unsteady loads, vortex flows.

AE 530

Aeroacoustics

3 Credits

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 590

Graduate Seminar

1-3 Credits

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.

Prerequisite: *Consent of the department.*

AE 606

Finite Element Aerospace Applications

3 Credits

Development of finite element representation of continuum using Galerkin and variational techniques. Boundary elements. Applications to statics and dynamics of solids, structures, fluids, and heat flow. Includes the use of finite element codes.

Prerequisite: *Graduate standing.*

AE 610

Advanced Computational Fluid Dynamics

3 Credits

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.

Prerequisite: *Graduate standing.*

AE 612

Analysis of Aircraft Plate and Shell Structures

3 Credits

Bending and buckling of plates. Cylindrical bending. Boundary value problems. Axisymmetric problems. Deformation of shells. Energy principles. Stress and stability analysis. Approximate methods. Finite element methods. Computer applications.

Prerequisite: *Graduate standing.*

AE 616

Advanced Aircraft Structural Dynamics

3 Credits

Analysis of structures subjected to dynamic loads. Hamilton's principle and Lagrange's equations. Rayleigh's principle. Numerical evaluation of natural frequencies and modes. Mode superposition and direct integration methods for dynamic response. Finite element modeling. Component mode synthesis. Computer applications.

Prerequisite: *Graduate standing.*

AE 620

Boundary Layer Theory

3 Credits

Navier-Stokes equations for laminar and turbulent flows. Boundary layers. Jets, wakes, elementary turbulence modeling. Skin friction, separation, drag, and aerodynamic heating. Approximate and exact finite-difference solutions including the effect of suction and blowing. Solutions of turbulent boundary layer equations.

Prerequisite: *Graduate standing.*

AE 640

Turbine Engine Propulsion Systems

3 Credits

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.

Prerequisite: *Graduate standing.*

AE 646

Nonlinear Dynamical Systems and Chaos

3 Credits

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

Basic equations of thermoelasticity. Thermal structures problems; rods, beams, and plates. Thermally induced vibration. Thermal buckling. Thermoviscoplasticity.

AE 652

Turbulent Flows

3 Credits

Laminar-turbulent transition, turbulent flow equations of motion. Definition of turbulence. Modeling, coherent structure, and large-Eddy simulations. Longitudinal and lateral correlations in homogeneous turbulence. Integral scales of turbulence. Eulerian space and time correlations. Lagrangian time correlations and diffusion. One- and three-dimensional energy spectrums. Hot-film anemometry.

AE 696

Graduate Internship in Aerospace Engineering

1-3 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. They are academic/professional activities coordinated by the University between offering organizations and the graduate student.

Prerequisite: *Graduate standing.*

AE 699

Special Topics in Aerospace Engineering

3 Credits

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.

Prerequisite: *Graduate standing.*

AE 700

M.S.A.E. Thesis
9 Credits

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.

BA - Business Administration

BA 511

Operations Research
3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 514

Strategic Marketing Management in Aviation
3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 517

Accounting for Decision Making
3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 520

Organizational Behavior, Theory, and Applications in Aviation
3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 590

Graduate Seminar

1-3 Credits

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.

Prerequisites: *As announced by the instructor conducting the seminar.*

BA 603

Aerospace Production and Operations Management

3 Credits

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 aeronautic/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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 604

International Management and Aviation Policy

3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 607

Human Resource Development

3 Credits

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.

Prerequisites: *Successful completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 609

Airline Operations and Management

3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 610

Airline Optimization and Simulation Systems

3 Credits

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.

Prerequisite: *Successful completion of BA 511.*

BA 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.

Prerequisite: *Successful completion of BA 518.*

BA 616

Electronic Commerce

3 Credits

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.

Prerequisites: *Business fundamentals, basic computer skills and an understanding of computer concepts.*

BA 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.

Prerequisite: *Successful completion of BA 518.*

BA 620

Organizational Theory

3 Credits

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.

Prerequisites: *Satisfactory completion of the Business Foundation courses and/or permission of the graduate program chair.*

BA 625

Airline Marketing

3 Credits

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.

Prerequisites: *Demonstrated completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 630

Aviation/Aerospace Systems Analysis

3 Credits

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 system's 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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 635

Business Policy and Decision Making

3 Credits

A capstone course in the MBA/A program that expands on the skills, knowledge, and abilities the students have achieved in their core courses. Students will examine applications of long-term planning and management tools in aviation-related industries and will be able to formulate strategic vision and policies to achieve such a perspective. Concepts of strategic management, total quality management, continuous quality improvement, reengineering, customer-driven management, and other evolving management methodologies will be examined. Applications of the concepts will be applied to the domestic and international activities of airlines, airports, manufacturing, and government to sustain a long-term competitive advantage.

Prerequisites: *Completion of all MBA/A core courses.*

BA 645

Airport Operations and Management

3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation Course and/or permission from the graduate program chair.*

BA 646

Air Cargo Logistics Management

3 Credits

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

A comprehensive examination and analysis of the symbiotic and often volatile relationship between airline management and airport management is provided. 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 global issues impacting the relationship between airlines and airports. Airline scheduling, fleet management, finance agreements, contracts and negotiation, service agreements, marketing issues, passenger and baggage handling, ground transportation, labor relations, public/media relations, and strategic management are studied.

Prerequisite: *Successful completion of either BA 609 or BA 645.*

BA 651

Strategic Airport Planning

3 Credits

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.

Prerequisite: *Successful completion of either BA 609, BA 645, or BA 650.*

BA 655

Aviation Law and Insurance

3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 696

Graduate Internship in Aviation Business Administration

1-3 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. 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

1-3 Credits

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.

Prerequisites: *Satisfactory completion of Business Foundation courses and/or permission of the graduate program chair.*

BA 700

Thesis Research

6 Credits

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: *Successful completion of BA 522 and permission of the graduate program chair.*

CEC - Computer Engineering

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.

***Prerequisite:** Graduate standing or department chair permission required.*

CEC 510

Digital Signal Processing

3 Credits

Fundamentals of discrete-time signal processing. Data acquisition, analog-to-digital and digital-to-analog conversions, sample rates, aliasing, and anti-aliasing filtering. Spectral analysis and system identification. Discrete-time filter design and implementations on digital signal processing microprocessors.

***Prerequisite:** Graduate standing or department chair permission required.*

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.

***Prerequisite:** Graduate standing or department chair permission required.*

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, 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 700

Graduate Thesis

9 Credits

A master-level research project in Computer 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.

CEC 599-699

Special Topics in Computer Engineering

1-3 Credits

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..

Prerequisites: *Concent of the instructor and the department chair.*

EE - Electrical Engineering

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.

Prerequisite: *Graduate standing or department chair permission required.*

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.

Prerequisite: *Graduate standing or department chair permission required.*

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.

Prerequisite: *Graduate standing or department chair permission required.*

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.

Prerequisite: *Graduate standing or department chair permission required.*

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, VOR/TAC, ILS, GPS, and aircraft radar.

Prerequisite: *Graduate standing or department chair permission required.*

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 noises; and analysis of communication performance in terms of bit error rates.

Prerequisites: *EE 510, 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.

Prerequisite: *Graduate standing or department chair permission 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 700

Graduate Thesis

9 Credits

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 599-699

Special Topics in Electrical Engineering

1-3 Credits

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..

Prerequisites: *Concent of the instructor and the department chair.*

EP - Engineering Physics

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.

EP 505

Advanced 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 509

Advanced Space Physics

3 Credits

Plasma physics applied to the interplanetary medium and planetary magnetospheres: solar wind. Magnetohydrodynamics. Interaction between planetary magnetospheres and the solar wind. Auroral dynamics. Planetary atmospheres and ionospheres. Magnetosphere-ionosphere coupling. Energetic particle dynamics. Ring currents. The space radiation environment. Space weather. Satellite missions to Earth and other planets.

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 Credits

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

1-3 Credits

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

Master of Science in Space Science Thesis

1-9 Credits

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.

HFS - Human Factors and Systems

HFS 500

Systems Concepts, Theory, and Tools

3 Credits

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 505

Systems Engineering I

3 Credits

Practical application of design, build, and test processes applied to systems that incorporate hardware, software, and human components. Focus is on the integration of system components throughout the product life cycle. Lab is a required part of this course.

Prerequisite: *HFS 500.*

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 nonexperimental 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.

Prerequisite: *Completion of an undergraduate course in statistics. (This course is the same as MSA 665.)*

HFS 515

Ergonomics

3 Credits

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.

Prerequisites: *HFS 500 and completion of an undergraduate course in human factors.*

HFS 520

Team Resource Management

3 Credits

This course addresses the social-psychology underpinnings of what is commonly referred to as team resource management and cockpit resource management (CRM). The class will review and discuss the basic theoretical concepts from social psychology and relate them to the effective operation of aviation teams. It will identify and discuss the basic issues associated with the effective evaluation of CRM-type programs.

HFS 521

Simulating Humans in Complex Systems

3 Credits

This course exposes students to concepts in modeling and simulating human behavior through experience with programming applications and software architectures. Practical applications for simulating complex physical and mental human behavior are provided through examples in Visual Basic, Javascript, Micro Saint Sharp, and Imprint. Advanced topics of neural networks, stress algorithms, statistical versions of chaos theory, and models of vision will be examined. Core theories in modeling behavior, validation of complex models, and future directions for the domain of simulating human performance are explored through a review of current literature. The student will become familiar with contemporary software approaches to modeling human behavior in realistic situations to assist in improving outcome efficiency.

HFS 526

Aerospace Physiology (3,0)

3 Credits

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.

Prerequisite: *PS 107 or equivalent.*

HFS 527

Drugs in Aviation and Society (3,0)

3 Credits

The aim of this introductory course is to familiarize the student with the impact of psychoactive drugs on the body and their importance to medicine. A general review of neurophysiology will precede basic pharmacological principles of agonist/antagonist interaction. The course will focus on psychoactive drugs, drugs of abuse, and therapeutics in medicine, particularly aerospace medicine. Graduate students will be required to give a lecture expanding on any lecture topic from class or some other realm of aerospace medicine. They will also have additional readings from related journal articles for which they will have to write a brief (4-5 page) report.

HFS 528

Discrete Event Simulation I (3,0)

3 Credits

This class addresses the basic concepts and topics in discrete event simulation (DES). In this course, students will learn advanced techniques in simulation modeling and analysis using ARENA simulation software. Students will learn fundamental concepts/theory involved in discrete event simulation, including simulation structure and logic, simulation languages (ARENA), statistical analysis of the results, and application to system situations.

HFS 530

Systems Psychology

3 Credits

This course will provide the student with a level view of human factors and ergonomics and how they fit into the overall system design and evaluation process. This class will address the human role and effectiveness as a system constituent. It will take a systemic and theoretical approach rather than a detailed empirical one. It will provide an overview of the system science and the time-phased, iterative systems approach. It will also review the assumptions and limitations of the analytic tools used to incorporate people into complex systems including systems test and evaluation tools.

HFS 535

Applied Ergonomic Design, Analysis, and Evaluation

3 Credits

An in-depth investigation of ergonomic principles is examined through complex real-world applications created in the computer modeling tool CATIA. Students will investigate how the design of human/machine systems is impacted by human physical dimensions of specified populations of system users and interactions between system components. Ergonomic analyses and computer modeling verification is incorporated into design creation examples. Central concepts and theories in ergonomics are explored through a review of the current research literature.

HFS 590

Graduate Seminar

3 Credits

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.

Prerequisite: *As announced by the instructor conducting the seminar.*

HFS 600

Human Factors in Systems

3 Credits

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 aviator's adaptation to flight, air traffic, and maintenance environments.

HFS 605

Systems Engineering II

3 Credits

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

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.

Prerequisite: *HFS 510.*

HFS 611

Work Physiology

3 Credits

This course will focus on the human as a biomechanical entity and evaluate the physiological loads and stresses of which we are capable. Topics include anthropometric applications, muscle and strength exertions, metabolism and work, the redesign of deteriorated and artificial body parts, and circadian rhythms in work design. The student will gain knowledge of the architecture, functioning, and biomechanics of bones, joints, muscles, tendons, and ligaments and the forces and torques that move the body at work or sports. The course will examine energy extraction from food and drink, and how human ability depends on the cooperation of the respiratory, circulatory, and metabolic systems. The effects of environmental conditions (lighting, noise, heat, cold, humidity, air movement) and shift work (day, evening, and night work; shift schedules) on task performance will be discussed in practical terms.

Prerequisite: *HFS 600.*

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.

Prerequisite: *Completion of an undergraduate course in the area of sensation and perception. (This course is the same as MSA 660.)*

HFS 620

Memory and Cognition

3 Credits

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.

Prerequisite: *Completion of an undergraduate course in the area of memory and cognition. (This course is the same as MSA 663.)*

HFS 625

Applied Testing and Selection

3 Credits

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 630

Cognitive Systems

3 Credits

The course addresses applied cognitive science, which draws on the knowledge and techniques of cognitive psychology and related disciplines to provide the basis for principle-driven design. Specifically it addresses human cognitive behavior in complex worlds that exist without the artificial boundaries of the laboratory. It specifically addresses those domains where there are multiple agents (that is, cognitive systems) and that are problem-driven and tool-constrained. The course also addresses the impact of mismatches between the models of the designers, their software, and the users.

Prerequisites: *HFS 600 and HFS 620.*

HFS 635

Human-Computer Interaction

3 Credits

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.

Prerequisite: *Completion of an undergraduate course in human factors or human/computer interaction. (This course is the same as MSA 661.)*

HFS 640

Aviation/Aerospace Psychology

3 Credits

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.

Prerequisite: *Completion of an undergraduate course in the area of aviation/aerospace psychology.*

HFS 645

Underpinnings of Human Factors and Ergonomics

3 Credits

Survey of historic human factors literature, particularly those papers considered classics. The class will review the key personalities, papers, theories, and research programs that provide the basis of current theory and best practice. The key historic papers addressing human capabilities, human-machine systems, workload, anthropometrics, perception, workspace design, and visual momentum will be read and critically discussed. The course pays particular attention to the key research addressing aviation psychology, cockpit design, cognitive engineering, and human physiology.

HFS 650

Human Factors of Aviation/Aerospace Applications

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.

Prerequisite: *Completion of an undergraduate course in human factors.*

HFS 660

Human Factors and Aircraft Safety and Airworthiness I

3 Credits

Aircraft safety and airworthiness will be considered as a coherent process running from the design of the aircraft to the monitoring of its condition in airline service. This class covers the technical aspects of certification along with the legal and economic implications. This class will specifically address the certification of an airliner, the safety of complex systems, and on-board software. This class is offered only at the Ecole Nationale de l'Aviation Civile.

Prerequisites: *HFS 500, HFS 590, HFS 600.*

HFS 665

Human Factors and Aircraft Safety and Airworthiness II

3 Credits

Aircraft safety and airworthiness will be considered as a coherent process running from the design of the aircraft to the monitoring of its condition in airline service. This class covers the technical aspects of certification along with the legal and economic implications. This class will specifically address the human factors of air transport safety and quality approval and concept. This class is offered only at the Ecole Nationale de l'Aviation Civile.

Prerequisites: *HFS 500, HFS 590, HFS 600, HFS 660.*

HFS 670

Human Factors and Aircraft Safety and Airworthiness III

3 Credits

Aircraft safety and airworthiness will be considered as a coherent process running from the design of the aircraft to the monitoring of its condition in airline service. This class covers the technical aspects of certification along with the legal and economic implications. This class will specifically address operational procedures, maintenance procedures, and continuing airworthiness. This class is offered only at the Ecole Nationale de l'Aviation Civile.

Prerequisites: *HFS 500, HFS 590, HFS 600, HFS 660, HFS 665.*

HFS 696

Graduate Internship in Human Factors and Systems

3 Credits

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.

Prerequisite: *As announced by the instructor.*

HFS 699

Special Topics in Human Factors and Systems

3 Credits

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

1-6 Credits

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 student's major professor and thesis committee. This project will provide evidence of the student's ability to perform applied research at the graduate level.

Prerequisites: *Completion of all core courses in the Human Factors Engineering track or the Systems Engineering track.*

MA - Mathematics

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.

Prerequisite: *MA 441 or equivalent.*

MA 504

Theory of the Potential

3 Credits

Potential theory and Green's function. Method of characteristics and solution of Cauchy's initial value problem for first and second order equations. Numerical methods. Application to fluid mechanics, electromagnetic fields, heat conduction, and other areas. Computer applications.

Prerequisite: *MA 502.*

MA 505

Statistics

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.

Corequisite: *MA 441 or MA 503.*

MA 506

Probability for Engineers

3 Credits

Foundations, combinations, conditional probability, expectations, and applications to discrete sample spaces. Random variable in one or more dimensions. Various continuum distributions. Characteristic functions. Applications to engineering problems. Computer applications.

Prerequisite: *MA 441 or equivalent.*

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.

Prerequisite: *MA 345.*

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.

Prerequisite: *MA 510.*

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.

Prerequisite: *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 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

1-3 Credits

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

6 Credits

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 - Mechanical Engineering

ME 500

Clean Energy Systems

3 Credits

This course will emphasize energy systems for both stationary and transportation applications. General energy requirements will be discussed for industrialized societies and the effects of waste energy and undesired byproducts. Clean energy process and minimizing the environmental effects. Examples of energy systems to be considered are fuel cells, wind energy, wave energy, geothermal energy, and solar energy.

Prerequisite: *Graduate standing or department chair permission required.*

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.

Prerequisite: *Graduate standing or department chair permission required.*

ME 506

Design for Manufacturing and Assembly

3 Credits

Manufacturing processes and life cycle design for the aerospace industry. Tolerances and materials properties. Design for manufacturing and associated costs for various manufacturing processes (machining, casting, molding, stamping, forming, forging, and extrusion) with aviation-related case studies. Design for product assembly and total assembly cost with case studies. Selection of materials and processes using design for manufacturing guidelines, standards, and tolerance fittings. Simulations using computer graphics software. Design for manufacturing course project.

Prerequisite: *Graduate standing or department chair permission required.*

ME 508

Hydrogen and Hybrid Vehicle Systems

3 Credits

This course is an introduction to the principles of hybrid electrical vehicle propulsion systems for Mechanical and Electrical Engineering students. A major emphasis of the course will be to broaden the mechanical engineering student's knowledge of electrical engineering so that he/she can understand the fundamentals of electrical motors, electrical motor controls, and electrical energy storage systems. The course is also intended to strengthen the knowledge of electrical engineering students relative to automotive powertrain design. With this background, the integration of these hybrid electric components into the hybrid electric vehicle powertrain system will be studied, including electric energy storage (batteries, flywheels, ultra-capacitors) and electrical energy production-fuel cells.

Prerequisite: *Graduate standing or department chair permission required.*

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.

Prerequisite: *Graduate standing or department chair permission required.*

ME 696

Graduate Internship in Mechanical Engineering

3 Credits

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.

Prerequisite: *Graduate standing or department chair permission required.*

ME 700

Graduate Thesis

9 Credits

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.

Prerequisite: *Graduate standing or department chair permission required.*

MSA - Aeronautical Science

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.

Prerequisites: *Demonstrated knowledge of flight rules and regulations and basic knowledge of the aviation industry, airports, and commercial aircraft used in the national air transportation system.*

MSA 509

Advanced Aerodynamics

3 credits

A study of current flight applications and problems that includes transonic, supersonic, and hypersonic aerodynamics, principles of aircraft stability and control, and operational strength considerations. Emphasis is placed on the applications of the rapidly changing technological innovations in aerodynamics and the solution to the problems created by these advancements

Prerequisites: *Demonstrated knowledge of basic aerodynamics*

MSA 510

Advanced Aircraft Performance

3 credits

An analysis of performance characteristics for transonic, supersonic, and near space air vehicles powered by jet or rocket engines. Problems related to high speed and high altitude flight such as aero-elastic effects, compressibility drag, Reynold’s Number effect, ram pressure rise, and aerodynamic-heating are explored. Discussions center on current developments and the problems associated with these advancement.

Prerequisites: *Demonstrated knowledge of basic aircraft performance.*

MSA 514

Computer-Based Instruction

3 Credits

This course addresses the design, development, and evaluation of instructional software as it applies to the aviation/aerospace industry. The course offers practice in the systematic design of computer-based instruction with emphasis in tutorials, drill and practice, and simulation. CBI lessons are developed using available authoring systems.

Prerequisite: *Demonstrated knowledge of basic computer operations.*

MSA 515

Aviation/Aerospace Simulation Systems

3 Credits

A comprehensive examination of simulation in modern aviation/aerospace that includes history, state-of-the-art, and current research and development. Discussion focuses on the extent and impact of simulator applications throughout the industry and the effects on training costs and safety. Topics include the flight crew being checked out, updated, evaluated, or retrained in aircraft and systems simulators to the simulation models used in management, flight operations, scheduling, or air traffic control.

MSA 516

Applications in Crew Resource Management

3 Credits

This course examines the common concepts of crew resource management (CRM) as developed by major air carriers and explores the theoretical basis of such training. Topics such as supervision of crewmembers, counseling, manner and style, accountability, and role management are 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. Additionally, each student uses simulators and computer-based instruction to supplement their academic instruction.

MSA 517

Advanced Meteorology

3 Credits

Course topics include atmospheric circulation; the derivation and application of the equations of motion, the hydrostatic equation, the equation of continuity, and equation of state; basic concepts of thermodynamics; fundamental weather analysis; aviation hazards associated with convection, icing, fog, wake vortices, and volcanic ash; high-altitude and radar meteorology; and solar impacts. The student practices stability analyses using a thermodynamic diagram, current weather analysis, and short-range weather forecasting using much of the latest equipment available in aviation.

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 519

Terrorism and Homeland Security

3 Credits

A study of the problems, issues, and strategies involving the protection of the American people, the safeguarding of our nation's critical infrastructure, and the insulation of our economy from the results of both terrorist attacks and natural disasters. The course begins with the events of Sept. 11, 2001, and a study of the problems, organization, methods, and weapons of terrorism, and goes on to study the birth and development of homeland security. The course continues with the mission, the function and responsibilities, and the legislative and regulatory framework governing the various agencies of the Department of Homeland Security, the intelligence community and its role in homeland security, and emergency management in the United States. Particular emphasis during the latter part of the course is on the safe carriage of people and property by air, rail, water, and highway, as well as the critical infrastructure protection and response roles of states, cities, and municipalities.

MSA 520

Air Traffic Management –VFR Tower

3 Credits

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 intrafacility 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 300, AT 302, AT 305.*

MSA 525

Advanced Aviation Meteorology

3 Credits

This course is a graduate-level treatment of aviation weather hazards such as convective weather, strong winds, low ceilings and visibility, icing, turbulence, winter weather, and volcanic ash. Practical application of theoretical concepts such as critical thickness, vertical wind shear, jet streams, jet streaks, cyclone formation, and atmospheric stability is achieved through a combination of traditional lectures, real-time weather discussions, and historical case studies. Implications of aviation weather hazards on decision-making in the National Airspace System are examined.

Prerequisite: *MSA 517 or undergraduate degree in Meteorology or Atmospheric Sciences.*

MSA 530

Research Seminar in Aviation Meteorology

3 Credits

This seminar-type course focuses on a single topic of interest to both the aviation and meteorological communities. Examples include, but are not limited to, weather/air traffic integration, investigating weather-related aircraft accidents/incidents, impacts of space weather on transpolar aviation, weather technology to the cockpit, and the role of weather analyses and forecasts in the next-generation air transportation system. In a seminar format, students and faculty will cover a variety of readings from the aviation and meteorological literature, and discuss their findings and conclusions. Students will have the opportunity to lead class discussions on assigned readings and develop a final project topic to be presented in class.

Prerequisites: *MSA 517 or undergraduate degree in Meteorology or Atmospheric Sciences; MSA 5XX.*

MSA 550

Aviation Education Foundations

3 Credits

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 590

Graduate Seminar

1-3 Credits

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.

Prerequisites: *As announced by the instructor conducting the seminar.*

MSA 602

The Air Transportation System

3 Credits

A study of air transportation as part of a global, multimodal transportation system. The course reviews the evolution of the technological, social, environmental, and political aspects of this system since its inception at the beginning of the 20th century. The long-term and short-term effects of deregulation, energy shortages, governmental restraints, and national and international issues are examined. Passenger and cargo transportation as well as military and private aircraft modes are studied in relation to the ever-changing transportation requirements.

Prerequisites: *Demonstrated knowledge of aviation rules and regulations and economics.*

MSA 603

Aircraft and Spacecraft Development

3 Credits

This course is an overview of aircraft and spacecraft development. Included are vehicle mission, the requirements directed by economics, military, and defense considerations, and research and developmental processes needed to meet vehicle requirements. Aviation and aerospace manufacturing organizations and techniques are addressed, including planning, scheduling, production, procurement, supply, and distribution systems. The course studies the aviation and aerospace maintenance systems from the built-in test equipment to the latest product-support activities.

Prerequisites: *Demonstrated knowledge of college-level mathematics and economics.*

MSA 604

Human Factors in the Aviation/Aerospace Industry

3 Credits

This course presents an overview of the importance of the human role in all aspects of the aviation and aerospace industries. It emphasizes the 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. The course will study human limitations in the light of human engineering, human reliability, stress, medical standards, drug abuse, and human physiology. The course will discuss 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.

Prerequisite: *Demonstrated knowledge of behavioral science.*

MSA 605

Research Methods and Statistics

3 Credits

A study of current aviation research methods that includes techniques of problem identification, hypothesis formulation, design and use of data-gathering instruments, and data analysis. Research reports that appear in professional publications are examined through the use of statistical terminology and computations. A formal research proposal will be developed and presented by each student as a basic course requirement.

Prerequisites: *Demonstrated knowledge of college-level mathematics, including introductory statistics, and basic computer operations.*

MSA 606

Aviation/Aerospace Communications/Control Systems

3 Credits

A detailed analysis of current and future developments and trends in the control of air traffic, including the evolution of current national policies and plans and their objectives. The most recent planned improvements for each major component of the ATC system are examined individually and as part of the system as a whole.

Prerequisites: *Demonstrated knowledge of flight rules and regulations and basic navigation.*

MSA 608

Aviation/Aerospace Accident Investigation and Safety Systems

3 Credits

A critical analysis of selected aircraft accidents and an evaluation of causal factors. Particular emphasis is placed on the study of human factors connected with flight and support crew activities in aviation operations. Identification and implementation of accident prevention measures are stressed as integral parts of the development of a complete safety program.

MSA 609

Aircraft Maintenance Management

3 Credits

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 used. A major course objective is to heighten awareness of the critical interface of maintenance with flight, supply, and training activities.

Prerequisite: *Demonstrated knowledge of management principles.*

MSA 610

Applied Aviation Safety Programs (3,0)

3 Credits

This course covers the U.S. proactive voluntary programs that are part of the FAA-NASA integrated safety research plan, as well as the voluntary aviation safety information sharing in the air carrier industry. ATC performance monitoring review complements that for FOQA and ASAP carrier data. Carrier practices that address discovered threats (AQP and LOSA) add to the synoptic review. Organizational safety includes the IEP and the 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. Practical significance of both quantitative and qualitative data analyses generated by all the programs pertains to hazard and risk identification. Student synopses and analyses also address the IOSA and the ICAO safety SARPs.

Prerequisite: *MSA 605.*

MSA 611

Aviation/Aerospace System Safety

3 Credits

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 students 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 612

Safety Program Management

3 Credits

This course examines the modern work setting from an occupational safety and health point of view that includes aviaion related situations. Examination of the history of occupational safety leads the student to an understanding of how and why safety management principles and techniques interconnect the interests and goals of management, the worker, and government agencies to their mutual benefit is the major focus of this course. Students will examine and develop key components of a Safety Management System as part of this course

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.

Prerequisites: *Demonstrated knowledge of performance of airports and airline operations management or related field.*

MSA 614

Advanced Aviation/Aerospace Curriculum Development

3 Credits

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 615

Applied Aviation Research Methods (3,0)

3 Credits

This course addresses the study of phenomena in aviation using quantitative, qualitative, and mixed methods designs. A review of descriptive and inferential statistics precedes the introduction of power analysis and a multivariate statistical procedure. Advancing tools available for (a) the research methods and procedures, (b) the analysis and interpretation of the vast quantities of data currently available in the industry, and (c) setting the results into practice are the foci of the course. Although the primary emphasis is on aviation research, the information and skills learned in this course will be applicable to most careers.

Prerequisites: *MSA 605 and approval of the instructor.*

MSA 616

Air Traffic Management Leadership and Critical Decision Making (3,0)

3 Credits

This course is designed to give students in the Air Traffic 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, the FAA, organizations, and the aviation/aerospace industry. The primary purpose is to examine practical leadership skills and applications about what aviation leaders including Air Traffic Management leaders do and how they do it in order to be more effective. 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, study critical decision-making concepts, and apply learned concepts to resolve problems in the industry.

MSA 617

Air Traffic Management V (3,0)

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.

Prerequisite: *Air Traffic Management IV.*

MSA 618

Air Traffic Management VI (3,0)

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).

Prerequisite: *Air Traffic Management IV.*

MSA 620

Air Carrier Operations

3 Credits

A study of air carrier flight operations systems from the viewpoints of the ground-based dispatcher, operations specialists, managers, and the cockpit flight crew. Topics include advanced flight planning, aircraft performance and loading considerations, impact of weather conditions, and routing priorities.

Prerequisites: *Demonstrated knowledge of flight rules and regulations, basic meteorology, basic navigation, and basic aircraft performance.*

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 627

Air Traffic Management in the NAS (3,0)

3 Credits

This course gives students an understanding of the political, economic, social, technical, and environmental importance of the air traffic control system in the National Airspace System. The course develops content knowledge in the following areas: the Federal Aviation Administration, its mission, organization, and operation; management and leadership concepts as they relate to a federal bureaucracy; safety management systems and culture; quality control; and air traffic facility management objectives and policies. Labor-management relations in the federal sector will also be covered, including statutes, regulations, and contracts; management rights and responsibilities; union and employee rights and responsibilities; grievances and unfair labor practices; the bargaining process; memoranda of understanding, facility directives, and past practices; participative management; supervisory notes; equal employment opportunities and model workforce issues; employee assistance programs; interpersonal skills; performance management and constructive discipline; employee ethics on and off the job; development from an organizational perspective; and technical training administration.

MSA 634

Aviation/Aerospace Psychology

3 Credits

A study of the complexities of human factors research in aviation, which draws 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 adaptation to the flight environment and attempts to design an occupant-friendly flight deck module.

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.

Prerequisites: *Demonstrated knowledge of management principles and economics.*

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, predelivery activities, and introduction into service.

Prerequisites: *Demonstrated knowledge of management principles and economics.*

MSA 643

Management of Research and Development for the Aviation/Aerospace Industry

3 Credits

The types and sources of aviation/aerospace research and development are analyzed through study of the structure and interrelationship of the industry, educational institutions, and other organizations. Sources and methods of funding, specification determination, the relationship of research and development to procurement and production, and the regulatory factors affecting progress from the initial development to production of the aircraft and components are examined. Concepts of motivation and management as applied to research scientists and engineers will be studied as well as procedures for promoting optimum creativity concurrently with efficient operations.

Prerequisites: *Demonstrated knowledge of management principles and economics.*

MSA 644

Integrated Logistics Support in Aviation/ Aerospace

3 Credits

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.

Prerequisites: *Demonstrated knowledge of management principles and economics.*

MSA 654

Adult Teaching and Learning Techniques

3 Credits

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 “cockpit 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.

Prerequisite: *Demonstrated knowledge of the use of computers, including programming familiarity with a high-level language.*

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.

MSA 665
Applied Experimental Design
3 Credits

The design, conduct, statistical analysis, and interpretation of common behavioral science research designs are covered in the context of aviation science topics. Students learn to differentiate research designs along dimensions of experimental/non-experimental approaches, questions of group differences, and questions of relationships between variables, adequacy of statistical power, statistical significance, and practical importance. Student projects include conducting statistical analyses and writing research results sections based on standard American Psychological Association format.

Prerequisite: *MSA 605 or completion of an undergraduate experimental psychology course. (This course is the same as HFS 510.)*

MSA 670
Research Methods for 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.

MSA 671
Professional Flight Crew Techniques and Procedures
3 Credits

In this course the student will be provided instruction in a jet airline flight training device and coursework for flight crew operations with emphasis on developing training and education to professionally qualify pilot s as highly skilled members of an air carrier's flight management team. Coursework focuses on enabling professionalism, meeting industry expectations, applying aeronautical decision making, performing crew resource management, implementing threat and error management, and enabling efficient airline operations.

Prerequisite: *FAA Commercial Pilot Certificate with instrument and multi-engine ratings, MSA*

MSA 690
Graduate Research Project
3 Credits

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 pursue 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.

Prerequisite: *MSA 605.*

MSA 696
Graduate Internship in Aeronautical Science
1-3 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. They are academic/professional activities coordinated by the University between offering organizations and a graduate student.

MSA 699
Special Topics in Aeronautical Science
1-3 Credits

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
6 Credits

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.

Prerequisite: *MSA 605.*

SE - Software Engineering

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.

Prerequisite: *Practical knowledge of a modern programming language such as Ada, C, C++, or Java.*

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.

Corequisite: *SE 500 or consent from the instructor.*

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.

Corequisite: *SE 500 or consent from the instructor.*

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.

Prerequisite: *Course in discrete mathematics or consent from the instructor.*

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.

Corequisite: *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.

Prerequisite: *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.

Prerequisite: *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, proficiency in use of modern OO programming languages such as Ada, C++, or Java.*

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.

Prerequisite: *SE 500 or consent of instructor.*

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.

Prerequisite: *SE 500 or consent from the instructor.*

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.

Prerequisite: *SE 500 or consent from the instructor.*

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.

Prerequisite: *SE 500 or consent from the instructor.*

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 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.

Prerequisite: *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.

Prerequisite: *SE 530 or consent from the instructor.*

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 or consent from the instructor, plus knowledge of basic statistics.*

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.

Prerequisite: *SE 520 or consent from the instructor.*

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.

Prerequisite: *Consent from the instructor.*

SE 696

Graduate Internship in Software Engineering

1-3 Credits

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, SE 555, and SE 610, or permission from the instructor.*

SE 599 - 699

Special Topics in Software Engineering

1-3 Credits

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.

Systems Engineering

SYS 500

Systems Engineering

3 Credits

This fast-paced course provides an overview of systems engineering in the development of multidisciplined 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.

Prerequisites: *Matrix/vector algebra, differential and integral calculus, introductory probability and statistics.*

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 610

System Architecture Design and Modeling

3 Credits

This course is focused on concepts and techniques for architecting systems and the process of developing and evaluating architectures. The course includes generating a functional, physical and operational architecture from a top level operations concept for the allocation and derivation of component-level requirements. Variety of modeling and analysis approaches will be discussed as well as the generation of analyzable architecture models for evaluating the behavior and performance of candidate system concepts. Additional topics include 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 Baldridge 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 599 - 699

Special Topics in Systems Engineering

1-3 Credits

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..

Prerequisites: *Concent of the instructor and the department chair.*

Faculty and Administration

Officials of the University

Johnson, John P.
President; Professor, College of Arts and Sciences.
B.A. and M.S., Florida State University; Ph.D., Kent State University.

Ayers Jr., Francis H.
Executive Vice President and Chief Academic Officer, Prescott Campus. B.A., Virginia Polytechnic Institute and State University; M.S., Embry-Riddle Aeronautical University; Ed.D., Nova Southeastern University.

Frederick-Recascino, Christina
Vice President for Research and Assistant to the President; Professor of Human Factors and Systems. B.A., State University of New York; M.S. and Ph.D., University of Rochester.

Heist, Richard H.
Executive Vice President and Chief Academic Officer, Daytona Beach Campus; Professor of Engineering. B.A., Catawba College; Ph.D., Purdue University.

McReynolds, Irene
Vice President, Human Resources. B.S., Bryant College; M.B.A./A., Embry-Riddle Aeronautical University.

Montplaisir, Daniel E.
Vice President, Institutional Advancement. B.A., University of Central Florida; M.S., Indiana Wesleyan University.

Murray, Michael O.
General Counsel. J.D., Indiana University School of Law.

Watret, John
Executive Vice President and Chief Academic Officer, Worldwide. B.Sc., Heriot-Watt University; M.S. and Ph.D., Texas A&M University; P-ASEL

Weekes, Eric
Senior Vice President, Chief Financial Officer. B.S., New York Institute of Technology; M.B.A., New York University.

Legend

Letter designations for aviation qualifications are as follows:

- A – Airplane
- C – Commercial Pilot
- G – Glider
- H – Helicopter
- I – Instrument
- L – Land
- P – Private Pilot
- S – Seaplane
- AD – Aircraft Dispatcher
- IA – Inspection Authorization
- ME – Multi-Engine
- SE – Single-Engine
- A&P – Airframe and Powerplant Maintenance Technician
- AGI – Advanced Ground Instructor
- ATP – Airline Transport Pilot
- BGI – Basic Ground Instructor
- CFI – Certified Flight Instructor
- CTO – Control Tower Operations
- DME – Designated Mechanic Examiner
- DWE – Designated Written Examiner
- HTA – Heavier Than Air
- IGI – Instrument Ground Instructor
- LTA – Lighter Than Air
- SME – Single- and Multi-Engine
- FCC – Federal Communication Commission
- FE – Flight Engineer
- AC – Advanced Graduate Credit

Daytona Beach Academic Administration

Barbie, Donna J.
Professor of Humanities and Communication and Chair, Department of Humanities and Social Sciences, College of Arts and Sciences. B.S., Mary University; M.A., North Dakota State University; Ph.D., Emory University.

Bazargan, Massoud
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Boquet, Albert J.
Assistant Vice President for Research; Associate Professor and Chair, Department of Human Factors and Systems, College of Arts and Sciences. B.A., Nicholls State University; M.A. and Ph.D., University of Southern Mississippi.

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Grams, William F.
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Grant, Christopher D.
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Luxion, Stephen P., COL U.S. Air Force
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Administration

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Kring, Jason P.
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Krom, Dean, Capt. U.S. Marines
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