Mechanical Engineering (MECH)

MECH 200L Machine Shop Laboratory 1 Credit (0,1)

Introduction to manufacturing techniques, including riveting, sheet metal forming, welding, and machining.
Prescott Corequisites: ENGR 200 or ENGR 201

Course Offered at: Daytona Beach, Prescott

MECH 201L Computer-Aided Manufacturing Laboratory 1 Credit (0,1)

Introduction to computer-aided manufacturing (CAM), including turning, milling, laser cutting, and additive manufacturing.
Prerequisites: ENGR 120

Course Offered at: Worldwide

MECH 208L Manufacturing Laboratory 1 Credit (0,1)

Mechanical assembly and disassembly. CAD/CAM tools used to design components and manufacture parts using CNCs, welding, and basic fabrication techniques.
Prerequisites: ENGR 120 and BSME enrollment only

Course Offered at: Daytona Beach

MECH 299 Special Topics in Mechanical Engineering 1-6 Credit (0,0)

Individual, independent, or directed studies of selected topics in mechanical engineering.
Course Offered at: Daytona Beach, Prescott

MECH 304 Introduction to Machine Design 3 Credits (3,0)

Design of machine components. Topics include mechanical properties, stress analysis, deformation equations, static failure theories, and fatigue analysis.
Daytona Beach Prerequisites: ESCI 202

Prescott Prerequisites: AE/ME students must have a C or better in ESCI 202 and ESCI 204 and ENGR 200 or ENGR 201

Worldwide Prerequisites: ESCI 202

Course Offered at: Daytona Beach, Prescott, Worldwide

MECH 304L Machine Design Laboratory 1 Credit (0,1)

Practical applications of machine component design.
Corequisites: MECH 304

Course Offered at: Prescott, Worldwide

MECH 307 Modeling and Simulation of Complex Engineering Problems 2 Credits (2,0)

Computer-aided modeling and simulation; numerical methods for solving algebraic systems, differential equations, curve fitting, data analysis, optimization; case-based approach to solve multidisciplinary engineering problems with non-unique solutions.
Prerequisites: ESCI 202 and ESCI 204 and MATH 345

Corequisites: MECH 307L

Course Offered at: Daytona Beach

MECH 307L Modeling and Simulation of Complex Engineering Problems Laboratory 1 Credit (0,1)

Advanced programming and scripting techniques for modeling and simulation of multidisciplinary engineering problems; project-based approach.
Corequisites: MECH 307

Course Offered at: Daytona Beach

MECH 309 Fluid Dynamics 3 Credits (3,0)

Physical characteristics of the fluid state, fluid statistics, kinematics of fluid motion, flow of an incompressible ideal fluid, the impulse-momentum principles, similitude and dimensional analysis and fluid measurements.
Prerequisites: ESCI 204 and MATH 345

Course Offered at: Daytona Beach

MECH 330 Fundamentals of Biomechanics 3 Credits (3,0)

Biomechanics principles and fundamentals of musculoskeletal anatomy; kinematics and kinetics related to human movement; biodynamic analysis of forces in human function; mechanical properties and functions of the musculoskeletal system; qualitative and quantitative movement approaches; overview of various biomechanical data collection and analysis.
Prerequisites: ESCI 204

Course Offered at: Daytona Beach

MECH 340 Alternative Energy I 3 Credits (3,0)

Survey of alternative energy resources and technologies; electricity generation and distribution; traditional fossil fuels, nuclear, hydro, wind, solar, geothermal, biomass, fuel cells, ocean energy; energy storage and energy economics.
Prerequisites: AE/ME students must have a C or better in ESCI 208

Course Offered at: Prescott

MECH 350 Longitudinal and Vertical Vehicle Dynamics 3 Credits (3,0)

Design and analysis of high-performance vehicles. Models for vertical and longitudinal dynamics using computational tools.
Daytona Beach Prerequisites: ESCI 202 and ESCI 204

Prescott Prerequisites: AE/ME students must have a C or better in ESCI 202 and ESCI 204

Course Offered at: Daytona Beach, Prescott

MECH 360 Airbreathing and Rocket Propulsion 3 Credits (3,0)

Study of airbreathing and rocket engines. Topics include thermodynamics, propulsion systems, and components like inlets, compressors, turbines, nozzles, and rockets.
Prescott Prerequisites: AE/ME students must have a C or better in ESCI 206 and ESCI 208

Course Offered at: Daytona Beach, Prescott

MECH 370 Introduction to Robotics 3 Credits (3,0)

Introduction to robotics with an emphasis on kinematics and dynamics of robot arms. Topics include forward/inverse kinematics, trajectory generation, and manipulator control.
Prescott Prerequisites: AE/ME students must have a C or better in ESCI 204 and MATH 335

Worldwide Prerequisites: COMM 221 and ESCI 204 and CESC 220/CESC 220L and ELEC 230/ELEC 230L or ELEC 327

Worldwide Corequisites: MECH 370L

Course Offered at: Prescott, Worldwide, Asia

MECH 370L Introduction to Robotics I Laboratory 1 Credit (0,1)

Basics of Robot Operating System (ROS); low-level sensor-actuator interfacing, motion planning, pose estimation, localization; projects using ROS libraries and frameworks.
Corequisites: MECH 370

Course Offered at: Prescott, Worldwide

MECH 371 Robotic Technologies for Uncrewed Systems 3 Credits (3,0)

Fundamentals of robotic and uncrewed systems; uncrewed system terminology; operating principles of common robot sensors; localization strategies and sensors; active ranging technologies and use cases; cameras and computer vision; autonomous behaviors and strategies.
Daytona Beach Prerequisites: ENGR 115 or CPSC 223

Prescott Prerequisites: AE/ME students must have a C or better in ENGR and CPSC 223

Course Offered at: Daytona Beach, Prescott

MECH 372 Robotic Architecture 3 Credits (3,0)

Foundational concepts and tools used to develop, analyze, debug, and use complex robotic systems. A Robot Operating System (ROS)-based framework used throughout.
Course Offered at: Daytona Beach

MECH 399 Special Topics in Mechanical Engineering 1-6 Credit (0,0)

Individual, independent, or directed studies of selected topics in mechanical engineering.
Course Offered at: Daytona Beach, Prescott, Worldwide

MECH 400 Mechanical Vibrations 3 Credits (3,0)

Basic concepts of vibration; free and undamped vibration; natural frequencies, damping mechanisms, torsional vibration; harmonically excited and transient vibration; multi-degree-of-freedom systems; rotor dynamics; vibratory response of complex structures.
Daytona Beach Prerequisites: MATH 345 and ESCI 202 and ESCI 204

Prescott Prerequisites: AE/ME students must have a C or better in MATH 345 and ESCI 202 and ESCI 204

Worldwide Prerequisites: MATH 345 and ESCI 202 and ESCI 204

Course Offered at: Daytona Beach, Prescott, Worldwide

MECH 402 Model-Based Control System Design 2 Credits (3,0)

Model-based control system design. Control synthesis, system simulation, plant modeling, controller programming; systematic approach to reduce development costs and time to market.
Prerequisites: MATH 345

Corequisites: MECH 402L

Course Offered at: Daytona Beach, Prescott

MECH 402L Model-Based Control System Design Laboratory 1 Credit (0,1)

Model-based design process; plant modeling; control system synthesis; system simulation; controller programming; lab instrumentation.
Daytona Beach Corequisites: MECH 402

Course Offered at: Daytona Beach, Prescott

MECH 404 Advanced Machine Design 3 Credits (3,0)

Design and analysis of mechanical systems and components under static and fluctuating loads; static and fatigue failures of determinate and indeterminate systems; finite element method and use of computer aided tools for analyzing machine component.
Prerequisites: MECH 304

Course Offered at: Daytona Beach, Worldwide

MECH 405 Thermal-Fluid Science and Energy Measurement 1 Credit (1,0)

Measurement techniques and instrumentation in thermal-fluid sciences. Temperature, pressure, flow, heat transfer measurement; design of experiments, data analysis methods.
Prerequisites: AE/ME students must have a C or better in ESCI 324 and ESCI 324L

Course Offered at: Prescott

MECH 405L Thermal-Fluid Science and Energy Measurement Laboratory 1 Credit (0,1)

Measurement techniques for temperature, pressure, flow, heat flux in thermal-fluid systems; data analysis and interpretation; reporting of experimental results; team-based projects.
Corequisites: MECH 405

Course Offered at: Prescott

MECH 430 Biofluid Mechanics 3 Credits (3,0)

Fluid mechanics principles applied to the human cardiovascular system. Cardiovascular structure, blood flow analysis, heart valves, mechanical assist devices.
Prerequisites: MECH 309 or ESCI 206

Course Offered at: Daytona Beach

MECH 431 Biosolid Mechanics 3 Credits (3,0)

Mechanical behavior of biological systems; stress-strain analysis of tissues under static load; cartilage, bone; finite element analysis of biomaterials; application of solid mechanics to biological structures.
Prerequisites: MECH 304 or AERO 318

Course Offered at: Daytona Beach

MECH 438 Biomedical Systems Preliminary Design 4 Credits (3,3)

Mechanical engineering design for biomedical systems. Professionalism, creativity, design logic, communication; long-term project assigned for practical implementation of the design process.
Prerequisites: MECH 304 and MECH 307 and MECH 307L

Corequisites: MECH 438L

Course Offered at: Daytona Beach

MECH 439 Biomedical Systems Detail Design 4 Credits (3,3)

Continuation of preliminary design; capstone project for biomedical engineering degree. Final project design, analysis, and presentation.
Prerequisites: MECH 438

Corequisites: MECH 439L

Course Offered at: Daytona Beach

MECH 440 Thermal Power Systems 3 Credits (3,0)

Thermodynamics of power and refrigeration cycles; psychrometrics and environmental control; ideal gas mixtures, combustion; internal combustion engines, gas turbines, fuel cells, direct energy conversion; design and optimization of power systems.
Daytona Beach Prerequisites: ESCI 208

Prescott Prerequisites: AE/ME students must have a C or better in ESCI 208 and MATH 345

Course Offered at: Daytona Beach, Prescott

MECH 442 Alternative Energy II 3 Credits (3,0)

Detailed analysis of alternative energy power generation. Traditional power cycles with alternative fuels; energy from air and water movement; electrochemical conversion; photovoltaic power generation.
Daytona Beach Prerequisites: ESCI 208 and MECH 440PC - AE/ME students must have a C or better in ESCI 208 and MECH 440

Course Offered at: Daytona Beach, Prescott

MECH 443 Environment Control and HVAC Systems 3 Credits (3,0)

Fundamentals of heating, ventilation, and air conditioning (HVAC). Heat transfer, energy consumption, human comfort in building structures.
Daytona Beach Prerequisites: ESCI 208

Prescott Prerequisites: ESCI 208 and MECH 440

Course Offered at: Daytona Beach, Prescott

MECH 445 Sustainable Design 3 Credits (3,0)

Sustainable design principles including climate change, sustainable power sources, the electric grid, energy storage, building and transportation loads. Utility-scale solar, wind, and energy storage, plus residential scale energy generation and storage approaches.
Prerequisites: ESCI 208

Course Offered at: Daytona Beach

MECH 448 Energy Systems Preliminary Design 4 Credits (3,3)

Alternative energy system design. Aerodynamic, thermodynamic calculations; system/site drawings, weight estimates, structural analysis, control system design, performance report.
Daytona Beach Prerequisites: MECH 304, MECH 307, MECH 307L

Daytona Beach Corequisites: MECH 448L

Prescott Prerequisites: C or better in ENGR 200 or ENGR 201 and four of the following: MECH 304, ESCI 324 and ESCI 324L, ESCI 320, ELEC 334, MECH 443, ESCI 403, and MECH 442

Prescott Corequisites: COMM 420 and COMM 430

Course Offered at: Daytona Beach, Prescott

MECH 449 Energy Systems Detail Design 4 Credits (3,3)

Continuation of the preliminary design course, including manufacturing, hardware testing & design validation Capstone project for the degree.
Daytona Beach Prerequisites: MECH 448

Daytona Beach Corequisites: MECH 449L

Prescott Prerequisites: AE/ME students must have a C or better in MECH 448

Course Offered at: Daytona Beach, Prescott

MECH 450 Combined Vehicle Dynamics 3 Credits (3,0)

Design and analysis of high-performance vehicles. Multi-degree-of-freedom models; roll, pitch, bounce; tire models (combined slip); suspension systems, cornering dynamics, bicycle model.
Prerequisites: MECH 350

Course Offered at: Daytona Beach

MECH 451 Vehicle Aerodynamics 3 Credits (3,0)

Aerodynamics of high-performance land vehicles. Influence of design on drag, lift, and moments; performance, handling, stability; noise, safety, comfort; internal flows, engine cooling; computational fluid dynamics for performance evaluation and design. Wind tunnel basics for testing vehicle aerodynamics.
Daytona Beach Prerequisites: MECH 309 and ESCI 208

Prescott Prerequisites: AE/ME students must have a C or better in MECH 309 and ESCI 208

Course Offered at: Daytona Beach, Prescott

MECH 458 High Performance Vehicles Preliminary Design 4 Credits (3,3)

Conceptual and detailed mechanical design for high-performance vehicles. Component design, manufacture, production; complete system design; specifications, analysis, drawings, performance report. For Senior undergraduate students.
Daytona Beach Prerequisites: MECH 304 and ESCI 208 and MECH 307 and MECH 307L

Daytona Beach Corequisites: MECH 458L

Course Offered at: Daytona Beach

MECH 459 High Performance Vehicles Detail Design 4 Credits (3,3)

Continuation of the preliminary design course, including manufacturing, hardware testing & design validation. Capstone project for the degree.
Prerequisites: MECH 458

Corequisites: MECH 459L

Course Offered at: Daytona Beach

MECH 460 Advanced Propulsion 3 Credits (3,0)

In-depth jet engine analysis. Parametric engine cycle analysis, ideal engines, engines with losses; operational condition analysis (altitude, throttle); turbojet, turbofan, turboprop, turbo shaft, scramjet.
Prerequisites: AE/ME students must have a C or better in MECH 360

Course Offered at: Prescott

MECH 461 Boost Rocket Propulsion 2 Credits (2,1)

Solid and liquid rocket propulsion systems; staging; chemical combustion; heat transfer, regenerative cooling, ablatives; nozzle flow, over- and under-expansion. Solid propellants, St. Robert's Law, grain geometry and thrust profile. Liquid propellants, mixture ratio, engine cycles, power balance. Sea-level and altitude simulation test stands; instrumentation.
Prerequisites: MECH 360 and ESCI 403

Corequisites: MECH 461L

Course Offered at: Prescott

MECH 461L Boost Rocket Propulsion Laboratory 1 Credit (0,1)

Hands-on experience with rocket propulsion components and systems. Solid propellants and motors; liquid engines and propellants. Use of test facilities, equipment, and instrumentation to measure thrust, impulse, and other performance parameters. Emphasis on safety and proper testing practices.
Corequisites: MECH 461

Course Offered at: Prescott

MECH 468 Propulsion System Preliminary Design 4 Credits (3,3)

Preliminary design of propulsion system components. Requirements analysis, propulsion system selection, system design characteristics; component integration with vehicle; complete paper design.
Prerequisites: Students must have a C or better in ENGR 200 or ENGR 201 and four of the following courses: MECH 304, ESCI 320, ELEC 334, MECH 460, ESCI 403, and ESCI 324 and ESCI 324L

Corequisites: COMM 420 and COMM 430

Course Offered at: Prescott

MECH 469 Propulsion System Detail Design 4 Credits (3,3)

Detailed design of propulsion system components. Design for operational environment; component integration; manufacture, testing of components; hardware design, manufacturing, and testing.
Prerequisites: AE/ME students must have a C or better in MECH 468

Course Offered at: Prescott

MECH 470 Mechatronics 3 Credits (3,0)

Introduction to mechatronics with an emphasis on integrating mechanical, electrical, and computer systems; microcontrollers, sensors, actuators, and other components for electromechanical devices.
Daytona Beach Prerequisites: ESCI 204

Daytona Beach Corequisites: ESCI 324 and ESCI 324L

Prescott Prerequisites: C or better in CPSC 223, CESC 220/ CESC 220L, (ELEC 335/ELEC 335L or ELEC 223/ELEC 223L)

Prescott Corequisites: MECH 470L

Worldwide Prerequisites: (ELEC 220/ELEC 220L and ELEC 230/ ELEC 230L) or ELEC 327

Worldwide Corequisites: MECH 470L

Course Offered at: Daytona Beach, Prescott, Worldwide, Asia

MECH 470L Mechatronics Laboratory 1 Credit (0,1)

Hands-on application of microcontrollers, sensors, and actuators; practical skills for programming and integration of mechatronic systems.
Corequisites: MECH 470

Course Offered at: Prescott, Worldwide, Asia

MECH 471 Robotics II 3 Credits (3,0)

Design and application of robotic systems for aviation and space; motion requirements, control systems, sensors, signal conditioning; actuators (motors, linear actuators); system modeling and control law development; software for robotic control systems.
Prescott Prerequisites: AE/ME students must have a C or better in ESCI 204 and MECH 370

Worldwide Prerequisites: ESCI 204 and MECH 370

Course Offered at: Prescott, Worldwide

MECH 471L Robotics II Laboratory 1 Credit (0,1)

Real-time control of robotic manipulators; multidegree-of-freedom systems; harmonic drives, AC servo motors, controllers.
Corequisites: MECH 471

Course Offered at: Prescott, Worldwide

MECH 478 Robotic Systems Preliminary Design 4 Credits (4,0)

Conceptual and detailed mechanical design for robotic applications. Component design, manufacture, production; complete system design; specifications, analysis, drawings, performance report.
Daytona Beach Prerequisites: MECH 304 and MECH 470 or (ESCI 324 and ESCI 324L) and MECH 307 and MECH 307L and Senior standing

Daytona Beach Corequisites: MECH 478L

Prescott Prerequisites: AE/ME students C or better in MECH 304 and MECH 470 or (ESCI 324 and ESCI 324L) and ELEC 426 and 426L and Senior standing

Prescott Corequisites: COMM 420 and COMM 430

Worldwide Prerequisites: MECH 304 and MECH 470

Course Offered at: Daytona Beach, Prescott, Worldwide

MECH 479 Robotic Systems Detail Design 4 Credits (4,0)

Continuation of the preliminary design course. Capstone project for the degree.
Daytona Beach Prerequisites: MECH 478

Daytona Beach Corequisites: MECH 479L

Prescott Prerequisites: AE/ME students must have a C or better in AERO 430 or ELEC 401 and MECH 478

Worldwide Prerequisites: MECH 478

Course Offered at: Daytona Beach, Prescott, Worldwide

MECH 496 Engineering Practice and Entrepreneurship 3 Credits (3,0)

Product conception, market research, conceptual design, project management, budgeting, leadership, and presentations. Preparation for entrepreneurial roles in engineering.
Prerequisites: MECH 438 or MECH 448 or MECH 458 or MECH 468 or MECH 478

Course Offered at: Daytona Beach

MECH 499 Special Topics in Mechanical Engineering 1-6 Credit (1-6,0)

Individual, independent, or directed studies of selected topics in mechanical engineering.
Course Offered at: Daytona Beach, Prescott, Worldwide