COLLEGE OF AERONAUTICS AND ENGINEERING

College of Aeronautics and Engineering
Aeronautics and Engineering Building
www.kent.edu/cae

Vision Statement

To be recognized as a global leader embracing a unique synergy of aeronautics, engineering, and technologies that inspires our diverse talent to innovate, impact and improve life, making the universe more accessible and the opportunities for our students immeasurable.

Mission Statement

To embrace a unique synergy of aeronautics, engineering and technologies, positively changing the trajectory of the regional, national and global community by:

- Providing a dynamic educational experience that fosters experiential learning;
- Cultivating innovative research that transforms ideas into reality; and
- Producing forward-thinking professionals dedicated to overcoming limits and improving lives.

Core Values

As a college community, we will pursue excellence in all we do, built upon the foundations of respect, compassion, and inclusiveness. We will operate and make decisions with integrity, as we engage in collaboration to build a sense of belonging and achieve our mission. We will embrace perseverance, recognizing that overcoming obstacles will ultimately lead to the kind of innovation that can most greatly impact and improve lives.

Undergraduate Programs

- Aeronautical Studies - B.S.
- Aeronautical Systems Engineering Technology - B.S.
- Aerospace Engineering - B.S.
- Air Traffic and Airspace Management - B.S.
- Applied Engineering - B.S.
- Aviation Maintenance Management - B.S.
- Aviation Management - B.S.
- Computer Engineering Technology - B.S.
- Cybersecurity Engineering - B.S.
- Mechanical Engineering Technology - B.S.
- Mechatronics Engineering - B.S.
- Mechatronics Engineering Technology - B.S.
- Professional Pilot - B.S.
- Unmanned Aircraft Systems Flight Operations - B.S.

Minors

- Aircraft Dispatch
- Aviation Law and Policy
- Aviation Management
- Aviation Weather
- Computer Engineering Technology
- Electronics
- Innovation
- Professional Pilot
- Safety, Quality and Lean in Manufacturing
- Sustainability
- Technology
- Unmanned Aircraft Systems

Graduate Programs

- Aerospace Engineering - M.S.
- Aerospace Engineering - Ph.D.
- Aviation Management and Logistics - M.S.
- Engineering Technology - M.E.T.
- Mechatronics Engineering - M.S.
- Mechatronics Engineering - Ph.D.

College of Aeronautics and Engineering Faculty

- Abdul-Aziz, Ali (2016), Associate Professor, Ph.D., Cleveland State University, 1985
- Bloebaum, Christina L. (2018), Professor
- Boergerhoff, Jason T. (2010), Associate Professor, M.S., University of North Dakota, 2010
- Boyd, Darwin L. (1983), Assistant Professor, Ph.D., Kent State University, 1991
- Chen, Xuhui (2019), Assistant Professor, Ph.D., Case Western Reserve University, 2019
- Du, Yanhai (2013), Professor, Ph.D., University of Waikato, 2004
- Fisch, Michael R. (1998), Associate Professor, Ph.D., Harvard College, 1982
- Fussell, Stephanie G. (2020), Assistant Professor, Ph.D., Embry-Riddle Aeronautical University, 2020
- Gurkan, Deniz (2023), Professor, Ph.D., University of Southern California, 2003
- Harrison, Joycelyn S. , Professor
- Harrison, Carl E. (2021), Associate Lecturer
- Hassler, Richard P. (2018), Assistant Professor, Ed.S., The Fielding Institute, 2005
- Koptur, Evren (2003), Associate Professor, Ph.D., Kent State University, 2016
- Kwasa, Benjamin (2021), Assistant Professor, Ph.D., Iowa State University, 2017
- LaBerge, Kelsen E. (2018), Associate Professor, Ph.D., Case Western Reserve University, 2009
- Liu, Rui (2019), Assistant Professor, Ph.D., Colorado School of Mines, 2018
- Lorenzon, Jason (2007), Assistant Professor, J.D., Cleveland State University, 2007
- Mangrum, Richard L. (2003), Professor, Ed.D., Oklahoma State University, 2003
- McFarland, Maureen R. (2003), Associate Professor, Ph.D., Kent State University, 2017
- Mirinejad, Hossein (2019), Assistant Professor

- Neff, Carissa M. (2013), Lecturer, B.S., Kent State University, 2015
- Nettey, Richmond I. (2001), Professor, Ph.D., University of Houston-Main Campus, 2000
- Palcho, Timothy L. (2000), Professor, M.S., Mountain State University, 2009
- Perez-Davis, Marla E. (2022), Professor
- Ripple, James E. (2008), Associate Professor, B.A., Kent State University, 1991
- Shen, Tao (2019), Assistant Professor
- Shihab, Syed Arbab Mohd (2020), Assistant Professor, Ph.D., Iowa State University, 2020
- Testa, Michael (2017), Lecturer, M.S., University of Akron, 1997
- True, Trent (2004), Associate Lecturer, M.Tech., Kent State University, 2007
- Weaver, Jonathan C. (2023), Associate Lecturer, M.A., The Open University, 2017

Aeronautics (AERN)

AERN 15000 INTRODUCTION TO AERONAUTICS 3 Credit Hours
Introduction to aeronautical and aerospace technology, including historical development, underlying science and technical applications. The past, present and future social, economic, technical and political impact of aviation are also explored.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 15740 ELEMENTS OF FLIGHT THEORY 5 Credit Hours
Basic instruction in all areas which gives the student aeronautical knowledge required for a private pilot certificate.
Prerequisite: Special approval.
Schedule Type: Lecture
Contact Hours: 5 lecture
Grade Mode: Standard Letter

AERN 15745 NON-PILOT ELEMENTS OF FLIGHT THEORY 3 Credit Hours
Basic instruction in areas to include: federal regulations, navigation, communication, airspace, weather, basic aerodynamics and aero-medical factors which give the student a foundation in aeronautics. This course does not satisfy the Federal Aviation Regulation requirement for endorsement to take the Airman Knowledge Exam for a private pilot nor does it satisfy the Aircraft Dispatch minor.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 15750 ELEMENTS OF FLIGHT THEORY I 3 Credit Hours
Basic Instruction in all areas which gives the student aeronautical knowledge required for a student pilot certificate.
Corequisite: AERN 15751.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 15751 PRIVATE PILOT FLIGHT I 2 Credit Hours
Flight course designed to fulfill FAA requirements for a student pilot completing their first supervised solo. Student is required to spend a minimum of two hours each day, five days a week, at the airport until course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must obtain student pilot certificate, hold a valid FAA medical and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: Professional Pilot major.
Pre/corequisite: MATH 11010.
Corequisite: AERN 15750.
Schedule Type: Flight Training
Contact Hours: 3.5 other
Grade Mode: Standard Letter-IP

AERN 15752 ELEMENTS OF FLIGHT THEORY II 2 Credit Hours
Basic instruction in all areas which gives the student aeronautical knowledge required for a private pilot certificate.
Prerequisite: AERN 15750 with a minimum C grade; and minimum 2.500 overall GPA.
Corequisite: AERN 15753.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 15753 PRIVATE PILOT FLIGHT II 3 Credit Hours
Flight course designed to fulfill FAA requirements for a private pilot certificate. Student is required to spend a minimum of two hours each day, five days a week, at the airport until course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must obtain student pilot certificate, hold a valid FAA medical and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: Minimum C grade in the following courses: AERN 15740 or (AERN 15750 and AERN 15751); and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 15752.
Schedule Type: Flight Training
Contact Hours: 4 other
Grade Mode: Standard Letter-IP

AERN 22500 INTRODUCTION TO AVIATION MAINTENANCE MANAGEMENT 2 Credit Hours
Introduction to the day-to-day concepts used by an aviation maintenance manager. Course provides an overview of the different aspects that go into managing human resources and overseeing the safe, legal and efficient inspection, repair and return to service of aircraft when working at a private maintenance repair organization (MRO), an airline, or a fixed-base operator (FBO). On a more practical level, course reviews leadership/management styles and challenge students to identify what type of manager they want to become.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 25100 INTRODUCTION TO AVIATION MANAGEMENT 3 Credit Hours
Introduction to the day-to-day concepts of airline, airport and other businesses pertaining to the aviation industry.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 25250 ELEMENTS OF AVIATION WEATHER 3 Credit Hours
Aviation weather provides a comprehensive look at the Earth's atmosphere, general patterns and specific phenomena and a focus on weather as related to flight.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: CTAG Air Transportation

AERN 25251 WEATHER INFORMATION SYSTEMS 3 Credit Hours
Introduction to various weather sensing equipment and the systems that deliver weather information to various users. An in-depth look at the National Weather Service, NOAA, NASA, FAA and commercially available weather information systems.
Prerequisite: AERN 25250 or GEOG 31062.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 25252 THUNDERSTORMS AND SEVERE WEATHER 3 Credit Hours
Analysis and forecast of thunderstorm and severe convective weather activity development and movement. Analysis of atmospheric information and clouds, radar, computer models and charts. A study of mid-latitude cyclones and some focused study on tropical depressions, hurricanes, tornadoes, dust and sand storms. Study includes geographic effects and cyclone life cycles. Provides an in-depth look at the development of severe weather products for aviation such as AIRMET, SIGMET and Convective SIGMET.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 25350 FUNDAMENTALS OF AIR TRAFFIC CONTROL 2 Credit Hours
Introduction to the National Airspace System (NAS) and the orders, manuals and procedures associated with the purposes and directives of the air traffic control environment. Introduces and discusses those areas of required knowledge of the AT-Basics needed to become an air traffic controller. These topics include the principles of flight, the FARs, navigation, aviation weather and other ATC related areas.
Prerequisite: Aeronautical Studies major or Air Traffic and Airspace Management major or Aviation Management major or Professional Pilot major or Unmanned Aircraft Systems Flight Operations major.
Corequisite: AERN 25351.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 25351 FUNDAMENTALS OF AIR TRAFFIC CONTROL LABORATORY 1 Credit Hour
Introductory laboratory course on air traffic management and the National Airspace System, the orders, manuals and procedures associated with the purposes and directives of the air traffic control environment. To include purposes and responsibilities of the ATC system.
Prerequisite: Aeronautical Studies major or Air Traffic and Airspace Management major or Aviation Management major or Professional Pilot major or Unmanned Aircraft Systems Flight Operations major.
Corequisite: AERN 25350.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

AERN 25800 INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS 3 Credit Hours
An overview of unmanned aircraft systems. Course topics include the history, development and evolution of unmanned aircraft; current and forecast trends and issues; capabilities and performance of unmanned aircraft; UAS applications; regulations governing unmanned aircraft systems; unmanned aircraft flight operations; and opportunities and career paths in unmanned aircraft systems.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: CTAG Air Transportation, ITAG Aircraft Transportation

AERN 30000 PROFESSIONAL DEVELOPMENT IN AERONAUTICS 1 Credit Hour
The course will build upon the lessons learned in Professional Development in Aeronautics I by providing direct opportunities for interviewing and networking with professionals working in the aeronautics industry. Students will continue preparation for a career in the aeronautics industry by revising and implementing their career plan and goals.
Prerequisite: Junior standing.
Schedule Type: Seminar
Contact Hours: 1 lecture
Grade Mode: Standard Letter

AERN 32100 ADVANCED AIRCRAFT COMPOSITE TECHNOLOGY 2 Credit Hours
As the changes and improvements in technology progress in aircraft manufacturing, composites are becoming commonplace on airframes of all sizes and varieties. This course provides a more in-depth look at composites than what an airframe and powerplant mechanic receives in their initial training. Students study the theory behind aircraft composites and composite inspection and repair with a focus on latest updates in composite technology. Students observe how composites are used practically in the aviation industry and investigate the most recent advances in composite technology. Non-aviation maintenance management majors with military experience or other technical aviation maintenance experience who are interested in registering for this course should speak with an advisor.
Prerequisite: Aviation Maintenance Management major.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 32200 AVIONICS MAINTENANCE FOR GLASS COCKPITS 2 Credit Hours
Advanced avionics utilizing computers and screens, "glass cockpits," has become standard on most new aircraft including smaller general aviation (GA) aircraft. Course focuses on the different maintenance and troubleshooting aspects of working with these systems, with a specific focus on those systems installed on smaller GA aircraft. Non-aviation maintenance management majors with military experience or other technical aviation maintenance experience who are interested in registering for this course should speak with an advisor.
Prerequisite: Aviation Maintenance Management major.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 32300 INSPECTION AUTHORIZATION I 2 Credit Hours
Course prepares students by instructing them in the knowledge and subject areas necessary to pass the Inspection Authorization (IA) exam. Inspection authorization is issued to students by the FAA to airframe and powerplant mechanics after they have completed experience requirements and passed the exam. To register for the course, students must meet the FAA eligibility requirements to sit for the IA exam and receive the authorization.
Prerequisite: Special approval.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 32400 AVIATION COMMUNICATIONS 2 Credit Hours
When it comes to communications between pilots, dispatchers, managers and aviation maintenance technicians, there can be many different terms and abbreviations that cause confusion and miscommunications. This course outlines common terms and abbreviations used in the different aviation departments and addresses how to avoid common pitfalls in communication between maintenance personnel, pilots, dispatchers and upper management. Additionally, students are introduced to techniques for interaction to foster a positive work and safety culture within their organizations.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 35020 AIRCRAFT PROPULSION SYSTEMS 3 Credit Hours
A study of basic reciprocating and gas turbine engine theory. Course investigates powerplant construction, component function, including propeller and fuel systems, ancillary systems that support aircraft propulsive systems and performance characteristics.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35021 RADAR SATELLITE WEATHER INFORMATION 3 Credit Hours
A study of satellite and radar imagery. A focus on both passive and active remote sensing systems. Student develops an understanding of the properties of meteorological radar sensing, signal propagation and estimating precipitation. Provides an in-depth look at radar and satellite products and their application to aircrew operations. Emphasis is placed on real-time identification of weather phenomena affecting a flight in progress.
Prerequisite: AERN 25250 or GEOG 31062.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35022 WEATHER STRATEGY FOR AIRCREWS 3 Credit Hours
Flying strategies for various weather conditions to include low ceilings and visibility, turbulence, cold weather, thunderstorms and wind shear. An exploration of basic and advanced weather theory and how to get the best use of FAA and commercially available forecast products and briefing services. Course takes a condition-by-condition look at various hazardous weather phenomena.
Prerequisite: AERN 25250 or GEOG 31062.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35030 INTRODUCTION TO CORPORATE AVIATION 3 Credit Hours
Introduces students to the business and corporate sectors of commercial aviation. Examines business and corporate aviation from the joint perspectives of operations and maintenance management as well as flight operations.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35031 AIR TRANSPORTATION INDUSTRY REGULATIONS 3 Credit Hours
This course will examine the functions of the regulatory agencies in the aviation industry. The evolution of Administrative Regulation, Federal Aviation Regulation and the rule making process.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35040 AIRCRAFT SYSTEMS I 3 Credit Hours
In-depth study of various aircraft systems including electrical systems, environmental control systems and fuel systems as applied to aircraft.
Prerequisite: PHY 13002 or PHY 13012 or PHY 23102.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35150 AIRCRAFT STRUCTURES 3 Credit Hours
Aircraft structural design investigations dealing with theory and applications in aviation.
Prerequisite: PHY 13001.
Schedule Type: Combined Lecture and Lab
Contact Hours: 3 other
Grade Mode: Standard Letter

AERN 35250 UNMANNED AIRCRAFT SYSTEMS LAW AND REGULATIONS 2 Credit Hours
This course introduces students to the changing and dynamic area of UAS laws and regulations. Students will study the Constitutional, statutory and regulatory sources of law. Students will study the Congressional and regulatory development of UAS laws. Students will learn how the regulatory process, advanced proposals of rulemaking and notice of proposed rule making operates. Students will also study pertinent case law regarding Constitutional, criminal, privacy issues, tort and products liability issues. Finally, students will learn and understand how to legally operate a UAS in the National Airspace System in an always changing legal and technology environment.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 35339 FIXED BASE OPERATOR OPERATIONS 3 Credit Hours
A study of general aviation operations and the role of fixed base operators in the National Aviation System; management functions; marketing; profit; cash flow; financing; human resources; organization; administration; management information systems; operations; maintenance; safety; liability; physical facilities; and the future of general aviation.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35340 AIRPORT MANAGEMENT 3 Credit Hours
Introduction to the many functions that are involved in the operation and management of an airport. Includes an analysis of the development of the airport-airway system, airport legislation, airport planning and airport operations.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35341 AIR TRANSPORTATION SYSTEMS 3 Credit Hours
Descriptive course in airline operations as seen from the air carrier's business perspective. Emphasis is on business practices and techniques unique to aviation.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35350 TERMINAL OPERATIONS 3 Credit Hours
Intermediate to advanced level terminal operations course. This course includes an emphasis on ATCT operations at the ground control and local control positions, as well as TRACON operations in arrival, departure and overflight roles. Topics covered include, but are not limited to, phraseology, maps, procedures, LOAs and weather.
Prerequisite: AERN 15740 or AERN 15745 or AERN 15750; and AERN 25350 and AERN 25351.
Corequisite: AERN 35351.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35351 TERMINAL OPERATIONS LABORATORY 2 Credit Hours
Intermediate to advanced level terminal operations course. This course includes an emphasis on ATCT operations at the ground control and local control positions, as well as TRACON operations in arrival, departure and overflight roles. Topics covered include, but are not limited to, phraseology, maps, procedures, LOAs and weather.
Prerequisite: AERN 15740 or AERN 15745 or AERN 15750; and AERN 25350 and AERN 25351.
Corequisite: AERN 35350.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

AERN 35650 NON-PILOT INSTRUMENT FLIGHT THEORY 3 Credit Hours
Course instruction for instrument flight to include: navigation facilities and equipment (both ground and aircraft), general weather theory and weather related to instrument meteorological conditions, weather charts and sources, FAA regulations pertinent to the conduct of instrument flight, aeronautical charts for instrument flight and techniques and procedures unique to the conduct of instrument flight. This course does not satisfy the Federal Aviation Regulation requirement for endorsement to take the Airman Knowledge Exam for an Instrument Rating nor does it satisfy the Aircraft Dispatch minor.
Prerequisite: AERN 15740 or AERN 15745; and AERN 25250.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35660 INSTRUMENT FLIGHT THEORY 3 Credit Hours
Course instruction on instrument flight to include navigation facilities (both ground and aircraft), weather theory and weather specific to instrument meteorological conditions, weather charts and sources, cross-country flight planning for IFR, FAA regulations specific to IFR flight, charts for instrument flight, aircraft performance, decision making, aircraft systems and instruments related to IFR flight and instrument flight techniques and procedures. This course meets the requirements for endorsement to take the FAA Airman Knowledge Exam for an instrument rating and satisfies the requirements of the training course outline approved by the FAA.
Prerequisite: AERN 25250; and minimum C grade in the following courses: AERN 15740 or (AERN 15752 and AERN 15753); and minimum 2.500 overall GPA; and Aeronautical Studies major or Air Traffic and Airspace Management major or Aviation Management major or Professional Pilot major or Unmanned Aircraft Systems Flight Operations major.
Corequisite: AERN 35661.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35661 INSTRUMENT PILOT FLIGHT 3 Credit Hours
Comprehensive flight course for the professional pilot candidate that introduces commercial pilot flight skills and meets the training requirements of the FAA instrument rating. Student is required to spend a minimum of two hours daily, five days a week, at the airport until all course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid private pilot certificate in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: MATH 11010; and AERN 15753 with a minimum C grade; and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 35660.
Schedule Type: Flight Training
Contact Hours: 6.9 other
Grade Mode: Standard Letter-IP

AERN 35665 COMMERCIAL PILOT FLIGHT: NAVIGATION 3 Credit Hours
Advanced flight course for the professional pilot candidate to meet aeronautical experience requirements of the FAA commercial pilot certificate. Primary emphasis is on cockpit resource management, advanced navigational practices and advanced instrument instruction. Students are required to spend a minimum of two hours daily, five days a week, at the airport until all course requirements have been attained. When not flying, students go through personalized ground instruction. Students must hold valid private pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. This course may not be repeated without special approval.
Prerequisite: AERN 35660 and AERN 35661 with a minimum C grade; and minimum 2.500 overall GPA; and Professional Pilot major.
Schedule Type: Flight Training
Contact Hours: 5 other
Grade Mode: Standard Letter-IP

AERN 35760 COMMERCIAL PILOT THEORY 2 Credit Hours
Comprehensive instruction covering all areas necessary to exercise the privileges of a commercial pilot.
Prerequisite: AERN 35660 with a minimum C grade; and minimum 2.500 overall GPA.
Corequisite: AERN 35761.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 35761 COMMERCIAL PILOT FLIGHT 3 Credit Hours
Comprehensive flight course for the professional pilot candidate to meet the requirements of the FAA commercial pilot certificate. Student is required to spend up to two hours daily, five days a week, at the airport until course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid private pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: AERN 35665 with a minimum C grade; and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 35760.
Schedule Type: Flight Training
Contact Hours: 4.7 other
Grade Mode: Standard Letter-IP

AERN 35810 UNMANNED AIRCRAFT SYSTEMS 3 Credit Hours
Provides an understanding of the theory of operation, architecture and performance characteristics of various airborne-onboard systems and subsystems utilized in unmanned aerial vehicles. Also includes examination of aircraft materials, structural components and configuration.
Prerequisite: AERN 25800.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35830 UNMANNED AIRCRAFT SYSTEMS SENSING AND SENSOR SYSTEMS 3 Credit Hours
An in-depth study of sensors and remote sensing systems used to support unmanned aircraft operations. Course emphasizes the theory, technical characteristics, capabilities and operational use of various sensors and sensing systems. Course also investigates sensor data generation and sensing system image interpretation and analysis.
Prerequisite: AERN 25800.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35840 UNMANNED AIRCRAFT SYSTEMS COMMAND, CONTROL AND COMMUNICATIONS 3 Credit Hours
Explores the technological and operational aspects of ground-based and airborne command, control and communications systems used in unmanned aircraft systems. Topics include UAV sense-and-avoid systems, data link systems, voice communications systems, telemetry systems, navigation systems and manual and automatic flight control systems.
Prerequisite: AERN 25800.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35850 EMERGENT AIR VEHICLES AND INFRASTRUCTURE 3 Credit Hours
This course examines the emerging vehicles and ground support technology that will constitute Advanced Air Mobility (AAM) and Urban Air Mobility (UAM). Students learn about the concepts of the vehicles that will be required to make up a safe and efficient aviation transportation system. Students study the highly automated aircraft that will operate and transport passengers or cargo at lower altitudes within urban and suburban areas. Students study UAM, which will be composed of an ecosystem that considers the evolution and safety of the aircraft, the framework for operation, access to airspace, infrastructure development and community engagement.
Prerequisite: None.
Corequisite: AERN 35851.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35851 EMERGENT AIR VEHICLES AND INFRASTRUCTURE LABORATORY 1 Credit Hour
Students develop and design the emerging vehicles and ground support technology that will constitute Advanced Air Mobility (AAM) and Urban Air Mobility (UAM). Students also design the framework for operation, access to airspace, infrastructure development and community engagement.
Prerequisite: None.
Corequisite: AERN 35850.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

AERN 35892 SMALL UNMANNED AIRCRAFT SYSTEMS FLIGHT PRACTICUM (ELR) 2 Credit Hours
Small Unmanned Aircraft Systems Operations Flight Practicum. Student is required to spend a minimum of 15 hours during the semester flying a small unmanned aircraft system. When not flying, the student goes through personalized ground instruction. Special emphasis will be placed on the regulatory requirements of sUAS operations, applied weather theory, mission planning and emergency procedures. Students must obtain FAA Part 107 Unmanned Aircraft System Certification prior to starting this course.
Prerequisite: AERN 25800.
Schedule Type: Flight Training, Practical Experience
Contact Hours: 1 lecture, 3 other
Grade Mode: Standard Letter-IP
Attributes: Experiential Learning Requirement

AERN 42000 HUMAN FACTORS IN AVIATION MAINTENANCE 2 Credit Hours
There are many different human factors at play when technicians are engaged in aviation maintenance, as well as when overseeing others doing this work. Using the PEAR model (people, environment, actions, resources), students in the course study the different aspects of human factors in relation to aviation maintenance, and address how these can affect an aviation maintenance manager.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 42392 ADVANCED PISTON AIRCRAFT MAINTENANCE (ELR) 1-8 Credit Hours
(Repeatable for credit) This variable credit course focuses on piston engine aircraft and the associated systems and engines on their respective airframes. Numerous aircraft utilize piston engines and advanced technology with unique sets of parts, equipment and maintenance recommendations, practices and procedures from original equipment manufacturers (OEM). Many OEM and other accredited organizations offer courses on these airframes and engines. Advanced standing course credit will be awarded based upon the evidence of certificates of completion from approved organizations for appropriate applicable courses.
Prerequisite: Special approval.
Schedule Type: Practical Experience
Contact Hours: 3-24 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 42492 INSPECTION AUTHORIZATION II (ELR) 2-4 Credit Hours
The Inspection Authorization (IA) credential is issued by the FAA to airframe and powerplant certified maintenance technicians after they have completed experiential requirements and passed an exam. After receiving the IA credential, a technician must keep up with the currency and renewal requirements through performing a required amount of inspections, repairs and alterations, or by completing yearly training courses. Advanced standing course credit is awarded based upon evidence of holding a current FAA Inspection Authorization, as well as having successfully renewed it.
Prerequisite: Special approval.
Schedule Type: Practical Experience
Contact Hours: 6-12 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 42592 ADVANCED TURBINE AIRCRAFT MAINTENANCE (ELR) 1-8 Credit Hours
(Repeatable for credit) Transport category aircraft utilize turbine engines and advanced technology with unique sets of parts, equipment and maintenance recommendations, practices, and procedures from manufacturers as they work on the systems in transport category aircraft with turbine engines. This variable credit course allows for experience on turbine engine aircraft and their associated systems with airframes to include, but not limited to, Airbus, Boeing, Cessna Citation, Embraer, Dassault Falcon, Beech King Air and Bombardier Lear Jet. Original Equipment Manufacturers (OEM) and other accredited organizations offer courses on these airframes and their associated turbine engines. Advanced standing course credit will be awarded based upon evidence of the certification of completion of appropriate applicable courses offered by an approved organization.
Prerequisite: Special approval.
Schedule Type: Practical Experience
Contact Hours: 3-24 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 42799 STRATEGIC AVIATION MAINTENANCE MANAGEMENT CAPSTONE (ELR) (WIC) 2 Credit Hours
Capstone course is designed to address evolving issues and challenges in aviation maintenance management. Students discriminate between effective and ineffective aircraft maintenance programs while working on teams to construct a preliminary plan to establish and run an efficient, reliable and safe aircraft maintenance program of their own.
Prerequisite: Senior standing.
Schedule Type: Lecture, Project or Capstone
Contact Hours: 2 lecture
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement, Writing Intensive Course

AERN 45001 INITIAL DISPATCH I 2 Credit Hours
Part I of III preliminary courses required for students not currently enrolled at Kent State University. Provided in order to meet Federal Aviation Regulation requirements under Part 65 for training to become an Aircraft Dispatcher. This course may be necessary as preliminary training to enroll in AERN 45010 and 45020 Aircraft Dispatch I and II respectively. Successful completion of Dispatch I and II results in authorization to take the FAA written and practical exams for the Aircraft Dispatcher certificate. Need for the course depends on previous coursework or FAA certificates completed.
Prerequisite: Special approval.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45002 INITIAL DISPATCH II 2 Credit Hours
Part II of III preliminary courses required for students not currently enrolled at Kent State University to enroll in Aircraft Dispatch I or Aircraft Dispatch II. This course is a continuation of training required by Part 65 of the Federal Aviation Regulations to earn an Aircraft Dispatcher Certificate. It may be required in order to meet the registration requirements for AERN 45010 and 45020, Aircraft Dispatch I and II of which successful completion results in authorization to take the FAA written and practical exams for the Aircraft Dispatcher Certificate. Need for the course depends on previous coursework or FAA certificates completed.
Prerequisite: Special approval.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45003 INITIAL DISPATCH III 2 Credit Hours
Part III of III preliminary courses required for students not currently enrolled at Kent State University to enroll in Aircraft Dispatch I or Aircraft Dispatch II. This course is the final course to complete preliminary training required by Part 65 of the Federal Aviation Regulations to earn an Aircraft Dispatcher Certificate. It may be required in order to meet the registration requirements for AERN 45010 and 45020, Aircraft Dispatch I and II respectively, of which successful completion results in authorization to take the FAA written and practical exams for the Aircraft Dispatcher Certificate. Need for the course depends on previous coursework or FAA certificates completed.
Prerequisite: Special approval.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45010 AIRCRAFT DISPATCH I 3 Credit Hours
This is the first of two courses required to qualify for the FAA Aircraft Dispatcher Airman Knowledge Test and the associated FAA Practical Exam for issuance of an Aircraft Dispatcher License. Topics include weather theory and weather services, regulations, aircraft systems, dispatch operations, decision making, human error, situational awareness, communications and aeronautical charts. Students must be 21 yrs of age or turn 21 during the semester taken. Special course fees apply.
Prerequisite: AERN 35650 or AERN 35660; and special approval.
Corequisite: AERN 45020.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45020 AIRCRAFT DISPATCH II 3 Credit Hours
Second of two courses designated for the practical application of previously acquired knowledge necessary to perform aircraft dispatcher functions. Topics as applied to dispatch functions include briefing techniques, weather analysis and flight planning, aircraft systems, resource management, decision making, and cargo carrying. Completion required to earn a Graduation Certificate required by FAR Part 65 to qualify for a practical exam. An instructor endorsement to take the FAA aircraft dispatcher practical test is also required and is issued separately and solely at the discretion of the course instructor. Special course fees may apply. Please visit www.kent.edu/caest/flight-technology and click on the Flight Course Fees link for more information. The student must be aged 21 or turn 21 during the semester taken.
Corequisite: AERN 45010.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45030 AIRCRAFT SYSTEMS II 3 Credit Hours
Continuation of AERN 35040. An in-depth study of various aircraft systems including auxiliary systems, undercarriage, hydraulics, flight controls, instruments and integrated systems as applied to aircraft.
Prerequisite: AERN 35040.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45040 LABOR RELATIONS IN THE AVIATION INDUSTRY 3 Credit Hours
Legislation governing labor relations in the private sector of the United States Economy consist of two separate and distinct pieces of legislation: the Railway Labor Act and the National Labor Relations Act. This course focuses on the examination of air transport labor relations in the context of these key laws. As the student of aviation management comes in contact with both Acts though this course, the student will learn similarities and differences of each and their resultant impact. The student will actively apply this knowledge in a mock labor relations negotiation.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45099 AERONAUTICAL STUDIES CAPSTONE (ELR) 3 Credit Hours
(Repeatable for credit) An in-depth study of the student's area of focus within aeronautical studies, culminating to a senior level project. At the discretion of the aeronautics faculty, students may substitute another capstone course for this course. Students must pass this capstone with a grade of C (2.000) or better in order to graduate.
Prerequisite: Senior standing.
Schedule Type: Senior Project/Honors Thesis
Contact Hours: 3 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 45130 PHYSIOLOGY AND HUMAN FACTORS OF FLIGHT 3 Credit Hours
A study of the interaction of the human body with flight and those human factors that affect flight operations.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45135 AVIATION SAFETY THEORY 3 Credit Hours
An in-depth study of aviation human safety theories and the basics of risk and safety management.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45150 APPLIED FLIGHT DYNAMICS I 3 Credit Hours
An applied aircraft flight dynamics course that demonstrates aircraft, engine and propeller performance with the overall flight performance and stability of the typical subsonic airplane. Emphasis is placed on the aerodynamics of flight.
Prerequisite: PHY 13001 or PHY 23101.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45199 AIRPORT OPERATIONS (ELR) 3 Credit Hours
This course focuses on the daily functions of airport operations. Students receive hands-on training in performing daily inspections at the Kent State Airport to evaluate and keep track of airfield discrepancies. Students use a database to address the Airport Certification Manual and FAR Part 139 criteria.
Prerequisite: AERN 35340.
Schedule Type: Lecture, Project or Capstone
Contact Hours: 2 lecture, 1 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 45250 AVIATION LAW 3 Credit Hours
Involves a study of the origins of Western jurisprudence, common law and aviation law as an integral part of law in the U.S. Also introduces international aviation law by lateral agreement, as well as U.S. Constitutional law and its amendments as they relate to the structure and process of aviation law. Criminal and civil law as they relate to civil aviation are also addressed. Case studies are included.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45255 LEGAL ANALYSIS OF AVIATION AND ENGINEERING DISASTERS 2 Credit Hours
This course examines legal issues of mass torts in the specific arena of aviation and engineering products liability, negligence and personal injury law. Special focus is on class action lawsuits that give rise to mass tort litigation. Emphasis is on strict product liability, design defect, manufacturing defect, negligence, defenses to negligence and the claims that have given rise to mass tort litigation in U.S. and international jurisprudence. The Federal Torts Claims Act (FTCA) is examined in the context of aviation and aerospace engineering.
Prerequisite: Sophomore standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45299 STRATEGIC AVIATION MANAGEMENT (ELR) 3 Credit Hours
Serves as the capstone course for the Aviation Management major. As such, it is designed to address evolving issues and challenges in aviation management with a particular emphasis on airlines and airports through an application of previously mastered aviation management courses. Students must pass the course with a minimum grade of C (2.000).
Prerequisite: AERN 35341 and AERN 45199; and senior standing.
Schedule Type: Lecture, Project or Capstone
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP
Attributes: Experiential Learning Requirement

AERN 45345 EN ROUTE OPERATIONS 3 Credit Hours
Intermediate to advanced en route course that focuses on low altitude and en route operations. We also discuss Non-RADAR, high altitude and special operations. Topics covered include, but are not limited to, phraseology, maps, LOAs, rules and procedures in non-RADAR and RADAR environments.
Prerequisite: AERN 35350 and AERN 35351; and junior standing.
Corequisite: AERN 45346.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45346 EN ROUTE OPERATIONS LABORATORY 1 Credit Hour
Intermediate to advanced level en route operations course. Students apply their knowledge and skills of en route operations in a practical setting. Topics covered include, but are not limited to, phraseology, maps, RADAR and D-Side procedures, LOAs and weather.
Prerequisite: AERN 35350 and AERN 35351; and junior standing.
Corequisite: AERN 45345.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

AERN 45399 AIR TRAFFIC CONTROL CAPSTONE (ELR) 1 Credit Hour
The culminating experience for the Air Traffic Control program of study. Students will work in groups to research and present a possible solution to a current event in the world of aviation and air traffic control.
Prerequisite: AERN 45345 and AERN 45346; and Aeronautical Studies major or Air Traffic and Airspace Management major or Aviation Management major or Professional Pilot major or Unmanned Aircraft Systems Flight Operations major.
Schedule Type: Project or Capstone
Contact Hours: 1 lecture
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 45400 AVIATION MAINTENANCE LAW AND REGULATIONS 2 Credit Hours
This course introduces students to the history, development of case law, statutory law and regulatory law of aviation maintenance. Special emphasis will be placed on the Federal Aviation Regulations and how they influence the Airframe and Power Plant Mechanic. Students will learn how the regulatory process works, the certification of mechanics works, and how to effectively read and interpret FAA regulations.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45499 AIR TRAFFIC CONTROL CAPSTONE LABORATORY (ELR) 2 Credit Hours
The culminating experience for the Air Traffic Control program of study. Students participate in realistic simulations where students take the roles within all three areas of ATC (Tower, TRACON, and ARTCC). These scenarios often involve multiple domains simultaneously where students must work together to successfully finish, simulating a normal day for many controllers.
Prerequisite: AERN 45345 and AERN 45346; and Aeronautical Studies major or Air Traffic and Airspace Management major or Aviation Management major or Professional Pilot major or Unmanned Aircraft Systems Flight Operations major.
Pre/corequisite: AERN 45399.
Schedule Type: Laboratory, Project or Capstone
Contact Hours: 4 lab
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 45550 MULTI-ENGINE PILOT - THEORY 1 Credit Hour
Course provides the required ground and flight instruction necessary to qualify students for the multi-engine rating from the FAA. Student is required to spend a minimum of two hours daily, three days a week, at the airport until course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program.
Prerequisite: AERN 35761; and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 45551.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

AERN 45551 MULTI-ENGINE PILOT - FLIGHT 1 Credit Hour
Course provides the required ground and flight instruction necessary to qualify students for the multi-engine rating from the FAA. Student is required to spend a minimum of two hours daily, three days a week, at the airport until course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: AERN 35761; and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 45550.
Schedule Type: Flight Training
Contact Hours: 1 other
Grade Mode: Standard Letter-IP

AERN 45648 THEORY OF FLIGHT INSTRUCTION (ELR) 3 Credit Hours
Detailed fundamentals of teaching flight and ground instruction and the analysis of flight techniques, in order to meet requirements of FAR's part 61.185(a).
Prerequisite: AERN 35040; and AERN 35665 or AERN 35760 with a minimum C grade; and AERN 35761 and AERN 45150 with a minimum C grade; and minimum 2.500 overall GPA.
Corequisite: AERN 45649.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 45649 FLIGHT INSTRUCTOR - AIRPLANES 3 Credit Hours
(Repeatable for credit) Flight course with emphasis on instructing techniques in aircraft from right seat. Includes student evaluation techniques to meet Federal Aviation Regulation for certified flight instructor. Student is required to spend a minimum of two hours daily, five days a week, at the airport until course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: AERN 35761; and AERN 35665 or AERN 35760 with a minimum C grade; and Professional Pilot major.
Corequisite: AERN 45648.
Schedule Type: Flight Training
Contact Hours: 4.5 other
Grade Mode: Standard Letter-IP

AERN 45655 ADVANCED MULTI-ENGINE PILOT FLIGHT 1 Credit Hour
Ground flight instruction for proficiency and required hours in preparation for multi-engine instruction. Special course fees may apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land, certified flight instructor airplane certificate and a valid FAA medical; maintain at least second class privileges; and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: AERN 45550 and AERN 45551 with a minimum C grade; and minimum 2.500 overall GPA; and Professional Pilot major.
Schedule Type: Flight Training
Contact Hours: 1 other
Grade Mode: Standard Letter-IP

AERN 45657 MULTI-ENGINE FLIGHT INSTRUCTOR 1 Credit Hour
(Repeatable for credit) Course provides the necessary ground and flight instruction to professionally qualify students for the multi-engine instructor rating by the FAA. Student is required to spend two hours daily, three days a week, at the airport. When not flying, the student goes through personalized ground instruction with the flight instructor. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land, certified flight instructor airplane certificate and a valid FAA medical; maintain at least second class privileges; and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: Minimum C grade in the following courses: AERN 45550 and AERN 45551 and AERN 45648 and AERN 45649 and AERN 45655; and minimum 2.500 overall GPA; and Professional Pilot major.
Schedule Type: Flight Training
Contact Hours: 1 other
Grade Mode: Standard Letter-IP

AERN 45659 UPSET RECOVERY TRAINING 1 Credit Hour
Consisting of both ground school and hands-on flight components, this upset training course prepares pilots for emergency situations they may encounter that cannot properly be replicated in a typical GA aircraft. Extensive piston driven and swept wing jet aerodynamic characteristics, accident analysis and recovery profile. Special course fees may apply. Please visit www.kent.edu for a list of fees. A private pilot certificate (airplane single engine land) is required. Students who hold a private pilot certificate meet the prerequisite requirement of AERN 15753. Please speak to an advisor for more information.
Prerequisite: AERN 15753 with a minimum C grade; and minimum 2.500 overall GPA.
Schedule Type: Flight Training
Contact Hours: 1 other
Grade Mode: Standard Letter

AERN 45660 FLIGHT INSTRUCTOR - INSTRUMENTS THEORY 1 Credit Hour
Flight theory course with emphasis on flight instructing techniques involved with instrument flight and air traffic control procedures. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program.
Prerequisite: AERN 45649; and AERN 45648 with a minimum C grade; and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 45661.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

AERN 45661 FLIGHT INSTRUCTOR - INSTRUMENTS FLIGHT 1 Credit Hour
Flight course with emphasis on flight instructing techniques involved with instrument flight and air traffic control procedures. Student is required to spend a minimum of two hours daily, three days a week, at the airport until course requirements have been met. When not flying, the student goes through personalized ground instruction. Special course fees apply. Actual flight training may exceed designated hours. Please visit www.kent.edu for a list of fees. Students must hold valid commercial pilot certificate with an instrument rating in an airplane single engine land and a valid FAA medical, maintain at least second class privileges and have TSA approval prior to starting course. Students must comply with university code of student conduct, Federal Aviation Regulations and policies outlined in the Kent State University Flight Operations Manual. Failure to comply may result in punitive actions, issuance of a failing course grade and/or dismissal from the professional pilot program. This course may not be repeated without special approval.
Prerequisite: AERN 45649; and AERN 45648 with a minimum C grade; and minimum 2.500 overall GPA; and Professional Pilot major.
Corequisite: AERN 45660.
Schedule Type: Flight Training
Contact Hours: 1 other
Grade Mode: Satisfactory/Unsatisfactory-IP

AERN 45710 TURBINE ENGINE THEORY AND OPERATION 2 Credit Hours
An in-depth study of the theory, operation and performance of turbine and turboprop engines and associated systems.
Prerequisite: AERN 35020.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45720 CREW RESOURCE MANAGEMENT 2 Credit Hours
In-depth study of the common principles of aviation crew resource management and human factors as utilized by air transport flight crews. Course presents crew/cockpit resource management (CRM), aeronautical decision making (ADM) and human factors theory and practice.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45730 APPLIED TRANSPORT CATEGORY AIRCRAFT SYSTEMS 3 Credit Hours
Course examines various systems in use on air transport aircraft. The course emphasizes the principles, operation and limitations of complex, integrated systems found in modern aircraft.
Prerequisite: AERN 35020.
Corequisite: AERN 45030.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45740 FLIGHT MANAGEMENT SYSTEMS 3 Credit Hours
Course examines various advanced avionics systems used on air transport type aircraft. The course emphasis is on the principles, operation and limitations of integrated avionics related to the "glass cockpit" found on modern aircraft.
Prerequisite: AERN 45030.
Schedule Type: Combined Lecture and Lab
Contact Hours: 3 other
Grade Mode: Standard Letter

AERN 45750 AEROSPACE MEDICINE 2 Credit Hours
This course examines the medical and legal issues of regulating the presence of humankind in aviation. Special emphasis will be given to the medical conditions that human life encounters when exposed to machines and different environments including atmospheric and non-atmospheric flight. Students will study the history, physiology and environment, clinical issues, operational issues, legal issues and future issues of aerospace medicine.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45791 AVIATION SECURITY AND POLICY SEMINAR (WIC) 3 Credit Hours
Examines policies, practices, procedures and regulatory provisions developed to create and enhance security in civil aviation with a special emphasis on airlines, airports, airspace and agencies responsible for civil aviation security.
Prerequisite: AERN 45250.
Schedule Type: Seminar
Contact Hours: 3 other
Grade Mode: Standard Letter
Attributes: Writing Intensive Course

AERN 45800 UNMANNED AIRCRAFT SYSTEMS FLIGHT OPERATIONS THEORY 4 Credit Hours
Classroom instruction to provide the general information and knowledge necessary to prepare students to pilot and operate unmanned aircraft. Emphasis is placed on the acquisition of knowledge required to engage in UAS flight operations, specifically focused on piloting UAVs and managing UAV sensors. This course provides students with the background knowledge required to begin flight training and to perform real-time mission management operations for high performance unmanned aircraft systems.
Prerequisite: AERN 25800.
Schedule Type: Lecture
Contact Hours: 4 lecture
Grade Mode: Standard Letter

AERN 45820 AIRSPACE MANAGEMENT 3 Credit Hours
This course studies the dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all controlling and operations entities and involving airborne and ground-based functions. Students also focus on the aggregation of the airborne and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations. This course compares and contrasts uncrewed operations and crewed operations within the context of Advanced Air Mobility and the National Airspace System. An introduction to space operations is also discussed.
Prerequisite: AERN 35850 and AERN 35851.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45892 UNMANNED AIRCRAFT SYSTEMS FLIGHT PRACTICUM (ELR) 2 Credit Hours
This is the practicum course for the Unmanned Aircraft Systems Flight Operations major. Student is required to spend a minimum of 15 hours during the semester flying an unmanned aircraft system. When not operating an unmanned system, the student goes through personalized ground instruction. Special emphasis is placed on flying commercial UAS, fixed wing platforms and other commercial platforms. Students deepen their knowledge of regulatory requirements of UAS operations, applied weather theory mission planning and emergency procedures. Students must obtain FAA Part 107 Unmanned Aircraft System Certification prior to starting this course. Flight fees apply.
Prerequisite: AERN 25800 and AERN 35892.
Schedule Type: Flight Training, Practical Experience
Contact Hours: 4 other
Grade Mode: Standard Letter-IP
Attributes: Experiential Learning Requirement

AERN 65091 SEMINAR IN EMERGING ISSUES IN AVIATION LOGISTICS 2 Credit Hours
Guided by issues set forth by the International Air Cargo Association the Cargo Airlines Association, this variable content seminar will provide an interactive, dynamic and in-depth discussion on topics of immediate concern for the air freight industry.
Prerequisite: AERN 65100; and graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65092 PRACTICUM IN AERONAUTICS 1-4 Credit Hours
(Repeatable for credit) Practicum to gain experience in the aerospace or aviation industry managing various aspects of logistics. Logistic projects related to systems analysis, product or vehicle movement, legal and ethical issues, economic issues, international needs, safety, human resources and managerial assessment, or other aspects of managing logistics as approved are the focus of the course.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Practical Experience
Contact Hours: 3-12 other
Grade Mode: Satisfactory/Unsatisfactory

AERN 65095 SPECIAL TOPICS IN AERONAUTICS 1-4 Credit Hours
(Repeatable for a maximum of 15 credit hours) Study of special topics that focus on subjects and issues in aeronautics.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 1-4 lecture
Grade Mode: Standard Letter

AERN 65100 LOGISTICAL STRATEGIES IN AVIATION MANAGEMENT 2 Credit Hours
This course presents the business of aviation logistics and its role in the global supply chain by examining different product sectors using air freight. By means of both domestic and international example, it then details some of the challenges facing the air cargo industry today and presents possible management options for their resolution.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65150 LEGAL AND REGULATORY ISSUES FOR AIR CARGO MANAGEMENT 2 Credit Hours
With a focus on both the domestic and global marketplace, this course provides in-depth coverage of the regulatory bodies and the protocols and procedures that govern the air cargo industry.
Prerequisite: AERN 65100; and graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65199 THESIS I 2-6 Credit Hours
Thesis students must register for a minimum of 6 hours, 2 to 6 hours in a single semester distributed over several semesters if desired.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Masters Thesis
Contact Hours: 2-6 other
Grade Mode: Satisfactory/Unsatisfactory-IP

AERN 65200 AVIATION ECONOMICS AND FISCAL MANAGEMENT 2 Credit Hours
Using examples from across key industries that make up the aviation sector, this course examines profit strategies employed by cargo-carrying airlines, all-cargo carriers, airports, ground transportation providers, and others with an aim of highlighting their role in and their impact on the business of air freight.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65201 AVIATION INDUSTRY CONTRACT MANAGEMENT 2 Credit Hours
The course provides students with practical experience in the realm of aviation contracts.
Prerequisite: BA 64041; and graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65230 MODELING AND FORECASTING FOR AVIATION LOGISTICS PLANNING 2 Credit Hours
This course presents topics and techniques necessary to understand and develop an aviation logistics model such that an accurate and effective aviation demand forecast can be made.
Prerequisite: AERN 65100 and AERN 65200; and graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65235 HUMAN ERROR ANALYSIS IN AVIATION 2 Credit Hours
Provides an in-depth look at human error and its implications in the realm of safety using examples from the aviation industry. Includes a basic overview of human error, discussion on the models available to examine error, provides knowledge on how to classify and provide recommendations of intervention strategies. A focus will be on the SHELL Model, the Human Factors Analysis and Classification System, and the 5M model. This course will use real examples of accidents and incidents for students to apply these strategies.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65240 AVIATION SAFETY MANAGEMENT SYSTEMS 2 Credit Hours
An in-depth study of the concepts and principles of aviation safety management and aviation Safety Management Systems (SMS). Provides a fundamental knowledge of SMS safety policy, safety risk management, safety assurance, and safety promotion. Also includes a thorough analysis of the design, implementation, and management of Safety Management Systems and its incorporation into various aviation sectors.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65299 THESIS II 2 Credit Hours
Thesis students must continue registration each semester until all degree requirements are met.
Prerequisite: AERN 65199; and graduate standing.
Schedule Type: Masters Thesis
Contact Hours: 2 other
Grade Mode: Satisfactory/Unsatisfactory-IP

AERN 65300 AIRLINE TRANSPORTATION OPERATIONS 2 Credit Hours
This course provides a managerial approach that highlights the importance of airline transportation. Students examine the framework for airline transportation from a micro and macro perspective. The focus is on operations management that is specialized or unique to the airline industry including regulation and public policy, as they overview operations, service and cost structure.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65301 AIR CARGO SECURITY 2 Credit Hours
This course examines Post 9-11 legislation put in place with respect to air cargo security and details unique challenges facing the industry today with an eye toward management of those challenges for future growth.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65400 WEATHER FOR AVIATION LOGISTICS PLANNING 2 Credit Hours
Introduction to weather concepts as related to aviation operations management. This course focuses on the effect of various phenomena on airport, airline, and small aircraft feeder operations. The emphasis is on understanding conditions that produce various phenomena, use of available weather products to determine conditions and hazardous conditions and their likely impact on aviation operations. An understanding of regulations relative to weather operations and aircraft capabilities will be gained. Regional weather is discussed.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 65496 INDIVIDUAL INVESTIGATION IN AERONAUTICS 1-4 Credit Hours
(Repeatable for a maximum of 9 credit hours) Individual investigation of various aeronautics-related topics.
Prerequisite: Graduate standing and special approval.
Schedule Type: Individual Investigation
Contact Hours: 1-4 other
Grade Mode: Standard Letter-IP

AERN 65499 CAPSTONE IN AERONAUTICS 2-4 Credit Hours
(Repeatable for credit) Culminating experience that requires completion of either a comprehensive project at a workplace through employment or internship or a comprehensive research paper from an investigation. The goal is for students to demonstrate competence in aviation management and logistics. Possibilities include empirical research, case studies, theoretical or applied projects or projects for identified clients. Student are evaluated on the use of knowledge and skills gained from other courses taken in their program.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Project or Capstone
Contact Hours: 2-4 other
Grade Mode: Standard Letter

College of Aeronautics and Engineering (CAE)

CAE 22095 SPECIAL TOPICS IN AERONAUTICS AND ENGINEERING 1-4 Credit Hours
(Repeatable for credit) Topics to be announced in the schedule of classes, offering current topics in technology based areas of study.
Prerequisite: Special approval.
Schedule Type: Combined Lecture and Lab
Contact Hours: 1-4 other
Grade Mode: Standard Letter

CAE 35095 SPECIAL TOPICS IN AERONAUTICS AND ENGINEERING 1-3 Credit Hours
(Repeatable for credit) Specialized offerings of interest in response to emerging or needed curricular needs in aeronautics and engineering. Topics will be announced in the schedule of classes.
Prerequisite: Sophomore standing.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

CAE 45092 AERONAUTICS AND ENGINEERING INTERNSHIP/ COOPERATIVE EDUCATION (ELR) (WIC) 1-3 Credit Hours
(Repeatable for a total of 6 hours) Work experience in aerospace/ aviation industry or related activity, laboratory or student professional organization.
Prerequisite: Special approval.
Schedule Type: Practical Experience
Contact Hours: 3-9 other
Grade Mode: Standard Letter-IP
Attributes: Experiential Learning Requirement, Writing Intensive Course

CAE 45096 INDIVIDUAL INVESTIGATION IN AERONAUTICS AND ENGINEERING 1-3 Credit Hours
(Repeatable for a maximum of 6 credit hours) Work study of an individual nature on a topic relating to professional aviation.
Prerequisite: Sophomore standing; and special approval.
Schedule Type: Individual Investigation
Contact Hours: 1-3 other
Grade Mode: Standard Letter-IP

Engineering (ENGR)

ENGR 10005 INTRODUCTION TO CYBERSECURITY 3 Credit Hours
This course introduces students to the fundamentals of computer technology and cybersecurity. Students develop an understanding of computer hardware and software, cybercrime, security principles, technologies and procedures used to defend networks. This course also explores cyber trends, threats and personal privacy.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 11000 INTRODUCTION TO ENGINEERING 3 Credit Hours
An introductory course in engineering covering topics including introductory topics in what it means to be an engineer. Additional topics include introductions to engineering standards, statistics, technical writing and communication, significant figures, and engineering problem solving. Students also learn about working in teams and managing a project and utilize the concepts learned in a semester long team design project.
Prerequisite: Minimum 67 ALEKS math score or a minimum C grade in either MATH 10675 or MATH 10775 or MATH 11010.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 11001 INTRODUCTION TO ENGINEERING 2 Credit Hours
An introductory course in engineering covering topics including introductory topics in what it means to be an engineer. Additional topics include introductions to engineering standards, statistics, technical writing and communication, significant figures and engineering problem solving. Students also learn about working in teams and managing a project and utilize the concepts learned in a semester long team design project.
Prerequisite: Minimum C- grade in the following courses: MATH 10675 or MATH 10775 or MATH 11010; or a pre/co-requisite of MATH 11022 or MATH 12002 or MATH 12011; or minimum 67 ALEKS math score.
Corequisite: ENGR 11002.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 11002 INTRODUCTION TO ENGINEERING LABORATORY 1 Credit Hour
An introductory course in engineering covering topics including introductory topics in what it means to be an engineer. Additional topics include introductions to engineering standards, statistics, technical writing and communication, significant figures and engineering problem solving. Students also learn about working in teams and managing a project and utilize the concepts learned in a semester long team design project.
Prerequisite: Minimum C- grade in the following courses: MATH 10675 or MATH 10775 or MATH 11010; or a pre/co-requisite of MATH 11022 or MATH 12002 or MATH 12011; or minimum 67 ALEKS math score.
Corequisite: ENGR 11001.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 13585 COMPUTER AIDED ENGINEERING GRAPHICS 3 Credit Hours
Introduction to 3D computer aided engineering graphics. Students will be able to create 3-D models and assemblies using a feature based parametric solid modeling CAD package. Students will learn concepts of engineering graphics as well as learn to generate, edit, and dimension drawing views.
Prerequisite: None.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 1 lecture, 4 lab
Grade Mode: Standard Letter

ENGR 13586 COMPUTER AIDED DESIGN I 2 Credit Hours
Introduction to 3D computer-aided design (CAD). Students create 3D models and assemblies using a feature-based parametric solid modeling CAD package. Students learn concepts of engineering graphics as well as learn to generate, edit and dimension drawing views. Students are required to bring their own portable computer.
Prerequisite: None.
Corequisite: ENGR 13587.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 13587 COMPUTER AIDED DESIGN I LABORATORY 1 Credit Hour
Introduction to 3D computer-aided design (CAD). Students create 3D models and assemblies using a feature-based parametric solid modeling CAD package. Students learn concepts of engineering graphics as well as learn to generate, edit and dimension drawing views. Students are required to bring their own portable computer.
Prerequisite: None.
Corequisite: ENGR 13586.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 15300 INTRODUCTION TO ENGINEERING ANALYSIS USING MATLAB® 2 Credit Hours
Introduction to basic concepts in engineering analysis using the Matlab® computing language, the industry-standard “first language” for engineers. Introduction to algorithm coding and development, debugging, analysis and interpretation. Students are required to bring their own portable computer and purchase the software for the course.
Prerequisite: Minimum C- grade in the following courses: MATH 10675 or MATH 10775 or MATH 11010; or a pre/co-requisite of MATH 11022 or MATH 12002 or MATH 12011; or minimum 67 ALEKS math score.
Corequisite: ENGR 15301.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 15301 INTRODUCTION TO ENGINEERING ANALYSIS USING MATLAB® LAB 1 Credit Hour
Laboratory session introducing basic concepts in engineering analysis using the Matlab® computing language, the industry-standard “first language” for engineers. Introduction to algorithm coding and development, debugging, analysis and interpretation.
Corequisite: ENGR 15300.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 20000 PROFESSIONAL DEVELOPMENT IN ENGINEERING 1 Credit Hour
Providing several direct opportunities for interviewing and networking with engineering industry professionals, the main goal of this course is to prepare students for internship and career opportunities. Students will also have opportunities to develop necessary financial literacy skills to succeed in post-graduate careers while detailing and implementing short, middle and long-term life goals as part of the life-long learning process.
Prerequisite: Sophomore standing.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 20002 MATERIALS AND PROCESSES 3 Credit Hours
Study and practice addressing the nature of basic manufacturing materials and the processes by which they are converted into manufactured products. Includes laboratory experience.
Prerequisite: None.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 4 lab
Grade Mode: Standard Letter

ENGR 21020 SURVEY OF ELECTRICITY AND ELECTRONICS 3 Credit Hours
Survey of DC and AC circuits, semiconductors and electronic devices, including microprocessors and embedded systems.
Prerequisite: PHY 13002 or PHY 23102.
Corequisite: ENGR 21022.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 21022 SURVEY OF ELECTRICITY AND ELECTRONICS LABORATORY 1 Credit Hour
Laboratory experiments related to the course ENGR 21020.
Prerequisite: PHY 13002 or PHY 23102.
Corequisite: ENGR 21020.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 23010 COMPUTER HARDWARE 3 Credit Hours
Introduction to the hardware, architecture and operation of the personal computer and associated devices. Topics include personal computer architecture and operation fundamentals; basic hardware; data buses and ports; hardware component packaging; auxiliary hardware components; computer assembly; basic hardware installation and configuration; and basic troubleshooting. This course is aligned with A+ content. CompTIA A+ is the preferred qualifying credential for technical support and IT operational roles.
Prerequisite: ENGR 10005.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 23585 COMPUTER AIDED DESIGN II 3 Credit Hours
Advanced applications of 3D, feature based, parametric, solid modeling software including finite element analysis, simulation, parameters, motion and mechanisms and other advanced tools in the design of parts and assemblies.
Prerequisite: ENGR 13585 or (ENGR 13586 and ENGR 13587).
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 1 lecture, 4 lab
Grade Mode: Standard Letter

ENGR 25200 STATICS 3 Credit Hours
Forces and moments; equilibrium in two and three dimensions; multi-force members; equilibrium, centroids and friction.
Prerequisite: MATH 12002 and PHY 23101 with a minimum C grade.
Pre/corequisite: ENGR 11000 or (ENGR 11001 and ENGR 11002).
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 25400 DYNAMICS 3 Credit Hours
Kinematics and kinetics of rigid bodies in planar motion, including force and acceleration, work and energy and impulse and momentum. Introduction to the kinematics and kinetics of rigid bodies in three-dimensional motion.
Prerequisite: ENGR 25200; and MATH 22005 or MATH 32051.
Pre/corequisite: ENGR 11000 or (ENGR 11001 and ENGR 11002).
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 25500 AERODYNAMICS FOR ENGINEERS I 3 Credit Hours
Basic fluid dynamics concepts, conservation laws, potential, airfoil and wing analysis. Boundary layers on plates and airfoils. Pressure gradients. Introduction to turbulent and vortex-dominated flows.
Prerequisite: ENGR 25200; and MATH 22005 or MATH 32051 .
Pre/corequisite: ENGR 11000 or ENGR 15500.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 26220 PROGRAMMING FOR ENGINEERS 2 Credit Hours
Introduction to engineering problem solving and use of programming language to solve those problems. Students are expected to develop basic mathematical modeling and engineering problem solving skills using mathematical tools and programming languages. Developing modeling and logical thinking are core objectives of this course. This course provides students with the required programming skills to work with embedded systems. Students are required to bring their own College of Aeronautics and Engineering (CAE) approved laptop. Specifications can be found on the CAE website.
Prerequisite: Sophomore standing.
Corequisite: ENGR 26222.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 26222 PROGRAMMING FOR ENGINEERS LABORATORY 1 Credit Hour
Lab to accompany ENGR 26220. Introduction to engineering problem solving and use of programming language to solve those problems. Students are expected to develop basic mathematical modeling and engineering problem solving skills using mathematical tools and programming languages. Developing modeling and logical thinking are core objectives of this course. This course provides students with the required programming skills to work with embedded systems. Students are required to bring their own College of Aeronautics and Engineering (CAE) approved laptop. Specifications can be found on the CAE website.
Prerequisite: Sophomore standing.
Corequisite: ENGR 26220.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 26305 NETWORKING I 2 Credit Hours
A hands-on, applied engineering-focused course emphasizing the operation, maintenance and performance aspects of personal computer networking hardware. Topics include networking hardware operation, characteristics, configuration and troubleshooting fundamentals. Course also includes network standards, protocols, configuration, topologies and administrative fundamentals as related to networking hardware systems.
Prerequisite: None.
Corequisite: ENGR 26306.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 26306 NETWORKING I LABORATORY 2 Credit Hours
A hands-on, applied engineering-focused course emphasizing the operation, maintenance and performance aspects of personal computer networking hardware. Topics include networking hardware operation, characteristics, configuration and troubleshooting fundamentals. Course also includes network standards, protocols, configuration, topologies and administrative fundamentals as related to networking hardware systems.
Prerequisite: None.
Corequisite: ENGR 26305.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 27100 FUNDAMENTALS OF OPERATING SYSTEMS FOR ENGINEERING 3 Credit Hours
The course will prepare students to engineer, install, monitor and manage systems using open-source operating systems. The students will learn operating system fundamentals for engineering applications, including cybersecurity engineering applications. Students will also learn how to configure local storage, create and configure systems, deploy and maintain systems, manage users and groups, and manage security. Different types of open source operating systems that are relevant for engineering systems will be introduced to students, in conjunction with key tools used in cybersecurity engineering.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 27210 INTRODUCTION TO SUSTAINABILITY 3 Credit Hours
Introduces students to the concepts of sustainability and its three pillars, namely, economic growth, environmental protection and social equality. Students taking the course understand the language and concepts of sustainability and acquire the knowledge to further study sustainability.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 30001 APPLIED THERMODYNAMICS 3 Credit Hours
Study of basic thermodynamic laws and how they apply to engineering applications. Topics include energy, entropy, enthalpy, heat engines and refrigerators. Introductory fluid mechanics, including Bernoulli's equation. Introductory heat transfer including conduction, convection and radiation.
Prerequisite: PHY 13001 or PHY 23101; and junior standing.
Pre/corequisite: ENGR 11000 or (ENGR 11001 and ENGR 11002).
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 31000 CULTURAL DYNAMICS TECHNOLOGY (DIVD) (WIC) 3 Credit Hours
This course provides a comprehensive exploration of how technology profoundly shapes and is shaped by society. It delves into the intricate relationship between technology and society, offering students a nuanced perspective on the cultural dynamics of technological change within an engineering context. Students explore how technology significantly influences, reflects and coevolves with society by analyzing a wide range of topics from genetic engineering and economic systems to communication infrastructure and governance, all within the framework of engineering practices and principles.
Prerequisite: ENG 21011.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Diversity Domestic, Writing Intensive Course

ENGR 31010 ENGINEERING AND PROFESSIONAL ETHICS 3 Credit Hours
Applications of codes of ethics in the engineering and technology professions reflective of social and moral responsibilities to the public, and accountability in engineering practice.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 31016 MANUFACTURING TECHNOLOGY 3 Credit Hours
This course is designed to provide experience in, and an understanding of, the interrelationships of the major aspects of a manufacturing enterprise. The content of the course is oriented around the laboratory activities necessary to organize and operate an enterprise that will apply mass production techniques necessary to produce a product or service. During the course, the student will apply the concepts from lecture in the selection, designing, financing, production, marketing and distributing of a product or service.
Prerequisite: ENGR 20002.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 31020 AUTOMATED MANUFACTURING 3 Credit Hours
Theory and operation of computer controlled machine tools, robots and processes.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 31065 CAST METALS 3 Credit Hours
Principles and processes of metal casting with a focus on current industrial practices. Includes laboratory experience with nonferrous metals and industrial tours.
Prerequisite: ENGR 20002.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 5 other
Grade Mode: Standard Letter

ENGR 31067 MACHINING TECHNOLOGY I 3 Credit Hours
Lecture and laboratory experiences in basic machine tool principles and processes.
Prerequisite: None.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 5 other
Grade Mode: Standard Letter

ENGR 33031 PROGRAMMABLE LOGIC CONTROLLERS 3 Credit Hours
An introduction to programmable logic controllers (PLCS) covering hardware, ladder logic programming, networking and communications. Programming timers, counters and sequencers and an introduction to human machine interfaces (HMIS).
Prerequisite: (EERT 12000 and EERT 12001) or ENGR 21020 or ENGR 35500.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter
Attributes: ITAG Engineering Technology, TAG Engineering Technology

ENGR 33032 PROGRAMMABLE LOGIC CONTROLLERS II 3 Credit Hours
Advanced principles and applications of programmable logic controllers with a focus on using sequential function charts to control complex industrial processes. Includes real time control issues, PLC networking, programming languages other than ladder logic, standards, motion control, supervisory control and data acquisition, process control, alarm management, power failure strategies and safety.
Prerequisite: ENGR 33031.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 33033 HYDRAULICS/PNEUMATICS 3 Credit Hours
Fluid properties, hydraulic design, viscosity, hydraulic components, pumps, systems and circuits, maintenance and safety, pneumatics, air systems control and design.
Prerequisite: PHY 13001 or PHY 23101.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 33041 CONTROL SYSTEMS 3 Credit Hours
Design and analysis of feedback control systems. Course includes introduction to feedback control systems, open loop and closed loop control, Laplace transforms, control system models, static and dynamic response, stability and performance of control systems, root locus technique, frequency response analysis (Bode plot) and design of controller for feedback control systems.
Prerequisite: (EERT 12000 and EERT 12001) or ENGR 21020 or ENGR 35500; and MATH 12002 or MATH 12012.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33092 COOPERATIVE EDUCATION - PROFESSIONAL DEVELOPMENT (ELR) (WIC) 1-3 Credit Hours
(Repeatable for a maximum of 6 credit hours) Supervised work-study experience in approved business or industrial environment relative to the student's major. A 3 credit hour co-op experience must be for a period of at least 12 consecutive weeks at 40 hours per week, or 30 hours per week for 15 weeks, totaling not less than 450 hours. Most co-ops occur during the summer. Students can earn up to an additional 3 credit hours (one to three per co-op – 150 work hours per credit hour) over the course of their college career as long as each co-op has a different focus.
Prerequisite: Minimum 2.250 overall GPA; and sophomore standing; and special approval.
Schedule Type: Practical Experience
Contact Hours: 10-30 other
Grade Mode: Standard Letter-IP
Attributes: Experiential Learning Requirement, Writing Intensive Course

ENGR 33111 STATICS AND STRENGTH OF MATERIALS 3 Credit Hours
An algebra-based analytical study of equilibrium of extended two-dimensional bodies; the concepts of elastic and thermal properties of materials; centroid and moment of inertia; and the relationship between the external forces applied to extended objects (generally beams and columns) and the resulting bending and shear stresses, the resulting strains and deformation of the object.
Prerequisite: PHY 13001 or PHY 23101.
Pre/corequisite: ENGR 11000 or (ENGR 11001 and ENGR 11002).
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33222 DIGITAL DESIGN FOR COMPUTER ENGINEERING 3 Credit Hours
Introduction to digital design. The operation and use of digital devices and components as used in microprocessors and digital computers. Topics include binary arithmetic operations, Boolean algebra, logic gates, combinational and sequential logic, buffers, registers, memory devices. Students are exposed to applied problem solving via basic programing with microcontrollers and microprocessors.
Prerequisite: (EERT 12000 and EERT 12001) or ENGR 21020 or ENGR 35500.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 33223 ELECTRONIC COMMUNICATION 3 Credit Hours
Principles of digital and analog telecommunications and data signals. Topics include electromagnetic signal time and frequency characteristics, signal propagation, signal modulation, transmission lines, wireless signals, antennas, digital signal characteristics and protocols, signal multiplexing, microwave devices and applications.
Prerequisite: (EERT 12000 and EERT 12001) or (ENGR 21020 and ENGR 21022) or (ENGR 35500 and ENGR 35501).
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 33320 APPLIED EMBEDDED SYSTEMS I 3 Credit Hours
Course teaches students to utilize embedded systems for engineering problem solving. Students are exposed to the history of the microcontroller that is at the heart of modern embedded systems. Students learn about the different classes of embedded systems and form a foundation from which they can begin to develop solutions to simple, but real-world, problems using simple embedded microcontrollers, electronic devices and sensors. Basic coding principles are explained from an engineering problem solving perspective.
Prerequisite: CS 13001 or CS 13012 or (ENGR 26220 and ENGR 26222); and (EERT 12000 and EERT 12001) or (ENGR 21020 and ENGR 21022) or (ENGR 35500 and ENGR 35501).
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 33334 INDUSTRIAL ROBOTICS 1 Credit Hour
Classification, characteristics and functions of industrial robots. Covers basic safety precautions for working with robots. Laboratory time is spent programming FANUC industrial robots and utilizing FANUC robot teach pendants. Students have the opportunity to obtain a FANUC Robotics Handling Tool Operation and Programming certificate of completion.
Prerequisite: PHY 13002.
Corequisite: ENGR 33335.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 33335 INDUSTRIAL ROBOTICS LABORATORY 1 Credit Hour
Classification, characteristics and functions of industrial robots. Covers basic safety precautions for working with robots. Laboratory time is spent programming FANUC industrial robots and utilizing FANUC robot teach pendants. Students have the opportunity to obtain a FANUC Robotics Handling Tool Operation and Programming certificate of completion. This is the laboratory portion of the course.
Prerequisite: PHY 13002.
Corequisite: ENGR 33334.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 33364 METALLURGY AND MATERIALS SCIENCE 3 Credit Hours
Scientific study of modern manufacturing materials (metals, plastics and ceramics) with an emphasis on metals and the laboratory test methods, and data used to determine their manufacturing specifications and properties.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33440 ELECTRONIC DEVICES 3 Credit Hours
Introduction to electronic non-linear devices including diodes, transistors, optoelectronic devices and operational amplifiers. Use and application of these devices in different types of application like rectifiers, amplifiers and linear integrated circuits.
Prerequisite: (EERT 12000 and EERT 12001) or (ENGR 21020 and ENGR 21022) or (ENGR 35500 and ENGR 35501).
Corequisite: ENGR 33442.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33442 ELECTRONIC DEVICES LABORATORY 1 Credit Hour
Course is lab component for ENGR 33440. Lab materials mirror concepts learned in lecture, including the introduction to electronic non-linear devices (e.g., diodes, transistors, optoelectronic devices, operational amplifiers). Use and application of these devices in different types of application like rectifiers, amplifiers and linear integrated circuits.
Prerequisite: (EERT 12000 and EERT 12001) or (ENGR 21020 and ENGR 21022) or (ENGR 35500 and ENGR 35501).
Corequisite: ENGR 33440.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 33657 INTRODUCTION TO LEAN SIX SIGMA 3 Credit Hours
An introduction to lean six sigma. Including understanding the systems, measuring and defining performance, analyzing, improving, and controlling processes, and leading six sigma initiatives.
Prerequisite: MATH 11010.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33700 QUALITY TECHNIQUES 3 Credit Hours
Introduction to quality management and the tools and techniques including the basic tools identified by ASQ (American Society for Quality) as well as an introduction to Lean and Six Sigma. Information presented helps prepare the student to qualify for the Quality Process Analyst Certification.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33870 FACILITY DESIGN AND MATERIAL HANDLING 3 Credit Hours
Provides students with a fundamental understanding of how layout affects the flow through a system. Both qualitative and quantitative tools are presented for complete approach to facility design and material handling.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 35200 THERMAL FLUID ENGINEERING 3 Credit Hours
First and Second Law of Thermodynamics for closed and open systems. Fundamentals of fluid mechanics and heat transfer.
Prerequisite: MATH 22005 or MATH 32051; and PHY 23101.
Corequisite: ENGR 35201.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 35201 THERMAL FLUID ENGINEERING LABORATORY 1 Credit Hour
Laboratory demonstrations and experiments for various heat transfer and fluid dynamics concepts.
Prerequisite: None.
Corequisite: ENGR 35200.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 35300 AIRCRAFT PERFORMANCE AND STABILITY I 3 Credit Hours
First of a two-course sequence in aircraft performance and flight mechanics. Performance analysis of fixed-wing performance. Development of the aircraft equations of motion. Static stability analysis. Introduction to rotary-wing performance.
Prerequisite: ENGR 15300 and ENGR 15301; and MATH 32044 or MATH 32052; and ENGR 25400 and ENGR 25500 with a minimum C grade.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 35500 SIGNALS AND CIRCUITS 3 Credit Hours
An introduction to electric circuit elements and electronic devices and a study of circuits containing such devices. Both analog and digital systems are considered.
Prerequisite: PHY 23102.
Corequisite: ENGR 35501.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 35501 SIGNALS AND CIRCUITS LABORATORY 1 Credit Hour
Laboratory demonstrations and experiments for electrical circuits, data acquisition, and signal measurements.
Corequisite: ENGR 35500.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 35550 LAW AND ETHICS FOR ENGINEERS 3 Credit Hours
This course examines legal and ethical issues in engineering design. Special focus will be given to Negligence Law, Strict Product Liability Law, Design and Manufacturing defects, Patent, Copyright and Trademark law. Employment law and whistleblower protection will be discussed in the context of the engineer. Special focus will be given through the examination of case studies including but not limited to the Space Shuttle Challenger disaster, the Space Shuttle Columbia Disaster, the Boeing 737 Max crashes.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 35600 AERODYNAMICS FOR ENGINEERS II 3 Credit Hours
Compressible flow relationships; compressibility effects on airfoil and wing aerodynamics; shock waves; boundary layer effects on aircraft performance.
Prerequisite: ENGR 25500; and MATH 32044 or MATH 32052.
Pre/corequisite: ENGR 35200.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 35765 QUALITY AND RELIABILITY ENGINEERING 3 Credit Hours
Introduction to reliability and quality engineering with an emphasis on manufacturing and techniques for improving quality and reliability. Includes reliability, reliability prediction, quality techniques, modeling statistical process control, control charts, sampling, experimental design, and designing and manufacturing for quality and reliability.
Prerequisite: MATH 11010.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 36305 NETWORKING II 2 Credit Hours
Continuation of ENGR 26305 and ENGR 26306. In-depth coverage of personal computer-based enterprise networking systems hardware with a focus on network hardware and software configuration, fault analysis, diagnostics and troubleshooting. Topics include router and switch operation, programming, configuration and troubleshooting, along with overall enterprise network maintenance, troubleshooting and repair. Course also includes WAN and VLAN fundamentals, intermediate TCP/IP and network administration and maintenance as related to fielding and maintaining networking hardware components and systems.
Prerequisite: ENGR 26305 and ENGR 26306.
Corequisite: ENGR 36306.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 36306 NETWORKING II LABORATORY 1 Credit Hour
Continuation of ENGR 26305 and ENGR 26306. In-depth coverage of personal computer-based enterprise networking systems hardware with a focus on network hardware and software configuration, fault analysis, diagnostics and troubleshooting. Topics include router and switch operation, programming, configuration and troubleshooting, along with overall enterprise network maintenance, troubleshooting and repair. Course also includes WAN and VLAN fundamentals, intermediate TCP/IP and network administration and maintenance as related to fielding and maintaining networking hardware components and systems.
Prerequisite: ENGR 26305 and ENGR 26306.
Corequisite: ENGR 36305.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 36337 INFORMATION TECHNOLOGY SECURITY 3 Credit Hours
This course provides the foundation for understanding the key issues associated with protecting information assets. It covers the essential principles for information security and risk management; making it an important stepping stone of an IT security career. The course is supported with case based industry problems and their solutions through simulation based labs. Additionally, this course prepares students for CompTIA's Security+ SY0-501 certification exam.
Prerequisite: ENGR 10005; and junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 36620 PROJECT MANAGEMENT IN ENGINEERING 3 Credit Hours
The planning, organizing, directing and controlling of company technology resources for project-based management functions. Includes project coordination requirements, management and planning methods and the use of various management and planning tools.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 37777 CYBERSECURITY OPERATIONS 2 Credit Hours
The course also aligns to the Cisco Certified CyberOps Associate certification and covers how to monitor, detect, and respond to cybersecurity threats, as outlined in the National Institute of Standards and Technology (NIST) Cybersecurity Framework. You will learn security concepts, security monitoring, host-based analysis, network intrusion analysis, and security policies procedures. This course also aligns with the National Initiative for Cybersecurity Education (NICE) Cybersecurity Workforce Framework to support consistent communication language for cybersecurity education, training, and workforce development.
Prerequisite: ENGR 26305 and ENGR 26306.
Corequisite: ENGR 37778.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 37778 CYBERSECURITY OPERATIONS LABORATORY 1 Credit Hour
Laboratory activities related to course ENGR 37777.
Prerequisite: ENGR 26305 and ENGR 26306.
Corequisite: ENGR 37777.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 41065 SOLID MODELING AND SOLIDIFICATION SIMULATION 3 Credit Hours
Introduction to casting simulation software with emphasis on projects related to design and filling of casting molds.
Prerequisite: ENGR 23585 and ENGR 31065.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 42111 STRENGTH OF MATERIALS FOR ENGINEERS 3 Credit Hours
(Slashed with ENGR 52111 and ENGR 72111) The mathematical study of how materials respond to external forces. Stress, strain, torsion; deformation of thin-walled pressure vessels, beams and columns; and an introduction to energy methods.
Prerequisite: ENGR 25200; and MATH 32044 or MATH 32052.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 42363 MATERIALS SELECTION IN DESIGN AND APPLICATIONS 3 Credit Hours
Description and analysis of procedures for selecting appropriate materials for a particular mechanical design. The affect of processing on material properties, introduction to materials science for users of materials. Extensive case studies of materials selection and materials and sustainability.
Prerequisite: ENGR 20002; and ENGR 33111 or ENGR 42111.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 42410 ENGINEERING OPTIMIZATION 3 Credit Hours
(Slashed with ENGR 52410 and ENGR 72410) This course will cover the theoretical foundations and present methods associated with the engineering optimization field, including: problem statement formulation; sensitivity methods; decomposition methods; Multidisciplinary Design Optimization (MDO) formulations; unconstrained and constrained 1-D and n-D search methods; and an introduction to heuristic search methods. Engineering optimization in the context of design of complex engineering systems will be discussed as well, with an emphasis on emerging techniques in the field.
Prerequisite: Junior or senior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 42610 INDUSTRIAL ROBOTICS AND VISION SYSTEMS 1 Credit Hour
Students learn how to program a FANUC industrial robot using the teach pendant. They also learn how to set up and use an industrial robot vision system. Students who successfully complete this course and the corequisite lecture will receive both FANUC Robotics Handling Tool Operation and Programming and FANUC V-iRVison Operation and Programming - 2D Certificates of Completion.
Prerequisite: PHY 13002 or PHY 23102; and senior standing.
Corequisite: ENGR 42611.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 42611 INDUSTRIAL ROBOTICS AND VISION SYSTEMS LABORATORY 2 Credit Hours
Students learn how to program a FANUC industrial robot using the teach pendant. They also learn how to set up and use an industrial robot vision system. Students who successfully complete this course and the corequisite lecture will receive both FANUC Robotics Handling Tool Operation and Programming and FANUC V-iRVison Operation and Programming - 2D Certificates of Completion.
Prerequisite: PHY 13002 or PHY 23102; and senior standing.
Corequisite: ENGR 42610.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 42620 INDUSTRIAL AUTOMATION AND CONTROL 1 Credit Hour
Course covers programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prerequisite: ENGR 21020 (and ENGR 21022) or ENGR 35500 (and ENGR 35501).
Corequisite: ENGR 42621.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 42621 INDUSTRIAL AUTOMATION AND CONTROL LABORATORY 2 Credit Hours
Laboratory utilizing programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prerequisite: ENGR 21020 (and ENGR 21022) or ENGR 35500 (and ENGR 35501).
Corequisite: ENGR 42620.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 42710 ADDITIVE MANUFACTURING 2 Credit Hours
An introduction to additive manufacturing (AM) technologies, designing for AM, post processing, AM applications and the future of additive manufacturing in engineering.
Prerequisite: ENGR 13585; and junior standing.
Corequisite: ENGR 42711.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 42711 ADDITIVE MANUFACTURING LABORATORY 1 Credit Hour
An introduction to additive manufacturing (AM) technologies, designing for AM, post processing, AM applications and the future of additive manufacturing in engineering.
Prerequisite: ENGR 13585; and junior standing.
Corequisite: ENGR 42710.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 43026 MICROPROCESSOR SYSTEMS 4 Credit Hours
(Slashed with ENGR 53026) Introduction to the architecture, operation and applications of an advanced microprocessor, focusing on assembly language programming and interfacing of standard programmable peripherals.
Prerequisite: ENGR 33222 and ENGR 46330.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 43030 MECHATRONICS 3 Credit Hours
(Slashed with ENGR 53030 and ENGR 73030) Application of automation concepts in motion control, electrical circuits, fundamental mechanics, control systems and programming, including modeling, interfacing and signal conditioning.
Prerequisite: ENGR 26220 and ENGR 26222; and PHY 13002 or PHY 23102.
Pre/corequisite: ENGR 33031 and ENGR 33041.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 43050 INVENTIVE PROBLEM SOLVING 3 Credit Hours
Theory of Inventive Problem Solving, TRIZ, is a collection of powerful problem-solving tools for a broad range of inventive problems. Capstone web-based course for students finishing their bachelor's degree. Assists students in utilizing material learned in earlier courses to solve many real world problems in multiple disciplines.
Prerequisite: Junior or senior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 43080 INDUSTRIAL AND ENVIRONMENTAL SAFETY 3 Credit Hours
Examines the occupational safety and health act and fundamentals of industrial safety programs.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 43096 INDIVIDUAL INVESTIGATION IN APPLIED SCIENCE AND TECHNOLOGY 1-3 Credit Hours
(Repeatable for credit) Work study of an individual nature on a topic in a field of applied science and technology.
Prerequisite: Junior standing; and special approval.
Schedule Type: Individual Investigation
Contact Hours: 1-3 other
Grade Mode: Standard Letter-IP

ENGR 43099 MECHATRONICS CAPSTONE (ELR) (WIC) 3 Credit Hours
Students work as members of integrated product teams to design and implement one or more mechatronics projects incorporating appropriate engineering standards and multiple design constraints. Final design report to include complete documentation of the design process, how constraints were met and all appropriate documentation of the final design (e.g. block and schematic diagrams, CAD models/drawings, a bill of materials, appropriate engineering calculations, discussion of the use of engineering standards).
Prerequisite: ENGR 43030.
Schedule Type: Project or Capstone
Contact Hours: 3 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement, Writing Intensive Course

ENGR 43220 ELECTRICAL MACHINERY 3 Credit Hours
Principles of operation and application of motors, generators, transformers and other magnetic devices; electrical power generation, distribution and use.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 43550 COMPUTER-AIDED MANUFACTURING 3 Credit Hours
(Slashed with ENGR 53550) The application of computers to the preparation of machine tool control programs.
Prerequisite: ENGR 13585 and ENGR 20002.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 43580 COMPUTER-AIDED MACHINE DESIGN 3 Credit Hours
Application of the principles of mechanics and strength of materials, with computer assistance to the design and selection of machine components under both static and dynamic loads.
Prerequisite: ENGR 13585 or (ENGR 13590 and ENGR 13591); and ENGR 33111 or ENGR 42111 or MERT 22007.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 43899 APPLIED ENGINEERING CAPSTONE (ELR) 3 Credit Hours
As the capstone course in Applied Engineering and Mechanical Engineering Technology, students develop and participate in all aspects of a project involving the solution of a problem through application of technology. Students must pass the ATMAE Certified Technology Manager (CTM) exam.
Prerequisite: Applied Engineering major or Mechanical Engineering Technology major; and senior standing.
Schedule Type: Project or Capstone, Seminar
Contact Hours: 1 lecture, 2 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 45099 CAPSTONE: FOUNDRY TOOLING AND PATTERN MAKING (ELR) 3 Credit Hours
Capstone course for Applied Engineering Foundry Technology concentration. A project based lecture-lab focused on production of foundry tooling, testing, and quality approval.
Prerequisite: ENGR 41065 and ENGR 43550.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab, Project or Capstone
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 45121 AEROSPACE PROPULSION FOR ENGINEERING 3 Credit Hours
An in-depth study of gas turbine engines, rockets and hypersonic propulsion systems used in aerospace applications. Includes propulsion system design and operation, and the analysis of performance characteristics.
Prerequisite: (PHY 13001 and PHY 13021) or PHY 23101; and junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 45151 APPLIED FLIGHT DYNAMICS II 3 Credit Hours
Aerodynamics, flight dynamics, and flight performance of high performance aircraft. Course includes supersonic aerodynamics, flight stability and handling, and an in-depth investigation and analysis of flight performance parameters including lift, drag, load factor, climb performance, and turn performance.
Prerequisite: AERN 45150.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP

ENGR 45600 AIRCRAFT PERFORMANCE AND STABILITY II 3 Credit Hours
Second of a two-course sequence in aircraft performance and flight mechanics. Aircraft design introduction, linearized equations of motion, aircraft dynamics modes, approximations and control, aircraft root locus analysis, aircraft handling qualities.
Prerequisite: ENGR 35300; and ENGR 33041 with a minimum C grade.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 45799 AIRCRAFT DESIGN I (ELR) 3 Credit Hours
(Slashed with ENGR 55799) First of a two-course series of aerospace design. Preliminary design or case study of an aerospace vehicle, including but not limited, to aircraft, rotorcraft and spacecraft. Primary focus on introduction to design, decision-making in design and preliminary sizing of an aerospace vehicle to meet customer requirements. Final technical report and presentation.
Prerequisite: (AERN 45030 and AERN 45150 and ENGR 45121) or (ENGR 35300 and ENGR 35500 and ENGR 45121).
Schedule Type: Project or Capstone
Contact Hours: 3 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 45899 AIRCRAFT DESIGN II (ELR) (WIC) 3 Credit Hours
(Slashed with ENGR 55899) Second of a two-course series of aerospace design. Preliminary design or case study of an aerospace vehicle, including but not limited to aircraft, rotorcraft, and spacecraft. Primary focus on sub-system design (i.e., propulsion, structure, controls, etc.), and overall vehicle integration of these subsystems. Cost analysis and safety analysis. Final technical report and or model prototype.
Prerequisite: ENGR 45799.
Schedule Type: Project or Capstone
Contact Hours: 3 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement, Writing Intensive Course

ENGR 45901 INTRODUCTION TO FINITE ELEMENT METHOD AND APPLICATIONS 3 Credit Hours
(Slashed with ENGR 55901 and ENGR 75901) The objective of this course is to teach in a unified manner the fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures. The course emphasizes the solution of real-life problems using the finite element method, and students get exposure to commercial finite element software (ANSYS or ABAQUS) and learn to critically evaluate finite element models. Examples are provided for solid, fluid and heat transfer applications. Finally, developing an understanding of the computational aspects of the finite element method and its application in realistic aerospace applications are the core goals of this course.
Prerequisite: ENGR 13585 or (ENGR 13586 and ENGR 13587); and MATH 32044 or MATH 32052; and senior standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 46099 COMPUTER ENGINEERING TECHNOLOGY CAPSTONE (ELR) 3 Credit Hours
The course provides students with an integrative experience, applying aspects of the student's required coursework in computer engineering technology. Students gain experience in developing requirements in engineering specifications for a practical problem in networking and/or telecom-related projects. This course addresses emerging issues, capabilities and challenges in the current field of study.
Prerequisite: (ENGR 46351 and ENGR 46352) or ENGR 47200; and senior standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab, Project or Capstone
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 46305 NETWORK SECURITY 2 Credit Hours
Introduction to network security with emphasis in identifying, analyzing and preventing various threats and attack patterns on computer networks. Students gain practical knowledge on network security protocols, firewalls, VPN, intrusion detection and prevention systems. Prepares students for industry certification.
Prerequisite: ENGR 26305 and ENGR 26306.
Corequisite: ENGR 46306.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 46306 NETWORK SECURITY LABORATORY 1 Credit Hour
Introduction to network security with emphasis in identifying, analyzing and preventing various threats and attack patterns on computer networks. Students gain practical knowledge on network security protocols, firewalls, VPN, intrusion detection and prevention systems. Prepares students for industry certification.
Prerequisite: ENGR 26305 and ENGR 26306.
Corequisite: ENGR 46305.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 46312 WIRELESS NETWORK AND TELECOMMUNICATION SYSTEMS 3 Credit Hours
(Slashed with ENGR 56312) Course builds upon existing wired networking skills and extends students' knowledge into the world of wireless networking. Students learn digital wireless fundamentals, wireless standards, how to implement a wireless network in an enterprise environment and how to troubleshoot wireless issues. Curriculum follows and prepares students for industry certification in wireless networking.
Prerequisite: ENGR 26305 and ENGR 26306.
Pre/corequisite: ENGR 36305 and ENGR 36306.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 46316 SERVER ADMINISTRATION AND CONFIGURATION I 3 Credit Hours
This course emphasizes on configuring and administering server operating systems to solve engineering problems. Students are expected to learn MS server management, Active Directory, OUs and server roles by utilizing variety of on-based and cloud based solutions.
Prerequisite: None.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 46317 SERVER ADMINISTRATION AND CONFIGURATION II 2 Credit Hours
Server Administration and Configuration II Lecture provides an in-depth coverage of the 70-741 certification exam objectives and focuses on the skills you need to configure networking with Windows Server 2016 and AZURE. After you finish this course, you'll have an in-depth knowledge of Windows Server 2016 networking services, including TCP/IP, DNS, DHCP, IPAM, remote access and advanced networking solutions.
Prerequisite: ENGR 46316.
Corequisite: ENGR 46318.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 46318 SERVER ADMINISTRATION AND CONFIG II - LABORATORY 1 Credit Hour
Server Administration and Configuration II Lab provides the hands-on component of ENGR 46317. It provides an in-depth coverage of the 70-741 certification exam objectives and focuses on the skills you need to configure networking with Windows Server 2016 and AZURE. After finishing this course, you'll have an in-depth knowledge of Windows Server 2016 networking services, including TCP/IP, DNS, DHCP, IPAM, remote access and advanced networking solutions.
Prerequisite: ENGR 46316.
Corequisite: ENGR 46317.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 46330 VISUAL BASIC PROGRAMMING IN ENGINEERING TECHNOLOGY 3 Credit Hours
(Slashed with ENGR 56330) Course includes programming in a high-level object-oriented, event- driven visual programming language, Visual Basic 2010 Express, conditional statements, iterative statements, arrays, object oriented programming, classes, objects, methods, inheritance, exception handling, graphical user interfaces with Windows Forms.
Prerequisite: ENGR 10005.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 4 other
Grade Mode: Standard Letter

ENGR 46351 NETWORK MANAGEMENT AND DESIGN 2 Credit Hours
Course covers the technical aspects of centrally managed and distributed wide area networks, with an emphasis on the techniques used to maintain and improve the performance of telecommunications and data networks. Students use software packages to monitor the real-time performance of a network and to diagnose various networking hardware and software problems. Topics include the five stacks of network management (fault management, configuration management, performance management, security management and accounting management). Examples of current specific network management products are reviewed.
Prerequisite: ENGR 36305 and ENGR 36306.
Corequisite: ENGR 46352.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 46352 NETWORK MANAGEMENT AND DESIGN LABORATORY 1 Credit Hour
Course covers the technical aspects of centrally managed and distributed wide area networks, with an emphasis on the techniques used to maintain and improve the performance of telecommunications and data networks. Students use software packages to monitor the real-time performance of a network and to diagnose various networking hardware and software problems. Topics include the five stacks of network management (fault management, configuration management, performance management, security management and accounting management). Examples of current specific network management products are reviewed.
Prerequisite: ENGR 36305 and ENGR 36306.
Corequisite: ENGR 46351.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 47200 SYSTEMS ENGINEERING 3 Credit Hours
(Slashed with ENGR 57200) Systems engineering as a method to solve problems. Introduction to the fundamental systems engineering principles, processes, and methodologies used to analyze, design, develop, and deploy complex, sustainable systems. Focuses on systems engineering as a logical, disciplined, systematic, and coherent approach to the design and development of a system, across the full life cycle of the system. Special emphasis is made on the concepts, methods, and activities used to analyze systems, to define and allocate requirements, to transform requirements into a system design, and to verify and validate the system.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 47210 SUSTAINABLE ENERGY I 3 Credit Hours
(Slashed with ENGR 57210) A comprehensive overview of energy sources and energy systems, with an emphasis on renewable energy and the implementation and sustainability of various forms of energy. Examines the characteristics of conventional non-renewable energy systems, along with alternate, renewable energy sources and systems. Includes fundamental energy concepts and the conversion, delivery, distribution, and storage of energy. Explores the technological application of various sources of energy and compares their benefits and limitations. Also presents an overview of present U.S. and global energy needs and demands, and the sustainable energy technologies that may be used to meet future energy demands.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 47211 SUSTAINABLE ENERGY II 3 Credit Hours
(Slashed with ENGR 57211) An in-depth study of the analysis, selection and implementation of various energy and power sources, with an emphasis on the use of renewable, sustainable energy systems. Focuses on determining energy needs, and on assessing and comparing energy systems with respect to efficiency, technical feasibility, available resources, cost and sustainability characteristics. Includes economics of energy systems, methods for determining costs, and cost-benefit analysis of various energy and power systems. Also includes the social, economic and environmental impact associated with the development, implementation and use of various forms of energy.
Prerequisite: ENGR 47210.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 48001 ORBITAL MECHANICS 3 Credit Hours
(Slashed with ENGR 58001 and ENGR 78001) The course is an introduction to orbital and trajectory design. Topics include Newton's law of gravity; two-body motion; relative equations of motion; conic sections; orbits in three dimensions; orbital maneuvers; and interplanetary transfers.
Prerequisite: ENGR 25400; and MATH 32044 or MATH 32052; and senior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 48002 SPACECRAFT ATTITUDE DYNAMICS, DETERMINATION AND CONTROL 3 Credit Hours
(Slashed with ENGR 58002 and ENGR 78002) Spacecraft rigid body dynamics in terms of direction cosine matrix, Euler angles, principal rotation vector and quaternions. Attitude determination using TRIAD, quaternion and matrix solutions to Wahba's problem and an introduction to recursive estimation and Kalman Filter. Nonlinear stability and control technique (i.e., Lyapunov Theory) is introduced and applied to the attitude stabilization and control problem.
Prerequisite: ENGR 25400 and MATH 32052; and senior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 48003 SPACECRAFT DESIGN 3 Credit Hours
Spacecraft mission design course with a focus on hands-on design experience. The first portion of the course is lecture-based. Topics include launch systems, space environment, spacecraft orbits, and ground tracks, spacecraft design and sizing, budget designs, subsystem design and evaluation, cost and risk. The second portion is dedicated to student teamwork on the spacecraft design.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 48010 MACHINE VISION 3 Credit Hours
(Slashed with ENGR 58010 and ENGR 78010) Course explores concepts and techniques for image/video processing and machine vision. Topics covered include image formation, image filtering, edge detection and segmentation, object recognition, object detection and tracking, 3D vision, etc.
Prerequisite: Senior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 48099 ENGINEERING CAPSTONE I (ELR) 3 Credit Hours
First of a two-course capstone sequence for engineering and engineering technology students. Students work as members of an integrated product team under a faculty advisor to develop a conceptual design/prototype of a complex system that accomplishes a set of functional requirements. These projects can take the form of state, regional or national design competitions; governmental-sponsored projects; or industry-sponsored projects.
Prerequisite: (AERN 45030 and AERN 45150) or ENGR 35300 or ENGR 47200.
Schedule Type: Project or Capstone
Contact Hours: 3 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 48199 ENGINEERING CAPSTONE II (ELR) (WIC) 3 Credit Hours
Second of a two-course capstone sequence for engineering and engineering technology students. Students work as members of an integrated product team under a faculty advisor to develop a conceptual design/prototype of a complex system that accomplishes a set of functional requirements. These projects can take the form of state, regional, or national design competitions, governmental-sponsored projects, or industry-sponsored projects.
Prerequisite: ENGR 48099.
Schedule Type: Project or Capstone
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP
Attributes: Experiential Learning Requirement, Writing Intensive Course

ENGR 52111 STRENGTH OF MATERIALS FOR ENGINEERS 3 Credit Hours
(Slashed with ENGR 42111 and ENGR 72111) The mathematical study of how materials respond to external forces. Stress, strain, torsion; deformation of thin-walled pressure vessels, beams and columns; and an introduction to energy methods.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 52363 MATERIALS SELECTION IN DESIGN AND APPLICATIONS 3 Credit Hours
(Slashed with ENGR 42363 and ENGR 72363) Description and analysis of procedures for selecting appropriate materials for a particular mechanical design. The affect of processing on material properties, introduction to materials science for users of materials. Extensive case studies of materials selection and materials and sustainability.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 52410 ENGINEERING OPTIMIZATION 3 Credit Hours
(Slashed with ENGR 42410 and ENGR 72410) This course will cover the theoretical foundations and present methods associated with the engineering optimization field, including: problem statement formulation; sensitivity methods; decomposition methods; Multidisciplinary Design Optimization (MDO) formulations; unconstrained and constrained 1-D and n-D search methods; and an introduction to heuristic search methods. Engineering optimization in the context of design of complex engineering systems will be discussed as well, with an emphasis on emerging techniques in the field.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 53030 MECHATRONICS 3 Credit Hours
(Slashed with ENGR 43030 and ENGR 73030) Application of automation concepts in motion control, electrical circuits, fundamental mechanics, control systems and programming, including modeling, interfacing and signal conditioning.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 53550 COMPUTER-AIDED MANUFACTURING 3 Credit Hours
(Slashed with ENGR 43550) The application of computers to the preparation of machine tool control programs.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 55799 AIRCRAFT DESIGN I 3 Credit Hours
(Slashed with ENGR 45799) First of a two-course series of aerospace design. Preliminary design or case study of an aerospace vehicle, including but not limited, to aircraft, rotorcraft and spacecraft. Primary focus on introduction to design, decision-making in design and preliminary sizing of an aerospace vehicle to meet customer requirements. Final technical report and presentation.
Prerequisite: Graduate standing.
Schedule Type: Project or Capstone
Contact Hours: 3 other
Grade Mode: Standard Letter

ENGR 55899 AIRCRAFT DESIGN II 3 Credit Hours
(Slashed with ENGR 45899) Second of a two-course series of aerospace design. Preliminary design or case study of an aerospace vehicle, including but not limited to aircraft, rotorcraft and spacecraft. Primary focus on sub-system design (i.e., propulsion, structure, controls, etc.), and overall vehicle integration of these subsystems. Cost analysis and safety analysis. Final technical report and or model prototype.
Prerequisite: ENGR 55799; and graduate standing.
Schedule Type: Project or Capstone
Contact Hours: 3 other
Grade Mode: Standard Letter

ENGR 55901 INTRODUCTION TO FINITE ELEMENT METHOD AND APPLICATIONS 3 Credit Hours
(Slashed with ENGR 45901 and ENGR 75901) The objective of this course is to teach in a unified manner the fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures. The course emphasizes the solution of real-life problems using the finite element method, and students get exposure to commercial finite element software (ANSYS or ABAQUS) and learn to critically evaluate finite element models. Examples are provided for solid, fluid and heat transfer applications. Finally, developing an understanding of the computational aspects of the finite element method and its application in realistic aerospace applications are the core goals of this course.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 56312 WIRELESS NETWORK AND TELECOMMUNICATION SYSTEMS 3 Credit Hours
(Slashed with ENGR 46312) Course builds upon existing wired networking skills and extends students' knowledge into the world of wireless networking. Students learn digital wireless fundamentals, wireless standards, how to implement a wireless network in an enterprise environment and how to troubleshoot wireless issues. Curriculum follows and prepares students for industry certification in wireless networking.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 56330 VISUAL BASIC PROGRAMMING IN ENGINEERING TECHNOLOGY 3 Credit Hours
(Slashed with ENGR 46330) Course includes programming in a high-level object-oriented, event- driven visual programming language, Visual Basic 2010 Express, conditional statements, iterative statements, arrays, object oriented programming, classes, objects, methods, inheritance, exception handling, graphical user interfaces with Windows Forms.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 57200 SYSTEMS ENGINEERING 3 Credit Hours
(Slashed with ENGR 47200) Systems engineering as a method to solve problems. Introduction to the fundamental systems engineering principles, processes, and methodologies used to analyze, design, develop, and deploy complex, sustainable systems. Focuses on systems engineering as a logical, disciplined, systematic, and coherent approach to the design and the development of a system, across the full life cycle of the system. Special emphasis is made on the concepts, methods and activities used to analyze systems, to define and allocate requirements, to transform requirements into a system design, and to verify and validate the system.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 57210 SUSTAINABLE ENERGY I 3 Credit Hours
(Slashed with ENGR 47210) A comprehensive overview of energy sources and energy systems, with an emphasis on renewable energy and the implementation and sustainability of various forms of energy. Examines the characteristics of conventional non-renewable energy systems, along with alternate, renewable energy sources and systems. Includes fundamental energy concepts and the conversion, delivery, distribution, and storage of energy. Explores the technological application of various sources of energy and compares their benefits and limitations. Also presents an overview of presents U.S. and global energy needs and demands, and the sustainable energy technologies that may be used to meet future energy demands.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 57211 SUSTAINABLE ENERGY II 3 Credit Hours
(Slashed with ENGR 47211) An in-depth study of the analysis, selection and implementation of various energy and power sources, with an emphasis on the use of renewable, sustainable energy systems. Focuses on determining energy needs, and on assessing and comparing energy systems with respect to efficiency, technical feasibility, available resources, cost and sustainability characteristics. Includes economics of energy systems, methods for determining costs, and cost-benefit analysis of various energy and power systems. Also includes the social, economic, and environmental impact associated with the development, implementation, and use of various forms of energy.
Prerequisite: ENGR 57210; and graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 58001 ORBITAL MECHANICS 3 Credit Hours
(Slashed with ENGR 48001 and ENGR 78001) The course is an introduction to orbital and trajectory design. Topics include Newton's law of gravity; two-body motion; relative equations of motion; conic sections; orbits in three dimensions; orbital maneuvers; and interplanetary transfers.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 58002 SPACECRAFT ATTITUDE DYNAMICS, DETERMINATION AND CONTROL 3 Credit Hours
(Slashed with ENGR 48002 and ENGR 78002) Spacecraft rigid body dynamics in terms of direction cosine matrix, Euler angles, principal rotation vector and quaternions. Attitude determination using TRIAD, quaternion and matrix solutions to Wahba's problem and an introduction to recursive estimation and Kalman Filter. Nonlinear stability and control technique (i.e., Lyapunov Theory) is introduced and applied to the attitude stabilization and control problem.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 58004 OPTIMAL CONTROL THEORY 3 Credit Hours
(Slashed with ENGR 78004) The course introduces students to the theory and numerical calculation of optimal space trajectories and related optimization problems in aerospace engineering. This course provides the essential technical components of space trajectory design and space trajectory optimization. Students develop basic engineering skills in formulating and solving open-ended problems and in writing a project report.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 58010 MACHINE VISION 3 Credit Hours
(Slashed with ENGR 48010 and ENGR 78010) Course explores concepts and techniques for image/video processing and machine vision. Topics covered include image formation, image filtering, edge detection and segmentation, object recognition, object detection and tracking, 3D vision, etc.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 60000 PROJECT MANAGEMENT IN A TECHNOLOGICAL ENVIRONMENT 3 Credit Hours
The planning, organizing, directing and controlling of company technology resources for relatively short term objectives. Students will also learn to make application of current projects.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 60003 SIX-SIGMA: TOOLS AND APPLICATIONS FOR TECHNOLOGY MANAGEMENT 2 Credit Hours
Principles and concepts of six-sigma to improve organizational efficiency, effectiveness and productivity by improving quality, reducing waste, defects and failures.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 60020 QUALITY STANDARDS 3 Credit Hours
This course introduces students to issues in quality standards, quality assurance and statistical inference in applied technology and process control. Topics include systems reliability, quality control, SPC, control charts, principles and methods of statistical analysis and prediction, and hypothesis testing.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 60030 QUANTITATIVE METHODS I 2 Credit Hours
Descriptive and inferential statistics used in technology and engineering. Emphasis is on the methods of analysis and the interpretation of data associated with research and development in technological and engineering environments. Course topics include representation of data, descriptive statistics, probability, and probability distributions. No previous familiarity with probability or statistics is assumed. The ability to utilize basic algebra is required.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 60040 QUANTITATIVE METHODS II 2 Credit Hours
Descriptive and inferential statistics used in technology and engineering. Emphasis is on the methods of analysis and the interpretation of data associated with research and development in technological and engineering environments. Course topics include inferential statistics, statistical design, and the analysis of experiments. The ability to utilize basic algebra is required.
Prerequisite: Graduate standing.
Pre/corequisite: ENGR 60030.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 60078 RESEARCH METHODS IN TECHNOLOGY 2 Credit Hours
Research techniques for the technologist. Methods for designing, conducting, analyzing and interpreting results of technological research. Course allows students to become informed consumers of all forms of research used in different fields. Students identify various research approaches and the strengths and limitations associated with different approaches. Focus is on the context of educational research; philosophy underlying research; the scientific method; the relationship of theory to research; research strategies; experimental design; non-experimental design; sampling; hypotheses; and other pertinent aspects of research.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 60092 INDUSTRIAL PRACTICE 1-4 Credit Hours
(Repeatable for credit) Practical experience in industry of a cooperative work-study nature.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Practical Experience
Contact Hours: 3-12 other
Grade Mode: Standard Letter

ENGR 61091 GRADUATE SEMINAR 1 Credit Hour
(Repeatable for credit) Discussions of selected technical topics related to engineering research.
Prerequisite: Graduate standing.
Schedule Type: Seminar
Contact Hours: 1 other
Grade Mode: Standard Letter

ENGR 61095 SPECIAL TOPICS IN ENGINEERING 1-3 Credit Hours
(Repeatable for credit) (Slashed with ENGR 81095) Study of significant and current issues in various engineering topics not covered in regular courses. Offered when opportunities and resources permit; the topic is announced when the course is scheduled.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

ENGR 61096 INDIVIDUAL INVESTIGATION IN ENGINEERING 1-3 Credit Hours
(Repeatable for credit) (Slashed with ENGR 81096) Individual investigation for a topic in the field of engineering.
Prerequisite: Graduate standing.
Schedule Type: Individual Investigation
Contact Hours: 3-9 other
Grade Mode: Standard Letter

ENGR 61099 ENGINEERING TECHNOLOGY CAPSTONE 2-6 Credit Hours
(Repeatable for credit) Students complete either a comprehensive project at a workplace through employment or internship or a comprehensive research paper from an investigation. Student's goal is to demonstrate competence in their graduate area of study. Possibilities include empirical research, case studies, theoretical or applied projects or projects identified for a specific client. Students are evaluated on the use of knowledge and skills gained from other courses taken in the program.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Project or Capstone
Contact Hours: 2-6 other
Grade Mode: Standard Letter

ENGR 62610 INDUSTRIAL ROBOTICS AND VISION SYSTEMS 1 Credit Hour
(Slashed with ENGR 72610) Students learn how to program a FANUC industrial robot using the teach pendant. They also learn how to set up and use an industrial robot vision system. Students who successfully complete this course and the corequisite lab will receive both FANUC Robotics Handling Tool Operation and Programming and FANUC V-iRVison Operation and Programming - 2D certificates of completion.
Prerequisite: Graduate standing.
Corequisite: ENGR 62611.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 62611 INDUSTRIAL ROBOTICS AND VISION SYSTEMS LABORATORY 2 Credit Hours
(Slashed with ENGR 72611) Students learn how to program a FANUC industrial robot using the teach pendant. They also learn how to set up and use an industrial robot vision system. Students who successfully complete this course and the corequisite lecture will receive both FANUC Robotics Handling Tool Operation and Programming and FANUC V-iRVison Operation and Programming - 2D certificates of completion.
Prerequisite: Graduate standing.
Corequisite: ENGR 62610.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 62620 INDUSTRIAL AUTOMATION AND CONTROL 1 Credit Hour
(Slashed with ENGR 72620) Course covers programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prerequisite: Graduate standing.
Corequisite: ENGR 62621.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 62621 INDUSTRIAL AUTOMATION AND CONTROL LABORATORY 2 Credit Hours
(Slashed with ENGR 72621) Laboratory utilizing programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prerequisite: Graduate standing.
Corequisite: ENGR 62620.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 62710 ADDITIVE MANUFACTURING 2 Credit Hours
(Slashed with ENGR 72710) An introduction to additive manufacturing (AM) technologies, designing for AM, post processing, AM applications and the future of additive manufacturing in engineering.
Prerequisite: Graduate standing.
Corequisite: ENGR 62711.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 62711 ADDITIVE MANUFACTURING LABORATORY 1 Credit Hour
(Slashed with ENGR 72711) An introduction to additive manufacturing (AM) technologies, designing for AM, post processing, AM applications and the future of additive manufacturing in engineering.
Prerequisite: Graduate standing.
Corequisite: ENGR 62710.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 63010 INFORMATION TECHNOLOGY FUNDAMENTALS 3 Credit Hours
Introduction to the hardware, architecture and operation of the personal computer and associated devices. Topics include personal computer architecture and operation fundamentals, basic hardware, data busses and ports, hardware component packaging, auxiliary hardware components, and computer assembly, basic hardware installation, configuration and troubleshooting.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 63031 PROGRAMMABLE LOGIC CONTROLLERS 3 Credit Hours
Programmable logic controllers (PLCS) covering hardware, ladder logic programming, networking and communications. Programming timers, counters and sequencers and an introduction to human machine interfaces (HMIS). An understanding of basic electricity and computer technology is required.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 63041 MOTORS AND CONTROLLERS 3 Credit Hours
Theory and application of AC and DC motors, motor control, and machine operations in mechatronic systems. Includes introduction to basic control system terms and devices, input and output transducers, signal conditioning, open loop and closed loop control, stability and performance.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 63050 TRIZ: THEORY OF INVENTIVE PROBLEM-SOLVING 3 Credit Hours
TRIZ is a collection of powerful problem-solving tools for a broad range of inventive problems. The theory originated in Russia by the study of more than two million patents. Students utilize material learned in earlier courses to solve real world problems in multiple disciplines.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 63070 COMPUTER HARDWARE DESIGN AND INTEGRATION 3 Credit Hours
In-depth study of personal computer (PC) and computer networking hardware. Topics include PC design, basic and auxiliary PC hardware components, PC assembly, PC upgrade and optimization, and PC repair, diagnosis and troubleshooting. Additional topics include computer networking hardware, network architecture, network communication protocols, and network installation, configuration and maintenance. Includes laboratory.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 63100 COMPUTER-AIDED DESIGN 3 Credit Hours
Study of modern industrial practice using computers in advanced graphics, design and analysis including geometric dimensioning and tolerancing, parametric design, solid modeling and finite element analysis. Two hours lecture and two hours lab.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 1 lecture, 4 lab
Grade Mode: Standard Letter

ENGR 64010 CONNECTIVITY AND INTEROPERABILITY IN INDUSTRY 3 Credit Hours
This course focuses on integrating and administering multiple systems in an industrial environment.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 64312 ADVANCED WIRELESS TELECOMMUNICATION SYSTEM AND NETWORK TECHNOLOGIES 3 Credit Hours
Describes technologies associated with wireless and telecommunications systems. Topics covered include public switch telephone network infrastructures, intelligent networks, wireless technologies in manufacturing enterprises, 3GPP standards, ITU standards.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 65098 RESEARCH 1-6 Credit Hours
(Repeatable for credit) Varied topics according to student interest and faculty approval. The work is designed to conduct research on a topic, and it will result in a paper or other appropriate product.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Research
Contact Hours: 3-18 other
Grade Mode: Satisfactory/Unsatisfactory

ENGR 65199 THESIS I 2-6 Credit Hours
(Repeatable for credit) Thesis students must register for a total of 6 hours, 2 to 6 hours in a single semester distributed over several semesters if desired.
Prerequisite: Graduate standing; and special approval.
Schedule Type: Masters Thesis
Contact Hours: 6-18 other
Grade Mode: Satisfactory/Unsatisfactory

ENGR 65299 THESIS II 2 Credit Hours
Thesis students must continue registration each semester until all degree requirements are met.
Prerequisite: Graduate standing.
Schedule Type: Masters Thesis
Contact Hours: 2 other
Grade Mode: Satisfactory/Unsatisfactory

ENGR 65500 QUALITY SYSTEMS AND INDUSTRIAL PRODUCTIVITY 3 Credit Hours
Tools and techniques for increasing industrial productivity through total quality management. Productivity improvement techniques involving human, technology, material, product and processes, utilizing value engineering, analytical models and scientific management tools in high-technology environment.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 65550 DESIGN AND ANALYSIS OF EXPERIMENTS IN TECHNOLOGY 3 Credit Hours
Introduces planning and conducting experiments, as well as analyzing the resulting data using statistical techniques to obtain valid and objective conclusions. Also focuses on experiments performed in areas such as product design, manufacturing process development and process improvement.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 65700 APPLIED RELIABILITY ENGINEERING 3 Credit Hours
Introduction to reliability engineering for engineering-technology management professionals. Course includes design for reliability, failure mode and failure effect analysis, reliability testing and measurement, statistical and mathematical modeling, assessment and forecasting.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 65800 BURN-IN AND STRESS-TESTING FOR RELIABILITY 3 Credit Hours
Comprehensive course on reliability testing to analyze and establish reliability standards for components, products and systems. Specific emphasis on burn-in and stress testing procedures to perform effective reliability statistical calculations will be the major focus of the course.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 66380 ADVANCED NETWORKING 3 Credit Hours
Provides students with experience in advanced computer networking techniques, including network architectures, network security, network virtualization and storage area networks.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 67010 ETHICS, TECHNOLOGY AND THE ENVIRONMENT 3 Credit Hours
Explores the fundamental issues of the interconnections between human beings and the environment, with an emphasis on the ethics and the importance of the sustainability. Takes an in-depth look at basic environmental concepts, ethics and values, as they relate to a wide range of practical subject matters, including technology, from global and national perspectives. Provides an in-depth look at sustainable systems and the ethical issues associated with sustainability as it relates to technology by focusing on common and future impacts as they apply to ethics, values and justice.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 67300 MEDICAL ROBOTICS 3 Credit Hours
(Slashed with ENGR 77300) Introduction to the current development of medical robot, study the design and control of medical robot. Main focus of course is surgical robots and walking assistant robots.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 67400 ROBOTICS: KINEMATICS AND DESIGN 3 Credit Hours
(Slashed with ENGR 77400) Course covers techniques to physically design, model, analyze and control a robotic system, especially robotic arms with serial structures. Provides students with a basic understanding of physics and mathematics of robotic kinematics and design. Students develop skills for force analysis, practice robotic programming and understand principles of robotic operation, sensing and path planning.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68003 SPACECRAFT DESIGN 3 Credit Hours
(Slashed with ENGR 78003) Spacecraft mission design course with a focus on hands-on design experience. The first portion of the course is lecture-based. Topics include launch systems, space environment, spacecraft orbits and ground tracks, spacecraft design and sizing, budget designs, subsystem design and evaluation, cost and risk. The second portion is dedicated to student teamwork on the spacecraft design.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68005 LINEAR SYSTEM ANALYSIS AND CONTROL 3 Credit Hours
(Slashed with ENGR 78005) This course covers the analysis and synthesis of linear dynamical systems. Fundamental concepts including canonical representations, the state transition matrix and the properties of controllability and observability are discussed. The existence and synthesis of stabilizing feedback control laws using pole placement and linear-quadratic optimal control are discussed.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68006 NONLINEAR SYSTEMS AND CONTROL 3 Credit Hours
(Slashed with ENGR 78006) Overview of stability concepts and examination of various methods for assessing stability such as linearization and Lyapunov methods. Introduction to various design methods based on linearization, sliding modes, adaptive control and feedback linearization.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68007 DIGITAL CONTROL SYSTEMS 3 Credit Hours
(Slashed with ENGR 78007) This course covers design and analysis of sampled data and digital control systems. Fundamental concepts include introduction to digital control and discrete transform (z-transform), discrete and hybrid signal flow graphs (SFGs), solution of discrete-time state space models, time-response and characteristic equations, stability analysis for discrete time systems, root locus, Bode plot and Nyquist method for sampled data systems, pole placement and state estimation for discrete time systems.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68008 INTRODUCTION TO ROBUST CONTROL 3 Credit Hours
(Slashed with ENGR 78008) Course covers the fundamentals of robust control theory, with emphasis on stability and performance analysis in the time and frequency domains and design tools for robust performance and robust stability. Course examines how a controller can be designed taking into account uncertainties in the model of the plant. Some current research topics such as application of robust identification and control techniques to active vision systems also are addressed.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68101 AUTONOMOUS UNMANNED AERIAL SYSTEMS 3 Credit Hours
(Slashed with ENGR 78101) This course provides an advanced-level understanding of unmanned aerial vehicles in physical system design; payload; and stealth design, navigation and deployment regulations. This course introduces students to state-of-the-art artificial intelligence methods for UAS deployments in different urban, forest and water surface scenarios.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 68102 INTELLIGENT SENSING AND PLANNING OF UNMANNED AERIAL SYSTEMS 3 Credit Hours
(Slashed with ENGR 78102) This course focuses on real world environment understanding for the UAV systems. This course introduces students to state-of-the-art artificial intelligence methods for planning UAV missions in the real world.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 71095 SPECIAL TOPICS IN ENGINEERING 1-3 Credit Hours
(Repeatable for credit) Study of significant and current issues in various engineering topics not covered in regular courses. Offered when opportunities and resources permit; the topic is announced when the course is scheduled.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

ENGR 72111 STRENGTH OF MATERIALS FOR ENGINEERS 3 Credit Hours
(Slashed with ENGR 42111 and ENGR 52111) The mathematical study of how materials respond to external forces. Stress, strain, torsion; deformation of thin-walled pressure vessels, beams and columns; and an introduction to energy methods.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 72363 MATERIALS SELECTION IN DESIGN AND APPLICATIONS 3 Credit Hours
(Slashed with ENGR 42363 and ENGR 52363) Description and analysis of procedures for selecting appropriate materials for a particular mechanical design. The affect of processing on material properties, introduction to materials science for users of materials. Extensive case studies of materials selection and materials and sustainability.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 72410 ENGINEERING OPTIMIZATION 3 Credit Hours
(Slashed with ENGR 42410 and ENGR 52410) This course will cover the theoretical foundations and present methods associated with the engineering optimization field, including: problem statement formulation; sensitivity methods; decomposition methods; Multidisciplinary Design Optimization (MDO) formulations; unconstrained and constrained 1-D and n-D search methods; and an introduction to heuristic search methods. Engineering optimization in the context of design of complex engineering systems will be discussed as well, with an emphasis on emerging techniques in the field.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 72610 INDUSTRIAL ROBOTICS AND VISION SYSTEMS 1 Credit Hour
(Slashed with ENGR 62610) Students learn how to program a FANUC industrial robot using the teach pendant. They also learn how to set up and use an industrial robot vision system. Students who successfully complete this course and the corequisite lab will receive both FANUC Robotics Handling Tool Operation and Programming and FANUC V-iRVison Operation and Programming - 2D certificates of completion.
Prerequisite: Doctoral standing.
Corequisite: ENGR 72611.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 72611 INDUSTRIAL ROBOTICS AND VISION SYSTEMS LABORATORY 2 Credit Hours
(Slashed with ENGR 62611) Students learn how to program a FANUC industrial robot using the teach pendant. They also learn how to set up and use an industrial robot vision system. Students who successfully complete this course and the corequisite lecture will receive both FANUC Robotics Handling Tool Operation and Programming and FANUC V-iRVison Operation and Programming - 2D certificates of completion.
Prerequisite: Doctoral standing.
Corequisite: ENGR 72610.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 72620 INDUSTRIAL AUTOMATION AND CONTROL 1 Credit Hour
(Slashed with ENGR 62620) Course covers programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prerequisite: Doctoral standing.
Corequisite: ENGR 72621.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 72621 INDUSTRIAL AUTOMATION AND CONTROL LABORATORY 2 Credit Hours
(Slashed with ENGR 62621) Laboratory utilizing programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prerequisite: Doctoral standing.
Corequisite: ENGR 72620.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 72710 ADDITIVE MANUFACTURING 2 Credit Hours
(Slashed with ENGR 62710) An introduction to additive manufacturing (AM) technologies, designing for AM, post processing, AM applications and the future of additive manufacturing in engineering.
Prerequisite: Doctoral standing.
Corequisite: ENGR 72711.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 72711 ADDITIVE MANUFACTURING LABORATORY 1 Credit Hour
(Slashed with ENGR 62711) An introduction to additive manufacturing (AM) technologies, designing for AM, post processing, AM applications and the future of additive manufacturing in engineering.
Prerequisite: Doctoral standing.
Corequisite: ENGR 72710.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 73030 MECHATRONICS 3 Credit Hours
(Slashed with ENGR 43030 and ENGR 53030) Application of automation concepts in motion control, electrical circuits, fundamental mechanics, control systems and programming, including modeling, interfacing and signal conditioning.
Prerequisite: Doctoral standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 75901 INTRODUCTION TO FINITE ELEMENT METHOD AND APPLICATIONS 3 Credit Hours
(Slashed with ENGR 45901 and ENGR 55901) The objective of this course is to teach in a unified manner the fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures. The course emphasizes the solution of real-life problems using the finite element method, and students get exposure to commercial finite element software (ANSYS or ABAQUS) and learn to critically evaluate finite element models. Examples are provided for solid, fluid and heat transfer applications. Finally, developing an understanding of the computational aspects of the finite element method and its application in realistic aerospace applications are the core goals of this course.
Prerequisite: Doctoral standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 77300 MEDICAL ROBOTICS 3 Credit Hours
(Slashed with ENGR 67300) Introduction to the current development of medical robot, study the design and control of medical robot. Main focus of course is surgical robots and walking assistant robots.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 77400 ROBOTICS: KINEMATICS AND DESIGN 3 Credit Hours
(Slashed with ENGR 67400) Course covers techniques to physically design, model, analyze and control a robotic system, especially robotic arms with serial structures. Provides students with a basic understanding of physics and mathematics of robotic kinematics and design. Students develop skills for force analysis, practice robotic programming and understand principles of robotic operation, sensing and path planning.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78001 ORBITAL MECHANICS 3 Credit Hours
(Slashed with ENGR 48001 and ENGR 58001) The course is an introduction to orbital and trajectory design. Topics include Newton's law of gravity; two-body motion; relative equations of motion; conic sections; orbits in three dimensions; orbital maneuvers; and interplanetary transfers.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78002 SPACECRAFT ATTITUDE DYNAMICS, DETERMINATION AND CONTROL 3 Credit Hours
(Slashed with ENGR 48002 and ENGR 58002) Spacecraft rigid body dynamics in terms of direction cosine matrix, Euler angles, principal rotation vector and quaternions. Attitude determination using TRIAD, quaternion and matrix solutions to Wahba's problem and an introduction to recursive estimation and Kalman Filter. Nonlinear stability and control technique (i.e., Lyapunov Theory) is introduced and applied to the attitude stabilization and control problem.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78003 SPACECRAFT DESIGN 3 Credit Hours
(Slashed with ENGR 68003) Spacecraft mission design course with a focus on hands-on design experience. The first portion of the course is lecture-based. Topics include launch systems, space environment, spacecraft orbits and ground tracks, spacecraft design and sizing, budget designs, subsystem design and evaluation, cost and risk. The second portion is dedicated to student teamwork on the spacecraft design.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78004 OPTIMAL CONTROL THEORY 3 Credit Hours
(Slashed with ENGR 58004) The course introduces students to the theory and numerical calculation of optimal space trajectories and related optimization problems in aerospace engineering. This course provides the essential technical components of space trajectory design and space trajectory optimization. Students develop basic engineering skills in formulating and solving open-ended problems and in writing a project report.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78005 LINEAR SYSTEM ANALYSIS AND CONTROL 3 Credit Hours
(Slashed with ENGR 68005) This course covers the analysis and synthesis of linear dynamical systems. Fundamental concepts including canonical representations, the state transition matrix and the properties of controllability and observability are discussed. The existence and synthesis of stabilizing feedback control laws using pole placement and linear-quadratic optimal control are discussed.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78006 NONLINEAR SYSTEMS AND CONTROL 3 Credit Hours
(Slashed with ENGR 68006) Overview of stability concepts and examination of various methods for assessing stability such as linearization and Lyapunov methods. Introduction to various design methods based on linearization, sliding modes, adaptive control and feedback linearization.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78007 DIGITAL CONTROL SYSTEMS 3 Credit Hours
(Slashed with ENGR 68007) This course covers design and analysis of sampled data and digital control systems. Fundamental concepts include introduction to digital control and discrete transform (z-transform), discrete and hybrid signal flow graphs (SFGs), solution of discrete-time state space models, time-response and characteristic equations, stability analysis for discrete time systems, root locus, Bode plot and Nyquist method for sampled data systems, pole placement and state estimation for discrete time systems.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78008 INTRODUCTION TO ROBUST CONTROL 3 Credit Hours
(Slashed with ENGR 68008) Course covers the fundamentals of robust control theory, with emphasis on stability and performance analysis in the time and frequency domains and design tools for robust performance and robust stability. Course examines how a controller can be designed taking into account uncertainties in the model of the plant. Some current research topics such as application of robust identification and control techniques to active vision systems also are addressed.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78010 MACHINE VISION 3 Credit Hours
(Slashed with ENGR 48010 and ENGR 58010) Course explores concepts and techniques for image/video processing and machine vision. Topics covered include image formation, image filtering, edge detection and segmentation, object recognition, object detection and tracking, 3D vision, etc.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78101 AUTONOMOUS UNMANNED AERIAL SYSTEMS 3 Credit Hours
(Slashed with ENGR 68101) This course provides an advanced-level understanding of unmanned aerial vehicles in physical system design; payload; and stealth design, navigation and deployment regulations. This course introduces students to state-of-the-art artificial intelligence methods for UAS deployments in different urban, forest and water surface scenarios.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78102 INTELLIGENT SENSING AND PLANNING OF UNMANNED AERIAL SYSTEMS 3 Credit Hours
(Slashed with ENGR 68102) This course focuses on real world environment understanding for the UAV systems. This course introduces students to state-of-the-art artificial intelligence methods for planning UAV missions in the real world.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 81091 GRADUATE SEMINAR 1 Credit Hour
(Repeatable for credit) Discussions of selected technical topics related to aerospace engineering.
Prerequisite: Doctoral standing.
Schedule Type: Seminar
Contact Hours: 1 other
Grade Mode: Standard Letter

ENGR 81095 SPECIAL TOPICS IN ENGINEERING 1-3 Credit Hours
(Slashed with ENGR 61095)(Repeatable for credit) Study of significant and current issues in various engineering topics not covered in regular courses. Offered when opportunities and resources permit; the topic is announced when the course is scheduled.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

ENGR 81096 INDIVIDUAL INVESTIGATION IN ENGINEERING 1-3 Credit Hours
(Slashed with ENGR 61096)(Repeatable for credit) Individual investigation for a topic in the field of engineering.
Prerequisite: Doctoral standing.
Schedule Type: Individual Investigation
Contact Hours: 3-9 other
Grade Mode: Standard Letter

ENGR 85098 RESEARCH 1-6 Credit Hours
(Repeatable for credit) Varied topics according to student interest and faculty approval. The work is designed to conduct research on a topic, and it will result in a paper or other appropriate product.
Prerequisite: Doctoral standing; and special approval.
Schedule Type: Research
Contact Hours: 3-18 other
Grade Mode: Satisfactory/Unsatisfactory

ENGR 85199 DISSERTATION I 15 Credit Hours
(Repeatable for credit) Doctoral dissertation, for which registration in at least two semesters is required, first of which will be semester in which dissertation work is begun and continuing until the completion of 30 hours.
Prerequisite: Doctoral standing; and special approval.
Schedule Type: Dissertation
Contact Hours: 15 other
Grade Mode: Satisfactory/Unsatisfactory

ENGR 85299 DISSERTATION II 15 Credit Hours
(Repeatable for credit) Continuing registration required for doctoral students who have completed the initial 30 hours of dissertation and continuing until all degree requirements are met.
Prerequisite: Doctoral standing; and special approval.
Schedule Type: Dissertation
Contact Hours: 15 other
Grade Mode: Satisfactory/Unsatisfactory