Mission

The mission of the College of Aeronautics and Engineering is to enhance technological literacy, education and training essential to the knowledge economy, socio-economic well-being and to the workforce development of the state of Ohio in general and Northeast Ohio in particular. The college's curricula leads to various certificates in emerging/high-technology areas and to a seamless articulation with technical associate, bachelor's and master's degree programs with global perspectives for careers in business, industry, education and government sectors.

Undergraduate Programs

- Aeronautical Systems Engineering Technology - B.S.
- Aeronautics - B.S.
- Aerospace Engineering - B.S.
- Applied Engineering - 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.

Minors

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

Graduate Programs

- Aviation Management and Logistics - M.S.
- Aerospace Engineering - M.S.
- Aerospace Engineering - Ph.D.
- Engineering Technology - M.E.T.
Aeronautics (AERN)

AERN 12500  SURVEY OF AERONAUTICS  3 Credit Hours
This course provides an overview of the air transportation industry and
gives students a broad overview of career requirements and opportunities
in several fields to include professional piloting, air traffic control and
aviation management. Student will gain historical perspective while
learning about emerging trends.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

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 15250  FAA ORIENTATION  3 Credit Hours
Introduction to the Federal Aviation Administration with particular
emphasis on its role and impact on air traffic management and the
National Airspace System (NAS). Course addresses the unique aspects
and requirements of federal employment, as well as federal regulations
affecting flight operations and the FAA's associated supporting agencies.
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.
Corequisite: AERN 15741.
Schedule Type: Lecture
Contact Hours: 5 lecture
Grade Mode: Standard Letter-IP

AERN 15741  PRIVATE PILOT FLIGHT  5 Credit Hours
Flight course designed to fulfill FAA requirements for private pilot
certificate. With special approval, this course may be repeated only
once. Student is required to spend a minimum of 2 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. Minimum FAA flight time requirements towards the private
pilot certificate is 48 hours. Actual flight training may exceed 48 hours.
Special course fees apply. Please visit www.kent.edu. Students must
obtain Student Pilot Certificate and have and maintain valid medical and
TSA approval prior to starting course.
Prerequisite: Must be a Professional Pilot concentration within the
Aeronautics major.
Corequisite: AERN 15740 and MATH 11010.
Schedule Type: Flight Training
Contact Hours: 9 other
Grade Mode: Standard Letter-IP

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 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 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: 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

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

College of Aeronautics and Engineering
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: Aeronautics 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: Aeronautics major.
Corequisite: AERN 25350.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

AERN 25743  COMMERCIAL PILOT FLIGHT I  2 Credit Hours
Advanced flight course providing flight instruction for the commercial pilot. Primary emphasis is on cockpit resource management, advanced navigational practices and basic instrument instruction. With special approval, this course may be repeated only once. Student is required to spend a minimum of two hours daily, four 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. Please visit www.kent.edu.ca for a list of fees.
Prerequisite: A minimum C grade in both AERN 15740 and AERN 15741; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Corequisite: AERN 25250 and MATH 11010.
Schedule Type: Flight Training
Contact Hours: 2 other
Grade Mode: Standard Letter-IP

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

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 are able to observe how composites are used practically in the aviation industry and investigate the most recent advances in composite technology.
Prerequisite: None.
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.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter
AERN 32300  INSPCTION AUTHORIZATION I  2 Credit Hours
Course prepares students by instructing them in the knowledge and
subject areas necessary to pass the inspection authorization 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 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 35001  AIRCRAFT FABRICATION  3 Credit Hours
The study and laboratory practice of government approved procedures
used in the fabrication, repair and testing of certificated aircraft.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 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 13012.
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 35342  TERMINAL OPERATIONS I  2 Credit Hours
Intermediate level terminal operations course. Emphasis on tower operations at the clearance delivery, ground control, and local control positions. Topics covered will include, but not be limited to phraseology, procedures, LOAs and weather.
Prerequisite: AERN 25350 and AERN 25351; and AERN 15740 or AERN 15745; and Aeronautics major.
Corequisite: AERN 35345.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 35343  EN ROUTE I  3 Credit Hours
Introduction to en route operations of air traffic control. Focus on the non-RADAR foundations of en route operations. Topics covered include, but are not limited to phraseology, maps, LOAs, rules and procedures in a non-RADAR environment.
Prerequisite: AERN 25250, AERN 25251, AERN 35342 and AERN 35345; and Aeronautics major.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35345  TERMINAL OPERATIONS I LABORATORY  1 Credit Hour
Application of terminal air traffic control operating principles explored in AERN 35342 Terminal Operations I.
Prerequisite: AERN 25350 and AERN 25351; and AERN 15740 or AERN 15745; and Aeronautics major.
Corequisite: AERN 35342.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

AERN 35644  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 15740 and AERN 25250; and Aeronautics major.
Corequisite: AERN 35645.
Schedule Type: Flight Training
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 35645  INSTRUMENT PILOT FLIGHT  2 Credit Hours
Comprehensive flight course for the professional pilot candidate to meet the requirements of the FAA instrument rating. This course may be repeated only once. 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. Please visit www.kent.edu for a list of fees.
Prerequisite: Minimum C grade in AERN 25743; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Corequisite: AERN 35644.
Schedule Type: Flight Training
Contact Hours: 2 lecture
Grade Mode: Standard Letter-IP

AERN 35647  COMMERCIAL PILOT FLIGHT II  2 Credit Hours
Comprehensive flight course for the professional pilot candidate once. Student is required to spend a minimum of two hours each day, four days a week, at the airport until course requirements have been attained. Special course fees may apply. When not flying, the student goes through personalized ground instruction. Special course fees apply. Please visit www.kent.edu for a list of fees.
Prerequisite: Minimum C grade in AERN 35644; and AERN 35645; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Corequisite: AERN 35746.
Schedule Type: Flight Training
Contact Hours: 2 lecture
Grade Mode: Standard Letter-IP

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 35746 COMMERCIAL PILOT THEORY 2 Credit Hours
Comprehensive instruction covering all areas necessary to exercise the privileges of a commercial pilot.
Prerequisite: AERN 35644.
Corequisite: AERN 35647.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 35747 COMMERCIAL PILOT FLIGHT III 2 Credit Hours
Comprehensive flight course for the professional pilot candidate to meet the requirements of the FAA commercial pilot certificate. With special permission, this course may be repeated only once. Student is required to spend up to two hours daily, four days a week, at the airport until the course requirements have been attained. When not flying, the student goes through personalized ground instruction. Special course fees apply. Please visit www.kent.edu for a list of fees.
Prerequisite: Minimum C grade in AERN 35647; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Schedule Type: Flight Training
Contact Hours: 2 other
Grade Mode: Standard Letter-IP

AERN 35749 COMMERCIAL PILOT HELICOPTER FLIGHT 3 Credit Hours
(Repeatable for credit) Flight course designed to fulfill FAA requirements for the Commercial Pilot Helicopter certificate. This course may only be repeatable twice. Student is required to spend 1.5 hours each day, five days a week, at the airport, until the FAA minimum requirements are attained. When not flying, the student goes through personalized ground instruction with an assigned flight instructor. Minimum FAA flight time requirements towards the Commercial Pilot Helicopter Flight Certificate is 150 hours. Actual flight training may exceed 150 hours.
Prerequisite: AERN 15742 or AERN 15743; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Corequisite: AERN 35746.
Schedule Type: Flight Training
Contact Hours: 5.5 other
Grade Mode: Standard Letter-IP

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 35644 or AERN 35650; and AERN 35810.
Schedule Type: Lecture
Contact Hours: 3 lecture
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 35740 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 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 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 will 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: AERN 35645 and AERN 42000 and AERN 42739.
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 35644 or AERN 35650; and special approval
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.
Prerequisite: AERN 45010.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 45025 DISPATCH LABORATORY 1 Credit Hour
Practical Aircraft Dispatch application and preparation for the ADX written, oral and practical exam.
Prerequisite: AERN 45010.
Corequisite: AERN 45020.
Schedule Type: Laboratory
Contact Hours: 2 lab
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/IP
Attributes: Experiential Learning Requirement
AERN 45100  AIRPORT OPERATIONS  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 will 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

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
(Slashed with AERN 55135) 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
(Slashed with AERN 55150) 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 45200  STRATEGIC AVIATION MANAGEMENT (ELR)  3 Credit Hours
Serves as the capstone course for the aviation management area of concentration in aeronautics. 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 45100; and senior standing.
Schedule Type: Lecture, Project or Capstone
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP
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: None.
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 will be on class action law suits that give rise to mass tort litigation. Emphasis will be 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) will be examined in the context of aviation and aerospace engineering.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter
AERN 45349  SYSTEMS MAINTENANCE AND RELIABILITY  5 Credit Hours
Combines theories of systems and operations with practical experience to meet FAA standards for an airframe and powerplant license (300 hours shop experience).
Prerequisite: AERN 45340.
Schedule Type: Lecture
Contact Hours: 5 lecture
Grade Mode: Standard Letter

AERN 45360  PROFESSIONAL DEVELOPMENT IN AERONAUTICS III  1 Credit Hour
Seminar on selected topics relating to problems, issues and conditions of employment within aviation.
Prerequisite: AERN 30000; and senior standing.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

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 45343 and AERN 45344; and aeronautics major.
Schedule Type: Project or Capstone
Contact Hours: 1 lecture
Grade Mode: Standard Letter

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. Pre/corequisites: AERN 45399.
Prerequisite: AERN 45343 and AERN 45344; and aeronautics major.
Schedule Type: Laboratory, Project or Capstone
Contact Hours: 4 lab
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

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, AERN 35746, AERN 35747 and AERN 45150.
Corequisite: AERN 45649.
Schedule Type: Flight Training
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

AERN 45649  FLIGHT INSTRUCTOR/AIRPLANES  2 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. With special approval, this course may be repeated only once. 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. Please visit www.kent.edu for a list of fees.
Prerequisite: AERN 35747; and minimum C grade in AERN 35746; and must be in the Professional Pilot concentration in the Aeronautics major.
Corequisite: AERN 45648.
Schedule Type: Flight Training
Contact Hours: 9 other
Grade Mode: Standard Letter-IP

AERN 45651  FLIGHT INSTRUCTOR-INSTRUMENTS  2 Credit Hours
(Repeatable for credit) Flight course with emphasis on flight instructing techniques involved with instrument flight and air traffic control procedures. With special approval this course may be repeated only once. 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. Please visit www.kent.edu for more information.
Prerequisite: AERN 45649; and AERN 45648 with a minimum C grade; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Schedule Type: Flight Training
Contact Hours: 2 lecture, 9 other
Grade Mode: Standard Letter-IP

AERN 45653  MULTI-ENGINE PILOT FLIGHT  1 Credit Hour
(Repeatable for credit) Course provides the required ground and flight instruction necessary to qualify students for the multi-engine rating from the FAA. With special approval this course may be repeated only once. 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. Please visit www.kent.edu for more information.
Prerequisite: AERN 35747; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Schedule Type: Flight Training
Contact Hours: 1 lecture, 9 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. Please visit www.kent.edu/caest/flight-technology and click on the Flight Course Fees link for more information.
Prerequisite: AERN 45653; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Schedule Type: Flight Training
Contact Hours: 9 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. This course may be repeated only twice. 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 may apply. Please visit www.kent.edu/caest/flight-technology and click on the Flight Course Fees link for more information.
Prerequisite: AERN 45649 and AERN 45655; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Schedule Type: Flight Training
Contact Hours: 9 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/caest/flight-technology and click on the Flight Course Fees link for more information.
Prerequisite: AERN 15741; and minimum 2.500 overall GPA; and must be in the Professional Pilot concentration in the Aeronautics major.
Schedule Type: Flight Training
Contact Hours: 9 other
Grade Mode: Standard Letter

AERN 45710  TURBINE ENGINE THEORY AND OPERATION  2 Credit Hours
An in-depth study of the theory, operation and performance of turbine 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: AERN 45130.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

AERN 45721  CREW RESOURCE MANAGEMENT LABORATORY  1 Credit Hour
Flight simulator-based laboratory that includes flight simulator experiences that integrate crew resource management (CRM) and line-oriented flight training (LOFT) in a multicrew environment. Special course fees may apply. Please visit www.kent.edu/caest/flight-technology and click on the Flight Course Fees link for more information.
Prerequisite: AERN 45130.
Pre/corequisite: AERN 45720.
Schedule Type: Combined Lecture and Lab
Contact Hours: 1 other
Grade Mode: Standard Letter-IP

AERN 45730  APPLIED TRANSPORT CATEGORY AIRCRAFT SYSTEMS  3 Credit Hours
Course examines various systems in use on air transport aircraft. The course emphasis is on 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 and AERN 45350.
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
(Slashed with AERN 55791) 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 UAV 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 25350; and AERN 25351; and AERN 35644 or AERN 35650; and AERN 35830; and AERN 35840; and AERN 45150.  
**Schedule Type:** Lecture  
**Contact Hours:** 4 lecture  
**Grade Mode:** Standard Letter  

**AERN 45982**  UNMANNED AIRCRAFT SYSTEMS FLIGHT PRACTICUM (ELR)  2 Credit Hours  
Unmanned Aircraft Systems Operations Flight Practicum. 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 will be placed on flying commercial UAS, fixed wing platforms and other commercial platforms. Students will 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 35815.  
**Schedule Type:** Flight Training, Practical Experience  
**Contact Hours:** 1 lecture, 3 other  
**Grade Mode:** Standard Letter-IP  
**Attributes:** Experiential Learning Requirement  

**AERN 45900**  AEROLEASTICITY  3 Credit Hours  
Review of beam analysis. Structural dynamics of one-dimensional systems. Analysis of static aeroelastic phenomena, unsteady aerodynamics and flutter. Equations of motion for complete aeroelastic systems; solution techniques.  
**Prerequisite:** AERN 35150 and ENGR 33111.  
**Schedule Type:** Lecture  
**Contact Hours:** 3 lecture  
**Grade Mode:** Standard Letter  

**AERN 55135**  AVIATION SAFETY THEORY  3 Credit Hours  
(Slashed with AERN 45135) An in-depth study of aviation human safety theories and the basics of risk and safety management.  
**Prerequisite:** Graduate standing.  
**Schedule Type:** Lecture  
**Contact Hours:** 3 lecture  
**Grade Mode:** Standard Letter  

**AERN 55150**  APPLIED FLIGHT DYNAMICS I  3 Credit Hours  
(Slashed with AERN 45150) 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:** AERN 15000; and MATH 11012 or MATH 12002; and PHY 13001 and PHY 13002 (or PHY 23101 and PHY 23102); and graduate standing.  
**Schedule Type:** Combined Lecture and Lab  
**Contact Hours:** 3 other  
**Grade Mode:** Standard Letter  

**AERN 55791**  AVIATION SECURITY AND POLICY SEMINAR  3 Credit Hours  
(Repeatable for credit) (Slashed with AERN 45791) 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:** Graduate standing.  
**Schedule Type:** Seminar  
**Contact Hours:** 3 other  
**Grade Mode:** Standard Letter  

**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 Credit Hour  
(Repeatable for credit) Up to 6 total credit hours of 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 other  
**Grade Mode:** Standard Letter-IP  

**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: MIS 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 65250  APPLIED HUMAN FACTORS ENGINEERING  3 Credit Hours
Survey of human factors engineering and ergonomics, emphasizing the human-centered approach to systems, product, workplace, and machine design. Discussions will include human factors research and design methodologies, human factors fundamentals (e.g., sensation and perception, information processing, anthropometry) and applications of human factors for the design of workplace and environment.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 65270  HUMAN FACTORS IN SYSTEMS DESIGN  3 Credit Hours
Human factors input into operator-system design, development, testing, and evaluation. Emphasis on the systems approach to human-machine-interface, with discussion and application of specific methodologies and analytical techniques. Highly focus on design of display and control systems.
Prerequisite: Graduate standing.
Pre/corequisite: AERN 65250.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

AERN 65280  HUMAN INFORMATION PROCESSING  3 Credit Hours
An examination of human information reception, information processing, and skilled performance capabilities and limitations in human-matching systems with an emphasis on models and techniques including psychophysics, signal detection theory, information theory, and decision-making theory.
Prerequisite: AERN 65250; and graduate standing.
Schedule Type: Lecture
Contact Hours: 3 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 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: AERN 65091 and AERN 65100 and AERN 65150 and AERN 65200 and ENGR 60001 and ENGR 60003 and ENGR 60078 and MIS 64005 and MIS 64041 and MIS 64042; and graduate standing.
Schedule Type: Project or Capstone
Contact Hours: 2 other
Grade Mode: Standard Letter

ENGR 10001 INFORMATION TECHNOLOGY 3 Credit Hours
Introduction to the operation and use of computer systems in technology-related applications. Laboratory assignments include the use of microcomputers for solving technical problems.
Prerequisite: None.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 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 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.
Pre/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.
Pre/corequisite: ENGR 15300.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 15500 INTRODUCTION TO AEROSPACE ENGINEERING 3 Credit Hours
Pre/corequisite: MATH 12002.
Schedule Type: Lecture
Contact Hours: 3 lecture
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 20001 ENERGY/POWER 3 Credit Hours
Study of basic thermodynamic laws and how they apply to the conversion and transfer of heat energy into useful power.
Prequisite: ENGR 21020 and ENGR 21022.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 3 lab
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 20004  FUNDAMENTALS OF CIRCUIT ANALYSIS  3 Credit Hours
Analysis of DC and AC electrical circuits consisting of resistive and reactive components using the basic circuit theorems, descriptions of AC signals in terms of phasors, power and resonance in electrical circuits, transformers and polyphase systems.
Prerequisite: PHY 23102.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 20005  INTRODUCTION TO CYBERSECURITY  3 Credit Hours
This course will introduce the students to the fundamentals of Cybersecurity. Students will be able to develop an understanding of cybercrime, security principles, technologies, and procedures used to defend networks. This course will also explore cyber trends, threats, personal privacy.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
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: MATH 11022 and PHY 13002.
Corequisite: ENGR 21022.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 21020  SURVEY OF ELECTRICITY AND ELECTRONICS LABORATORY  1 Credit Hour
Laboratory experiments related to the course ENGR 21020.
Prerequisite: MATH 11022 and PHY 13002.
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: EMAT 26010 or ENGR 26010.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 23585  ADVANCED COMPUTER AIDED DESIGN  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.
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 12003 and PHY 23101.
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 and an introduction to the kinematics and kinetics of rigid bodies in three-dimensional motion.
Prerequisite: ENGR 25200; and MATH 22005 or MATH 32051.
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 15500; and MATH 22005 or MATH 32051 .
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 26010  INTRODUCTION TO COMPUTER ENGINEERING TECHNOLOGY  3 Credit Hours
Describes Computer Engineering Technology concepts and principles. Topics include computer hardware, computer hardware operations, digital systems design, networking hardware, technology of networking, computer aided design and embedded systems.
Pre/corequisite: MATH 11022.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 26200  PROGRAMMING FOR ENGINEERS I  3 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 the core objective of this course.
Prerequisite: Sophomore standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 26301  NETWORKING HARDWARE I  4 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: ENGR 21020 (and ENGR 21022) or EMAT 26010 or ENGR 26010.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 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 the students to the concepts of sustainability and its three pillars, namely, economic growth, environmental protection, and social equality. Students taking the course will understand the language and concepts of sustainability and will acquire the knowledge to further study sustainability.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 31000  CULTURAL DYNAMICS TECHNOLOGY (DIVD) (WIC)  3 Credit Hours
Study of technology and the forces it exerts upon society.
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 31015  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 31020  POWER TECHNOLOGY  3 Credit Hours
Principles of energy conversion and power application. Overview of basic heat engines, machines and transmission devices. Alternative energy systems and conservation techniques.
Prerequisite: ENGR 20001 and ENGR 20004.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 32001  MATERIALS AND PROCESSES II  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 33010  COMPUTER HARDWARE FOR ANIMATION  3 Credit Hours
Students will gain a complete, step-by-step approach for learning the fundamentals of supporting and troubleshooting computer hardware. Throughout this course, students will learn the technical skills for PC configuration and troubleshooting. Finally, the students will be exposed to the concepts of Animation and Design through exploring Deep learning concepts, GPUs benchmark tests, peripherals and gaming platforms.
Prerequisite: Junior standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter
ENGR 33016  PC/NETWORK ENGINEERING AND TROUBLESHOOTING  3 Credit Hours
Covers the service, maintenance, upgrade and optimization of personal computers. Specification, installation and maintenance of local area networks are covered. Students learn communication protocols and network architecture. Two lectures and two labs a week.
Pre requisite: EERT 22014 or ENGR 33010.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 other
Grade Mode: Standard Letter

ENGR 33020  COMPUTER HARDWARE II  3 Credit Hours
An in-depth look at personal computer design and hardware components, and an introduction to the fundamentals of personal computer networks. Topics include the operation, assembly, configuration, diagnosis, and unit-level troubleshooting of personal computers and their associated hardware components. Also includes an introduction to PC network configuration, hardware, and troubleshooting fundamentals.
Pre requisite: ENGR 23010.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
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).
Pre requisite: ENGR 21020 or ENGR 35500.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter Attributes: 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.
Pre requisite: 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.
Pre requisite: PHY 13001 or PHY 23101.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 33040  CONTROL SYSTEMS  3 Credit Hours
Analysis of mathematical models of feedback control systems. Includes introduction to basic control system terms and devices, open loop and closed loop control, Laplace transforms, static and dynamic response, stability and performance of control systems, frequency response analysis, Bode plot, root locus.
Pre requisite: MATH 12002; and ENGR 20004 or ENGR 21020 (and ENGR 21022).
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
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.
Pre requisite: 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 33095  SPECIAL TOPICS: APPLIED SCIENCE AND TECHNOLOGY  1-3 Credit Hours
(Repeatable for credit) Special topics of immediate interest in applied science and technology.
Pre requisite: Junior standing; and special approval.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

ENGR 33111  STATICS AND STRENGTH OF MATERIALS  3 Credit Hours
An algebra based analytical study of equilibrium of extended 2-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.
Pre requisite: PHY 13001 or PHY 23101.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 33220  ELECTRONIC DEVICES  4 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.
Pre requisite: ENGR 20004 or ENGR 35500.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 lecture, 2 lab
Grade Mode: Standard Letter
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<tr>
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<td>ENGR 33322</td>
<td>INDUSTRIAL ROBOTICS</td>
<td>3</td>
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<td>ENGR 33333</td>
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<td>ENGR 33363</td>
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<td>3</td>
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<td>Lecture</td>
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<td>ENGR 33500</td>
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<td>ENGR 33670</td>
<td>FACILITY DESIGN AND MATERIAL HANDLING</td>
<td>3</td>
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<td>3 lecture</td>
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<tr>
<td>ENGR 34002</td>
<td>ADVANCED COMPUTER-AIDED DESIGN II</td>
<td>3</td>
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<td>3</td>
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<td>3</td>
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<td>3 lecture</td>
<td>Lecture</td>
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**Course Descriptions**

**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.

**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.

**ENGR 33225 INDUSTRIAL CONTROL SYSTEMS** 3 Credit Hours
The application of electronics to the control of industrial machines and processes. Includes laboratory.

**ENGR 33320 APPLIED EMBEDDED SYSTEMS I** 3 Credit Hours
Course builds upon the content of several other applied engineering courses to establish a foundation for 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. Student 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 principals are explained from an engineering problem-solving perspective.

**ENGR 33322 INDUSTRIAL ROBOTICS** 3 Credit Hours
Classification, characteristics, and functions of industrial robots. Covers basic safety precautions for working with robots. Laboratory time will be spent programming FANUC industrial robots and utilizing FANUC robot teach pendants. Students will have the opportunity to obtain a FANUC Robotics Handling Tool Operation and Programming Certificate of Completion.

**ENGR 33363 MATERIALS SCIENCE AND TECHNOLOGY** 3 Credit Hours
Scientific study of modern manufacturing materials (metals, plastics and ceramics) and the laboratory test methods used to determine their manufacturing specifications and properties.

**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.

**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.

**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.

**ENGR 33900 ADVANCED COMPUTER-AIDED DESIGN II** 3 Credit Hours
Continuation of AGD 22000 with an emphasis on the use of a Parametric-based CAD software (Pro/Engineer) for the design and modeling of industrial products.
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  AEROSPACE VEHICLE PERFORMANCE I  3 Credit Hours
Prerequisite: ENGR 25500; and MATH 32044 or MATH 32052.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ENGR 35400  SYSTEM DYNAMICS AND CONTROL  3 Credit Hours
Dynamic modeling and response of systems with mechanical, hydraulic, electrical, and/or thermal elements. Classical methods of feedback control system design and analysis.
Prerequisite: MATH 32044 or MATH 32052; and minimum C grade in ENGR 25400.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ENGR 35500  SIGNALS AND CIRCUITS  3 Credit Hours
An introduction to electronic 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.  
Prerequisite: 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 36200  PROGRAMMING FOR ENGINEERS II  3 Credit Hours
Emphasizes engineering problems and applications of programming language and mathematical tools to analyze and solve them. Students are expected to learn problem solving techniques, modeling, simulation, presentation of engineering application oriented problems using programming languages. Advanced modeling, simulations and analysis are the core objective of this course.
Prerequisite: ENGR 26200; and junior standing.  
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab  
Contact Hours: 2 lecture, 2 lab  
Grade Mode: Standard Letter

ENGR 36302  NETWORKING HARDWARE II  3 Credit Hours
Continuation of ENGR 26301. 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 26301.  
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab  
Contact Hours: 2 lecture, 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: None.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter
ENGR 36620 PROJECT MANAGEMENT IN ENGINEERING AND TECHNOLOGY 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 or senior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 37666 KINEMATICS AND DYNAMICS OF MAC 3 Credit Hours
The study of the kinematics and dynamics of machinery with an emphasis on links, cams and gears.
Prerequisite: MATH 32051.
Corequisite: MATH 32052.
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 20005 and ENGR 26301.
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 the course ENGR 37777 Cybersecurity Operations
Prerequisite: ENGR 20005 and ENGR 26301.
Corequisite: ENGR 37777.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

ENGR 41065 SOLID MODELING AND SOLIDIFICATION 3 Credit Hours
Introduction to casting simulation software with emphasis on projects related to design and filling of casting molds.
Prerequisite: ENGR 31065 and ENGR 34002.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 41092 INDUSTRIAL PRACTICE (ELR) 1-8 Credit Hours
(Repeatable for credit) Practical experience in industry of cooperative work-study nature.
Prerequisite: Junior standing.
Schedule Type: Practical Experience
Contact Hours: 3-24 other
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 41093 VARIABLE TOPIC WORKSHOP IN TECHNOLOGY 1-3 Credit Hours
(Repeatable for credit) (Slashed with ENGR 51093) Specialized instructional unit oriented toward the application of current technology concepts.
Prerequisite: None.
Schedule Type: Workshop
Contact Hours: 1-3 other
Grade Mode: Standard Letter

ENGR 42100 TRAINING TOPICS IN TECHNOLOGY 1-4 Credit Hours
(Repeatable for credit) Specialized advanced instruction oriented primarily to the theoretical base and application of current technology developed by experts in the specific technology. This course requires substantial base knowledge.
Prerequisite: Special approval.
Schedule Type: Lecture
Contact Hours: 1-4 lecture
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, MATH 32051 and MATH 32052.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 42200 RADIATION PROCESSING OF MATERIALS 3 Credit Hours
Description of the radiation sources used in radiation technology and the study of the effects of electrons and gamma rays on materials of technological interest. Experiments deal with the effects of radiation in different materials.
Prerequisite: PHY 13002 or PHY 12202; and MATH 12002 or MATH 19002; and ENGR 33363.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 other
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, MATH 32052 and PHY 23102.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
ENGR 42400  RADIATION DOSIMETRY AND SAFETY  3 Credit Hours
(Slashed with ENGR 52400) Basic concepts of dosimetry and its units as applied to radiation technology, including theory of dosimeter response and use of dosimeters in radiation environments. Safety principles and practices followed in radiation environments, including terminology, maximum exposure limits, and procedures to minimize exposure to radiation.
Prerequisite: ENGR 42200.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
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 43016  ADVANCED PC-NETWORK ENGINEERING AND TROUBLESHOOTING  3 Credit Hours
An in-depth look at the architecture, operation, configuration, fault analysis, troubleshooting and repair of personal computer and computer network hardware components. Topics include the operation, assembly, configuration, diagnosis, and unit-level troubleshooting of personal computer hardware, computer networking hardware, and related hardware components.
Prerequisite: ENGR 33020 and ENGR 36302.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 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: PHY 13002 or PHY 23102; and ENGR 33040; and ENGR 26200.
Pre/corequisite: ENGR 33031.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 43031  MECHATRONICS II  3 Credit Hours
Advanced modeling, system response, closed loop control and system software for mechatronic systems.
Prerequisite: ENGR 43030.
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 43060  MANAGEMENT OF TECHNOLOGY INNOVATION  3 Credit Hours
Subjects covered in this course are case studies of innovative companies, elements of an innovation process, review of major problem solving methods, technical opportunity analysis, technical planning, technological forecasting, concept development and elements of patents. A project is included that utilizes TRIZ software and innovation model elements.
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. A project is included that utilizes TRIZ software and innovation model elements.
Prerequisite: Junior standing; and special approval.
Schedule Type: Individual Investigation
Contact Hours: 1-3 other
Grade Mode: Standard Letter-IP

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 43221  DIGITAL CONTROL SYSTEMS AND INSTRUMENTATION  4 Credit Hours
(Slashed with ENGR 53221) Focuses on applications of instrumentation and control systems using computers and cirocontrollers including sensors, transducers, instruments, data acquisition boards, software programs, signal conditioning and transmission methods.
Prerequisite: MATH 12003 and PHY 23102 and ENGR 43026.
Pre/corequisite: ENGR 33222.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 43222  COMPUTER HARDWARE ENGINEERING AND ARCHITECTURE  3 Credit Hours
(Slashed with ENGR 53222) Internal architecture and operation of digital computers. Topics include computer processor datapaths and control, computer memory datapaths and control, pipelining and parallel processing, memory architecture and management, IO control, system bus architecture and properties, storage systems, and computer control timing and synchronization. Students gain understanding in how system software manages system resources and abstracts programming requirements. Alternative architectures such as embedded systems and SoC platforms are discussed. Industry standards for calculating system performance are used.
Prerequisite: EMAT 26010 or ENGR 33222.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 43320  APPLIED EMBEDDED SYSTEMS II  3 Credit Hours
This course serves as an extension of ENGR 33333. The student will develop advanced engineering problem solving techniques using embedded system microcontrollers. Further programming in Embedded C is supported by this practical problem solving approach. Assembler language is discussed to solve specific hardware issues. A broad survey of special use computing hardware such as FPGAs, ASICs and SoC platforms is covered with basic approaches to leverage and program these devices.
Prerequisite: ENGR 33333 and ENGR 36200.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
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 10001 or ENGR 26010; and ENGR 20002.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 5 other
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 10001 or ENGR 26010; and ENGR 33111 or ENGR 42111; and ENGR 34002 or ENGR 23585; and PHY 13001 or PHY 23101.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 43700  COMPUTER-INTEGRATED MANUFACTURING  3 Credit Hours
(Slashed with ENGR 53700) Study of the computer-integrated manufacturing system as it relates to product design, estimating inventory, machining and assembly, quality control and distribution.
Prerequisite: ENGR 43550.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 5 other
Grade Mode: Standard Letter

ENGR 43899  APPLIED ENGINEERING TECHNOLOGY SEMINAR (ELR)  3 Credit Hours
As the capstone course in Applied Engineering and Mechanical Engineering Technology, students will 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 44000  ANDROID DEVELOPMENT TOOLS FOR INSTRUMENT CONTROL  3 Credit Hours
The Android Development Tools for Instrument Control course examines the principles of application design and development for instrument control. More specifically, this course's focus on device control using various android tools, for example, robots. Students will learn how to control and manage hardware using android tools. Topics will include android architecture, security, different types of hardware devices and their architecture.
Prerequisite: ENGR 26200 or ENGR 46330; and senior standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

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 AND ENGINEERING TECHNOLOGY  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: None.
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 AEROSPACE VEHICLE PERFORMANCE II 3 Credit Hours
Three-dimensional aircraft rigid body dynamics, aircraft equations of motion, principles of static stability and control, dynamic stability of uncontrolled motion, gyroscopic instruments.
Prerequisite: A minimum C grade in ENGR 25500 and ENGR 35400.
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 will emphasize the solution of real-life problems using the finite element method and students will get exposure to commercial finite element software (ANSYS or ABAQUS) and will learn to critically evaluate finite element models. Examples will be 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: 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 will address emerging issues, capabilities and challenges in the current field of study.
Prerequisite: Senior standing.
Pre/corequisite: ENGR 46350.
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 46300 NETWORK SECURITY 3 Credit Hours
Introduction to Network security with emphasis in identifying, analyzing and preventing various threats and attack patterns on computer networks. Students will gain practical knowledge on network security protocols, firewalls, VPN, Intrusion detection and prevention systems. Prepares students for industry certification.
Prerequisite: ENGR 26301.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ENGR 46312 WIRELESS NETWORK AND TELECOMMUNICATION SYSTEMS 3 Credit Hours
(Slashed with ENGR 56312) Course builds upon existing wired networking skills and extends the 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 trouble shoot wireless issues. Curriculum follows and prepares students for industry certification in wireless networking.
Prerequisite: ENGR 26301.
Pre/corequisite: ENGR 36302.
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 46350  NETWORK MANAGEMENT AND DESIGN TECHNOLOGY  3 Credit Hours
(Slashed with ENGR 56350) 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 will 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 36302.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 46411  REQUIREMENTS ENGINEERING AND ANALYSIS  3 Credit Hours
(Slashed with ENGR 56411) Techniques to conceptualize, develop and analyze requirements engineering specifications for practical systems. Topics covered include identifying stakeholders and how to effectively work with them, requirements elicitation techniques; requirements engineering in the problem and solution domains. The students are provided with an opportunity to participate in formal review of their projects by industry experts. Strong analytic skills, algorithms or programming experience is recommended.
Prerequisite: EMAT 26010 or ENGR 26010 with a minimum C grade.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 46510  APPLIED INFORMATION TECHNOLOGY SECURITY  3 Credit Hours
The purpose of the course is to provide the student with an overview of the field of information security and assurance. Students will be exposed to the spectrum of security activities, methods, methodologies, and procedures. Coverage will include inspection and protection of information assets, detection of and reaction to threats to information assets, and examination of pre and post incident procedures and an overview of the information technology security.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
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 47400  ROBOTICS: KINEMATICS AND DESIGN  3 Credit Hours
(Slashed with ENGR 57400 and 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: ENGR 25400.
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 35400 and 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 equations of motion in terms of direction cosines, angles, and quaternions. Determination of the attitude stability with external torques and coupling with orbital motion. Overview of state-of-the-art hardware and technology for attitude control, including gas jet, electric thrusters, momentum wheels and magnetic torquers; attitude sensing hardware: sun sensors, magnetometers, GPS, IMUs, star tracker. Attitude determination technique; attitude stabilization and control.
Prerequisite: None.
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 48004  OPTIMAL CONTROL THEORY  3 Credit Hours
(Slashed with ENGR 58004 and 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: ENGR 35400 and MATH 32052; and senior standing.
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: ENGR 47200.
Schedule Type: Project or Capstone
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP
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, government-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 50092 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 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 52200 RADIATION PROCESSING OF MATERIALS 3 Credit Hours
Understand the basic mechanisms of the interaction of alpha, beta, and gamma radiation with matter. Understand how radiation is absorbed in matter. Learn the effects of radiation in different materials of consumers' importance like, biological materials, medical devices, polymers, inks and coatings.
Prerequisite: ENGR 52400; and graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
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 52400 RADIATION DOSIMETRY AND SAFETY 3 Credit Hours
(Slashed with ENGR 42400) Basic concepts of dosimetry and its units as applied to radiation technology, including theory of dosimeter response and use of dosimeters in radiation environments. Safety principles and practices followed in radiation environments, including terminology, maximum exposure limits, and procedures to minimize exposure to radiation.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 52410 ENGINEERING OPTIMIZATION 3 Credit Hours
(Slashed with ENGR 72410) This course will 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 designed 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 52511 INDUSTRIAL ROBOTICS AND VISION SYSTEMS 1 Credit Hour
(Slashed with ENGR 42511 and ENGR 72511) 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 52611.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 52510 INDUSTRIAL ROBOTICS AND VISION SYSTEMS LABORATORY 2 Credit Hours
(Slashed with ENGR 42510 and ENGR 72510) 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 52610.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter
ENGR 52620  INDUSTRIAL AUTOMATION AND CONTROL  1 Credit Hour
(Slashed with ENGR 42620 and ENGR 72620) Course covers programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prequisite: Graduate standing.
Corequisite: ENGR 52621.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter

ENGR 52621  INDUSTRIAL AUTOMATION AND CONTROL LABORATORY  2 Credit Hours
(Slashed with ENGR 42621 and ENGR 72621) Laboratory utilizing programmable logic controllers, variable frequency drive motor control, human machine interfaces and industrial networking.
Prequisite: Graduate standing.
Corequisite: ENGR 52620.
Schedule Type: Laboratory
Contact Hours: 4 lab
Grade Mode: Standard Letter

ENGR 52710  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.
Prequisite: Graduate standing.
Corequisite: ENGR 52711.
Schedule Type: Lecture
Contact Hours: 2 lecture
Grade Mode: Standard Letter

ENGR 52711  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.
Prequisite: Graduate standing.
Corequisite: ENGR 52710.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter

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

ENGR 53221  DIGITAL CONTROL SYSTEMS AND INSTRUMENTATION  4 Credit Hours
(Slashed with ENGR 43221) Focuses on applications of instrumentation and control systems using computers and microcontrollers including sensors, transducers, instruments, data acquisition boards, software programs, signal conditioning and transmission methods.
Prequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 53222  COMPUTER HARDWARE ENGINEERING AND ARCHITECTURE  3 Credit Hours
(Slashed with ENGR 43222) Internal architecture and operation of digital computers. Topics include computer processor datapaths and control, computer memory datapaths and control, pipelining and parallel processing, memory architecture and management, IO control, system bus architecture and properties, storage systems, and computer control timing and synchronization. Students gain understanding in how system software manages system resources and abstracts programming requirements. Alternative architectures such as embedded systems and SoC platforms are discussed. Industry standards for calculating system performance are used.
Prequisite: 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.
Prequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 53700  COMPUTER INTEGRATED MANUFACTURING  3 Credit Hours
(Slashed with ENGR 43700) Study of the computer-integrated manufacturing system as it relates to product design, estimating inventory, machining and assembly, quality control and distribution.
Prequisite: ENGR 53550; and 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.
Prequisite: 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 will emphasize the solution of real-life problems using the finite element method and students will get exposure to commercial finite element software (ANSYS or ABAQUS) and will learn to critically evaluate finite element models. Examples will be 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 56350  NETWORK MANAGEMENT AND DESIGN TECHNOLOGY  3 Credit Hours
(Slashed with ENGR 46350) 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 will 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: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 56411  REQUIREMENTS ENGINEERING AND ANALYSIS TECHNOLOGY  3 Credit Hours
Techniques to conceptualize, develop and analyze requirements engineering specifications for software and telecommunications systems. Topics covered include identifying stakeholders and how to effectively work with them, requirements elicitation techniques, requirements engineering in the problem and solution domains. Strong analytic skills, algorithms or programming experience is recommended.
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 57300 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 57400 ROBOTICS: KINEMATICS AND DESIGN 3 Credit Hours
(Slashed with ENGR 47400 and 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 programing 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 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 equations of motion in terms of direction cosines, angles, and quaternions. Determination of the attitude stability with external torques and coupling with orbital motion. Overview of state-of-the-art hardware and technology for attitude control, including gas jet, electric thrusters, momentum wheels and magnetic torquers; attitude sensing hardware: sun sensors, magnetometers, GPS, IMUs, star tracker. Attitude determination technique; attitude stabilization and control.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 58003 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 58004 OPTIMAL CONTROL THEORY 3 Credit Hours
(Slashed with ENGR 48004 and 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 58005 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 will be discussed. The existence and synthesis of stabilizing feedback control laws using pole placement and linear-quadratic optimal control will be discussed.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 58006 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 58007 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 58008  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 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 58100  INTELLIGENT SENSING AND PLANNING OF UNMANNED AERIAL SYSTEMS  3 Credit Hours  
(Slashed with ENGR 78100) This course will focus on real-world environment understanding for the UAV systems. This course introduces students the state-of-the-art artificial intelligence methods for planning UAV missions in real-world.  
Prerequisite: Graduate standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter  

ENGR 58200  AUTONOMOUS UNMANNED AERIAL SYSTEMS  3 Credit Hours  
(Slashed with ENGR 78200) 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 the 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 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 60001  QUANTITATIVE METHODS IN TECHNOLOGY  3 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, inferential statistics, statistical design, and the analysis of experiments. 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: 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 60010  RADIATION SOURCES FOR RADIATION PROCESSING  3 Credit Hours  
Description of the basic types of radiations used for Radiation Processing and how these radiations are produced. Describe the types of gamma, electron, and Bremsstrahlung facilities used in the area of Radiation Processing and the qualifications of an irradiator to be used in this area. The student will also learn about the different industries that use ionizing radiation in their processes.  
Prerequisite: ENGR 52400; and graduate standing.  
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab  
Contact Hours: 2 lecture, 2 lab  
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: ENGR 60030; and graduate standing.
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 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) 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 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 63010 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 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 63020 FIBER OPTIC SYSTEMS 3 Credit Hours
Principles and characteristics of fiber optics, fiber optic system components and applications of fiber optics in electronic communication systems.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
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 63032 ADVANCED PROGRAMMABLE LOGIC CONTROLLERS 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 63031; and graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

ENGR 63040 ELECTRONIC COMMUNICATIONS 3 Credit Hours
Study of electronic communications systems fundamentals, characteristics, design considerations and implementation. Topics include signal modulation and demodulation, multiplexing, noise, transmitters, receivers, signal propagation, digital communications, transmission lines, antennas and practical applications.
Prerequisite: Graduate standing.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter
ENGR 63041  MOTOR S 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 63045  MECHATRONICS  3 Credit Hours
Application of automation concepts in motion control, electrical circuits, fundamental mechanics, control systems and programming including modeling, interfacing and signal conditioning. 
Prerequisite: ENGR 63032 and ENGR 63040; and graduate standing. 
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab 
Contact Hours: 2 lecture, 2 lab 
Grade Mode: Standard Letter 

ENGR 63046  ADVANCED MECHATRONICS  3 Credit Hours
Advanced modeling, system response, closed loop control and system software for mechatronic systems. 
Prerequisite: ENGR 63045; and 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 63060  MANAGEMENT OF TECHNOLOGY INNOVATION  3 Credit Hours
Subjects covered in this course include: case studies of innovative companies, elements of an innovation process, review of major problem solving methods, technical opportunity analysis, technical planning, technological forecasting, concept development and elements of patents. A project is included that utilizes TRIZ software and innovation model elements. 
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 63496  INDIVIDUAL INVESTIGATION IN ENERGY/POWER TECHNOLOGY  1-4 Credit Hours
(Repeatable for credit) Individual investigation of selected topics associated with energy and power technology. 
Prerequisite: Graduate standing; and special approval. 
Schedule Type: Individual Investigation 
Contact Hours: 3-12 other 
Grade Mode: Standard Letter-IP 

ENGR 63870  FACILITY DESIGN AND MATERIAL HANDLING  3 Credit Hours
Intended to provide students with a fundamental understanding of how layout affects the flow through a system. Both qualitative and quantitative tools are presented for a complete approach to facility design and material handling. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
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 64012  INFORMATION TECHNOLOGY AND AUTOMATION IN INDUSTRY  3 Credit Hours
Course focuses on developing systems that analyze and automate industrial processes and provide decision support. 
Prerequisite: Graduate standing; and special approval. 
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab 
Contact Hours: .5 lecture, 2.5 lab 
Grade Mode: Standard Letter 

ENGR 64095  SPECIAL TOPICS IN COMPUTER ENGINEERING TECHNOLOGY  1-4 Credit Hours
(Repeatable for credit) Study of significant and current issues in computer and network engineering technologies 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: 1-4 lecture 
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: ENGR 56350; and graduate standing.

Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 65098  RESEARCH  1-6 Credit Hours
(Repeatable for credit) Research or individual investigation. Credits are applied toward degree requirements with approval if grade of "S" is given.
Prerequisite: Graduate standing.

Schedule Type: Research
Contact Hours: 1-6 other
Grade Mode: Satisfactory/Unsatisfactory

ENGR 65199  THESIS I  2-6 Credit Hours
Thesis student 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.

Schedule Type: Masters Thesis
Contact Hours: 2-6 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 65330  ADVANCED VISUAL BASIC PROGRAMMING IN ENGINEERING TECHNOLOGY  3 Credit Hours
Advanced concepts in Visual Basic programming for solving engineering problems. Topics covered include classes and objects, SQL server databases, Language Integrated Query, creating web apps, programming web forms and security.
Prerequisite: ENGR 56330; and graduate standing.

Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 2 lab
Grade Mode: Standard Letter

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 65551  INTRODUCTION TO NANOTECHNOLOGY  3 Credit Hours
Provides an in-depth overview of the fundamentals of nanoscience and nanotechnology. Includes a survey of developments within the breadth of the nanotechnology in various fields such as electronics, materials, energy and biomedical science.
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 66350  ADVANCED NETWORK MANAGEMENT AND DESIGN TECHNOLOGY  3 Credit Hours
Covers network management techniques including the TMN framework and the ISO Model for managing WAN communication networks. Topics covered include network management technologies, TMN protocols, Common Management Information Protocol, ISO Model, management information base (MIB) architecture, network operations center and network design. Examples of current network management tools are reviewed. Upon completion of this course, students have a good understanding of network management framework and network management technologies for communication networks.
Prerequisite: ENGR 56350; and graduate standing.

Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
ENGR 66380 ADVANCED NETWORKING 3 Credit Hours
Provides student with experience in advanced computer networking techniques, including network architectures, network security, network virtualization and storage area networks.
Prerequisite: ENGR 56350; and graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 66382 NETWORK SECURITY 3 Credit Hours
Provides student with experience in fundamental and advanced computer networking techniques, including network architectures, LAN systems, network security, and network management and administration.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 66411 WIRELESS AND TELECOMMUNICATION SYSTEMS REQUIREMENTS ENGINEERING 3 Credit Hours
Methods and techniques to develop requirements engineering specifications for wireless and telecommunication systems. Topics covered include Industry standards for telecom and wireless communications, reference data models, functional requirements specifications, performance analysis, the requirements review process and systems verification.
Prerequisite: ENGR 56411; and graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 67000 SUSTAINABLE SYSTEMS AND TECHNOLOGY 3 Credit Hours
Introduction to the fundamental concepts and principles of sustainability, sustainable technologies and sustainable systems. Provides students with an understanding of the basic principles and key issues of environmental, social and economic sustainability. Closely examines sustainability as it applies to the relationships among human beings, technology and the environment, with a special emphasis on sustainability in the context of meeting humanity’s current needs. Also stresses the ethics and importance of sustainability and the use of sustainable systems.
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 67220 LIFE CYCLE DESIGN I 3 Credit Hours
An in-depth investigation of Life Cycle Design of sustainable systems. Explores the cradle to cradle path of products with an emphasis on system Life Cycle stages and processes from a sustainability perspective. Examines how environmentally conscious system design can be accomplished by considering the environmental impact of technology and engineering as the part of the sustainable design process. Includes the study of sustainable development with respect to Green Technologies, hazardous materials and processes and reducing the environmental impact of product development and utilization. Also includes an introduction to Life Cycle Assessment and various Environmental and Life Cycle standards.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP

ENGR 67221 LIFE CYCLE DESIGN II 3 Credit Hours
An in-depth study of environmental performance, environmentally conscious design and sustainable development. Focuses on Life Cycle Analysis and Assessment as a means to determine the potential economic, environmental, and ecological impact of products, processes, and activities across their entire life cycle. Takes a close look at the beneficial and detrimental effects of various technologies, materials, products and processes with special attention to the reduction of harmful effects to human beings, the ecosystem, and the environment. Covers the analysis and assessment of energy consumption, natural resource depletion, and environmental degradation, and ways to minimize detrimental effects on the environment. Includes the use of various life cycle engineering and assessment processes, models and analytical tools to identify, evaluate, and compare the environmental consequences associated with various products/activities, across a wide range of impact categories, to assist in design and decision making.
Prerequisite: ENGR 67220; and graduate standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter-IP

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 effect 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 52410) Covers 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 designed 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 72610 INDUSTRIAL ROBOTICS AND VISION SYSTEMS 1 Credit Hour
(Slashed with ENGR 52610) 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 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 52611) 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 52620) 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 52621) 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 52710) 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 52711) 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.
Corequisite: ENGR 73030.
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 will emphasize the solution of real-life problems using the finite element method and students will get exposure to commercial finite element software (ANSYS or ABAQUS) and will learn to critically evaluate finite element models. Examples will be 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 57300) 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 47400 and ENGR 57400) 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 programing 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 equations of motion in terms of direction cosines, angles, and quaternions. Determination of the attitude stability with external torques and coupling with orbital motion. Overview of state-of-the-art hardware and technology for attitude control, including gas jet, electric thrusters, momentum wheels and magnetic torquers; attitude sensing hardware: sun sensors, magnetometers, GPS, IMUs, star tracker. Attitude determination technique; attitude stabilization and control.  
Prerequisite: Doctoral standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ENGR 78003  SPACECRAFT DESIGN  3 Credit Hours  
(Slashed with ENGR 58003) 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, Project or Capstone  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ENGR 78004  OPTIMAL CONTROL THEORY  3 Credit Hours  
(Slashed with ENGR 48004 and 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 58005) 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 will be discussed. The existence and synthesis of stabilizing feedback control laws using pole placement and linear-quadratic optimal control will be 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 58006) 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 58007) 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 58008) 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 78100 INTELLIGENT SENSING AND PLANNING OF UNMANNED AERIAL SYSTEMS 3 Credit Hours
(Slashed with ENGR 58100) This course will focus on real-world environment understanding for the UAV systems. This course introduces students the state-of-the-art artificial intelligence methods for planning UAV missions in real-world.
Prerequisite: Doctoral standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ENGR 78200 AUTONOMOUS UNMANNED AERIAL SYSTEMS 3 Credit Hours
(Slashed with ENGR 58200) 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 the 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 81091 GRADUATE SEMINAR 1 Credit Hour
(Repeatable for credit) Discussions of selected technical topics related to aerospace engineering.
Prerequisite: Graduate standing.
Schedule Type: Seminar
Contact Hours: 1 other
Grade Mode: Standard Letter

ENGR 85098 RESEARCH 1-6 Credit Hours
(Repeatable for credit) Research or individual investigation. Credits are applied toward degree requirements with approval if grade of "S" is given.
Prerequisite: Doctoral standing.
Schedule Type: Research
Contact Hours: 1-6 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.
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.
Schedule Type: Dissertation
Contact Hours: 15 other
Grade Mode: Satisfactory/Unsatisfactory