Program Overview

The Master of Science (M.S.) degree with a major in Engineering provides a practical, industry-driven focus via a long-term, targeted thesis or courses related to real-world engineering applications. The degree requires a thesis or relevant additional courses because the abilities to solve problems, innovate and make immediate contributions to industry are best developed by having students confront a substantial, open-ended problem; perform detailed research on the problem; develop various solutions; choose and implement the best solution; validate their choice; and effectively communicate the process to professional colleagues, executives, and customers.

Application Requirements

- completed online application
- $55 nonrefundable application fee

  or

- $90 nonrefundable application fee for applications with international credentials
- baccalaureate degree engineering, computer science, physics, technology, or a closely related field from a regionally accredited university (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.)
- official transcripts from **each institution** where course credit was granted
- minimum 2.75 overall GPA or 2.75 GPA in the last 60 hours of undergraduate course work (plus any completed graduate courses)
- official GRE (general test only) with competitive scores in the verbal reasoning and quantitative reasoning and writing sections will be required. Texas State University students are exempt from this requirement
- resume/CV detailing prior work experience, research experience, awards, scholarships, and other related qualifications
- statement of purpose (two pages) conveying research interests, plans for graduate study, and professional aspirations
- two letters of recommendation from non-related individuals familiar with the student's scholarly work and/or relevant work experience

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum program requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver).

- official TOEFL iBT scores required with a 78 overall
- official PTE scores required with a 52 overall
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo Scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall

This program does **not** offer admission if the scores above are not met.

Additional Information

Non-credit (leveling) course work may be required prior to admission into the program if the student lacks sufficient background course work. Any required leveling course work must be completed with grades of B or better prior to admission.

Degree Requirements

The Master of Science (M.S.) degree with a major in Engineering concentration in Mechanical and Manufacturing Engineering requires 31 semester credit hours, including a thesis.

Non-credit (leveling) course work may be required prior to admission into the program if you lack sufficient background course work. Any required leveling course work must be completed with grades of B or better prior to admission.

All students will have a faculty advisor and a graduate committee composed of a minimum of three graduate faculty members (including the faculty advisor). The faculty advisor will provide technical direction for the student's thesis, and the graduate committee will be responsible for approving the thesis proposal, receiving thesis progress reports, and approving the final thesis presentation and written report. The oral project presentation will serve as the comprehensive examination.

Course Requirements

Code	Title	Hours
Required Courses		
ENGR 5100	Seminar in Engineering	1
ENGR 5310	Probability, Random Variables, & Stochastic Processes for Engineers	3
Choose 6 hours from the following:		6
ME 5310	Continuum Mechanics	
ME 5312	Mechanics of Composite Materials	
MFGE 5315	Energy and Thermofluids Engineering	
MFGE 5316	Advanced Computer Aided Design and Manufacturing	
MFGE 5318	Additive Manufacturing	
MFGE 5320	Polymer Nanocomposites	
MFGE 5326	Advanced Robotics in Manufacturing Automation	
MFGE 5330	Multiscale Manufacturing	
MFGE 5398B	Advanced Composite Materials	
Engineering Electives		
Choose 15 hours from the following:		15
CE 5320	Water Quality Management	
CE 5340	Advanced Infrastructure Materials	
CE 5350	Highway Bridge Design	
CE 5360	Pavement Design	
CE 5370	Urban Stormwater Management	
CE 5390	Infrastructure Systems Analysis	
CE 5391	Advanced Mechanics of Materials	
EE 5320	Advanced Computer Architecture and Arithmetic	
EE 5321	Computer-Aided Engineering Simulations on HPC Systems	
EE 5323	Digital Image Processing	

EE 5330	Embedded and Real-Time Computing
EE 5331	Machine Learning for Engineering Applications
EE 5350	Advanced Electronic Circuit Design
EE 5353	Fundamentals of Advanced Semiconductor Technology
EE 5354	Flexible Electronics
EE 5355	Electronic Materials and Devices
EE 5357	Power Systems for Engineering
EE 5360	Thin Film Technology
EE 5361	Nanofabrication Technology for Semiconductor Device Processing
EE 5372	Advanced Networking
EE 5374	Advanced Wireless Communication
EE 5375	Smart Grid: an Application Development Platform
EE 5377	Statistical Signal Processing
EE 5380	Advanced Electric Machines
EE 5381	Advanced Sustainable Energy & Storage
EE 5382	Advanced Power Systems Analysis
EE 5398A	Antenna Theory, Design and Applications
EE 5398B	Electronic Materials and Beyond for Sustainable Energy
ENGR 5321	Environmental Chemistry
ENGR 5323	Soil and Groundwater Remediation
ENGR 5330	Advanced Soil Mechanics
ENGR 5333	Ground Improvement Techniques
ENGR 5334	Advanced Foundation Engineering
ENGR 5341	Advanced Bituminous Materials
ENGR 5352	Advanced Prestressed Concrete
ENGR 5362	Advanced Traffic Engineering
ENGR 5363	Road Infrastructure Safety
ENGR 5384	Problems in Engineering
IE 5310	Advanced Statistical Design of Experiments for Engineers
IE 5320	Modeling and Analysis of Manufacturing Systems
IE 5330	Advanced Quality Control and Reliability Engineering
IE 5340	Applied Deterministic Operations Research for Engineers
IE 5343	Non-Linear Optimization Techniques for Engineers
IE 5345	Advanced Optimization
IE 5347	Advanced Heuristic Optimization
IE 5397	System Thinking and Analysis
ME 5310	Continuum Mechanics
ME 5312	Mechanics of Composite Materials
MFGE 5315	Energy and Thermofluids Engineering
MFGE 5318	Additive Manufacturing
MFGE 5320	Polymer Nanocomposites
MFGE 5330	Multiscale Manufacturing
Multidisciplinary Electives	
Choose 6 hours from the following:	6
Business Administration	
BLAW 5333	Legal Issues of Sustainability and Responsibility
ISAN 5357	Computing for Data Analytics
ISAN 5358	Agile Project Management For Business Professionals
ISAN 5370	Enterprise Resource Planning and Business Intelligence
MGT 5311	Process Improvement Management in Organizations
MGT 5315	New Venture Management
MGT 5321	Supply Chain Management
MGT 5390	Managerial Data Analysis
ANLY 5334	Statistical Methods for Business
ANLY 5335	Forecasting and Simulation
Technology	
TECH 5315	Engineering Economic Analysis
TECH 5382	Industrial Ecology and Sustainability Engineering
TECH 5390	Research in Technology
Computer Science	
CS 5306	Advanced Operating Systems
CS 5346	Advanced Artificial Intelligence
Geography	
GEO 5312	Managing Urbanization
GEO 5313	Environmental Studies
GEO 5334	Applied Water Resources
GEO 5336	Transportation Systems
GEO 5351	Regional Waste Management
GEO 5352	Air Quality Management
GEO 5393D	Water Resource Planning
Mathematics	
MATH 5315	Mathematical Statistics
MATH 5340	Scientific Computation
MATH 5345	Regression Analysis
MATH 5376A	Design and Analysis of Experiments
MATH 5376B	Analysis of Variance
MATH 5376D	Statistical Applications in Genetics and Bioinformatics
MATH 5388	Discrete Mathematics
Physics	
PHYS 5322	Semiconductor Device Microfabrication
PHYS 5324	Thin Film Synthesis and Characterization Laboratory
PHYS 5327	Semiconductor Device Physics
PHYS 5332	Materials Characterization
Materials Science, Engineering and Commercialization	
ENGR 5324	Water Reuse
ENGR 5353	Earthquake Engineering
ENGR 5372	Water, Climate, and Disasters
ME 5311	Mechanical Vibrations
ME 5321	Applied Finite Element Analysis
ME 5332	Modern Heating, Ventilating, and Air Conditioning
ME 5341	Computational Fluid Dynamics
ME 5355	Autonomous Systems and Robotics
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship

MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	
MSEC 7340	Biomaterials and Biosensors	
MSEC 7395H	Environmental Chemistry	
Total Hours		**31**

Students pursuing a non-thesis degree are required to have an advisor by the end of their first long term of enrollment in the graduate program. The advisor will normally be a faculty member specializing in an area of particular interest to the student who will supervise the student for the duration of the individual's program. Prior to the final term of enrollment the non-thesis student must, in consultation with the advisor, select a committee that will administer the final comprehensive examination.

Comprehensive Examination Requirement for non-thesis option

The comprehensive examination takes the form of either a written exam based on a course(s) in their concentration, a written review paper or an oral examination as determined by the advisor. Students who were not successful on the exam may take the exam a second time. If the student does not successfully complete the requirements for the degree within the timelines specified he/she will be dismissed from the program.

Master's level courses in Engineering: ENGR (p. 3), CE (p. 6), EE (p. 7), IE (p. 9), MFGE (p. 10)

Courses Offered

Engineering (ENGR)

ENGR 5100. Seminar in Engineering.
Graduate students attend seminars by invited speakers presenting relevant topics in academia and industry. The schedule of speakers will be developed each semester with strict faculty supervision. This course may only be taken for credit one time.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

ENGR 5101. Academic Instruction for Engineering Graduate Assistants.
This course is seminar based and covers topics related to teaching and employment responsibilities. Completion of this course is required as a condition of employment for graduate assistants. This course does not earn graduate degree credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

ENGR 5105. Engineering Internship.
This course is a faculty-supervised, experiential, work-integrated learning course intended to help the student acquire engineering curriculum-related industrial experience and hence successfully make the transition into the workforce. Course cannot be counted toward graduation. Course may be repeated once. Prerequisite: Instructor approval.
1 Credit Hour. 0 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5198B. Project.
This course represents a student's continuing project enrollments. The student continues to enroll in this course until the project is completed. Prerequisite: Instructor approval.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5199B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5201. Academic Instruction for Engineering Graduate Assistants.
This course is seminar based and covers topics related to teaching and employment responsibilities. Completion of this course is required as a condition of employment for graduate assistants. This course does not earn graduate degree credit.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

ENGR 5298B. Project.
This course represents a student's continuing project enrollments. The student continues to enroll in this course until the project is completed.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5299B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5310. Probability, Random Variables, & Stochastic Processes for Engineers.
This course develops theory underlying analysis and design of systems. Fundamental distributional concepts, applications of statistical methods, and theory of stochastic processes are introduced to create a mathematical foundation for engineering analysis of physical systems involving randomness. Applications to engineering topics are taught, including estimation, control, and systems theory.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5321. Environmental Chemistry.
This course introduces environmental chemistry, emphasizing aquatic resources and engineering. It also examines fundamental geochemistry and atmospheric chemistry principles relating to pollutant impacts on aquatic ecosystems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5322. Low Impact Development and Green Infrastructure.
This course covers the principles and practices of Low Impact Development and Green Infrastructure (LID/GI) for sustainable development and water sustainability through rain harvesting, small systems, resource recovery, and technology-enhanced innovation.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5323. Soil and Groundwater Remediation.
This course covers various remediation technologies to clean up contaminated soil and groundwater. Topics include, but are not limited to, subsurface hydrology, contaminant fate and transport, physicochemical and biological remediation, monitoring, and brownfield redevelopment. Significance of subsurface contamination and the importance of environmental health will also be addressed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5324. Water Reuse.
This course explores the critical role of water reuse in sustainable resource management, addressing both the engineering principles and interdisciplinary challenges involved. Students will examine water treatment technologies, regulatory frameworks, and the environmental and economic impacts of water reuse across various sectors. Case studies will highlight applications in agriculture, industry, and urban environments, with a focus on emerging technologies and innovative solutions. This course fosters cross- disciplinary collaboration and provides the technical and scientific foundations needed to advance water reuse initiatives in diverse contexts.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5330. Advanced Soil Mechanics.
This course is a fundamental graduate-level geotechnical engineering course, covering the physical, mechanical, hydraulic, and electrical properties of soil. The mandatory laboratory component will provide hands-on experience with characterizing soils for engineering purposes (stress-deformation and strength characteristics) and help to familiarize students with ASTM geotechnical laboratory testing procedures and standards.
3 Credit Hours. 2 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

ENGR 5332. Earth retaining structures and slopes.
The course will cover the design and analysis of various earth retaining structures as well as slope stability analysis. Fundamental lateral earth pressure theories will be taught, followed by application through design for gravity walls, cantilever walls, mechanically stabilized earth walls, soil nails, and tiebacks. Slope stability analysis will include infinite methods, methods of slices, chart methods, and finite element methods with commercial software. Additional topics include slope remediation techniques and geosynthetics for slope stabilization.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5333. Ground Improvement Techniques.
This course presents advanced topics in ground improvement for challenging sites to remediate seepage and/or strength issues. Students will learn to assess and implement techniques such as deep soil mixing, jet grouting, compaction, stone columns and rigid inclusions. Emphasis is placed on mitigating issues like liquefaction, settlement, hydraulic conductivity and stability. The course integrates practical field investigation methods, design principles, and performance evaluation, preparing students to address complex engineering challenges in both natural and reclaimed land environments.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5334. Advanced Foundation Engineering.
This course examines advanced topics in foundations design including design, analysis and construction of shallow and deep foundations. Deep foundations include driven piles, drilled shafts, micropiles, and auger cast in place piles. The course will cover bearing/axial capacity, settlement, pile group effects, and lateral capacity of the various foundation types. Additional topics include subsurface exploration and analysis of pile behavior using wave equation analysis.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5341. Advanced Bituminous Materials.
This course provides a comprehensive presentation of bituminous materials, mix design procedures, and construction techniques. Emphasis is placed on a fundamental understanding of asphalt cements and aggregates, and how these materials affect mixture design and pavement performance. Modern asphalt pavement design and construction practices are also introduced.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5351. Advanced Reinforced Concrete Members.
This course covers advanced topics related to reinforced concrete materials and specifications, and the behavior and design of reinforced concrete members. The topics includes the following: flexural behavior and design of reinforced concrete, behavior and design of slender columns, design of structural components, frame joints, and walls, serviceability and durability issues, and anchorage design using splices, hooks, and mechanical devices.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5352. Advanced Prestressed Concrete.
This course covers the theories, principles, and concepts of prestressed concrete, including analysis and design of prestressed components for axial, flexure, shear, and torsion. This course will also introduce the applications of prestressed elements in various types of infrastructure.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5353. Earthquake Engineering.
This course covers the theories, principles, and concepts of earthquake waves and wave equations, structural dynamics, and the effect of earthquakes on structures, including modal analysis and linear and nonlinear analyses of single- and multi-degree of freedom systems. Additionally, different earthquake-resistant design principles (e.g., force-based, displacement-based, and energy-based) will be discussed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5361. Pavement Asset Management.
This course is about applications of pavement condition evaluation technologies, pavement distress data analysis and modeling, and pavement maintenance and rehabilitation decision making in the management of pavement systems. The course covers methods of evaluating field performance of rigid and flexible pavements by measuring surface distresses, profiles, friction resistance, and structural integrity. In addition, the course also discusses pavement performance evaluation models, and ranking and optimization methods for decision-making of pavement maintenance and rehabilitation strategies.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5362. Advanced Traffic Engineering.
This course is an introduction to basic components of transportation systems and fundamentals of transportation engineering. Topics include geometric design of highways, study of warrants for traffic control devices, analysis of traffic flow theory and characteristics, levels of service, capacity of urban and rural highways, design and analysis of traffic signals and timing plans, and analysis of urban and highway traffic characteristics using simulation software.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5363. Road Infrastructure Safety.
This course will cover topics including an introduction to road infrastructure safety, fundamentals of road safety analysis, highway safety management systems, count data modeling, crash severity modeling, highway safety design, basics of artificial intelligence and machine learning, human factors, and safe system design.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5372. Water, Climate, and Disasters.
This course introduces the interactions between water and climate systems and their relationship with occurrences, magnitude, and frequencies of natural disasters with a focus on climate impacts on hydrology, water resources, and extreme events (e.g., floods, drought, heat waves, landslides, and wildfires). This course covers disaster risk management and adaptation strategies for a sustainable and resilient natural environment and human society against weather and climate extreme disasters.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5384. Problems in Engineering.
Graduate students investigate a special topic by developing a technical problem, researching the topic, and presenting the findings. Plans will be developed on an individual basis with strict faculty supervision. This course may be repeated once for additional credit with permission of the School Director. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

ENGR 5398A. Project.
This course represents a student's initial project enrollment. No project credit is awarded until the student has completed the project in ENGR 5x98B. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5398B. Project.
This course represents a student's continuing project enrollments. The student continues to enroll in this course until the project is completed. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5399A. Thesis.
This course represents a student's initial thesis enrollment. No thesis credit is awarded until the theses is completed in ENGR 5x99B.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

ENGR 5399B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5598B. Project.
This course represents a student's continuing project enrollments. The student continues to enroll in this course until the project is completed. Prerequisite: Instructor approval.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5599B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

ENGR 5998B. Project.
This course represents a student's continuing project enrollments. The student continues to enroll in this course until the project is completed. Prerequisite: Instructor approval.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

ENGR 5999B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

Civil Engineering (CE)

CE 5320. Water Quality Management.
This course is an advanced study of the processes used to monitor, measure, and manage water quality for municipal, commercial, or industrial use. The use of technology to enhance water quality management processes is also investigated. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5331. Computational Methods in Civil Engineering.
This course is an introduction to numerical analysis and computational methods as applicable to civil engineering. A survey of finite element method with a review of differential equations, boundary conditions, integral forms and numerical integration will be covered. This course particularly focuses on application of numerical techniques to simulate and solve steady-state and transient solid and fluid problems in civil engineering.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5340. Advanced Infrastructure Materials.
This course provides a comprehensive presentation of advanced infrastructure materials including cement concrete, asphalt concrete, wood, steel, etc. Emphasis is placed on a fundamental understanding of the raw ingredients of cement concrete and how these ingredients affect concrete fresh and hardened properties. A brief introduction of other common infrastructure materials is also included in this course.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5350. Highway Bridge Design.
This course covers the design of highway bridge structures, including both the super- and sub-structure. Design is in accordance with current Federal Highway Administration (FHWA) specifications. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5360. Pavement Design.
This course covers the design of concrete, asphalt, and pervious pavements. Included are highway pavements, urban streets, airport pavements, industrial pavements, and roller compacted concrete. Design is in accordance with current FHWA specifications. Common construction methods are also addressed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5370. Urban Stormwater Management.
This course examines the planning, design, operation, and maintenance of urban stormwater management systems. Political, social, economic, and environmental influences on such systems are examined. The impact of extreme events on stormwater systems and the urban landscape are also considered. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5390. Infrastructure Systems Analysis.
This course is an advanced study of the planning, operation, and maintenance of municipal and commercial infrastructure assets. Political, social, economic, environmental, and engineering influences on infrastructure systems are addressed. Use of technology to enhance the safety and economic value of the infrastructure is also investigated. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5391. Advanced Mechanics of Materials.
This course is an advanced study of stress, strain, and deformation in elastic bodies. Topics covered include torsion, unsymmetrical bending, nonlinear beams, stress concentrations, beams on elastic foundations, Mohr's circle, and an introduction to the theory of elasticity.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

Electrical Engineering (EE)

EE 5320. Advanced Computer Architecture and Arithmetic.
This course teaches design and analysis of high-performance computer systems, focusing on quantitative analysis of the latest processors and compilers. Current processor architectures are surveyed for system design. Topics include instruction sets, parallelizing architectures, pipelining, I/O, memory and cache organization, parallel/vector processing, fast arithmetic units design, and implementation using HDL.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5321. Computer-Aided Engineering Simulations on HPC Systems.
This course covers development of simulations for engineering applications that are solved using High Performance Computing (HPC) environments. Topics include programming techniques for multicore processors, processor and memory architecture, computation for dense and spare linear algebra applications, computational temperature analysis, fluid dynamics, stencil and stochastic algorithms, and other applications. Prerequisite: EE 5320 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5323. Digital Image Processing.
This course provides the necessary fundamental techniques to analyze and process digital images. It covers principles, concepts, and techniques of digital image processing and computer vision. Restricted to students enrolled in the MS Engineering program.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5330. Embedded and Real-Time Computing.
This course teaches development of embedded computing systems with strong resource constraints. Key concepts include managing constrained memory and processing speed limitations, and programming for soft and hard real-time constraints. Students will learn use of a Real-Time Operating System (RTOS).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5331. Machine Learning for Engineering Applications.
This course covers an introduction to machine learning focused on deep learning techniques using engineering applications with Python. Topics include model characteristics, neural network theory, classifiers for network and signal processing applications, regression and convolutional modeling for object-detection, time-series and forecasting machine learning models for Smart City concepts. Prerequisite: ENGR 5310 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5350. Advanced Electronic Circuit Design.
This course includes low and high power RF amplifier design techniques, oscillators, FM demodulators, limiters, and mixer design. Additional topics include circuit design to minimize intermodulation and other forms of distortion, and RD and high-speed analog circuits with emphasis on digital-friendly applications.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5353. Fundamentals of Advanced Semiconductor Technology.
In this course students will learn key concepts and trends of advanced semiconductor device technology. Topics include Moore's law, MOSFET, CMOS and scaling, high-K gate dielectrics, new channel materials replacing silicon, three dimensional and compound semiconductor device structures. In addition students will be involved in laboratories and seminar presentations. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5354. Flexible Electronics.
This course will cover the materials systems, processes, device physics and applications of flexible electronics. The materials range from amorphous and nanocrystalline silicon, organic and polymeric semiconductors to solution cast films of carbon nanotubes. Real device discussions include high speed transistors, photovoltaics, flexible flat-panel displays, medical image sensors, etc. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 5355. Electronic Materials and Devices.
This course covers theoretical concepts applicable to the understanding of unique properties exhibited by electronic materials, especially by dielectrics, oxide semiconductors, ferroelectrics, pyroelectrics, piezoelectrics, magnetic, and multifunctional and multiferroic materials. The various microelectronic devices and modern novel technologies based on these materials are emphasized.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5357. Power Systems for Engineering.
This course introduces the analysis of various elements of power systems, including power generation, transformer action, transmission line modeling, symmetrical components, power factor correction, real and quadrature power calculations, load flow analysis, and economic considerations in operating systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5360. Thin Film Technology.
This course covers the theoretical and practical aspects of thin film technology in modern devices. The design and fabrication of thin film heterostructures is discussed. Growth and nucleation of epitaxial thin films with diverse properties and devices with combined properties will be emphasized.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5361. Nanofabrication Technology for Semiconductor Device Processing.
This course provides an overview of nanofabrication techniques for conventional and emerging micro- and nano-electronic devices. Topics include semiconductor crystal growth, wafer preparation, epitaxial growth, oxidation, control of dopant profiles for the formation of shallow junctions, ion-implantation, thin film deposition, photolithography, metallization etching, device and circuit formation, and testing.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5372. Advanced Networking.
This course develops important theoretical and application topics related to advanced networking. Theoretical topics are introduced using mathematical treatments, including queuing theory and some random processes. The course includes applications of these topics to communications networks, and focuses on architectures, applications and technologies which affect modern computer and data networks.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5374. Advanced Wireless Communication.
This course teaches principles and practices in designing and analyzing cellular and other wireless communication systems. Topics include RF propagation modeling, fast and slow fading, modulation, demodulation, coding, and multiple access techniques.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5375. Smart Grid: an Application Development Platform.
This course introduces students to the development of real applications for the smart grid and models its performance with simulations and stochastic models. Topics include energy informatics, smart metering, home energy management, demand response, load disaggregation and APIs/OpenData. The mathematical tools used include: Optimization/ Control, Machine Learning and Stochastic Processes.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5377. Statistical Signal Processing.
This course develops the theory and applications of random processes using mathematical treatments, including elementary discrete and continuous time linear systems theory, elementary probability, and transform theory. Topics include applications of random processes to information and communication theory, estimation and detection, control, signal processing, and stochastic systems theory. Prerequisite: ENGR 5310 with a grade of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5380. Advanced Electric Machines.
This course teaches the principles and analysis of electromechanical systems. Students will develop analytical techniques for predicting device and system interaction characteristics as well as learn to design major classes of electric machines.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5381. Advanced Sustainable Energy & Storage.
This course examines the consumption and production of energy and the principles and technologies behind renewable energy sources. It also introduces the basics of energy storage systems such as batteries, gravitational, and hybrid. Current research in the field is examined.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5382. Advanced Power Systems Analysis.
This course is an advanced treatment of various elements of power systems, including case studies, analysis of relevant peer-reviewed literature, symmetrical and unsymmetrical faults, symmetrical components, system protection, transient stability, transient operation of transmission lines, and supervisory control and data acquisition (SCADA).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5398A. Antenna Theory, Design and Applications.
This course covers the basic theory, design and applications of antennas. The topics include antenna radiation, fundamental parameters of antennas, linear wire antennas, loop antennas, antenna arrays, long-periodic antennas, horn antennas, microstrip antennas and modern nano-antennas.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

EE 5398B. Electronic Materials and Beyond for Sustainable Energy.
This course covers the basic science and technology for sustainable energy from the view of materials, where electronic materials are highly emphasized. The topics include solar cells, thermoelectrics, batteries, supercapacitors, artificial photosynthesis, fuel cells, biomass and nuclear energy.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

Industrial Engineering (IE)

IE 5310. Advanced Statistical Design of Experiments for Engineers.
This course examines the design and analysis of controlled experiments, demonstrating engineering applications of design of experiments (DOE) in the manufacturing and service industries. Topics include full and fractional factorial designs, response surface methodology, and Taguchi methods. In a semester-long project, students apply DOE to improve a real manufacturing process. Prerequisite: ENGR 5310 with a grade of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5320. Modeling and Analysis of Manufacturing Systems.
This course covers the methods for modeling and analyzing manufacturing systems. Critical manufacturing issues that are addressed by these models include sustainable production systems, material handling systems, scheduling, and supply chains. Prerequisite: IE 3320 and IE 3340 and MFGE 4396 all with grades of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5330. Advanced Quality Control and Reliability Engineering.
This course provides in-depth knowledge in reliability modeling and maintenance optimization for components and systems. The course also covers advanced quality control techniques including multivariate process control. Methodologies are applied to solve practical problems arising from various industry domains. Restricted to students enrolled in the MS Engineering program. Prerequisite: ENGR 5310 with a grade of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5340. Applied Deterministic Operations Research for Engineers.
This course introduces students to modeling of linear, non-linear, and integer problems applied to engineering design, manufacturing, service, supply chain, healthcare and electrical systems. Mathematical programming software is emphasized in class exercises, homework, and project. Techniques including revised simplex method, duality theory, sensitivity analysis, and networks are also covered.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5343. Non-Linear Optimization Techniques for Engineers.
This course covers engineering applications of mathematical modeling and computational methods for nonlinear programming problems. The primary goal of this course is to present techniques and strategies essential to optimize non-linear models. Prerequisite: IE 3340 with a grade of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5345. Advanced Optimization.
This course covers advanced concepts in linear and integer programming. Solution techniques for stochastic and dynamic programming and formulation and solution of decision models in manufacturing, service, supply chain, healthcare and electrical systems are presented. Prerequisite: IE 5340 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5347. Advanced Heuristic Optimization.
This course covers heuristic methods that search beyond local optima such as simulated annealing, tabu search, genetic algorithms, ant-colony systems and particle swarm. Papers from the literature, problem-specific heuristics, evaluation methods, and implementations are discussed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5360. Advanced Inventory Control.
This course delves into advanced concepts of inventory management systems, focusing on analytical techniques and strategic decision-making processes essential for efficient production and operations management. Students will gain practical and theoretical insights crucial for effective inventory control in complex environments by exploring demand forecasting, inventory policies, and supply chain optimization. Prerequisite: IE 5340 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5370. Scheduling.
This course focuses on advanced scheduling methodologies and algorithms applied to real-world problems in industrial engineering. The topics covered include deterministic and stochastic scheduling models, single and multi-machine environments, job shop scheduling, flow shop scheduling, and multi-echelon systems. Students will explore theoretical concepts and learn to apply these using both mathematical and computational tools. Prerequisite: IE 5340 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5397. System Thinking and Analysis.
This course is an introduction to systems engineering and the systems thinking process, providing important considerations related to the engineering of large scale systems. These considerations include system understanding, modeling and design, the system development process, needs analysis, concept exploration and definition, design, integration and evaluation, and systems engineering management. Prerequisite: ENGR 5310 with a grade of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

Manufacturing Engineering (MFGE)

MFGE 5315. Energy and Thermofluids Engineering.
This course covers core engineering concepts of energy and thermofluids based on fluid mechanics, thermodynamics, and heat transfer. The main topics include properties of pure substances, fluid statics and dynamics, non-Newtonian fluid, differential analysis of fluid flow, viscous flow in pipes, external flows, boundary layer, open channel flows, mass and energy analysis of control volumes, first and second laws of thermodynamics, steady-state and transient conduction, internal and external forced convection, natural convection, fundamentals of radiation, and mass transfer.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5316. Advanced Computer Aided Design and Manufacturing.
Topics include design process, mathematical presentation of wireframe/surface/solid modes, transformation and manipulation of objects, finite element analysis, data exchange, process planning, fundamentals of multi-axis NC programming for turning and milling processes, fundamentals of CAD/CAM systems, CNC code generation by CAD.CAM software for the CNC, and waterjet machines. Prerequisites: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5318. Additive Manufacturing.
In this course CAD standards, theory, techniques, applications, and development of additive manufacturing technology, photopolymerization, powder bed fusion, extrusion-based systems, printing processes, sheet lamination processes, beam deposition processes, design for additive manufacturing, and safety considerations in a hands-on approach will be explained. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5320. Polymer Nanocomposites.
This course covers polymer nanocomposites focusing on materials, manufacturing, characterization, and applications. The primary focus is on fiber reinforced polymer nanocomposites. Morphological, Thermal, Mechanical, and Electrical Characterization will be discussed in detail. Applications include fire-resistant, ablative, fatigue-resistant, impact-resistant, and bio-based composites. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5326. Advanced Robotics in Manufacturing Automation.
This course covers principles and techniques involved in advanced robotics. Topics include introduction to robotics, industrial robotics, robot kinematics, path planning, robot dynamics, advanced control, force control, sensors and actuators, mobile robotics, and introduction to nanorobotics. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5330. Multiscale Manufacturing.
This course covers the multiscale manufacturing processes, techniques, and applications. Topics include micro and nano-manufacturing, polymer and semiconductor fabrication, thin film technologies, bulk and surface micromachining, physics of multiscale manufacturing, microelectromechanical (MEMS) devices, and design issues for fabrication of micro and nano-systems. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5398B. Advanced Composite Materials.
This course examines various aspects of fiber-reinforced polymeric composites. The topics covered include constituent materials (fibers and matrices), mechanics, performance, manufacturing, and introduction to nanocomposites, This course also provides introductory treatments concerning ceramic matrix composites, metal matrix composites, and carbon/carbon composites.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter