MASTER OF SCIENCE (M.S.) MAJOR IN ENGINEERING (ELECTRICAL ENGINEERING THESIS OPTION)

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 technical project or thesis related to real-world engineering applications. These projects will be conducted in partnership with local industries and may involve off-campus collaborations. The degree requires a large-scale project or thesis 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

Application requirements consist of institutional and program requirements for applicable semesters of entry during the current academic year. Additional information and changes to admission requirements for semesters other than the current academic year can be found on The Graduate College's website (http://www.gradcollege.txstate.edu/).

Unless otherwise noted on The Graduate College program page, AI tools can only be used to correct spelling and grammar errors in application materials.

Institutional Requirements

Institutional requirements are the minimum standards for admission to any graduate program at Texas State. These include:

- Completed online application
- Nonrefundable application fee
  - Degree Programs (Doctoral and Master's)
    - $55 fee, or
    - $90 for applications with international credentials
  - Post-Baccalaureate Programs (Certificate, Certification, Non-Degree, and Visiting)
    - $20 fee, or
    - $60 for applications with international credentials
- Official transcripts from each institution where course credit was granted. Final transcripts showing degree completion are required before the student may register for their second term of enrollment.
- GPA requirements (a higher GPA may be listed in the Program Requirements)
  - Doctoral programs require a 3.00 overall GPA or a 3.00 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
  - Master's and Specialist programs require a 2.75 overall GPA or a 2.75 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
  - Post-Baccalaureate programs require a 2.50 overall GPA or a 2.50 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
- Baccalaureate degree 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.)

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum 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). Some programs may restrict acceptable tests or require higher scores than the institutional scores; this will be noted in the Program Requirements.

- official TOEFL iBT scores required with a 78 overall if taken on or before January 21, 2026
- official TOEFL iBT scores required with a 4 overall if taken after January 21, 2026
- 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
- official Texas State Intensive English Program score of 90% or higher in the highest-level course (level 5)

The institution does **not** offer admission if the scores above are not met.

- 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
- 2.75 overall GPA or a 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 Electrical 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
EE 5320	Advanced Computer Architecture and Arithmetic	3
EE 5350	Advanced Electronic Circuit Design	3
Engineering Electives		
Choose 9-15 hours from the following:		9-15
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 5321	Computer-Aided Engineering (CAE) Simulations on High-Performance Computing (HPC) Systems	
EE 5323	Digital Image Processing	
EE 5330	Embedded and Real-Time Computing	
EE 5331	Machine Learning for Engineering Applications	
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		
EE 5398B		
ENGR 5321	Environmental Chemistry	
ENGR 5323	Soil and Groundwater Remediation	
ENGR 5324	Water Reuse	
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 5353	Earthquake Engineering	
ENGR 5362	Advanced Traffic Engineering	
ENGR 5363	Road Infrastructure Safety	
ENGR 5372	Water, Climate, and Disasters	
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 5311	Mechanical Vibrations	
ME 5312	Mechanics of Composite Materials	
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	
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	Semiconductor Manufacturing	
Multidisciplinary Electives		
Choose up to 6 hours from the following: [1]		0-6
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 5358	Agile Project Management For Business Professionals	
MGT 5311		
MGT 5315		
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	Solid Waste Management and Resource Recovery	
GEO 5352	Air Quality Management	
GEO 5393D		
Mathematics		
MATH 5315		
MATH 5340	Scientific Computation	
MATH 5345		
MATH 5376A		
MATH 5376B		
MATH 5376D		
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		
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	
Thesis		
ENGR 5399A	Thesis	3
Choose a minimum of 3 hours from the following:		3
ENGR 5199B	Thesis	
ENGR 5299B	Thesis	
ENGR 5399B	Thesis	
ENGR 5599B	Thesis	
ENGR 5999B	Thesis	
Total Hours		**31**

[1] Choose up to 6 hours from the Multidisciplinary Electives above to make the total hours selected from Engineering Electives and from Multidisciplinary Electives to equal 15 hours.

Comprehensive Examination Requirement

An oral thesis defense is required. This oral defense will serve as the comprehensive examination requirement. If the thesis committee is not satisfied with a graduate student's oral defense, they specify all deficiencies the student must resolve. The thesis committee will not sign the Master's Comprehensive Examination Report Form and the Thesis Submission Approval Form until all specified deficiencies have been resolved. Should the thesis committee decide to hold a second oral defense, the chair of the thesis committee shall not schedule the second defense until the student has resolved all specified deficiencies.

Students who do not successfully complete the requirements for the degree within the timelines specified will be dismissed from the program.

If a student elects to follow the thesis option for the degree, a committee to direct the written thesis will be established. The thesis must demonstrate the student's capability for research and independent thought. Preparation of the thesis must be in conformity with the *Graduate College Guide to Preparing and Submitting a Thesis or Dissertation*.

Thesis Proposal (http://www.gradcollege.txstate.edu/docs/Thesis_Diss_Guide.pdf)

The student must submit an official Thesis Proposal Form (http://www.gradcollege.txstate.edu/forms.html) and proposal to his or her thesis committee. Thesis proposals vary by department and discipline. Please see your department for proposal guidelines and requirements. After signing the form and obtaining committee members' signatures, the graduate advisor's signature if required by the program and the

department chair's signature, the student must submit the Thesis Proposal Form with one copy of the proposal attached to the dean of The Graduate College for approval before proceeding with research on the thesis. If the thesis research involves human subjects, the student must obtain exemption or approval from the Texas State Institutional Review Board prior to submitting the proposal form to The Graduate College. The IRB approval letter should be included with the proposal form. If the thesis research involves vertebrate animals, the proposal form must include the Texas State IACUC approval code. It is recommended that the thesis proposal form be submitted to the dean of The Graduate College by the end of the student's enrollment in 5399A. Failure to submit the thesis proposal in a timely fashion may result in delayed graduation.

Thesis Committee

The thesis committee must be composed of a minimum of three approved graduate faculty members.

Thesis Enrollment and Credit

The completion of a minimum of six hours of thesis enrollment is required. For a student's initial thesis course enrollment, the student will need to register for thesis course number 5399A. After that, the student will enroll in thesis B courses, in each subsequent semester until the thesis is defended with the department and approved by The Graduate College. Preliminary discussions regarding the selection of a topic and assignment to a research supervisor will not require enrollment for the thesis course.

Students must be enrolled in thesis credits if they are receiving supervision and/or are using university resources related to their thesis work. The number of thesis credit hours students enroll in must reflect the amount of work being done on the thesis that semester. It is the responsibility of the committee chair to ensure that students are making adequate progress toward their degree throughout the thesis process. Failure to register for the thesis course during a term in which supervision is received may result in postponement of graduation. After initial enrollment in 5399A, the student will continue to enroll in a thesis B course as long as it takes to complete the thesis. Thesis projects are by definition original and individualized projects. As such, depending on the topic, methodology, and other factors, some projects may take longer than others to complete. If the thesis requires work beyond the minimum number of thesis credits needed for the degree, the student may enroll in additional thesis credits at the committee chair's discretion. In the rare case when a student has not previously enrolled in thesis and plans to work on and complete the thesis in one term, the student will enroll in both 5399A and 5399B.

The only grades assigned for thesis courses are PR (progress), CR (credit), W (withdrew), and F (failing). If acceptable progress is not being made in a thesis course, the instructor may issue a grade of F. If the student is making acceptable progress, a grade of PR is assigned until the thesis is completed. The minimum number of hours of thesis credit ("CR") will be awarded only after the thesis has been both approved by The Graduate College and released to Alkek Library.

A student who has selected the thesis option must be registered for the thesis course during the term or Summer I (during the summer, the thesis course runs ten weeks for both sessions) in which the degree will be conferred.

Thesis Deadlines and Approval Process

Thesis deadlines are posted on The Graduate College (http://www.gradcollege.txstate.edu/) website under "Current Students." The completed thesis must be submitted to the chair of the thesis committee on or before the deadlines listed on The Graduate College website.

The following must be submitted to The Graduate College by the thesis deadline listed on The Graduate College website:

1. The Thesis Submission Approval Form bearing original (wet) and/or electronic signatures of the student and all committee members.
2. One (1) PDF of the thesis in final form, approved by all committee members, uploaded in the online Vireo submission system.

After the dean of The Graduate College approves the thesis, Alkek Library will harvest the document from the Vireo submission system for publishing in the Digital Collections database (according to the student's embargo selection). **NOTE: MFA Creative Writing theses will have a permanent embargo and will never be published to Digital Collections.**

While original (wet) signatures are preferred, there may be situations as determined by the chair of the committee in which obtaining original signatures is inefficient or has the potential to delay the student's progress. In those situations, the following methods of signing are acceptable:

- signing and faxing the form
- signing, scanning, and emailing the form
- notifying the department in an email from their university's or institution's email account that the committee chair can sign the form on their behalf
- electronically signing the form using the university's licensed signature platform.

If this process results in more than one document with signatures, all documents need to be submitted to The Graduate College together.

No copies are required to be submitted to Alkek Library. However, the library will bind copies submitted that the student wants bound for personal use. Personal copies are not required to be printed on archival quality paper. The student will take the personal copies to Alkek Library and pay the binding fee for personal copies.

Master's level courses in Engineering: ENGR (http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/engineering-electrical-thesis-ms/#engineering), CE (http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/engineering-electrical-thesis-ms/#Civil Engineering (CE), EE (http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/engineering-electrical-thesis-ms/#Electrical Engineering), IE (http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/engineering-electrical-thesis-ms/#Industrial Engineering), MFGE (http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/engineering-electrical-thesis-ms/#Mechanical and Manufacturing Engineering)

Courses Offered

Engineering (ENGR)

ENGR 5100. Seminar in Engineering.
This course examines principles of professional engineering discourse and current research trends in academia and industry. Students analyze technical presentations and scholarly work to evaluate emerging technologies and interdisciplinary research approaches. Topics include professional ethics, leadership in engineering, and the societal context of technological development. The course emphasizes critical assessment of research methodologies, synthesis of complex technical information, and effective communication of engineering ideas. Students examine connections between theoretical frameworks and applied engineering practice.
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 examines principles of pedagogical theory and professional responsibilities associated with academic instruction in engineering contexts. Students analyze teaching methodologies, classroom management strategies, and assessment practices used in undergraduate instruction. Topics include technical communication, academic policies, laboratory safety, and student privacy regulations. The course also addresses inclusive instructional practices and evaluation of teaching effectiveness. Emphasis is placed on the relationship between subject matter expertise and the communication of complex engineering concepts in classroom and laboratory settings.
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 examines engineering practice in professional work environments through supervised internship experiences. Students analyze organizational structures, workflows, and technical processes within engineering firms. The course emphasizes application of engineering theory to real-world projects, including design, manufacturing, or system management contexts. Topics include professional ethics, workplace safety, technical communication, and documentation of engineering work. Students evaluate the relationship between academic preparation and professional practice while engaging in collaborative project environments. 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 examines advanced project implementation and technical documentation in graduate engineering study. Students analyze experimental or theoretical data to evaluate project outcomes and design objectives. The course emphasizes application of analytical methods, integration of complex data, and development of technical conclusions under faculty supervision. Topics include evaluation of project results in relation to industry standards, documentation of methodologies, and preparation of comprehensive project reports. Students present and communicate project findings using professional engineering formats. 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 examines advanced data synthesis and technical writing required for completion of a master's thesis in engineering. Students analyze experimental or theoretical results to evaluate research questions and hypotheses. The course emphasizes application of analytical frameworks, integration of complex data, and documentation of research methodologies under faculty supervision. Topics include evaluation of findings in relation to existing scholarly literature and professional standards, as well as preparation of a formal thesis. Students present and defend their research using appropriate academic and professional formats.
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 examines pedagogical strategies, instructional design, and professional responsibilities for graduate instructional assistants in engineering. Topics include development of course materials, grading methodologies, and university policies related to academic instruction. Students engage in reflective analysis of teaching practices, with attention to critical thinking and instructional approaches in technical curricula. The course addresses evaluation of student learning outcomes, classroom and laboratory management strategies, and development of instructional plans in engineering education contexts.
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 5299B. Thesis.
This course examines advanced data synthesis and technical writing required for completion of a master's thesis in engineering. Students analyze experimental or theoretical results to evaluate research questions and hypotheses. The course emphasizes application of analytical frameworks, integration of complex data, and documentation of research methodologies under faculty supervision. Topics include evaluation of findings in relation to existing scholarly literature and professional standards, as well as preparation of a formal thesis. Students present and defend their research using appropriate academic and professional formats.
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 introduces the fundamental principles of probability, statistics, random variables, and stochastic processes used in the analysis and design of engineering systems. Core topics include probability theory, discrete and continuous probability distributions, and mathematical descriptions of random variables. Statistical methods for analyzing engineering data, including estimation and inference, are examined. Stochastic processes are presented as models for systems that evolve over time under uncertainty. Applications of probabilistic and statistical methods are analyzed in engineering contexts such as system performance evaluation, signal behavior, control systems, and modeling of physical systems affected by randomness.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5321. Environmental Chemistry.
This course examines environmental chemistry principles relevant to natural and engineered systems. Topics include geochemistry and atmospheric chemistry to understand pollutant sources, transport, transformation, and impacts across the atmosphere, hydrosphere, lithosphere, and biosphere. The course integrates concepts from sustainability, green chemistry, and green engineering. Students engage in quantitative analysis, modeling, and evaluation of treatment and remediation processes. Emphasis is placed on analyzing contaminant behavior and evaluating environmentally responsible approaches to materials, processes, and technologies.
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 management. Students study approaches such as rainwater harvesting, small-scale systems, and resource recovery. The course examines design strategies and technologies used to reduce environmental impacts and manage water resources. Students evaluate LID/GI practices related to system performance, efficiency, and sustainability. Emphasis is placed on practical applications and techniques used in water resources and urban infrastructure systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5323. Soil and Groundwater Remediation.
This course covers remediation technologies for contaminated soil and groundwater. Topics include subsurface hydrology, contaminant fate and transport, and physicochemical and biological remediation methods. The course examines monitoring techniques and strategies for brownfield redevelopment. Students evaluate subsurface contamination and its environmental impacts. Emphasis is placed on practical applications, regulatory considerations, and approaches to site cleanup. The course addresses design and implementation of remediation systems in environmental engineering contexts.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5324. Water Reuse.
This course explores the role of water reuse in water resources management, addressing engineering principles and interdisciplinary considerations. Topics include advanced treatment technologies, regulatory frameworks, and environmental and economic impacts across agricultural, industrial, and urban applications. Students engage in case studies, quantitative analysis, and system-level evaluation of water reuse applications. Emphasis is placed on design and assessment of water reuse systems in relation to regulatory requirements and operational considerations.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5330. Advanced Soil Mechanics.
This course is a graduate-level geotechnical engineering course covering fundamental principles of soil behavior. Topics include soil composition, index properties, classification, compaction, total and effective stress, consolidation and secondary compression, and drained and undrained shear strength, including friction, cohesion, dilatancy, and critical state concepts. The course also examines the effects of stress history and rate of loading. A required laboratory component provides experience in characterizing soils for engineering purposes, including stress–deformation and strength behavior, and introduces 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.
This course covers the analysis and design of a range of earth retaining structures and the evaluation of slope stability. Students learn fundamental lateral earth pressure theories and apply them to the design of gravity walls, cantilever walls, mechanically stabilized earth walls, soil nails, and tiebacks. Slope stability analysis includes infinite slopes, methods of slices, chart-based solutions, and finite element methods using commercial software. Additional topics address slope remediation techniques and the use of geosynthetics for stabilization in geotechnical engineering practice.
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, including remediation of seepage and strength-related issues. Topics include techniques such as deep soil mixing, jet grouting, dynamic compaction, vibro-compaction, stone columns, rigid inclusions, and permeation grouting. Emphasis is placed on addressing liquefaction, settlement, hydraulic conductivity, and stability concerns. The course integrates field investigation methods, design principles, performance evaluation, and long-term monitoring considerations. Applications include natural and reclaimed land environments, such as coastal, offshore, and urban redevelopment sites.
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 foundation design, including analysis and construction of shallow and deep foundations. Shallow foundation topics emphasize mat foundations and their application to pile-raft systems. Deep foundation topics include driven piles, drilled shafts, micropiles, and auger cast-in-place piles. The course covers axial and lateral capacity, settlement, and pile group effects for various foundation types. Additional topics include subsurface exploration and analysis of pile behavior using wave equation methods.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5341. Advanced Bituminous Materials.
This course examines advanced concepts in bituminous materials, including asphalt binders, aggregates, and mixture systems used in pavement engineering. Emphasis is placed on the characterization of asphalt materials and their influence on mixture design and performance. The course analyzes mix design procedures, material interactions, and factors affecting mechanical response and durability. Modern approaches to asphalt pavement design and construction are considered, including performance-based specifications and evaluation methods. Applications include the assessment of mixture behavior under traffic loading and environmental conditions using current engineering practices.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5351. Advanced Reinforced Concrete Members.
This course examines advanced topics in reinforced concrete materials, specifications, behavior, and structural design. Topics include flexural behavior and design of reinforced concrete members, behavior and design of slender columns, and design of structural components such as frame joints and walls. Additional emphasis is placed on serviceability, durability, and anchorage design using splices, hooks, and mechanical devices. Students interpret design provisions and apply engineering principles to evaluate and design reinforced concrete systems in accordance with relevant standards and specifications.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5352. Advanced Prestressed Concrete.
This course examines the fundamental theories, principles, and behavior of prestressed concrete systems. Topics include the analysis and design of prestressed components subjected to axial, flexural, and shear loads. Emphasis is placed on prestress effects, load transfer mechanisms, and structural responses under service and ultimate limit states. Applications of prestressed elements in infrastructure systems, including bridges and structural components, are addressed, with attention to practical design considerations, material behavior, and relevant design codes and specifications for engineering practice.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5353. Earthquake Engineering.
This course examines earthquake ground motion, wave propagation, and structural dynamics, including modal analysis and linear and nonlinear response of single- and multi-degree-of-freedom systems. The effects of earthquakes on structures are analyzed, and earthquake-resistant design principles, including force-based, displacement-based, and energy-based approaches, are evaluated. Emphasis is placed on understanding dynamic structural response, interpreting analytical results, and applying seismic design concepts to structural systems subjected to earthquake loading in practical engineering applications and design scenarios encountered in engineering practice.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5361. Pavement Asset Management.
This course examines data-driven strategies for managing pavement systems at network and project levels. Topics include condition evaluation technologies for flexible and rigid pavements, including distress, roughness, friction, and structural assessment based on national and state standards. The course covers application of statistical models for performance prediction and interpretation of results to inform maintenance and rehabilitation decisions. Students design optimization and ranking techniques for resource allocation. The course includes collaborative projects involving analysis and communication of pavement management solutions.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5362. Advanced Traffic Engineering.
This course provides an advanced introduction to the components of highway traffic systems and traffic engineering principles. Topics include traffic stream characteristics, level of service, and capacity of urban and rural highways. The course covers traffic data collection using fixed and mobile sources, macroscopic and microscopic traffic modeling, warrants for traffic control devices, and design and analysis of traffic signals and timing plans. Analysis of traffic characteristics using empirical data and simulation software is included.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5363. Road Infrastructure Safety.
This course introduces road infrastructure safety and related analytical methods. Topics include road safety analysis, highway safety management systems, count data modeling, crash severity modeling, short-term crash prediction, road safety audits, network screening, and choice modeling. The course also covers fundamentals of artificial intelligence and machine learning, human factors in transportation, and safety-focused design principles, including the Safe System Approach. Emphasis is placed on analysis of roadway safety data and evaluation of engineering approaches to roadway safety.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5372. Water, Climate, and Disasters.
This course examines interactions between water and climate systems and their relationship to the occurrence, magnitude, and frequency of natural disasters. Topics include climate impacts on hydrology, water resources, and extreme events such as floods, droughts, heat waves, landslides, and wildfires. The course also addresses disaster risk management and adaptation strategies in relation to weather- and climate-related hazards. Emphasis is placed on analysis of hydroclimatic processes and evaluation of approaches to managing risks associated with extreme events.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

ENGR 5384. Problems in Engineering.
This course provides graduate students with the opportunity to investigate a specialized engineering topic through development of a technical problem, review of relevant literature, and presentation of findings. Students conduct independent study under faculty supervision, focusing on a defined area of engineering. The course includes formulation of research questions, application of appropriate analytical or design methods, and evaluation of results. Deliverables may include research papers, presentations, or project reports that demonstrate application of engineering principles and technical communication skills. 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 examines foundational project development and methodologies required for initiating a graduate-level engineering study. Students analyze technical literature and existing frameworks to define an original engineering problem. The course emphasizes formulation of a project proposal and identification of experimental or theoretical approaches to address technical challenges. Students apply analytical methods, simulation tools, and engineering principles under faculty supervision. Topics include preliminary data collection, feasibility assessment, and consideration of ethical and regulatory factors in project design. 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 examines advanced project implementation and technical documentation in graduate engineering study. Students analyze experimental or theoretical data to evaluate project outcomes and design objectives. The course emphasizes application of analytical methods, integration of complex data, and development of technical conclusions under faculty supervision. Topics include evaluation of results in relation to industry standards, documentation of methodologies, and preparation of a comprehensive project report. Students present and communicate project findings using professional engineering formats. 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 examines foundational research methods and processes required for development of a master's thesis in engineering. Students analyze technical literature to define a research problem and develop a thesis proposal. The course emphasizes selection of experimental or theoretical approaches, application of analytical methods, and integration of modeling and simulation tools under faculty supervision. Topics include feasibility assessment, preliminary data analysis, and consideration of ethical and intellectual property issues. Students prepare a formal thesis proposal and supporting documentation.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

ENGR 5399B. Thesis.
This course examines advanced data synthesis and technical writing required for completion of a master's thesis in engineering. Students analyze experimental or theoretical results to evaluate research questions and hypotheses. The course emphasizes application of analytical frameworks, integration of complex data, and documentation of research methodologies under faculty supervision. Topics include evaluation of findings in relation to scholarly literature and professional standards, as well as preparation of a formal thesis and presentation of research results.
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 5599B. Thesis.
This course examines advanced data synthesis and technical writing required for completion of a master's thesis in engineering. Students analyze experimental or theoretical results to evaluate research questions and hypotheses. The course emphasizes application of analytical frameworks, integration of complex data, and documentation of research methodologies under faculty supervision. Topics include evaluation of findings in relation to scholarly literature and professional standards, as well as preparation of a formal thesis and presentation of research results.
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 5999B. Thesis.
This course examines advanced data synthesis and technical writing required for completion of a master's thesis in engineering. Students analyze experimental or theoretical results to evaluate research questions and hypotheses. The course emphasizes application of analytical frameworks, integration of complex data, and documentation of research methodologies under faculty supervision. Topics include evaluation of findings in relation to scholarly literature and professional standards, as well as preparation and defense of a formal thesis.
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 examines principles and practices for drinking water quality management in engineered water supply systems. Topics include physicochemical and microbiological characteristics of drinking water, regulatory frameworks (e.g., primary and secondary standards, health advisories, and emerging contaminant programs), and public health implications. Emphasis is placed on contaminant sources, occurrence, and treatability in relation to water treatment processes. Students engage in evaluation of water quality requirements and treatment approaches for compliance and protection of public health. By the end of the course, students are expected to assess drinking water quality and select appropriate treatment and management strategies.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5331. Computational Methods in Civil Engineering.
This course introduces numerical analysis and computational methods in civil engineering. Topics include a survey of the finite element method, along with a review of differential equations, boundary conditions, integral formulations, and numerical integration techniques. Emphasis centers on applying numerical methods to model and solve steady-state and transient problems in solid and fluid systems. Students develop practical skills in simulation and computational problem-solving relevant to real-world civil engineering applications, strengthening their ability to analyze complex systems using modern numerical tools.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5340. Advanced Infrastructure Materials.
This course examines advanced topics in infrastructure materials, including cement concrete and asphalt concrete, with emphasis on material behavior, performance, and characterization of cement concrete. The composition and interactions of cementitious systems are analyzed in relation to fresh and hardened properties, microstructure development, and long-term performance. This course evaluates factors influencing material response under mechanical and environmental loading and considers advanced material design and modification approaches. Asphalt materials are reviewed in the context of engineering applications and emerging developments. Emphasis is placed on analytical frameworks and current practices used to assess and predict material performance in civil engineering systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5350. Highway Bridge Design.
This course presents the principles and practices involved in the design of highway bridge structures, including both superstructure and substructure components. Emphasis focuses on structural analysis, load evaluation, material selection, and design detailing in accordance with current Federal Highway Administration (FHWA) specifications. Students develop the ability to design bridge elements, assess structural performance, and apply relevant codes and standards. The course integrates practical design considerations with engineering judgment to address safety, serviceability, and durability requirements in modern bridge engineering projects.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5360. Pavement Design.
This course develops students' ability to analyze, evaluate, and design modern pavement systems using state-of-practice and advanced methodologies. Students examine ASTM, AASHTO, and FHWA standard and specifications in pavement materials. Students explore key design approaches, identify critical input variables, and apply AASHTO methods for flexible and rigid pavements. Students also design flexible and rigid pavements using advanced mechanistic-empirical design framework, interpretation of design outcomes, and recommendation of optimal solutions. Through real-world case studies and collaborative projects, students synthesize knowledge, develop rehabilitation strategies, and demonstrate effective teamwork, leadership, and communication skills.
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. It explores political, social, economic, and environmental factors that influence system development and performance. Students analyze how these factors shape decision making and infrastructure outcomes. The course also evaluates the impacts of extreme events on stormwater systems and the urban landscape. Emphasis is placed on sustainable design strategies, resilience, and practical approaches to managing runoff, reducing flood risks, and protecting communities and ecosystems in rapidly changing urban environments.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 5390. Infrastructure Systems Analysis.
This course examines the planning, operation, and maintenance of infrastructure systems in municipal and commercial contexts. Political, social, economic, environmental, and engineering factors influencing infrastructure decision-making are analyzed. Methods for evaluating system performance, lifecycle considerations, and system interactions are investigated. Strategies for enhancing infrastructure safety, reliability, and economic value are evaluated within the context of modern infrastructure management practices, including asset management, risk assessment, long-term system performance evaluation, decision-making under uncertainty, and integration of data-driven approaches for infrastructure system analysis and management.
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 with emphasis on rigorous formulation and solution of structural mechanics problems. Topics covered include torsion of noncircular members, unsymmetrical bending of prismatic and thin-walled sections, nonlinear beam behavior, and stress concentrations in structural details and connections. Additional topics address beams on elastic foundations, energy methods, stability-related effects, and advanced use of Mohr's circle for multi-axial stress and strain. The course also includes an introduction to the theory of elasticity, emphasizing the formulation of governing equations and classical two- and three-dimensional solution techniques.
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 examines the design and analysis of high-performance computer systems through the quantitative evaluation of modern processor and compiler technologies. Students analyze current processor architectures to facilitate effective system design and performance optimization. Inquiry focuses on instruction set architectures, parallelizing structures, and advanced pipelining techniques. Students examine the organization of I/O subsystems, memory hierarchies, and multi-level cache structures. Analysis includes parallel and vector processing paradigms alongside the design of high-speed arithmetic units. Students investigate the implementation of these complex architectural components using hardware description languages (HDL). Evaluation of these computational frameworks identifies the fundamental limits of processing speed and system efficiency. Systematic inquiry into computer organization provides a framework for the development of advanced processing platforms.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5321. Computer-Aided Engineering (CAE) Simulations on High-Performance Computing (HPC) Systems.
This course examines the development of engineering simulations optimized for high-performance computing (HPC) environments. Students analyze programming techniques for multicore processors and the architectural constraints of processor and memory systems. Inquiry focuses on the implementation of algorithms for dense and sparse linear algebra within parallel frameworks. Students examine computational models for thermal analysis, fluid dynamics, and stencil operations to evaluate system behavior. Analysis includes the application of stochastic algorithms and other numerical methods to complex engineering problems. Students investigate the relationship between hardware architecture and computational efficiency in large-scale simulation. Evaluation of these high-performance strategies identifies the fundamental limits of speed and scalability in technical computing. Systematic inquiry into parallel architectures provides a framework for the design of robust simulation tools for various engineering disciplines. 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 examines the fundamental principles and methodologies of digital image processing and computer vision. Students analyze digital image representation, sampling, and quantization to evaluate data integrity within visual systems. Inquiry focuses on the application of spatial and frequency domain filtering techniques for image enhancement and restoration. Students examine the behavior of image segmentation algorithms and feature extraction processes for object recognition. Analysis includes the study of image compression standards, morphological operations, and color image processing within diverse technical frameworks. Students investigate the impact of noise and distortion on automated visual analysis and system reliability. Evaluation of these computational techniques identifies the relationship between pixel-level manipulation and high-level scene interpretation. Systematic inquiry into digital processing supports the development of robust visual perception systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5330. Embedded and Real-Time Computing.
This course examines the development of embedded computing systems operating under significant hardware and resource constraints. Students analyze strategies for managing limited memory and processing cycles to evaluate system performance and reliability. Inquiry focuses on the design and implementation of software for both soft and hard real-time environments. Students examine the functional principles of Real-Time Operating Systems (RTOS) to determine task scheduling and resource allocation methodologies. Analysis includes the study of interrupt latency, priority inversion, and concurrency control within deterministic systems. Students investigate the relationship between low-level hardware interfaces and high-level software abstractions. Evaluation of these embedded frameworks identifies the technical trade-offs between responsiveness and power consumption in specialized computing applications. Systematic inquiry into real-time theory provides a framework for the development of robust and predictable autonomous systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5331. Machine Learning for Engineering Applications.
This course examines the principles of machine learning and deep learning architectures through the lens of engineering applications. Students analyze neural network theory and model characteristics to evaluate the performance of diverse computational structures. Inquiry focuses on the implementation of classifiers for network traffic and signal processing to determine signal integrity and classification accuracy. Students examine regression models and convolutional neural networks for object detection and feature extraction in complex visual data. Analysis includes the study of time-series analysis and forecasting models. Students investigate the relationship between data preprocessing, model optimization, and the reliability of predictive systems in real-world environments. Evaluation of these learning algorithms identifies the trade-offs between computational complexity and inference speed. Systematic inquiry into machine learning provides a framework for the development of intelligent and adaptive engineering solutions. 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 examines the principles of high-performance analog and radio frequency (RF) integrated circuit design through the analysis of active and passive components. Students analyze low and high-power RF amplifier topologies to evaluate gain, stability, and power-added efficiency. Inquiry focuses on the operational physics of oscillators, FM demodulators, limiters, and mixers within modern communication systems. Students examine circuit methodologies to minimize intermodulation and other nonlinear forms of distortion to optimize signal fidelity. Analysis includes the investigation of high-speed analog circuits with an emphasis on digital-friendly architectures for integrated system-on-chip applications. Students investigate the relationship between matching network design and noise figure characterization in RF front-ends. Evaluation of these circuit frameworks identifies the technical trade-offs between power consumption, linearity, and operating frequency. Systematic inquiry into advanced electronic design provides a framework for the development of high-speed telecommunication and data acquisition hardware.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5353. Fundamentals of Advanced Semiconductor Technology.
This course examines the fundamental concepts and evolutionary trends of advanced semiconductor device technology within the context of global scaling limits. Students analyze the progression of Moore's Law and the physical constraints of MOSFET and CMOS scaling. Inquiry focuses on the implementation of high-K gate dielectrics and the characterization of new channel materials intended to replace traditional silicon substrates. Students examine the transition from planar to three-dimensional architectures, such as FinFET and gate-all-around structures. Analysis includes the study of compound semiconductor devices and their performance in high-frequency and high-power applications. Students investigate the relationship between material properties and carrier transport in nanometer-scale transistors. Evaluation of these emerging technologies identifies the technical challenges of maintaining performance gains in post-silicon electronics. Systematic inquiry into semiconductor physics provides a framework for the development of next-generation integrated circuits.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5354. Flexible Electronics.
This course examines the materials systems, fabrication processes, and device physics of flexible electronic architectures. Students analyze the properties of semiconductor materials, including amorphous silicon, nanocrystalline silicon, and organic or polymeric substrates. Inquiry focuses on the application of solution-cast films, such as carbon nanotubes, and their role in achieving mechanical flexibility. Students examine the operational principles of high-speed transistors, thin-film photovoltaics, and flexible flat-panel displays. Analysis includes the study of medical image sensors and other integrated flexible systems to evaluate performance under mechanical strain. Students investigate the relationship between material deposition techniques and the functional reliability of conformable electronic devices. Evaluation of these emerging technologies identifies the technical challenges of integrating non-rigid components into modern electronic platforms. Systematic inquiry into flexible electronics provides a framework for the development of next-generation wearable and portable technologies.
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 examines the theoretical concepts and functional properties of advanced electronic materials and their applications in modern microelectronic systems. Students analyze the physics of dielectrics and oxide semiconductors to evaluate their role in charge storage and carrier transport. Inquiry focuses on the unique characteristics of ferroelectric, pyroelectric, and piezoelectric materials to determine their response to electric fields, thermal gradients, and mechanical stimuli. Students examine the operational principles of magnetic, multifunctional, and multiferroic materials within integrated device architectures. Analysis includes the investigation of modern novel technologies based on these materials, including high-density sensors, actuators, and non-volatile memory components. Students investigate the relationship between material morphology and the resulting electrical, magnetic, and optical functionalities. Evaluation of these complex material systems identifies the technical challenges of integrating smart materials into high-performance electronic platforms. Systematic inquiry into material science provides a framework for the development of next-generation multifunctional devices.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5357. Power Systems for Engineering.
This course examines the analysis of electrical power system components and the operational principles of interconnected energy networks. Students analyze the mechanics of power generation and the functional role of transformer action within high-voltage distribution systems. Inquiry focuses on transmission line modeling and the application of symmetrical components to evaluate system stability under unbalanced conditions. Students examine real and quadrature power calculations alongside methodologies for power factor correction to optimize energy efficiency. Analysis includes the implementation of load flow algorithms to determine voltage regulation and power distribution across complex grid architectures. Students investigate the economic considerations of system operations, including optimal resource dispatch and the management of generation assets. Evaluation of these power system elements identifies the technical constraints of maintaining grid reliability and stability. Systematic inquiry into power engineering provides a framework for the development of modern and sustainable energy infrastructures.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5360. Thin Film Technology.
This course examines the theoretical and practical aspects of thin film technology and its application in modern microelectronic and optoelectronic devices. Students analyze the design and fabrication of thin film heterostructures to evaluate material interface properties and device performance. Inquiry focuses on the physical mechanisms of growth and nucleation in epitaxial thin films to determine structural and electronic characteristics. Students examine the deposition of films with diverse properties and the realization of devices that integrate multifunctional characteristics. Analysis includes the study of physical and chemical vapor deposition techniques alongside the characterization of film morphology and crystallinity. Students investigate the relationship between process parameters and the resulting functional reliability of thin film systems. Evaluation of these fabrication methodologies identifies the technical challenges of developing high-performance thin film architectures. Systematic inquiry into thin film science provides a framework for the development of advanced solid-state and nanotechnology-based devices.
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 examines the theoretical and application-based principles of advanced networking through the study of modern computer and data architectures. Students analyze communication networks using mathematical treatments, including queuing theory and random processes, to evaluate system performance and resource allocation. Inquiry focuses on the design and implementation of network architectures and the technologies that define high-speed data exchange. Students examine the protocols and algorithms governing packet switching, traffic management, and quality of service within heterogeneous environments. Analysis includes the investigation of network delay models, throughput optimization, and the impact of stochastic variables on link reliability. Students investigate the relationship between physical layer constraints and upper-layer application requirements in distributed systems. Evaluation of these networking frameworks identifies the technical trade-offs between latency, scalability, and security in modern infrastructures. Systematic inquiry into advanced networking provides a framework for the development of robust and efficient information systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5374. Advanced Wireless Communication.
This course examines the principles and analytical frameworks required for the design and evaluation of cellular and advanced wireless communication systems. Students analyze radio frequency (RF) propagation modeling and the mathematical characterization of fast and slow fading environments. Inquiry focuses on the implementation of modulation and demodulation techniques to optimize spectral efficiency and signal integrity. Students examine the role of channel coding in ensuring reliable data transmission across stochastic wireless channels. Analysis includes the study of multiple access techniques, such as TDMA, FDMA, and CDMA, alongside modern orthogonal frequency-division multiplexing paradigms. Students investigate the relationship between signal-to-noise ratios and system capacity in multi-user environments. Evaluation of these wireless frameworks identifies the technical trade-offs between coverage, mobility, and data throughput. Systematic inquiry into communication theory provides a framework for the development of next-generation mobile networks and satellite systems.
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 examines the development of functional applications for the smart grid and the mathematical modeling of system performance through stochastic simulations. Students analyze energy informatics and smart metering infrastructures to evaluate data-driven energy management strategies. Inquiry focuses on the implementation of home energy management systems and demand response protocols to optimize grid stability. Students examine the mechanics of load disaggregation and the integration of APIs and OpenData into application platforms. Analysis includes the application of optimization and control theory alongside machine learning algorithms to address dynamic energy demands. Students investigate the relationship between stochastic processes and the reliability of distributed energy resources. Evaluation of these application platforms identifies the technical trade-offs between computational overhead and grid responsiveness. Systematic inquiry into smart grid architectures provides a framework for the development of intelligent and resilient power distribution systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5377. Statistical Signal Processing.
This course examines the theoretical and applied principles of random processes within the context of linear systems and transform theory. Students analyze discrete and continuous-time signals using probability theory to evaluate the behavior of stochastic systems. Inquiry focuses on the application of random processes to estimation and detection theory for signal characterization. Students examine the mathematical frameworks of information and communication theory to determine channel capacity and data integrity. Analysis includes the study of optimal filtering and control strategies under conditions of uncertainty and noise. Students investigate the relationship between spectral density and the performance of signal processing algorithms. Evaluation of these statistical models identifies the technical trade-offs between computational complexity and estimation accuracy. Systematic inquiry into stochastic systems provides a framework for the development of advanced communications and automated control platforms. 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 5380. Advanced Electric Machines.
This course examines the advanced principles of electromechanical energy conversion and the mathematical analysis of rotating electrical machinery. Students analyze electromagnetic field interactions and the fundamental laws governing motor and generator dynamics. Inquiry focuses on the development of high-fidelity analytical models to predict transient and steady-state device performance. Students examine the design and operational physics of major classes of electric machines, including synchronous, induction, and permanent magnet architectures. Analysis includes the study of magnetic circuit modeling, winding configurations, and the impact of non-linear material properties on torque production. Students investigate the relationship between energy efficiency, thermal constraints, and power density in complex electromechanical systems. Evaluation of these design frameworks identifies the technical trade-offs between speed-torque characteristics and system control requirements. Systematic inquiry into advanced machine theory provides a framework for the development of modern electric propulsion and industrial automation systems.
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 principles of sustainable energy conversion and the technical frameworks of advanced storage technologies. Students analyze the operational physics of solar, wind, and geothermal systems to evaluate power generation capacity and efficiency. Inquiry focuses on the integration of variable renewable resources into modern electrical grids and the impact on system stability. Students examine the mechanics of electrochemical batteries, gravitational storage, and hybrid energy systems to determine discharge characteristics. Analysis includes the study of energy density, lifecycle assessment, and the thermodynamic limits of conversion processes. Students investigate the relationship between energy demand profiles and the scalability of distributed generation infrastructures. Evaluation of these sustainable frameworks identifies the technical trade-offs between environmental impact, cost, and grid reliability. Systematic inquiry into energy storage and production provides a framework for the development of resilient and carbon-neutral power systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5382. Advanced Power Systems Analysis.
This course examines the principles of power system analysis and the operational dynamics of interconnected electrical networks through the study of technical case studies and peer-reviewed literature. Students analyze symmetrical and unsymmetrical faults to evaluate system response and protection requirements using symmetrical component theory. Inquiry focuses on the implementation of protection schemes and the integration of Supervisory Control and Data Acquisition (SCADA) frameworks for real-time monitoring. Students examine transient stability and the power-angle relationship to determine grid resilience against sudden disturbances. Analysis includes the investigation of transient operations on transmission lines and the mechanics of surge propagation. Students investigate the relationship between fault analysis, relay coordination, and the reliability of high-voltage infrastructures. Evaluation of these power system elements identifies the technical trade-offs between protection sensitivity and grid stability. Systematic inquiry into power dynamics provides a framework for the development of secure and resilient energy systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

Industrial Engineering (IE)

IE 5310. Advanced Statistical Design of Experiments for Engineers.
This course examines advanced methods in the statistical design and analysis of experiments for engineering applications. Topics include full and fractional factorial designs, response surface methodology, optimal and robust design strategies, random and mixed factor experiments, and industrial experimentation techniques. Emphasis is placed on experimental optimization, model adequacy evaluation, and application of DOE methodologies to complex manufacturing and service systems. Students develop advanced experimental strategies to improve system performance and reliability. By the end of the course, students will be able to design advanced experimental frameworks and critically evaluate engineering experimentation outcomes. 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 examines methods for modeling and analyzing manufacturing systems. Topics include sustainable production systems, material handling operations, scheduling methods, and supply chain coordination. Analytical and quantitative models are used to evaluate production flow, resource utilization, and system performance in manufacturing environments. The course analyzes how modeling techniques support decision-making in production planning and operational management. Emphasis is placed on identifying system inefficiencies, evaluating alternative production strategies, and improving productivity, cost efficiency, and sustainability across manufacturing and supply chain processes.
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. Main subjects include parametric lifetime models such as exponential, Weibull, lognormal and gamma distribution for components and systems, reliability block diagram for series, parallel, series-parallel, k-out-of-n active redundancy and networks, accelerated life testing and proportional hazard rate model, stress and strength interference model, failure-in-time and design for reliability, preventive and condition-based maintenance, repairable parts inventory, and Markov decision process with applications in predictive maintenance. 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

IE 5340. Applied Deterministic Operations Research for Engineers.
This course covers mathematical modeling and computational methods for linear and integer programming in engineering applications. The course presents solution techniques and concepts, including graphical solution, simplex method, duality theory, sensitivity analysis, and branch-and-bound method. Instructional methodology comprises lectures and hands-on computational experiences using Python and multiple contemporary optimization software. Applications are drawn from areas such as manufacturing, service systems, supply chain, healthcare operations and transportation. By the end of the course, students should be able to formulate and solve engineering problems using linear and integer programming methods and report on the results in applied contexts.
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 mathematical modeling and computational methods for nonlinear programming problems in engineering applications. The course presents techniques for optimizing unconstrained and constrained nonlinear models. Instructional methodology includes lectures and hands-on computational experiences using Python and multiple contemporary nonlinear optimization software. Students examine how problem structure affects tractability and solution quality and present results in a technical report. By the end of the course, students should be able to formulate and solve engineering problems using nonlinear programming approaches and evaluate solution performance in applied contexts.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5345. Advanced Optimization.
This course examines advanced optimization techniques, including decomposition methods for linear and integer programming as well as multiobjective, stochastic and dynamic programming models. Emphasis is placed on analyzing how model structure and decomposition strategies influence computational tractability and solution quality. Applications are drawn from areas such as manufacturing, supply chain, healthcare operations and energy systems. Instruction includes lectures, case studies, and hands-on computational experiences using Python and contemporary optimization software. By the end of the course, students should be able to design advanced models and decomposition methods for solving large-scale linear and integer programs in applied contexts. 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 examines heuristic and metaheuristic optimization techniques with an emphasis on real world engineering applications. Methods that search beyond local optima, including simulated annealing, tabu search, genetic algorithms, ant colony systems, and particle swarm optimization, are studied and applied to practical problems such as scheduling, routing, logistics, and resource allocation. The course addresses problem specific heuristic design, performance evaluation, and serial and parallel implementations. Students analyze selected research papers and conduct computational experiments to assess solution quality and computational efficiency. Emphasis is placed on applying heuristic methods to large scale optimization problems where exact algorithms are impractical. The course is intended for advanced undergraduate students in engineering and related fields.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 5360. Advanced Inventory Control.
This course introduces advanced analytical approaches used in inventory management within industrial and supply chain settings. Students examine quantitative forecasting methods, inventory policy design, and optimization techniques that support data#informed decision#making. Emphasis is placed on evaluating model assumptions, comparing alternative strategies, and interpreting system behavior in environments characterized by uncertainty and variable demand. Through case#based and computational exercises, students apply analytical tools to assess the performance of different inventory systems. The course provides a foundation for understanding how inventory models support operational planning and production efficiency without endorsing specific managerial or policy choices. 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 examines advanced scheduling methodologies and the analytical frameworks used to model and optimize production and service systems. Students study deterministic and stochastic scheduling models across single#machine, multi#machine, job shop, flow shop, and multi#echelon environments. Emphasis is placed on evaluating theoretical foundations, comparing alternative solution approaches, and applying mathematical and computational tools to realistic industrial engineering problems. Through structured problem#solving and model#based analysis, students gain experience formulating scheduling problems, assessing algorithmic performance, and interpreting results to support decision#making in complex operational settings. 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 explores the strategic design and management of complex, large-scale systems and their interdependencies within a "systems of systems" framework. The scope encompasses the entire lifecycle, from initial needs analysis and concept definition to final integration and evaluation. Students will apply systems thinking methodologies to model and solve multi-disciplinary engineering challenges. Upon completion, participants will be equipped to lead technical projects using standardized systems engineering processes to ensure operational efficiency and resilience. 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

Manufacturing Engineering (MFGE)

MFGE 5315. Energy and Thermofluids Engineering.
This course provides an advanced study of energy and thermofluids engineering based on fundamental principles of fluid mechanics, thermodynamics, and heat transfer. The scope includes properties of pure substances, fluid statics and dynamics, non-Newtonian fluids, differential analysis of fluid flow, viscous flow in pipes, external flows, boundary layers, open channel flows, control volume analysis of mass and energy, first and second laws of thermodynamics, steady and transient conduction, forced and natural convection, radiation, and mass transfer. The course is delivered through lectures, problem-solving sessions, and applied engineering examples. By the end of the course, students are expected to analyze thermofluid systems and apply principles to optimize energy-related processes.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5316. Advanced Computer Aided Design and Manufacturing.
This course provides an advanced study of Computer Aided Design and Manufacturing (CAD/CAM) with emphasis on theoretical and practical aspects of modeling and multi-axis manufacturing. The scope includes design processes, theoretical foundations of CAD modeling, mathematical representation of wireframe, surface, and solid models, geometric transformations and object manipulation, process planning, fundamentals of 2-, 3-, and 5-axis CNC milling operations, CNC code generation, and waterjet machining. The course is delivered through lectures, software exercises, and applied projects. By the end of the course, students are expected to develop complex CAD models and generate CNC programs for advanced manufacturing processes.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5318. Additive Manufacturing.
This course provides an advanced study of additive manufacturing (AM) theory, techniques, and applications with emphasis on research-level understanding and system integration. The scope includes CAD standards, process physics, material behavior, photopolymerization, powder bed fusion, extrusion-based systems, sheet lamination, beam deposition processes, design for additive manufacturing (DfAM), and safety considerations. Students critically examine process–structure–property relationships, parameter optimization, and emerging developments in AM technologies. The course is delivered through lectures, technical literature review, hands-on activities, and analytical projects. By the end of the course, students are expected to evaluate, optimize, and develop additive manufacturing strategies for advanced engineering applications.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5320. Polymer Nanocomposites.
This course provides an advanced study of polymer nanocomposites with emphasis on materials, manufacturing, characterization, and engineering applications. The scope focuses primarily on nanofilled polymer composites, covering morphological, thermal, mechanical, and electrical characterization techniques. Applications such as magnetic, low thermal expansion, fire-resistant, ablative, fatigue-resistant and bio-based composites are explored. The course is delivered through lectures, laboratory exercises, literature review, and applied problem-solving projects. By the end of the course, students are expected to evaluate material properties, optimize manufacturing processes, and design nanocomposite systems for advanced engineering applications.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5326. Advanced Robotics in Manufacturing Automation.
This course explores advanced principles and techniques in robotics for manufacturing automation. Topics include industrial robotics, robot kinematics and dynamics, path planning, advanced and force control, sensors and actuators, mobile robotics, and an introduction to nanorobotics. Emphasis is placed on analytical modeling, simulation, and implementation of robotic systems in automated manufacturing environments. Students engage in problem-solving and system-level evaluation to assess robotic performance. Upon completion, students will be able to analyze, design, and evaluate advanced robotic systems for complex manufacturing applications. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5330. Semiconductor Manufacturing.
This course focuses on the principles, processes, and technologies involved in modern semiconductor manufacturing. Students will explore the fundamental physics, materials science, and integrated circuit manufacturing. Topics include crystal growth and wafer preparation, photolithography, thin-film deposition, doping and ion implantation, etching techniques, oxidation, planarization, cleanroom protocols, and contamination control. The course also introduces trends in microelectromechanical (MEMS) devices and design issues for fabrication of micro and nano-systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5367. Polymer Matrix Composites.
This course develops students' ability to explain, analyze, and evaluate composite materials formed by combining polymer matrices with reinforcing fibers. Students analyze how material structure and processing methods affect physical and mechanical properties and evaluate materials and manufacturing techniques for aerospace, automotive, and related applications. Emphasis is placed on comparing and selecting composite processing methods—including vacuum bag molding, lay up, resin transfer molding, compression molding, filament winding, pultrusion, and automated fiber placement—based on design, quality, and testing considerations. An introductory application of micromechanics supports material selection and design decisions.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5395. AI-Based Manufacturing.
This course focuses on the integration of artificial intelligence (AI) and emerging technologies within modern manufacturing systems, emphasizing Industry 4.0 and Industry 5.0 frameworks. Students explore the application of AI, cybersecurity, data analytics, augmented and virtual reality, digital twins, cyber-physical systems, and programmable logic controllers (PLCs) in advanced manufacturing environments. Emphasis is placed on system integration, intelligent automation, and data-driven decision making. Students develop the ability to design, evaluate, and manage adaptive, secure, and resilient manufacturing systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter