

The Master of Science in Industrial and Business Operations Engineering (thesis option) prepares competent professionals with analytical skills and cutting-edge research experience in data-driven modeling, mathematical problem-solving, and statistical analysis applicable to industry, service and business operations. Students align their interests with a curriculum emphasizing data science, advanced prescriptive analytics/operations research, resilient supply chain, sustainable operations, and systems engineering areas.

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#wave>). 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.

Program Requirements

- baccalaureate degree in industrial engineering, computer science, mathematics, mechanical engineering, 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 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

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 Industrial and Business Operations Engineering requires 31 semester credit hours, including a thesis.

Non-credit (leveling) course work may be required prior to admission into the program if the applicant lacks 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.

Code	Title	Hours
Required Courses		
ENGR 5100	Seminar in Engineering	1
IE 5310	Advanced Statistical Design of Experiments for Engineers	3
IE 5320	Modeling and Analysis of Manufacturing Systems	3
IE 5330	Advanced Quality Control and Reliability Engineering	3
IE 5340	Applied Deterministic Operations Research for Engineers	3
IE 5347	Advanced Heuristic Optimization	3
Prescribed Electives		9-6
EE 5331	Machine Learning for Engineering Applications	
MMIE 7310	Machine Learning and Artificial Intelligence for Engineers	
MMIE 7317	Applied Data Science I	
MMIE 7318	Applied Data Science II	
IE 5343	Non-Linear Optimization Techniques for Engineers	
IE 5345	Advanced Optimization	
IE 5397	System Thinking and Analysis	
MMIE 7362	Time Series Analysis and Forecasting	
MMIE 7367	Large-Scale Optimization	
MMIE 7370	Stochastic Simulation	
MMIE 7372	Network Flow Optimization	
MMIE 7374	Multi-Objective Optimization	
IE 5360	Advanced Inventory Control	
IE 5370	Scheduling	
MMIE 7379	Modeling and Design of Net-Zero Manufacturing and Service Enterprises	
Open Electives		0-3
BLAW 5333	Legal Issues of Sustainability and Responsibility	
ISAN 5355	Database Management Systems	
ISAN 5357	Computing for Data Analytics	
ISAN 5358	Agile Project Management For Business Professionals	
ISAN 5370	Enterprise Resource Planning and Business Intelligence	
MGT 5310	Organizational Change Management	
MGT 5311	Process Improvement Management in Organizations	
MGT 5315	New Venture Management	
MGT 5318	Cross-Cultural Management	
MGT 5321	Supply Chain Management	
MGT 5390	Managerial Data Analysis	
TECH 5315	Engineering Economic Analysis	

TECH 5382	Industrial Ecology and Sustainability Engineering	
CS 5316	Data Mining	
CS 5326	Advanced Studies in Human Factors of Computer Science	
CS 5332	Database Theory and Design	
CS 5334	Advanced Internet Information Processing	
CS 5346	Advanced Artificial Intelligence	
CS 5351	Parallel Processing	
MATH 5315		
MATH 5345		
MATH 5360	Mathematical Modeling	
ENGR 5384	Problems in Engineering	
ENGR 5310	Probability, Random Variables, & Stochastic Processes for Engineers	
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	
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship	
MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	
Thesis		6
ENGR 5399A	Thesis	
ENGR 5199B	Thesis	
ENGR 5299B	Thesis	
ENGR 5399B	Thesis	
ENGR 5599B	Thesis	
Total Hours		31

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 and Industrial Engineering: ENGR (<http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/industrial-business-operations-thesis-ms/#ENGR>), IE (<http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/industrial-business-operations-thesis-ms/#IE>)

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

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