The Doctor of Philosophy degree with a major in Mechanical and Manufacturing Engineering (MME) program is student-focused, multi-disciplinary, and collaborative. Applicants with a B.S. or M.S. degree in Mechanical Engineering, Manufacturing Engineering, Industrial Engineering, or closely related fields, are the main audience for this program.

Educational Objectives

- Application of disruptive technologies in the fields of mechanical and manufacturing engineering (MME).

  Although these new skillsets are in high demand by industry and government sectors, they are rarely covered in a holistic way in conventional graduate programs in mechanical, manufacturing, or industrial engineering programs. By providing series of prescribed electives and depth courses in the curriculum, students will get an applied exposure to these technologies.

- Depth in the conventional MME fields.

  The core courses and a set of prescribed electives will give required depth skills in conventional topics to students while elective courses provide cross-disciplinary and breadth exposure to other fields. These courses will also familiarize students with literature in the discipline.

- Development of professional skills to pursue career paths in academia, industry, or start-up companies dealing with or developing advanced or emerging technologies.

  Courses related to commercialization and entrepreneurship and an elective course provide choices to students to enhance their professional skills and improve their employability in their desired career path.

Application Requirements

The items listed below are required for admission consideration for applicable semesters of entry during the current academic year. Submission instructions, additional details, 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). International students should review the International Admission Documents page (http://mycatalog.txstate.edu/graduate/admission-documents/international/) for additional requirements.

- completed online application
- $55 non-refundable application fee

  or

- $90 non-refundable application fee for applicants with international credentials
- exceptional applicants with a bachelor's degree in mechanical engineering, manufacturing engineering, industrial engineering, or a closely related discipline, from a regionally accredited university will be considered for admission. These exceptional applicants will be required to complete an additional 24 semester credit hours of mechanical, manufacturing, or industrial engineering master's level courses when admitted.
- official transcripts from **each institution** where course credit was granted
- GRE scores are not required for applicants with a minimum 3.5 GPA (on a 4.0 scale) in all completed undergraduate course work.
- GRE scores (general test only) required for applicants with GPA less than 3.5 on all completed undergraduate course work*
- resume/CV outlining education, work experience, scholarships/grants, publications/presentations, and other accomplishments
- statement of purpose outlining the applicant's personal history and goals that are relevant to obtaining this doctoral degree and explaining why the applicant wants to purse this degree at TXST
- three letters of recommendation evaluating the applicant's skill and potential for the degree program
- interviews may be conducted with semifinalists as part of the admission process.

TOEFL, PTE, IELTS or Duolingo Scores

Non-native English speakers who do not qualify for an English proficiency 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 these scores are not met.

Additional Information:

A committee that includes the doctoral program director will conduct a holistic review of all applications. Students will be assessed for readiness to enroll in our doctoral program based on their background in mechanical engineering, manufacturing engineering, or industrial engineering, interest in our program and faculty research, and potential for research.

The program will admit full-time and part-time students one time per year.

Degree Requirements

The Doctor of Philosophy (Ph.D.) degree with a major in Mechanical and Manufacturing Engineering requires 79 semester credit hours.

Course Requirements

Code	Title	Hours
Required Courses		
MMIE 7305	Advanced Design of Experiments	3
MMIE 7310	Machine Learning and Artificial Intelligence for Engineers	3
MMIE 7340	Advanced Computer Aided Engineering	3
MMIE 7100	PhD Seminar	1
Prescribed Electives		
Entering with a Bachelor's		
Choose 24 hours from the following or other courses with the approval of the program coordinator: [1]		24

ENGR 5310	Probability, Random Variables, & Stochastic Processes for Engineers	
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	
IE 5398A		
IE 5398B		
IE 5398C		
ME 5310	Continuum Mechanics	
ME 5312	Mechanics of Composite Materials	
MFGE 5315	Energy and Thermofluids Engineering	
MFGE 5316	Advanced Computer Aided Design and Manufacturing	
MFGE 5318	Additive Manufacturing	
MFGE 5320	Polymer Nanocomposites	
MFGE 5326	Advanced Robotics in Manufacturing Automation	
MFGE 5330	Multiscale Manufacturing	
MFGE 5398B	Advanced Composite Materials	
Disruptive Technologies		
Choose a 6 hours from the following:		6
MMIE 7311	Cyber-Physical Systems Architecture	
MMIE 7312	Digital Twins	
MMIE 7313	Advanced Robotics	
MMIE 7314	Human-Robot Interaction	
MMIE 7315	Advanced Additive Manufacturing	
MMIE 7316	Cybersecurity for Mechanical and Manufacturing Systems	
MMIE 7317	Applied Data Science I	
MMIE 7318	Applied Data Science II	
Commercialization and Entrepreneurship		
Choose 6 hours from the following:		6
MGT 7314	Organizational Behavior and Theory	
MKT 7321	Marketing Management	
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship	
MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	
MSEC 7325	Principles of Technical Project Management	
Domain (Depth)		
Choose 6 hours from the following:		6
MMIE 7311	Cyber-Physical Systems Architecture	
MMIE 7312	Digital Twins	
MMIE 7313	Advanced Robotics	
MMIE 7314	Human-Robot Interaction	
MMIE 7315	Advanced Additive Manufacturing	
MMIE 7316	Cybersecurity for Mechanical and Manufacturing Systems	
MMIE 7317	Applied Data Science I	
MMIE 7318	Applied Data Science II	
MMIE 7320	Advanced Solid Mechanics	
MMIE 7322	Advanced Fluid Mechanics	
MMIE 7324	Advanced Heat Transfer	
MMIE 7326	Advanced Mechanical System Control	
MMIE 7330	Advanced Finite Element Analysis	
MMIE 7332	Computations in Fluid Mechanics and Heat Transfer	
MMIE 7341	Advanced Micro and Nano Manufacturing	
MMIE 7342	Advanced Polymer Nanocomposites	
MMIE 7362	Time Series Analysis and Forecasting	
MMIE 7367	Database Analytics for Web-Based Optimization	
MMIE 7370	Stochastic Simulation	
MMIE 7372	Network Flow Optimization	
MMIE 7374	Applications of Data Science in Multi-Objective Optimization	
MMIE 7379	Modeling and Design of Net-Zero Manufacturing and Service Enterprises	
Choose 3 hours from the following:		3
BIO 7360Y	Applied Bioinformatics	
BIO 7405	Statistics and Experimental Design I	
BIO 7406	Statistics and Experimental Design II	
CI 7351	Beginning Quantitative Research Design and Analysis	
CI 7353	Intermediate Quantitative Research Design and Analysis	
CI 7354	Intermediate Qualitative Design and Analysis	
CS 7312	Advanced Data Mining	
CS 7313	Advanced Machine Learning and Pattern Recognition	
CS 7314	Bioinformatics	
ED 7359	Seminar in Quantitative Research	
ENG 7314	Specializations in Professional and Technical Communication Topics	
MATH 7325	Statistics 1	
MATH 7335	Statistics II: Linear Modeling	
MSEC 7310	Nanoscale Systems and Devices	
MSEC 7310	Nanoscale Systems and Devices	
MSEC 7311	Materials Characterization	
MSEC 7320	Nanocomposites	
MSEC 7340	Biomaterials and Biosensors	
MSEC 7355	Fluid Flow in Porous Media	
MSEC 7360	Nanomaterials Processing	
MSEC 7370	Advanced Polymer Science	
MSEC 7395C	Materials for Sustainable Energy	
MSEC 7395D	Polymer Characterization and Processing	
MSEC 7395I	Structure and Properties of Alloys	
MSEC 7395L	Advanced Solid State Physics	
MSEC 7395M	Semiconductor Devices and Processing	
Dissertation		

Choose a minimum of 24 hours from the following:		24
MMIE 7199	Dissertation	
MMIE 7299	Dissertation	
MMIE 7399	Dissertation	
MMIE 7599	Dissertation	
MMIE 7699	Dissertation	
MMIE 7999	Dissertation	
Total Hours		**79**

[1] Other ENGR, CE, EE, MSEC courses maybe be taken to satisfy this requirement. Please contact your advisor for approval.

Candidacy Criteria

Students will advance to candidacy after they have completed all required and elective coursework (except for dissertation credit hours), passed their comprehensive exam, and successfully defended their dissertation proposal. Students are expected to complete their dissertation proposal by the end of year 2 if starting from an M.S. degree or by the end of year 3 if starting from a B.S. degree. Appropriate adjustments are made if students are part-time students. Once all requirements are met, the doctoral program director will forward the Application for Advancement to Candidacy form to the Dean of The Graduate College for review and approval.

Comprehensive Exam

Each doctoral student must pass a comprehensive examination. This should be done by the time the student has completed 37 semester credit hours if starting from an M.S. degree or 61 semester credit hours if starting from a B.S. degree and can only be done after identifying the dissertation committee and completing all required courses.

The comprehensive exam will be a written take-home exam. The dissertation committee will provide the student with a list of topics for the comprehensive exam. The topics in the list will be based on graduate courses that the student took at Texas State University. The exam will have four questions and the student will have 24 hours to complete the exam. Members of the dissertation committee will grade the exam questions. The answer to each question will be graded as satisfactory or unsatisfactory. To pass the exam, the student must receive a satisfactory grade in all the exam questions. Any student who does not pass the comprehensive exam by the time 45 semester credit hours have been accrued if starting from an M.S. degree or 69 semester credit hours have been accrued if starting from a B.S. degree will be dismissed from the program. If any section(s) of the comprehensive exam is not passed, the student will have the option of retaking the section(s) they failed a second and final time in the following long semester. Students will be dismissed from the program if they do not pass all sections of the comprehensive exam the second time.

Dissertation Proposal and Proposal Defense

Each Ph.D. student must prepare a written dissertation proposal and defend it orally. This should be done by the time the student has completed 37 semester credit hours if starting from an M.S. degree or 61 semester credit hours if starting from a B.S. degree and after identifying the dissertation committee and completing all required courses. Any student who does not defend his/her dissertation proposal by the time 45 semester credit hours have been accrued if starting from an M.S. degree or 69 semester credit hours have been accrued if starting from a B.S. degree will be dismissed from the program. If the proposal defense is not passed, the student will have the option of taking a second and final proposal defense in the following long semester. Students will be dismissed from the program if they do not pass the proposal defense the second time.

The dissertation proposal must outline the substance and scope of the planned dissertation research and explain its merits. It must include at least an introduction, the methodology to be used, a survey of the relevant literature, and preliminary results that demonstrate the feasibility. The goal of the proposal is to establish that the student has a sufficient grasp of the fundamentals of the chosen dissertation topic to execute the research.

The proposal defense entails a public presentation of the student's dissertation proposal followed immediately by a closed defense of the proposal attended only by the student and his/her dissertation committee. The dissertation proposal must be approved by the student's dissertation advisor and a majority of the remaining members on the dissertation committee. The student's dissertation committee members must indicate their approvals on the doctoral Dissertation Proposal Form as well as on the Defense of Dissertation Proposal Form. These forms are available on The Graduate College's website.

A final copy of the dissertation proposal, accompanied by the signed approval forms, must be turned in to the doctoral program director, who will forward them to the Dean of The Graduate College for review and final approval.

Candidacy and Dissertation

When all requirements for admission to candidacy have been met, the doctoral program director forwards the Application for Advancement to Candidacy to the Dean of The Graduate College for review and approval. This application form is available on The Graduate College's website.

A minimum GPA of 3.0 on all coursework undertaken in the doctoral program is required for admission to candidacy. Grades below a "B" on any graduate coursework cannot be applied toward the doctoral degree. Incomplete grades must have been cleared before approval for advancement to candidacy can be granted. No more than six semester credit hours of dissertation research can be taken before advancing to candidacy. No credit will be applied toward a student's doctoral degree for coursework completed more than five years before the date on which the student is admitted to candidacy if starting from an M.S. degree or more than seven years if starting from a B.S. degree. Appropriate time adjustments are made for part-time students. This time limit applies to course credit earned at Texas State as well as course credit transferred to Texas State from other institutions.

All doctoral students must complete a dissertation that consists of original research and demonstrates mature scholarship and critical judgment in addition to familiarity with tools and methods in the chosen area. The dissertation project must adhere to the dissertation proposal and cover the topic approved by the student's dissertation committee.

After being admitted to candidacy, students must be continuously enrolled for dissertation hours each fall and spring semester until the defense of their dissertation. At least 24 semester credit hours of dissertation research must be taken after having advanced to candidacy. If a student is receiving supervision on a dissertation during the summer or if the student is graduating in the summer, the student must be enrolled in dissertation hours for the summer. All candidates for graduation must be enrolled in dissertation hours during the semester in

which the degree is to be conferred, even if they have already satisfied the minimum dissertation hours.

Dissertation Committee

The initial dissertation committee chair assignment, and its continuation, is subject to the approval of both parties. A dissertation committee chair can be changed with the approval of a student's assigned dissertation committee chair, a student's new dissertation committee chair, and the doctoral program director. If a dissertation committee chair withdraws mentorship, the student must secure a new dissertation committee chair within one long semester to stay on track in the program. Failure to do so will result in dismissal from the program.

The Dissertation Committee will be responsible for administering the Comprehensive Exam and the Dissertation Proposal Defense and will oversee the research and writing of the student's dissertation. The committee will consist of 5 members, including the student's dissertation committee chair who must be a regular graduate faculty member in the program, three other graduate faculty members from the Ingram School of Engineering (note that the majority of faculty members must come from the program), and one graduate faculty from another department at Texas State University or from another university, or a Ph.D. holder in industry or a government agency. The student's dissertation committee chair will chair the committee. The student, the dissertation committee chair, and the Dean of The Graduate College will approve the composition of the dissertation committee.

As per The Graduate College policy, the Dissertation Committee Chair Assignment form and the Dissertation Committee Request form must be completed and approved by the Dean of The Graduate College to form the dissertation committee. Any changes to the dissertation committee must be submitted using the Dissertation Committee Chair/Committee Member Change Request form for approval of the dissertation committee chair, the doctoral program director, and the Dean of The Graduate College. Committee changes must be submitted no later than 60 days before the dissertation defense.

Dissertation Defense

Once the dissertation has been completed, a final exam (referred to as the dissertation defense) on the dissertation must be conducted. The dissertation defense cannot be scheduled until all other academic and program requirements have been fulfilled. A complete draft of the dissertation must be given to the members of the dissertation committee at least one month before the defense. However, students are highly encouraged to provide drafts earlier so that the committee members can provide feedback, which the student, in consultation with the dissertation advisor, will address in later drafts to ensure that the dissertation is defendable, and each committee member is satisfied before the dissertation defense takes place.

The dissertation defense consists of two parts. The first part is a public presentation of their dissertation research. The second part of the defense immediately follows the public presentation. It is restricted to participation of the student's dissertation committee and entails an oral examination of the dissertation research. Approval of the dissertation requires positive votes from the student's dissertation advisor and from the majority of the remaining members of the dissertation committee. Notice of the defense presentation will be publicly posted at least two weeks in advance.

If the dissertation defense is not approved, the student will have the option of taking a second and final dissertation defense in the following long semester. Students who do not pass the dissertation defense the second time will be dismissed from the program.

The results of the dissertation defense must be recorded in the Dissertation Defense Report Form and submitted to The Graduate College before the Dean of The Graduate College can give final approval of the dissertation. This form can be downloaded from The Graduate College's website. The student must submit his/her dissertation to The Graduate College for final approval. The guidelines for submission and approval of the dissertation can be obtained from The Graduate College.

Students must pass the dissertation defense by the time 30 semester credit hours of dissertation have been accrued. The doctoral program will review each student annually to ascertain his/her progress towards the degree and will consult the student's dissertation advisor and dissertation committee on this matter as needed.

Doctoral level courses in Mechanical and Manufacturing Engineering: MMIE (p. 4)

Courses Offered

Mechanical and Manufacturing Engineering (MMIE)

MMIE 7100. PhD Seminar.
This course provides information regarding the resources that are available to the students in the mechanical and manufacturing engineering Ph.D. program for finding literature, using labs and facilities, selecting research topic and advisor, copyright and plagiarizing, and technical writing. It is expected that by the end of this course, students can select their advisor and research topic and write and present a literature review on the topic.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MMIE 7199. Dissertation.
This course consists of original research and writing in mechanical and manufacturing engineering to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MMIE 7299. Dissertation.
This course consists of original research and writing in mechanical and manufacturing engineering to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MMIE 7305. Advanced Design of Experiments.
This course teaches students to plan, design and conduct experiments efficiently and effectively, and to analyze the resulting data for obtaining valid conclusions. Students use computer experiments and software tools to optimize manufacturing, energy and service operations based on both deterministic and stochastic models. Topics include full and fractional factorial designs, blocking and confounding design, regression model, response surface method and design, and robust parameter design or Taguchi method. Through the course project, students apply the optimal design methodology to improve a real manufacturing or service process.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7310. Machine Learning and Artificial Intelligence for Engineers.
This course examines fundamental artificial intelligence and machine learning techniques useful for developing intelligent software tools to support engineering design and other engineering activities. The course covers the theory of techniques such as search, constraint satisfaction, probability, data mining, pattern recognition, and neural networks, and examines issues related to their implementation. It also considers their application to engineering tasks, such as design representation and automation.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7311. Cyber-Physical Systems Architecture.
This course covers principles and methods for technical system architecture with a focus on cyber-physical systems. Topics include the resolution of ambiguity to identify system goals and boundaries, the creative process of mapping form to function, and methods of decomposition and re-integration. Heuristic and formal methods are presented.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7312. Digital Twins.
This course introduces the concept of Digital Twins and describes how they are applied in engineering and what should be considered to implement this technology in products and manufacturing systems. Considerations include information technology infrastructure, enabling technologies, the business value of implementing Digital Twins, and what needs to happen across the organization to ensure successful implementation. This course also explores the digital twin approach to the design, operation, and maintenance of industrial assets and products.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7313. Advanced Robotics#.
This course provides knowledge of robotic technology and design techniques to improve the interaction between robots and humans through effective and safe automated solutions. Topics include forward and inverse kinematics, velocity kinematics, introduction to dynamics and control theory, sensors, actuators, basic probabilistic robotics concepts, fundamentals of computer vision, and robot ethics. In addition, modular robot programming will be covered, and the concepts learned will be applied using realistic simulators.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7314. Human-Robot Interaction.
This course focuses on human-robot interaction and social robot learning, exploring the leading research, design principles and technical challenges faced in developing robots capable of operating in real-world human environments. The course will cover a range of multidisciplinary topics, including physical embodiment, mixed-initiative interaction, multi-modal interfaces, human-robot teamwork, learning algorithms, aspects of social cognition, and long-term interaction. Prerequisite: MMIE 7313 with grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7315. Advanced Additive Manufacturing.
This course examines the standards, theory, techniques, applications, and development of additive manufacturing technology. Safety considerations, contemporary technologies, ideas, and processes will also be studied. Because additive manufacturing technologies are relatively new and growing, the course involves literature reviews and team projects. Projects include in-depth studies on futuristic ideas, biomimicry, contemporary technologies, materials, and processes.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MMIE 7316. Cybersecurity for Mechanical and Manufacturing Systems.
This class covers the protection of information assets and systems by integrating technical controls with policies, best practices, and guidelines of cybersecurity. Taking both a policy-based and technical approach, this course examines external and internal security threats in highly connected enterprises and risks to core businesses relative to people, processes, data, facilities, and technologies. The course also addresses how to implement and effectively manage the major technical components of security architectures and selected methods of attacking enterprise architectures.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7317. Applied Data Science I.
This course covers machine learning tools. Topics include supervised algorithms, techniques for improving model performance, evaluation techniques, and software packages for implementation. Emphasis will be placed on real-world applications across various domains particularly relevant to mechanical, manufacturing or industrial engineering (MMIE) and engineering management (EM) fields. Prerequisite: MMIE 7305 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7318. Applied Data Science II.
This course focuses on concepts and techniques in unsupervised machine learning. Students will explore various algorithms and methodologies for extracting meaningful information from unlabeled data. The course covers dimensionality reduction, clustering methods, generative models, and deep unsupervised learning. Emphasis will be placed on understanding and implementation of unsupervised learning models across various domains particularly relevant to mechanical, manufacturing and industrial engineering (MMIE) and engineering management (EM) fields. Prerequisite: MMIE 7317 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7320. Advanced Solid Mechanics.
This course develops principles of advanced strength of materials and elasticity theory leading to solution of practical engineering problems concerned with stress and deformation analysis. Topics include tensor analysis, coordinate transformations, alternative measures of strain, stress measures, elastic constitutive equations, and formulation and solution of elasticity problems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7322. Advanced Fluid Mechanics.
This course is an in-depth exploration of the principles, theories, and applications of fluid dynamics at an advanced level. The topics covered in this course include the conservation of mass, momentum, and energy, as well as incompressible inviscid and viscous flows, and the Navier-Stokes equations. Moreover, students will explore similarity and dimensional analysis, boundary layers, separation phenomena, circulation and vorticity theorems, and both laminar and turbulent boundary layers, including high-speed flows.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7324. Advanced Heat Transfer.
This course offers specialized knowledge in advanced heat transfer principles and applications. It covers topics such as conduction in complex geometries, convective heat transfer, heat exchanger design, and radiative heat transfer. Emphasis is placed on real-world engineering applications, including thermal management in electronics and renewable energy systems. Students will engage in theoretical lectures, practical exercises, and numerical simulations. The course explores cutting-edge research, enabling students to solve complex engineering problems and optimize thermal systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7326. Advanced Mechanical System Control.
This course covers dynamic modeling, simulation, and control techniques applied to mechanical systems. Topics include state-space representation, controllability and observability, state and output feedback, state estimation and observers, full-state and reduced order observers, quadratic regulator theory, phase plane analysis, limit cycles, bifurcation and Lyapunov stability theories, feedback linearization, and selected techniques for non-linear control design.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7330. Advanced Finite Element Analysis.
This course covers variational and weighted residual approaches to the formulation of finite element equations with emphasis on solid mechanics problems. Topics include element formulation, numerical integration, imposition of constraints, convergence, error estimation, and an introduction to more advanced topics such as geometric and material nonlinearities, contact problems, and the solution of dynamic problems and time integration.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7332. Computations in Fluid Mechanics and Heat Transfer.
This course covers the theory and application of state-of-the-art computational fluid dynamics techniques. Topics include discretization methods such as the finite volume method and the finite element method and presents numerical modeling concepts like conservation and stability that are common to all methods. Specific physical modeling topics that will be covered are turbulence modeling (basic turbulent flow physics, Reynolds averaged models, and Large Eddy Simulation), and techniques for modeling flows with moving boundaries.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7340. Advanced Computer Aided Engineering.
This course covers application of computer-assisted math-based analysis and simulation techniques to the product development process. It combines computer-aided design (CAD) with disciplines such as finite element analysis (FEA), computation fluid dynamics (CFD), multiphysics, and engineering calculations. CAE aims to create products, assemblies, and component parts that are not only validated to survive their operating conditions but also optimized for desired characteristics like weight and strength.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7341. Advanced Micro and Nano Manufacturing.
This course covers advanced topics on micro and nano manufacturing processes, techniques, and applications. Topics include overall semiconductor manufacturing processes and materials, lithography, oxidation, etching, ion implantation, physical and chemical vapor deposition, atomic layer deposition, chemical mechanical planarization, thin film and surface technologies, 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

MMIE 7342. Advanced Polymer Nanocomposites#.
This course covers materials, processing, characterization, and applications of thermoset and thermoplastics polymer nanocomposites. Morphological, thermal, mechanical, ablative, magnetic, and electrical characterization will be discussed in detail. Applications include fire-resistant, ablative, fatigue-resistant, impact-resistant, bio-based, electrically conductive, magnetic, and high-temperature composites.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7362. Time Series Analysis and Forecasting.
This course aims to introduce theory and application of both Box-Jenkins statistical methods and deep learning techniques for time series modelling and forecasting. The course covers model identification, estimation, diagnostics and forecasting techniques for stationary and non-stationary univariate and multivariate time series. All data analysis in the course is performed using state-of-the-art software and real-world examples.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7367. Database Analytics for Web-Based Optimization.
This course teaches students how to develop data-driven and scalable optimization applications that bring high value to decision-makers in manufacturing and service enterprises. Design of user interfaces, database systems and access to cloud computing servers is covered. The scalable and distributed decision support systems taught in this course are also indispensable for students researching on mathematical optimization and doing large-scale experimentation. The techniques for experimenting with mathematical programming models in non-cloud high-performance computer clusters are also covered.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7370. Stochastic Simulation.
This course covers simulation modeling and programming in general-purpose languages (specifically VBA for Excel) and in specialized simulation environments (Simio, @Risk). The probability foundations of stochastic simulation, simulation optimization, and proper design and analysis of the simulation experiment are emphasized. Applications are drawn from manufacturing, financial, logistics and service systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7372. Network Flow Optimization.
This course covers network flow optimization, focusing on three classes of problems: shortest path problems, maximum flow problems, and minimum cost flow problems. The class will emphasize modeling and algorithms, introducing theory as needed. Students will extensively use network optimization software, with applications relevant to mechanical, manufacturing or industrial engineering (MMIE).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7374. Applications of Data Science in Multi-Objective Optimization.
This course gives students an in-depth understanding of the intersection between data science techniques and multi-objective optimization. It equips students with the knowledge and skills required to address real-world problems that involve multiple conflicting objectives by leveraging data-driven approaches and optimization techniques. This course assumes a prerequisite solid understanding of data analysis, programming, and optimization concepts. Prerequisite: MMIE 7317 with a grade of "B"or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7379. Modeling and Design of Net-Zero Manufacturing and Service Enterprises.
This course teaches students to design and operate carbon neutral and zero-energy manufacturing, transportation, and service infrastructure through the integration of renewable energy. Students use statistics and probability theory, design of experiments, discrete event and agent-based simulation, and stochastic optimization to solve large scale, multi-layer manufacturing supply chain design and operation problems. Through the semester-long team project, students make both strategic and operational decisions on production, warehousing, transportation, and microgrid generation in the nexus of manufacturing, energy and climate.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MMIE 7399. Dissertation.
This course consist of original research and writing in mechanical and manufacturing engineering to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MMIE 7599. Dissertation.
This course consist of original research and writing in mechanical and manufacturing engineering to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MMIE 7699. Dissertation.
This course consist of original research and writing in mechanical and manufacturing engineering to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MMIE 7999. Dissertation.
This course consist of original research and writing in mechanical and manufacturing engineering to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit