DEPARTMENT OF MECHANICAL ENGINEERING

THE UNIVERSITY OF TEXAS AT SAN ANTONIO (UTSA)

Master of Science in Advanced Manufacturing and Enterprise Engineering (MS in AMEE)

The Master of Science program in Advanced Manufacturing and Enterprise Engineering (M.S. in AMEE) is designed to offer an opportunity to individuals for continued study toward positions of leadership in industry and academia and for continuing technical education in a more specialized area. The graduates of this program will have the fundamental knowledge and understanding of the operational complexity of enterprises, manufacturing and business process improvement/optimization, and integrated product/process/system design. In addition, they will have the cognitive skills to critically evaluate the potential benefits of alternative manufacturing strategies; to use virtual/simulated platforms to facilitate and improve business processes; and to analyze enterprise systems as systems of interacting units, components, and sub-systems. The program offers a thesis option and a nonthesis option.

As lean thinking, enterprise process reengineering, and digital manufacturing are becoming more prevalent in the work place, engineering students need to be prepared to design and analyze the enterprise as a holistic system of technology, decision-making processes, and cultural components. Advanced Manufacturing, as the core component of enterprise systems, encompasses effective and efficient integration and synthesis of automation technologies, human resources, and decision-making models that facilitate design, planning, scheduling, and control of production of goods and provision of services. Enterprise Engineering is defined as the body of knowledge, principles, and practices having to do with the analysis, design, implementation and operation of an enterprise.

The MS in AMEE is truly an interdisciplinary program founded on the strong collaboration of the Departments of Mechanical Engineering, Electrical and Computer Engineering, Information Systems and Technology Management, Management Science and Statistics, and Computer Science and the Center for Advanced Manufacturing and Lean Systems (CAMLS). Graduate students are exposed to research problems through interaction with the industry members of CAMLS and its state-of-the-art laboratory facilities.

Program Admission Requirements. Applicants must meet University-wide graduate admission requirements as outlined in Chapter 1, Admission, of this catalog. Applicants must also comply with general University regulations as outlined in Chapter 2, General Academic Regulations, and Chapter 4, Master's Degree Regulations, of this catalog. Due to the multidisciplinary nature of the program, the Graduate Advisor of Record (GAR), in consultation with the Mechanical Engineering Graduate Program Committee and the Department Chair, will evaluate each student's transcript and determine any course deficiencies on a case-by-case basis. Students admitted with course deficiencies will be required to take additional courses within their Program of Study to make up the deficiencies. Courses taken to make up deficiencies may not count toward the graduate degree. Applicants who have insufficient preparation for the program, or who lack certain supporting documentation, may be admitted on a conditional basis.

Degree Requirements. The minimum number of semester credit hours required for the degree is 30 for the thesis option and 33 for the nonthesis option. Courses offered for the graduate programs of these collaborating departments complement the MS in AMEE program in the form of elective courses. Through core and a variety of elective courses, students can customize their program of study according to their specific needs, professional development related goals, and career objectives in consultation with the Graduate Advisor of Record (GAR), as well as their thesis advisor and thesis committee.

A. 3 semester credit hours of a Required Math Course selected from the following:

EGR	5023	Numerical Techniques in Engineering Analysis
EGR	5213	Topics in Systems Modeling
MAT	5603	Numerical Analysis
STA	5083	Methods of Statistics II

B. 9 semester credit hours of Required Topical Courses selected from the following:

ME	5503	Lean Manufacturing and Lean Enterprises
ME	5563	Computer Integrated Manufacturing
ME	5583	Advanced Enterprise Process Engineering
ME	5603	Advanced Manufacturing Systems Engineering

C. Degree candidates must complete the following course requirements for one of the degree options:

Thesis Option	*Hours*
Required Math Course	3
Required Topical Courses	9
ME 6953 Independent Study	6
Prescribed Electives (see list below)	6
ME 6983 Master's Thesis	6
Minimum total semester credit hours required for Thesis Option	30

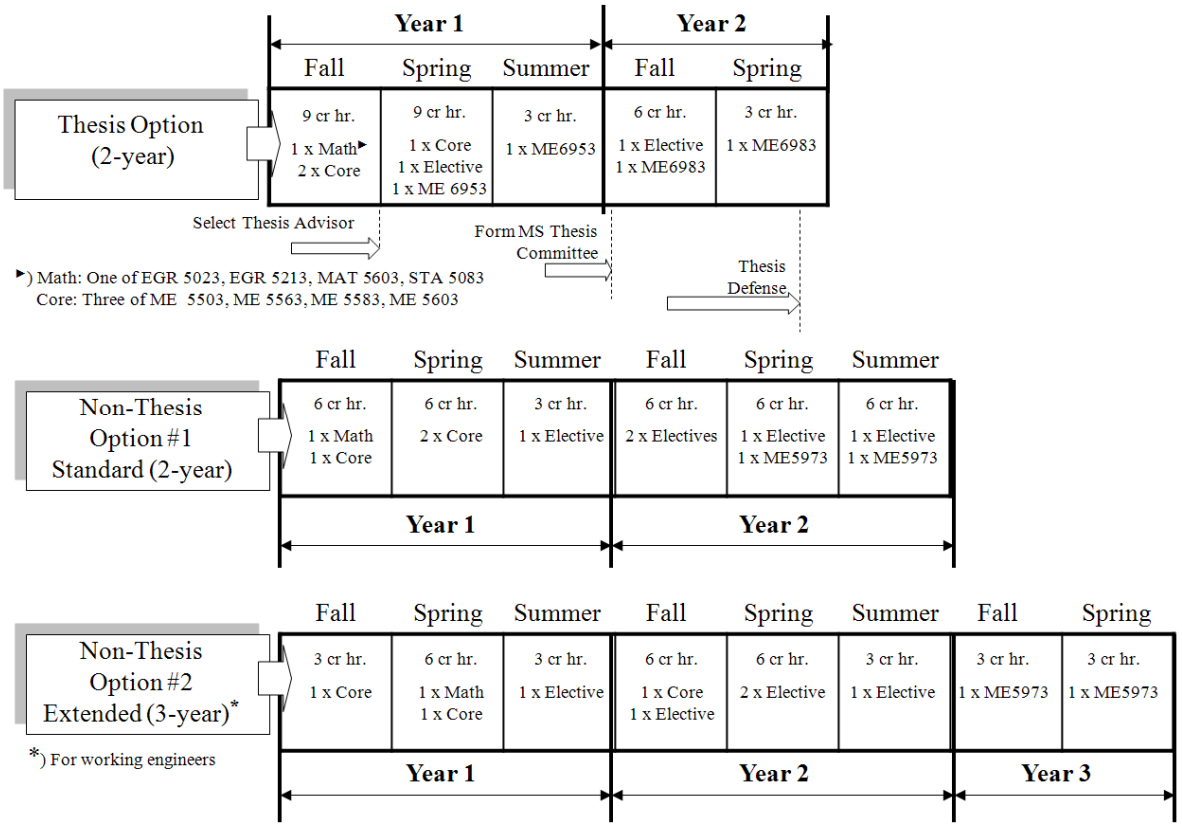
Nonthesis Option	*Hours*
Required Math Course	3
Required Topical Courses	9
ME 5973 Special Project	6
Prescribed Electives (see list below)	15
Minimum total semester credit hours required for Thesis Option	33

Prescribed Electives

CS	5233	Artificial Intelligence
CS	5253	Expert Systems
CS	5623	Simulation Techniques
EE	5143	Linear Systems and Control
EE	5243	Topics in Systems and Control
EE	5343	Intelligent Control and Robotics
EE	5413	Principles of Microfabrication
EGR	5233	Advanced Quality Control
EGR	5613	New and Emerging Technologies
IS	5043	Analysis and Design of Information Systems
IS	5143	Information Technology
IS	6433	Supervisory Control and Data Acquisition
ME	5113	Advanced Systems Dynamics and Control
ME	5143	Advanced Dynamics

ME	5503	Lean Manufacturing and Lean Enterprises
ME	5563	Computer Integrated Manufacturing
ME	5573	Facilities Planning and Design
ME	5583	Advanced Enterprise Process Engineering
ME	5593	Advanced Topics in Manufacturing and Enterprise Engineering
ME	5603	Advanced Manufacturing Systems Engineering
ME	6563	Flexile Automation and Manufacturing Systems
ME	6573	Robotics Design and Analysis
MOT	5163	Management of Technology
MOT	5233	Advanced Topics in Project Management
MOT	5313	Emerging Technologies
MS	5023	Decision Analysis and Production Management
MS	5343	Logistics Systems Management
MS	5393	Topics in Production Operations Management
MS	5453	Management and Control of Quality
MS	5483	Operations Research Methods in Statistics
STA	5073	Methods of Statistics I
STA	5103	Applied Statistics
STA	5803	Process Control and Acceptance Sampling

Degree Plans. There recommended degree plans (thesis option, non-thesis option standard, and non-thesis option extended for working engineers) are shown below.



For more information, contact Dr. Can Saygin at can.saygin@utsa.edu • 210-458-7614 or visit http://engineering.utsa.edu/~mechanical/amee

Students in the nonthesis option are advised by the GAR throughout their program. Students in the thesis option, upon completion of the first 9 semester credit hours of their program, must select a Thesis Advisor from the program contributing faculty members and obtain the faculty member's consent to serve in this capacity. After this point, the student's Thesis Advisor assumes the role of the student's advisor.

Upon completion of 18 credit hours (typically the end of the second semester), students in the thesis option are expected to form a Thesis Committee in consultation with their Thesis Advisor. In addition to the Thesis Advisor, the Thesis Committee must include two additional faculty members who are also members of the UTSA Graduate Faculty. Thesis option students are expected to defend their research work during their last semester (i.e., completion of 30 semester credit hours).

COURSE DESCRIPTIONS

Department of Computer Science (College of Sciences)

CS 5233 Artificial Intelligence
(3-0) 3 hours credit.
This course covers the construction of programs that use knowledge representation and reasoning to solve problems. Major topics include informed search, logical and probabilistic inference, machine learning, planning, and natural language processing.

CS 5253 Expert Systems
(3-0) 3 hours credit.
This course presents an in-depth study of the area of artificial intelligence known as expert systems. Example expert systems are examined as a means of identifying the generally accepted methodologies for developing such systems as well as the basic research issues involved.

CS 5623 Simulation Techniques
(3-0) 3 hours credit.
This course introduces discrete-event simulation techniques, statistical models in simulation, random number generation, input modeling, output analysis and comparisons, and verification and validation of simulation models.

Department of Electrical and Computer Engineering (College of Engineering)

EE 5143 Linear Systems and Control
(3-0) 3 hours credit.
Advanced methods of analysis and synthesis of linear systems, continuous and discrete-time systems, analytical approach to linear control theory.

EE 5243 Topics in Systems and Control
(3-0) 3 hours credit. Topics may include the following:
Topic 1: Adaptive Systems and Control. Current methods in adaptive systems and control including stability, convergence, robustness, system identification, recursive parameter estimation, and design of parameterized controllers.
Topic 2: Optimal Control. Optimal and suboptimal techniques for controller design using the principle of optimality, min-max principles, and induced norm minimization.

EE 5343 Intelligent Control and Robotics
(3-0) 3 hours credit.
Study of artificial neural networks control, knowledge-based control, and fuzzy-logic control. Analytical techniques and fundamental principles of robotics; dynamics of robot arms, motion control, robot sensing, and robot intelligence.

EE 5413 Principles of Microfabrication
(1-6) 3 hours credit.
Photolithography, thin film deposition, doping, wet patterning, plasma etching, thin film characterization. Students will fabricate simple microstructures such as coplanar waveguides, micro-fluidic devices and nano-powder silica films.

Engineering (College of Engineering)

EGR 5023 Numerical Techniques in Engineering Analysis
(3-0) 3 hours credit.
Advanced methods of applied mathematics, including numerical linear algebra, initial value problems, stability, convergence, partial differential equations, and optimization.

EGR 5213 Topics in Systems Modeling
(3-0) 3 hours credit.
Systems analysis approach to formulating and solving engineering problems. Topics include operational research, mathematical modeling, optimization, linear and dynamic programming, decision analysis, and statistical quality control.
Topic 1: Applied Operations Research. Application of operations research methods to practical engineering problems.
Topic 2: Engineering Systems Modeling. Modeling of modern engineering systems for operational and management control.

EGR 5233 Advanced Quality Control
(3-0) 3 hours credit.
Methods and techniques for process control, process and gage capabilities, inspection plans, American National Standard, and recent advanced techniques. Tour of manufacturing industry. Case studies in process control, outgoing quality, and costs. A project, assigned by a manufacturing company, is required, along with a final presentation of the project.

EGR 5613 New and Emerging Technologies
(3-0) 3 hours credit.
Examines entrepreneurial and managerial perspectives on the process of technology innovation. Design is the organizing concept used to study the continuum from idea to sale of products and services that are spawned by innovators using new and emerging technologies. Seminar format, case-study preparation, presentation, and cooperative learning are defining characteristics of this course.

Department of Information Systems and Technology Management (College of Business)

IS 5043 Analysis and Design of Information Systems
(3-0) 3 hours credit.
This course concentrates on the procedures for conducting the analysis and design of an information system. The techniques necessary to determine the requirements of a large-scale information system will be the focal point of the course. Translating the user requirements to system specifications will also be one of the main objectives of the course. Credit for this course cannot be counted toward the Master of Science degree in Information Technology.

IS 5143 Information Technology
(3-0) 3 hours credit.
Broad coverage of technology concepts underlying modern computing and information management. Topics include computer architecture and operating systems, information retrieval techniques, graphical user interfaces, networks, groupware, computer performance evaluation, efficiency of algorithms, and cryptography. Hands-on exposure to Internet services, SQL database language, PowerBuilder graphical interface language, and object-oriented programming language.

6433 Supervisory Control and Data Acquisition
(3-0) 3 hours credit.
Supervisory control and data acquisition systems are used to control many utility networks, chemical plants, pipelines and many other types of industries. This course will examine the vulnerabilities associated with these systems and discuss how they can be made secure from outside attack. Fundamentals of software-controlled processes will also be discussed.

MOT 5163 Management of Technology
(3-0) 3 hours credit.
Examines a broad range of topics and issues involved in the management of technology, including the international research and development environment and infrastructure; government, industry, and university roles in technology development; managing the research and development function; technology forecasting and assessment; and new product development.

MOT 5233 Advanced Topics in Project Management
(3-0) 3 hours credit.
An advanced course that examines contemporary issues in project management. Includes topics such as, the value of project management, organizational project management maturity, project selection models, enterprise project management, and project office implementation. Synthesis and evaluation are emphasized. A basic understanding of project management is required.

MOT 5313 Emerging Technologies
(3-0) 3 hours credit.
Examines science-based innovations with the potential to either create or transform a constellation: emerging technologies may involve either a single discovery or a bundle of innovations that converge to create a new technological system. This course focuses not only on the emergence of technology from basic research to implementation, but also on the commercialization of technology. Seminar format, case-study preparation, presentation, and cooperative learning are defining characteristics of this course.

Department of Mechanical Engineering (College of Engineering)

ME 5113 Advanced Systems Dynamics and Control
(3-0) 3 hours credit.
Dynamic modeling of mechanical and multi-energy domain systems; state-space and frequency-domain analysis of dynamic systems; feedback control systems; multivariable state-feedback control; principles of controllability, observability, stability; computer-based simulation system dynamics.

ME 5143 Advanced Dynamics
(3-0) 3 hours credit.
Review of Newtonian mechanics, 3-D particle kinematics, dynamics of a system of particles, analytical mechanics, Lagrange's equations, kinematics and rigid-body dynamics, Eulerian angles, computational analysis using a symbolic language.

ME 5503 Lean Manufacturing and Lean Enterprises
(3-0) 3 hours credit.
Methodologies for transforming an enterprise into a lean enterprise. Topics include Lean Manufacturing basics and tools; Lean Implementation Guidelines; Lean Metrics and Performance Measures; Lean Extended Enterprise; Six-Sigma; and Lean Supply Chain Design and Management. Hands-on applications include lean simulation games and various Web-based applications.

5563 Computer Integrated Manufacturing
(3-1) 3 hours credit.
Advanced concepts and models related to computer-aided design, computer-aided process planning, computer-aided manufacturing, production planning and scheduling, and manufacturing execution systems. Laboratory work includes computer-aided applications and programming of automated production equipment.

ME 5573 Facilities Planning and Design
(3-0) 3 hours credit.
Advanced concepts and fundamentals essential to understand, analyze, and solve problems related to manufacturing plant layout and material handling system selection. Topics include Product, Process, and Schedule Design; Flow, Space, and Activity Relationships; Material Handling; Layout Planning Models and Design Algorithms; and Warehouse Operations. The subjects included in this course are organized around integrated product, process, and manufacturing system design principles.

ME 5583 Advanced Enterprise Process Engineering
(3-0) 3 hours credit.
Theory and applications of lean manufacturing and six-sigma to enterprise functions beyond production shop floor, with focus on lean product and process development, lean costing, and integration of IT and ERP systems to sustain continuous improvement.

ME 5593 Advanced Topics in Manufacturing and Enterprise Engineering
(3-0) 3 hours credit. Current topics in the manufacturing engineering area.

ME 5603 Advanced Manufacturing Systems Engineering
(3-0) 3 hours credit.
Design, planning, scheduling, and control of manufacturing systems with emphasis on information flow and decision-making. After introducing students to system simulation, simulation models of manufacturing systems are developed and evaluated in terms of system performance under different production planning and control policies. Contemporary manufacturing topics and research areas are emphasized.

ME 5973 Special Project
3 hours credit.
The directed research course is offered only for nonthesis option students and may involve either a laboratory or a theoretical problem. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master's degree.

ME 6563 Flexible Automation and Manufacturing Systems
(3-0) 3 hours credit.
This course focuses on major integration issues related with flexible manufacturing systems and their components. Introduces mathematical models related to design, planning, scheduling, and control of flexible manufacturing systems. Contemporary manufacturing topics and research areas are emphasized.

ME 6573 Robotics Design and Analysis
(3-0) 3 hours credit.
Serial manipulator design and controls; electromechanical issues at the actuator level; analytic modeling and synthesis techniques with emphasis on the influence of sensors, machine vision, and control at the actuator-level and robot system designs.

ME 6953 Independent Study
3 hours credit.
Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master's degree.

ME 6983 Master's Thesis
3 hours credit.
Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress.

Department of Management Science and Statistics (College of Business)

MS 5023 Decision Analysis and Production Management
(3-0) 3 hours credit.
Study of applications of quantitative approaches (such as mathematical programming, networks, stochastic processes, multicriteria analysis, and simulation) to business decision analysis. Emphasis is given to production management applications (such as resource allocation, scheduling, inventory control, capital budgeting) and the use of computerized decision support systems.

MS 5343 Logistics Systems Management
(3-0) 3 hours credit.
Study of business logistics: the process of planning, implementing, and controlling the flow and storage of goods or services and related information from point of origin to point of consumption to achieve customer satisfaction. Focuses on the cost and value added to products or services by making them available in the desired condition when and where they are needed.

MS 5393 Topics in Production Operations Management
(3-0) 3 hours credit.
Survey of the body of knowledge concerning the management of operations. Considers manufacturing and service principles. The course reviews a variety of topics necessary in the field of production and inventory management, including logistics and distribution processes. The unique nature of service operations is stressed.

MS 5453 Management and Control of Quality
(3-0) 3 hours credit.
An examination of the fundamental nature of quality assurance, its strategic importance in business and industry, and the economic impact of quality. Theoretical and management issues relating to quality problem solving are emphasized. The contribution of the leaders in modern quality management are discussed.

MS 5483 Operations Research Methods in Statistics
(3-0) 3 hours credit.
Theory and applications of mathematical programming techniques applied to statistical analysis. Mathematical topics such as linear, integer and quadratic program theory and algorithms will be covered. Support vector machines as an application of quadratic programming will be introduced. Mathematical programming techniques for regression and classification analysis will be discussed. Simulation methods for jackknife and bootstrap estimation and or stochastic analysis will also be covered.

STA 5073 Methods of Statistics I
(3-0) 3 hours credit.
Emphasis on methods and applications of statistics. Measure of location, variability, and association. Interpretation of categorical data, hypothesis testing, and use of SAS programs and applications.

STA 5083 Methods of Statistics II
(3-0) 3 hours credit.
Emphasis on linear statistical models. Use of SAS programs and applications. Topics in applied statistics may include maximum likelihood estimation and its properties, and likelihood ratio tests. Procedures in regression and model fitting, transformations of data, analysis of variance, and others.

STA 5103 Applied Statistics
(3-0) 3 hours credit.
Simple linear model, correlation, multiple regression, one-way analysis of variance, fixed effects model, random effects model, mixed effects model, model selection, and analysis of covariance.

STA 5803 Process Control and Acceptance Sampling
(3-0) 3 hours credit.
Introduction to statistical process control and product inspection plans. Topics include control charts by attributes and variables, special control charts, specification limits, process capability, and acceptance sampling plans by attributes and variables. Use of statistical software.

Department of Mathematics (College of Sciences)

MAT 5603 Numerical Analysis
(3-0) 3 hours credit.
Emphasis on the mathematical analysis of numerical methods. Areas of study include solution of nonlinear equations and function optimization, approximation theory and numerical quadrature.