

# MANUFACTURING ENGINEERING

Manufacturing uses advanced technologies to transform materials into new products or parts of products. Today's manufacturing industry includes (but is not limited to) aerospace, biotechnology, electronic equipment manufacturing, engineering in machining and equipment, food processing and supply, light metals, marine industries, etc.

Missouri S&T's manufacturing engineering education program offers the interdisciplinary master of science (M.S.) and master of engineering (M.E.) degrees on campus or through distance learning via the internet. Both degree programs are intended for a student with a B.S. degree in engineering to learn about modern manufacturing technologies involving computers and automation.

Also offered are graduate manufacturing engineering certificate programs, including manufacturing systems and CAD/CAM and rapid product realization for working professionals who want to stay ahead of rapidly changing technology.

The M.S. program is a research-oriented degree where the courses supplement the thesis research. The M.E. program is designed such that the course selection is flexible and the student is allowed to take courses pertaining to his or her area of interest. A practice-orientated project is required by the M.E. program, which provides an opportunity for the student to participate in a practical project related to a manufacturing process. The M.E. program is structured so that individuals, such as working engineers, who wish to improve their knowledge and skills can complete their degree in one year.

The M.S. program requires 30 credit hours and a thesis:

- 12 credit hours from the manufacturing core areas
- 6 credit hours of 6000-level courses in manufacturing
- 6 to 9 credit hours for thesis research
- 3 to 6 credit hours of graduate courses in manufacturing as approved by the academic advisor

The M.E. program requires 30 credit hours and a practice-oriented project. The course requirements include 12 credit hours from the manufacturing core areas, 6 credit hours of 6000-level courses in manufacturing; 3 credit hours of approved mathematics/computer science or any suggested manufacturing courses, 3 credit hours for work related to the practice-oriented project, and 6 credit hours of graduate courses in manufacturing. The practice-orientated project is defined by the student and academic advisor. At the end of the project experience, the student should demonstrate not only the proficiency of operating certain manufacturing processes, but also the capability to improve the process. At the end of the M.E. program, a presentation and a report documenting the practice oriented projects are required. For both programs, at most 6 credit hours of 4XXX level classes can be completed in the degree.

For both programs, each student must take at least one course from each of the core areas in manufacturing engineering during his or her first two semesters of graduate work. The core requirements may be deemed satisfied if a student has already taken a core course as a technical elective in his or her undergraduate program, thus allowing more freedom in the selection of other courses. The related courses in manufacturing core areas are selected and offered from various departments.

The manufacturing core areas include:

- Materials and Manufacturing Processes
- Process, Assembly and Product Engineering
- Manufacturing Competitiveness
- Manufacturing System Design

The graduate committee for each student in the interdisciplinary Master of Science degree program will consist of three faculty of which at least two must be from the Manufacturing Education Committee (MEC). The major advisor should also be a member of the Manufacturing Education Committee. The master of engineering student does not need a committee, but the advisor should be from MEC. MEC is formed by over 40 faculty members from various departments, such as ceramic engineering, chemical engineering, computer science, electrical and computer engineering, engineering management, mechanical and aerospace engineering, metallurgical engineering, mining engineering, and business administration. For details regarding the application, curriculum, courses in manufacturing core areas, and MEC faculty, you may also wish to explore the program's web page at: <http://mae.mst.edu>. Some examples of research areas in which you can specialize include:

- Additive Manufacturing
- Manufacturing Process Modeling
- Design for Manufacturing/Assembly
- CAD/CAM/CIM
- Product/Process Development
- Manufacturing Management
- Manufacturing Processes
- Manufacturing Materials
- Lean Manufacturing
- Rapid Product Realization
- Assembly & Automation
- CNC machining
- Environmentally Friendly Manufacturing
- Product Quality Control

This is a truly interdisciplinary program, which will provide you with a variety of options in manufacturing. The existing laboratories which can be used in this proposed program include Innovative Additive Manufacturing Laboratory, Industrial Automation and Flexible Manufacturing, Laser-Aided Manufacturing Processes (LAMP) Lab, Rapid Prototyping Laboratory, Laser-Based Manufacturing Laboratory, Caterpillar Mechatronics Laboratory, The Precision Motion Control Laboratory, Manufacturing Automation and Control Laboratory (MAC Lab), Multiscale Manufacturing Laboratory, Metal and Ceramic Processing Laboratory, Materials Design and Manufacturing Laboratory, Femtosecond Laser Nanophotonics Laboratory, Thermal Radiation Laboratory, Structural Health Monitoring & Non-Destructive Evaluation Laboratory, and Foundry to Melt and Cast Ferrous and Non-ferrous Alloys.

The graduate certificate program consists of a four-course sequence from existing graduate-level courses. While the students admitted to the Certificate Program will have non-matriculated status, if they complete the four-course sequence with a grade of "B" or better in each of the courses taken, they will be admitted to the M.S. program if they so choose. The Certificate credits taken by students admitted to the M.S. program will count toward their master's degree.

## CAD/CAM & Rapid Product Realization Certificate

One each from the four core areas in the Manufacturing Engineering program as outlined below:

### Course I

MECH ENG 5763	Computer Aided Design: Theory and Practice
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### Course II

MECH ENG 6659	Advanced Topics in Design and Manufacturing
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### Course III

Select one of the following:

ENG MGT 5515/ MECH ENG 5757	Integrated Product And Process Design
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MECH ENG 5708	Rapid Product Design And Optimization
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### Course IV

Select one of the following:

AERO ENG 5760	Probabilistic Engineering Design
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MECH ENG 5656	Design For Manufacture
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## Manufacturing Systems Certificate

For the Manufacturing Systems Graduate Certificate Program the students will need to take four course sequences, one each from the four course areas in the Manufacturing Engineering program as outlined below:

### Course I-Materials and Manufacturing Processes

Select one of the following:

MECH ENG 5220	Advanced Mechanics of Materials
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MECH ENG 5236	Fracture Mechanics
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MECH ENG 5282	Introduction to Composite Materials & Structures
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MECH ENG 6659	Advanced Topics in Design and Manufacturing
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### Course II-Process, Assembly and Product Engineering

Select one of the following:

ENG MGT 5515/ MECH ENG 5757	Integrated Product And Process Design
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MECH ENG 5708	Rapid Product Design And Optimization
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MECH ENG 5763	Computer Aided Design: Theory and Practice
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### Course III-Manufacturing Competitiveness

Select one of the following:

ENG MGT 5710	Six Sigma
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ENG MGT 5613	Value Analysis
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ENG MGT 5615	Production Planning And Scheduling
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ENG MGT 5714	Statistical Process Control
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ENG MGT 6611	Lean Systems
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AERO ENG 5760	Probabilistic Engineering Design
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ERP 5110	Enterprise Resource Planning Systems Design and Implementation
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### Course IV-Manufacturing Systems Design

Select one of the following:

ENG MGT 5314	
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MECH ENG 5478	Mechatronics
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MECH ENG 5655	Manufacturing Equipment Automation
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MECH ENG 5656	Design For Manufacture
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