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. 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
- 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
- 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:

<table>
<thead>
<tr>
<th>Course I</th>
<th>Course II</th>
<th>Course III</th>
<th>Course IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>MECH ENG 5763 Computer Aided Design: Theory and Practice</td>
<td>MECH ENG 6659 Advanced Topics in Design and Manufacturing</td>
<td>Select one of the following:</td>
<td>Select one of the following:</td>
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<tr>
<td></td>
<td></td>
<td>ENG MGT 5515/MECH ENG 5757 Integrated Product And Process Design</td>
<td>AERO ENG 5760 Probabilistic Engineering Design</td>
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<td>MECH ENG 5708 Rapid Product Design And Optimization</td>
<td>MECH ENG 5656 Design For Manufacture</td>
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</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Course I-Materials and Manufacturing Processes</th>
<th>Course II-Process, Assembly and Product Engineering</th>
<th>Course III-Manufacturing Competitiveness</th>
<th>Course IV-Manufacturing Systems Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select one of the following:</td>
<td>Select one of the following:</td>
<td>Select one of the following:</td>
<td>Select one of the following:</td>
</tr>
<tr>
<td>MECH ENG 5220 Advanced Mechanics of Materials</td>
<td>ENG MGT 5515/MECH ENG 5757 Integrated Product And Process Design</td>
<td>ENG MGT 5710 Six Sigma</td>
<td>ENG MGT 5314</td>
</tr>
<tr>
<td>MECH ENG 5236 Fracture Mechanics</td>
<td>MECH ENG 5708 Rapid Product Design And Optimization</td>
<td>ENG MGT 5613 Value Analysis</td>
<td>MECH ENG 5478 Mechatronics</td>
</tr>
<tr>
<td>MECH ENG 5282 Introduction to Composite Materials &amp; Structures</td>
<td>MECH ENG 5763 Computer Aided Design: Theory and Practice</td>
<td>ENG MGT 5615 Production Planning And Scheduling</td>
<td>MECH ENG 5655 Manufacturing Equipment Automation</td>
</tr>
<tr>
<td>MECH ENG 6659 Advanced Topics in Design and Manufacturing</td>
<td></td>
<td>ENG MGT 5714 Statistical Process Control</td>
<td>MECH ENG 5656 Design For Manufacture</td>
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<td>ENG MGT 5611 Lean Systems</td>
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<td>AERO ENG 5760 Probabilistic Engineering Design</td>
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<td>ERP 5110 Enterprise Resource Planning Systems Design and Implementation</td>
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*2023-2024*