MANUFACTURING SYSTEMS ENGINEERING, M.S.

The master of science in manufacturing systems engineering (MSE) is an on-campus, multidisciplinary degree, drawing courses and faculty from engineering, business, computer sciences, and statistics. As the first program of its kind in the United States, and among the first in the world, MSE has long been recognized as a leading provider of resourceful engineers for global and dynamic manufacturing firms. Hands-on projects, along with classes taught by internationally recognized experts and state-of-the-art technology, provide an ideal foundation for anyone entering today's advanced manufacturing environment.

MSE graduates leave the program skilled beyond narrow specialties and equipped to lead technical teams. Students are exposed to practical problems and cutting-edge concepts, resulting in engineers who combine management skills with advanced technical abilities. Courses cover a broad range of manufacturing issues, while reinforcing a systems approach. The variety of subjects allows students to tailor their studies to individual goals or interests. More than 400 MSE alumni currently work in industry.

The student body of the MSE program is predominantly composed of students returning from industry or working for their degrees while employed. The program also has a substantial number of international students. Prospective students find the midsized program an ideal learning environment.

Specifically, the program addresses solutions to problems in the design, development, implementation, operation, evaluation, and management of modern manufacturing systems. An named option in the MSE M.S. degree titled "engineering management specialization" is also offered, ideal for engineering students with a special interest in management issues pertaining to manufacturing. For students seeking advanced training in management, the School of Business offers an MBA in operations and technology management. A maximum of 6 advanced credits of MSE course work can be used to satisfy some of the MBA degree requirements.

REQUIREMENTS

MINIMUM DEGREE REQUIREMENTS AND SATISFACTORY PROGRESS
To make progress toward a graduate degree, students must meet the Graduate School Minimum Degree Requirements and Satisfactory Progress (http://guide.wisc.edu/graduate/#policiesandrequirementstext) in addition to the requirements of the program.

MASTER'S DEGREES
M.S., with available course only, industry thesis, and research thesis tracks, M.S. with named option Engineering Management Specialization

MINIMUM GRADUATE DEGREE CREDIT REQUIREMENT
30 credits

MINIMUM GRADUATE RESIDENCE CREDIT REQUIREMENT
16 credits

MINIMUM GRADUATE COURSEWORK (50%) REQUIREMENT
Half of degree coursework (15 credits out of 30 total credits) must be completed in graduate-level coursework in the College of Engineering, the School of Business, the Department of Statistics, the Department of Biological Systems Engineering, or the Department of Computer Sciences; courses with the Graduate Level Coursework attribute are identified and searchable in the university's Course Guide (http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle).

PRIOR COURSEWORK REQUIREMENTS: GRADUATE WORK FROM OTHER INSTITUTIONS
With program approval, students are allowed to count no more than 12 credits of graduate coursework from other institutions toward the minimum graduate degree requirement and toward the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission is not allowed to satisfy requirements.

PRIOR COURSEWORK REQUIREMENTS: UW–MADISON UNDERGRADUATE
With program approval, up to 7 credits from the UW–Madison Undergraduate career numbered 400 or above may be counted toward the minimum graduate degree credit requirement. No prior coursework from the UW–Madison undergraduate career may be counted toward the minimum graduate coursework (50%) requirement or the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission is not allowed to satisfy requirements.

PRIOR COURSEWORK REQUIREMENTS: UW–MADISON UNIVERSITY SPECIAL
With program approval, students are allowed to count up to 15 credits of coursework numbered 400 or above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement and the minimum graduate degree credit requirement; coursework numbered 700 or above may satisfy the minimum graduate coursework (50%) requirement. Coursework earned five or more years prior to admission is not allowed to satisfy requirements.

CREDITS PER TERM ALLOWED
15 credits

OVERALL GRADUATE GPA REQUIREMENT
3.00

OTHER GRADE REQUIREMENTS
The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.

PROBATION POLICY
The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300
or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

**ADVISOR / COMMITTEE**

Every graduate student is required to have an advisor. To ensure that students are making satisfactory progress toward a degree, the Graduate School expects them to meet with their advisor on a regular basis.

The director of the Manufacturing Systems Engineering Program is assigned as the advisor to incoming students. Students can be suspended from the Graduate School if they do not have an advisor. An advisor is a faculty member, or sometimes a committee, from the major department responsible for providing advice regarding graduate studies.

**ASSESSMENT AND EXAMINATIONS**

Requirements determined by the program.

**TIME CONSTRAINTS**

Master’s degree students who have been absent for five or more consecutive years lose all credits that they have earned before their absence.

**LANGUAGE REQUIREMENTS**

No language requirements.

**COURSES**

The on-campus manufacturing systems engineering M.S. program has three tracks: course only, industrial thesis, and research thesis. Students may also pursue a named option in engineering management specialization. Students must take four courses from the core course areas with at least one course from each of the core course areas. All students are required to take the capstone course I SY E/M E 641 Design and Analysis of Manufacturing Systems. The remaining course requirements vary depending on the program track that is chosen and are described in the table below.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I SY E/M E 641</td>
<td>Design and Analysis of Manufacturing Systems (offered in spring semester)</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the following tracks: 30

**Program Tracks**

**Course-Only Track:**

Select four courses from the Core Course Areas listed below

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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<td></td>
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</table>

Select 12 credits of elective courses

Industry Thesis - Not required for courses only track

**Industry Track:**

Select four courses from the Core Course Areas listed below

<table>
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</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

Industrial Thesis

Select 12 credits of elective courses

**Research Thesis Track:**

Select four courses from the Core Course Areas listed below

<table>
<thead>
<tr>
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<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I SY E/M E 641</td>
<td>Design and Analysis of Manufacturing Systems (spring semester)</td>
<td></td>
</tr>
</tbody>
</table>

Research Thesis

Select three hours of elective courses

**CORE COURSE AREAS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE 450</td>
<td>Process Design</td>
<td>3</td>
</tr>
<tr>
<td>CBE 470</td>
<td>Process Dynamics and Control</td>
<td>3</td>
</tr>
<tr>
<td>CBE 540</td>
<td>Polymer Science and Technology</td>
<td>3</td>
</tr>
<tr>
<td>CBE 541</td>
<td>Plastics and High Polymer Laboratory</td>
<td>1-3</td>
</tr>
<tr>
<td>CBE 770</td>
<td>Advanced Process Dynamics and Control</td>
<td>3</td>
</tr>
<tr>
<td>E CE 412</td>
<td>Power Electronic Circuits</td>
<td>3</td>
</tr>
<tr>
<td>E CE 453</td>
<td>Embedded Microprocessor System Design</td>
<td>4</td>
</tr>
<tr>
<td>E CE/B ME 462</td>
<td>Medical Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>E CE/E N 528</td>
<td>Plasma Processing and Technology</td>
<td>3</td>
</tr>
<tr>
<td>E CE 549</td>
<td>Integrated Circuit Fabrication Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>I SY E 415</td>
<td>Introduction to Manufacturing Systems, Design and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>I SY E 605</td>
<td>Computer Integrated Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>M E 417</td>
<td>Introduction to Polymer Processing</td>
<td>3</td>
</tr>
<tr>
<td>M E 418</td>
<td>Engineering Design with Polymers</td>
<td>3</td>
</tr>
<tr>
<td>M E 419</td>
<td>Fundamentals of Injection Molding</td>
<td>3</td>
</tr>
<tr>
<td>M E 429</td>
<td>Metal Cutting</td>
<td>3</td>
</tr>
<tr>
<td>M E 437</td>
<td>Advanced Materials Selection</td>
<td>3</td>
</tr>
<tr>
<td>M E/ECE 439</td>
<td>Introduction to Robotics</td>
<td>3</td>
</tr>
<tr>
<td>M E 446</td>
<td>Automatic Controls</td>
<td>3</td>
</tr>
<tr>
<td>M E 447</td>
<td>Computer Control of Machines and Processes</td>
<td>3</td>
</tr>
<tr>
<td>M E 469</td>
<td>Internal Combustion Engines</td>
<td>3</td>
</tr>
<tr>
<td>M E/N E 565</td>
<td>Power Plant Technology</td>
<td>3</td>
</tr>
<tr>
<td>M E 514</td>
<td>Additive Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>M E/ECE 577</td>
<td>Automatic Controls Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>M E 601</td>
<td>Special Topics in Mechanical Engineering (Fundamentals of Microfabrication)</td>
<td>1-3</td>
</tr>
<tr>
<td>M E 601</td>
<td>Special Topics in Mechanical Engineering (Design and Prototype Fabrication)</td>
<td>1-3</td>
</tr>
<tr>
<td>M E 601</td>
<td>Special Topics in Mechanical Engineering (Material Selection)</td>
<td>1-3</td>
</tr>
<tr>
<td>M E 717</td>
<td>Advanced Polymer Processing</td>
<td>3</td>
</tr>
<tr>
<td>M E/ECE 739</td>
<td>Advanced Robotics</td>
<td>3</td>
</tr>
<tr>
<td>M E 747</td>
<td>Advanced Computer Control of Machines and Processes</td>
<td>3</td>
</tr>
<tr>
<td>M E/CBE 567</td>
<td>Solar Energy Technology</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 434</td>
<td>Introduction to Thin-Film Deposition Processes</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 461</td>
<td>Advanced Metal Casting</td>
<td>3</td>
</tr>
</tbody>
</table>
N E 405 Nuclear Reactor Theory 3
M S & E 465 Fundamentals of Heat Treatment 3
N E 405 Nuclear Reactor Theory 3

Fundamentals of Systems Engineering and Design

C B 430 Chemical Kinetics and Reactor Design 3
C IV ENGR 498 Construction Project Management 3
C IV ENGR 370 Transportation Engineering 3
C IV ENGR 498 Construction Project Management 3
C OMP SCI/E C E 755 VLSI Systems Design 3
C OMP SCI/E C E 756 Computer-Aided Design for VLSI 3
E C E 427 Electric Power Systems 3
M E 418 Engineering Design with Polymers 3
M E 444 Design Problems in Elasticity 3
M E 535 Computer-Aided Geometric Design 3
M E 549 Product Design 3
M E 601 Special Topics in Mechanical Engineering (Mechatronics in Control and Product Realization) 3
M E 601 Special Topics in Mechanical Engineering (Design of Computer Control Systems) 3
M E 601 Special Topics in Mechanical Engineering (Computer Aided Design and Analysis of Mechanical Systems) 3
M E 748 Optimum Design of Mechanical Elements and Systems 3
M A R K E T N G 427 Enterprise Systems and Supply Chain Management 3
M A R K E T N G 440 Emerging Issues in New Product Development 3
M A R K E T N G 740 Emerging Issues in New Product Development 3
O T M 860 Sustainable Design of Innovative Products, Services and Systems 3
I S Y E/M E 510 Facilities Planning 3
I S Y E/M E 512 Inspection, Quality Control and Reliability 3
I S Y E 515 Engineering Management of Continuous Process Improvement 3
I S Y E 520 Quality Assurance Systems 3
I S Y E/B M E 564 Occupational Ergonomics and Biomechanics 3
I S Y E 575 Introduction to Quality Engineering 3
I S Y E 612 Information Sensing and Analysis for Manufacturing Processes 3
I S Y E/O T M 620 Simulation Modeling and Analysis 3
I S Y E/M E 643 Performance Analysis of Manufacturing Systems 3
O T M 654 Production Planning and Control 3
O T M 770 Sustainable Approaches to System Improvement 3
O T M 875 Seminar in Operations and Technology Management 3
S T A T /M E 424 Statistical Experimental Design 3

Fundamentals of Business and Management

A C C T I S 300 Accounting Principles 3
A C C T I S 301 Financial Reporting I 3
A C C T I S 710 Managerial Accounting 3
G E N B U S 765 Contemporary Topics 3-4
F I N A N C E /E C O N 300 Introduction to Finance 3
F I N A N C E 757 Entrepreneurial Finance 3
I S Y E/P S Y C H 653 Organization and Job Design 3
M H R 700 Organizational Behavior 3
M H R 715 Strategic Management of Innovation 3
M H R 722 Entrepreneurial Management 3
M H R 765 Contemporary Topics 3-4
M A R K E T N G /O T M 421 Fundamentals of Supply Chain Management 3
M A R K E T N G /O T M 422 Logistics Management 3
M A R K E T N G 724 Strategic Global Sourcing 3
O T M 365 Contemporary Topics and Contemporary Topics 2-7
O T M 758 Managing Technological and Organizational Change 3
O T M 861 Strategic Systems and Sustainability 3

1 Most 700-level courses are only taught every three or four semesters. Please check with instructor about the next offering before completing study plan.
2 This course number is used for multiple seminar classes. Please check the Course Guide for correct listing.
3 Offered online through Sustainable Systems Engineering.

ADMISSIONS

Admission information for the on-campus Manufacturing Systems Engineering M.S. To be admitted to the M.S. program, applicants must satisfy the Graduate School's minimum admission requirements as well as the following program requirements: undergraduate engineering degree from an ABET-accredited program or its equivalent (students with a physical sciences degree other than engineering and considerable industry experience are also eligible); an undergraduate grade point average of at least 3.0 on a 4.0 scale (exceptions may be made by the admissions committee in favor of applicants with industry experience); and at least two years of work experience in manufacturing. Students applying from non-U.S. universities must supply GRE and either TOEFL, MELAB, or IELTS scores. For more information, contact mse@engr.wisc.edu.

LEARNING OUTCOMES

KNOWLEDGE AND SKILLS

• demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field.
• demonstrate an ability to formulate, analyze, and solve advanced engineering problems.
• demonstrate creative, independent problem solving skills.
• apply the latest scientific and technological advancements, advanced techniques, and modern engineering tools to these problems.

PROFESSIONAL CONDUCT
• recognize and apply principles of ethical and professional conduct.

PEOPLE

Faculty: Pfefferkorn (director; Mechanical Engineering), Ceglarek (Industrial and Systems Engineering), DeCroix (School of Business), Duffie (Mechanical Engineering), Engelstad (Mechanical Engineering), Finster (School of Business), Krishnamurthy (Industrial and Systems Engineering), Lazimy (School of Business), Li (Industrial and Systems Engineering), Livny (Computer Science), Lorenz (Mechanical Engineering), Matusumura (School of Business), Moskwa (Mechanical Engineering), O'Leary (Engineering Professional Development), Oliva (Civil and Environmental Engineering), Osswald (Mechanical Engineering), Radwin (Industrial and Systems Engineering), Ran (Civil and Environmental Engineering), Rowlands (Mechanical Engineering), Russell (Civil and Environmental Engineering), Shi (Industrial and Systems Engineering), Stone (Material Science and Engineering), Suresh (Mechanical Engineering), Turng (Mechanical Engineering), Veeramani (Industrial and Systems Engineering), Vieth (Engineering Professional Development), Wemmerlov (School of Business), Zhou (Industrial and Systems Engineering)