THE MASTER OF SCIENCE
in
MANUFACTURING ENGINEERING

THE COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

SYRACUSE UNIVERSITY

The program of Master of Science in Manufacturing Engineering prepares individuals to address critical needs of manufacturing enterprises in the areas of design of integrated manufacturing systems, information systems and technology, product design for manufacturability, and quality engineering. The graduates will acquire understanding of far-reaching implication of their activities and decisions on enterprise-wide business processes and supply chain management. The program draws a rich set of courses from the College of Engineering and Computer Science, the School of Management, and the School of Information Studies at Syracuse University.

This document proposes a new curriculum reflecting changed needs of the students, the industry and the faculty. The new curriculum has the following features:

- Emphasis on multidisciplinary nature of manufacturing engineering drawing relevant courses from other units across the campus,
- Incorporation of the input from manufacturing industry on the curriculum,
  - Society of Manufacturing Engineers (SME)\(^1\)
  - Institute for Manufacturing Enterprises (IME) advisory board
- Incorporation of the input from the faculty of the School of Management and the School of Information Studies,
- Provision for in-depth study on an area of concentration,
- Provision for expansion of areas of concentration,
- Provision for Dual-Degree options in MFE/EM (Manufacturing Engineering & Engineering Management), MFE/IRM (Manufacturing Engineering & Information Resource Management), and MFE/MBA (Manufacturing Engineering & Master of Business Administration)\(^2\),
- Distinction from the M.S. Degree Program in Engineering Management.

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\(^1\) “Manufacturing Education for the 21\textsuperscript{st} century,” Society of Manufacturing Engineers, 1999.
\(^2\) The Information Resource Management Program in the School of Information Studies is going through its revision process at the same time. Its new program approved by the School has been consulted.
\(^3\) The MBA Program in the School of Management is going through its revision process at the same time. Its new program approved by the School has been consulted.
**Program Description**

Students wishing to pursue an M.S. degree in manufacturing engineering must satisfy the following degree requirements. Out of 30 required credits, at least 24 credits must be 600 level or above.

- **Group A: Foundational Courses**

  Students must take three (3) foundational courses:
  - ECS 526 Statistics for Engineers
  - MFE 636 Materials and Processing in Manufacturing
  - MBC 632 Management Accounting.

- **Group B: Core Courses**

  Students must take at least two (2) core courses out of the following three options:
  - MFE 635 Manufacturing Systems
  - MFE 654 Production System Design and Control
  - MFE 692 Design for Manufacturing

- **Group C: Courses in an Area of Concentration**

  Students must choose a departmentally approved area of concentration and satisfy its requirements that include 15 credits of coursework. Of the 15 credits, at least 6 credits must be from Manufacturing Engineering courses (MFE designation). Students may choose to do a M.S. project (MFE 996) or a M.S. thesis (MFE 997).

- **A Capstone Paper**

  Students not doing a M.S. project or a M.S. thesis must complete a departmentally approved capstone paper which carries no credit.

** Examples of possible concentrations are given below. More concentrations may be developed and available in the future.
Concentration 1: Manufacturing System Design

CSE 581 (Introduction to Database Management Systems)
IST 552 (Information Systems Analysis: Concepts and Practice)
IST 642 (Electronic Commerce)
IST 659 (Data Administration Concepts and Database Management)
MAR 802 (Model Building in Marketing)
MFE 534 (Statistical Quality Control)
MFE 629 (Modeling and Optimization Techniques)
MFE 635 (Manufacturing Systems)
MFE 654 (Production System Design and Control)
MFE 676 (Computer Control of Machines and Processes)
MFE 850 (Advanced Topics in Manufacturing)
MFE 996 (Master's Project)
MFE 997 (Master's Thesis)
MFE 998 (Individual Study Program)
MIS 635 (The MIS Data Base)
OPM 864 (Manufacturing Management Systems)
SCM 701 (Introduction to Supply Chain Management)
SCM 702 (Principles of Management Science)

Concentration 2: Manufacturing Information Systems and Technology

CSE 581 (Introduction to Database Management Systems)
CSE 682 (Software Engineering)
ELE 558 (Data Networks: Basic Principles)
IST 552 (Information Systems Analysis: Concepts and Practice)
IST 555 (Distributed Computing for Information Professionals)
IST 575 (Managing Information Systems Projects)
IST 642 (Electronic Commerce)
IST 653 (Introduction to Telecommunications and Network Management)
IST 656 (Telecommunication and Information Network Technology)
IST 659 (Data Administration Concepts and Database Management)
MFE 534 (Statistical Quality Control)
MFE 629 (Modeling and Optimization Techniques)
MFE 635 (Manufacturing Systems)
MFE 639 (CAD/CAM Systems)
MFE 654 (Production System Design and Control)
MFE 850 (Advanced Topics in Manufacturing)
MFE 996 (Master's Project)
MFE 997 (Master's Thesis)
MFE 998 (Individual Study Program)
MIS 635 (The MIS Data Base)
SCM 701 (Introduction to Supply Chain Management)

Concentration 3: Product Development

CIS 625 (Computer Graphics)
CSE 581 (Introduction to Database Management Systems)
CSE 683 (Expert Systems)
CSE 684 (Introduction to Artificial Intelligence)
LAW 726 (Intellectual Property)
MAR 757 (Managing Innovative Products and New Ventures)
MAR 761 (Marketing Strategies for the Diffusion of Innovations)
MFE 534 (Statistical Quality Control)
MFE 548 (Engineering Economics and Project Evaluation)
MFE 634 (Productivity and Quality Engineering)
MFE 635 (Manufacturing Systems)
MFE 639 (CAD/CAM Systems)
MFE 692 (Design for Manufacturing I)
MFE 693 (Design for Manufacturing II)
MFE 850 (Advanced Topics in Manufacturing)
MFE 996 (Master’s Project)
MFE 997 (Master’s Thesis)
MFE 998 (Individual Study Program)
MOT 701 (Technology Development)
MOT 702 (Product Realization)
Appendix: Description of Courses for the Manufacturing Engineering Program

CIS 625 Computer Graphics 3 IR


CSE 581 Introduction to Database Management Systems 3 Y

Basic concepts of entity, attribute, field, record, file, and database, File design and organization, sequential list and hierarchical structures, File accessing and updating, Keys, directories, and hashing, Storage considerations and existing systems. Prereq: CSE 382.

CSE 682 Software Engineering 3 Y

Requirements and specifications including tools such as PSL/PSA, SREM, design techniques, Functional decomposition, data flow, data structure, theoretical issues in testing, testing strategies: path, domain, mutation and error specific, cost and reliability models. Prereq: knowledge of a high level language.

CSE 683 Expert Systems 3 Y

Production rules, forward/backward chaining, Rete algorithm, structured objects, introduction to an expert system language/shell, probabilistic inference networks, fuzzy logic, knowledge acquisition, and explanation generation. Programming project or term paper required.

CSE 684 Introduction to Artificial Intelligence 3 SI

Knowledge representation, production systems, search algorithms, game playing, uncertainty handling, learning, automated reasoning, computer vision, and natural language processing. Programming project or term paper required.

ECS 526 Statistics for Engineers 3 Y

Point estimation, confidence intervals, simple hypothesis testing, nonparametric tests, curve fitting and regression, analysis of variance, factorial experiments, and engineering applications. Prereq: ECS 525 or MAT 521 or equivalent.

ELE 558 Data Networks: Basic Principles 3

Data communication networks, multiplayer network architecture, data transmission fundamentals, network protocols, local and wide area networks, transport and application protocols.

IST 552 Information Systems Analysis: Concepts and Practice 3 S

Concepts and methods of systems analysis through decomposition and modeling, Extensive practice with structured methodologies, Systems analysis project management techniques, Introduction to automated tools and technology, Group project to apply skills, Prereq: Graduate standings or IST 352.
IST 555  Distributed  Computing for Information Professionals  3  S
Coverage of technical and organization issues related to distributed computing.  In-depth
consideration of microcomputer hardware and operating system concepts at the local and
network levels.  Hands-on applications development in microcomputer-based client/ server
environment.

IST 575  Managing Information Systems Projects  3  Y
Emphasis on concepts and techniques, focusing on role of managers who work in information
systems function of an organization.

IST 642  Electronic Commerce  3
Current developments in information systems and networks for electronic business transactions.
Includes electronic data interchange, secure financial transactions, and evolving marketplace
mechanisms.  Social impacts and opportunities are discussed.

IST 653  Introduction to Telecommunications and Network Management  3  S
Telecommunications management and application.  Planning, design, implementation, and
evaluation of voice and data networks, local and wide-area networks, and overall network
management.  Industry trends and career planning.

IST 656  Telecommunication and Information Network Technology  3  Y
Essential elements, hardware and software technologies in telecommunication and information
Prereq: IST 653

IST 659  Data Administration Concepts and Database Management  3  Y
Definition, development, and management of databases for information systems.  Data analysis
techniques, data modeling, and schema design.  Query languages and search specifications.
Overview of file organization for databases.  Data administration concepts and skills.

LAW 726  Intellectual Property  3  Y
Survey of the foundations of copyright, patent, unfair competition, and trade law.  For students
who wish to concentrate in intellectual property or who want a basic course as preparation for
business planning or litigation practice.  Co-requisite for Copyright—Literary and Artistic Works
and for Copyright Protection of New Technologies.  Patents course and Unfair Competition may
be taken as co-requisites.

MAR 757  Managing Innovative Products and New Ventures  3  Y
Commercializing new products, services, and technologies.  Designing innovation strategies, risk
taking, technology planning, evaluation of new product proposals, and managing the innovation
team.  Prereq: MBC 636 or permission of instructor.

MAR 761  Marketing Strategies for the Diffusion of Innovations  3

MAR 802  Model Building in Marketing  3  IR
Statistical/  econometric and management science modeling approaches to marketing problem
solving.
MBC 632 Management Accounting 3 Y
Theory, design elements and application of cost management accounting to manage economic organizations. Focus on how accounting measures can be used to promote efficient resource allocation/consumption within the organization.

MFE 534 Statistical Quality Control 3 IR
Controlling product quality through the control of the manufacturing process and acceptance sampling. Industrial project required. Prereq: MFE 326.

MFE 548 Engineering Economics and Project Evaluation 3 Y

MFE 629 Modeling and Optimization Techniques 3 SI
Introduction to major deterministic and stochastic techniques in operations research, including linear programming and its extensions, inventory models, queuing models, and simulation. Computer applications. Not open to Industrial and Systems Engineering students. Prereq: MAT 521 or 327

MFE 634 Productivity and Quality Engineering 3 Y
Measuring, evaluating and improving productivity in conjunction with total quality methods. Multidimensional measures of performance. Quality function deployment, concurrent engineering, loss function; system, parameter and tolerance design using statistically designed experiments. Statistical quality control overview. Prereq: EGR 526

MFE 635 Manufacturing Systems 3 Y
Theory and applications of computer control to manufacturing processes and operations. Flexible manufacturing systems, computer aided design, group technology, computer aided process planning, integrated CAD/CAM data bases. Laboratory experiments. Prereq: MFE 629.

MFE 636 Materials and Processing in Manufacturing 3 Y
Properties of metals, polymers, ceramics; mechanics and mechanisms of deformation processing, manufacturing processes. Laboratory demonstrations.

MFE 639 CAD/CAD Systems 3 Y

MFE 654 Production System Design and Control 3 Y
Problems in design and control of manufacturing facilities. Layout design, line balance, production planning, sequencing, material requirements planning, group technology and quality control. Not open to Industrial and Systems Engineering students. Prereq: MFE 629
MFE 676  Computer Control of Machines and Processes  3  SI
Application of micro-computers, programmable controllers, numerical controls, analog-digital conversion, robotics, software development, laboratory experiments. Prereq: course in controls or a linear systems theory.

MFE 692,693  Design for Manufacturing  3  Y
Major design product which would include initial design definition, analysis/CAD, manufacturability studies, design modification, manufacturing layout and databases. Prereq: core courses in master’s degree in manufacturing engineering.

MFE 850  Advanced Topics in Manufacturing  3  IR
Selected topics in conventional and non-conventional manufacturing processes, flexible manufacturing cell, automated manufacturing, production planning, quality control. May be repeated once for credit.

MFE 996  Master's Project  1-6  S
MFE 997  Master’s Thesis  1-9  S
MFE 998  Individual Study Program  1-6  S
MIS 545  Decision Support Systems  3  IR

MIS 635  The MIS Data Base  3  Y
Data base concepts and methods that enhance managerial decision making. Machine-user interface, data base model modularity, and integration. Criteria for file organization and data base management system selection. Prereq: MIS 625/ ISM 741 or permission of instructor.

MOT 701  Technology Development  6  Y
This course focuses on how technologies are identified, evaluated, and developed. The role of both information technology and management controls are also investigated. Prereq: Graduate standing or permission of instructor.

MOT 702  Product Realization  6  Y
The transformation of technology development ideas into successful products using appropriate manufacturing process technologies. Issues such as resource planning and scheduling are integrated with the process control and IT management issues. Prereq: MOT 701 or permission of instructor.

OPM 864  Manufacturing Management Systems  3  Y
SCM 701  Introduction to Supply Chain Management  
Supply chain systems and global approaches to designing and operating transportation and distribution sub-systems. Prereq: MBC 635, 636 and 638 or permission of instructor.

SCM 702  Principles of Management Science  
Concepts and development of analytical model building as used in global supply chain decision. Prereq: MBC 624, 635, and 638 or permission of instructor.