

MANUFACTURING ENGINEERING TECHNOLOGY

Manufacturing Engineering Technology

College of Science, Engineering & Technology

Department of Automotive & Manufacturing Engineering Technology

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The mission of the Manufacturing Engineering Technology (MET) degree program at Minnesota State University, Mankato, is to provide a broad-based education to enable graduates to enter a variety of globally competitive manufacturing careers to serve the needs of the citizens of Minnesota, and the world by:

- providing the highest quality education to prepare application oriented graduates for career opportunities in both traditional and computer-automated manufacturing environments;
- encouraging and supporting faculty, and students to engage in scholarly activities and research that support effective and ethical transfer of technology;
- equipping or developing access to state of the art equipment, facilities, and methodologies, along with faculty expertise to benefit MET students; and
- engaging in partnerships with area industry and other constituencies to broaden access to the program for traditional and diverse populations, while supporting K-12 pipeline development.

Program Description. Manufacturing Engineering Technology (MET) degree program awards a Bachelor of Science degree (BS) to successful students through a four-year curriculum.

"Engineering Technology" is the profession in which knowledge of the applied mathematical and natural sciences gained by higher education, practical experience, and competence developed in a specific field, is devoted to application of engineering principles and the implementation of technological advances for the benefit of humanity through its focus on product improvement, manufacturing, and automation of technological processes and operational functions. - Engineering Technology Council of the American Society of Engineering Education (ASEE).

"Modern manufacturing activities have become exceedingly complex because of rapidly increasing technology and expanded environmental involvement. This, coupled with increasing social, political, and economic pressures, has increased the demand for highly skilled manufacturing technologists, engineers, and managers." – Society of Manufacturing Engineers Fundamentals of Manufacturing 2005. Students use major study areas of applied mathematics, engineering sciences and materials, product design, manufacturing processes, automated systems and controls, quality, manufacturing management and personal and professional effectiveness to perform in careers requiring the application of scientific and engineering knowledge and methods. Combined with technical skills in support of engineering activities; student careers often fit in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer. Engineering technology is oriented less toward theory and more toward practical applications. - American Society of Engineering Education (ASEE).

Manufacturing involves plans, materials, personnel, and equipment which are transformed in some way that adds value. Students require leadership and managerial skills necessary to enter careers in process and systems design, manufacturing operations, maintenance, technical sales or service functions. The curriculum concentrates on the study of individual subsystems and their overall optimization of cost, quality, speed, and flexibility goals for the success of a manufacturing enterprise. Students from the program are currently employed in a wide variety of industries including medical, electronics, power systems, defense, and automotive. A list of companies and industry sectors employing MET graduates may be obtained from the Department Chair.

The Society of Manufacturing Engineers (sme.org) is the lead professional society used in developing program criteria guiding program relevance and improvement directions. Students are encouraged to take the Certified Manufacturing Technologist (CMfgT) exam in the senior year and pursue other certifications as their experience broadens.

The primary goal of the MET program is to provide all graduates with the solid technical foundation necessary to insure their success in a wide variety of employment opportunities. To accomplish this goal, program outcomes and objectives are defined and assessed for continuous improvement. These are consistent with the mission of the university and college and reviewed by the Industrial Advisory Board on an annual basis. They are as follows:

Program Outcomes. Students at the time of graduation are prepared to:

1. apply knowledge, problem solving techniques, and hands-on skills in the assessment, design, application, and continuous improvement of manufacturing systems, including automated manufacturing, processes, process controls, manufacturing operations, management, and systems integration.
2. specify and implement hard and soft technologies to solve manufacturing system problems using creativity in design.
3. demonstrate the application of their knowledge of mathematics, statistics, science, engineering and technology.
4. conduct, analyze and interpret experiments and apply results to improve processes and systems.
5. recognize the need and develop the skills for lifelong learning.
6. communicate effectively across all design and management interface levels of an organization.
7. function effectively in a team and or leadership environment.
8. implement accepted professional standards of integrity and ethical conduct.
9. understand and engage in behavior which respects diversity and global cultures
10. practice timeliness and quality with regard to work requirements

Program Objectives. Graduates two to three years into their careers should have the foundation to:

1. deliver products, services, and support to both internal and external organizations by applying technical knowledge, problem solving techniques and hands-on skills in traditional and emerging areas of manufacturing.
2. actively participate in ongoing professional development, professional growth and increasing professional responsibility.
3. effectively communicate ideas to technical and non-technical people.
4. perform, lead, and manage in cross functional teams
5. work within the accepted standards of professional integrity and conduct.
6. design, analyze, build, and test virtual or real models in product development and continuous improvement environments.
7. implement, and continuously improve cost, quality, time, and flexibility goals using world class management methodologies.

Accreditation. The MET degree program is accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Phone: 410-347-7700, Fax: 410-625-2238, e-mail: tac@abet.org, web: <http://www.abet.org>

Admission to Major is granted by the department. Minimum university admission requirements are:

- a minimum of 32 earned semester credit hours.

- a minimum cumulative GPA of 2.00 ("C").

Contact the department for application procedures.

MANUFACTURING ENGINEERING TECHNOLOGY

MANUFACTURING ENGINEERING TECHNOLOGY BS

Required General Education (25 credits):

ENG 101	Composition (4)
SPEE 100	Fundamentals of Speech Communication (3) OR
SPEE 102	Public Speaking (3)
MATH 115	Precalculus Mathematics (4)
MATH 121	Calculus I (4)
PHYS 211	Principles of Physics I (4)
CHEM 104	Introduction to Chemistry (3)
STAT 154	Elementary Statistics (3)

plus additional B.S. General Education as required by university

Required Support Courses (12 credits):

ENG 271	Technical Communication (4)
MATH 127	Calculus II for Engineering Technology: Integration (2)
PHYS 212	Principles of Physics II (4)
CS 171	Introduction to C++ Programming (2)

Required for Major (60 credits):

MET 104	Introduction to Manufacturing Engineering Technology (1)
MET 142	Computer Aided Drafting (3)
MET 144	Product Development and Design (3)
MET 177	Materials Processing I and Metallurgy (4)
MET 277	Materials Processing II (4)
MET 322	Statics, Dynamics, and Mechanics of Materials (5)
MET 341	Advanced Computer Aided Design (4)
MET 347	Manufacturing Automation (4)
MET 387	Junior Design Project (1)
MET 407	Manufacturing Resource Planning and Control (4)
MET 423	Ergonomics and Work Measurement (4)
MET 424	Industrial Safety (2)
MET 425	Project and Value Management (4)
MET 426	Logistics and Transportation (2)
MET 427	Quality Management Systems (3)
MET 488	Senior Design Project I (1)
MET 489	Senior Design Project II (2)
AET 334	Fluid Power (3)
AET 378	Composite Materials (3)
EET 113	DC Circuits (3)

Minor Required: None.

MANUFACTURING ENGINEERING TECHNOLOGY MINOR

Total Credits (16 credits)

Required for Minor (8 credits):

MET 104	Introduction to Manufacturing Engineering Technology (1)
MET 142	Computer Aided Drafting (3)
MET 177	Materials Processing I and Metallurgy (4)

Additional electives required for minor (8 credits):

Required for Minor (Electives, 8 credits):

Choose 8 credits of MET/AET courses from major core courses.

POLICIES/INFORMATION

GPA Policy. A minimum GPA of 2.0 is required.

Refer to the College regarding required advising for students on academic probation.

Department Grade Policy. All courses in the MET Major, and the required Communications, Basic Science, and Mathematics courses must be completed with a grade of "C" or better.

P/N Grading Policy. No more than 1/4 of all undergraduate credits may be P/N, except those courses offered P/N only.

Residency. A minimum of 50 percent of the credits for a major or minor in Manufacturing Engineering Technology must be taken at Minnesota State Mankato.

Prerequisites and co-requisites must be observed unless written permission is obtained from the instructor and the Department of AMET. A flow chart of prerequisites is available in the Department Office.

The scheduling of all department courses is done bi-annually, based on enrollment and staffing. To obtain a current class schedule, contact the Department.

COURSE DESCRIPTIONS

MET 104 (1) Introduction to Manufacturing Engineering Technology

An overview of careers, technology and requirements for individuals interested in Manufacturing Engineering Technology. Hands-on experience is gained in a variety of new technologies. Careers in engineering and technology are examined along with professional organizations and ethics. The course is intended as a first step toward a career in manufacturing.

MET 142 (3) Computer Aided Drafting

Computer Aided Designing covers a process of developing and analyzing solid parametric models for mechanical applications. Course includes solving technical designing problems based on real-world applications as well as creation of technical documentation: working and assembly drawings. Introduction to the Finite Element Analysis is included in the course.

MET 144 (3) Product Development and Design

Analysis and application of key steps in the product realization process. External and internal factors affecting strategic product life-cycle management are emphasized along with the relationship of design to marketing and manufacturing activities and product development cost implications. Students work individually and in teams on a competitive semester-long design project assessing customer needs, product specifications, generation and selection of concepts, prototype development, test and product production planning. Concentrates on development of verbal, written and e-communication skills. Provides knowledge and practice in conducting effective project management.

MET 145 (2) Computer Graphics

A course intended for engineering students. Principles of CAD along with engineering applications are covered.

MET 177 (4) Materials Processing I and Metallurgy

Fundamentals of machine technology and metallurgy. Theory and step-by-step procedures are used to provide instruction on how to turn materials into products. Students learn to perform machining on a lathe, mill, and drill press, and also inspect the products. Basics of metal processing, plastic molding, and other processes are discussed. Extra lab time is required.

Pre or Co-req: MATH 112 or MATH 115

MET 222 (3) Introduction to Statics and Mechanics of Materials

Course introduces the design theory and applied principles of force equilibrium, stress and strain, shear, bending moments, force diagrams, deformations of beams, and stress/strain analysis.

Pre: PHYS 101, MATH 115

Fall, Spring

MET 277 (4) Materials Processing II

A study of the principles of manufacturing technologies, measurements and equipment used in processing of an end product. Advanced manufacturing processes including casting, forging, sheet metal forming, material removal, joining, and powder metals are discussed. Topics also include materials treatment, preparation, and design for manufacture. Extra lab time is required.

Pre: MET 177

MET 322 (5) Statics, Dynamics, & Mechanics of Materials

Course covers principles of force equilibrium, stress and strain, shear and torsion, bending moments, force diagrams, deformations of beams, stress/strain analysis, kinematics and kinetics of rigid bodies, work, energy, and power.

Pre: PHYS 211 and MATH 121

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MET 341 (4) Advanced Computer Aided Design

This course emphasizes the use of CAD in design, analysis, and manufacturing. Topics include component design, mechanics, animation, finite element analysis, CNC machining and rapid prototyping using CAD.

Pre: MET 142, Co-req: MET 322

MET 345 (1-2) CAD Projects

Advanced applications of computer aided design. Solid and parametric systems.

Pre: MET 245

MET 347 (4) Manufacturing Automation

CNC programming, computer-aided manufacturing (CAM), flexible automations, machining centers, robotics, programmable logic controllers, tooling systems. Extra lab time is required.

Pre: MET 277; Pre or Coreq: MET 341

MET 387 (1) Junior Design Project

An examination of manufacturing design and research, along with a review of topics such as ethics, professionalism, measurement, statistics, and career development/placement. This course prepares the student for MET 488, Senior Design Project I, where the design proposal, design project and final report are completed.

Pre: MET 104; Coreq: STAT 154

MET 407 (4) Manufacturing Resource Planning and Control

Strategic plant resource management for global manufacturing applications through hard and soft technology integrated supply chain management. Approaches examine and practice continuous improvements to the value stream related to design integration, production scheduling, staffing, facilities planning, and material flow.

Pre: Junior status in program of discipline, or basic manufacturing and design knowledge in industry sector discipline and background in elementary statistics.

MET 423 (4) Ergonomics & Work Measurement

Investigates work design and automated and manual operations. Measurement, and development of design based solutions for reduction of environmental stresses to the human body through worker-machine systems analysis are applied. Regulatory, legal, and ethical issues are reviewed in the context of global manufacturing applications.

Pre: Junior status in program of discipline, or basic manufacturing and design knowledge in industry sector discipline and background in elementary statistics.

MET 424 (2) Industrial Safety

Techniques of developing safety practices in an industrial environment. Topics include OSHA, current legislation, cost analysis, personal protection, employee selection, psychological aspects, product safety, hazard materials and catastrophe control.

MET 425 (4) Project and Value Management

Principles of engineering economy are enhanced through spreadsheet modeling and proposal development for capital purchase applications. Planning, organizing, directing, and reporting for industrial team based project management are studies in relationship to organizational factors of structure and culture.

Pre: Junior status in program of discipline, or basic manufacturing and design knowledge in industry sector discipline and background in elementary statistics.

MET 426 (2) Logistics and Transportation

Fundamentals of logistics: supply chain management, control of materials, WIP, finished goods, costs of logistics. Theory and step-by-step procedures are used to analyze logistic systems, packaging and transportation, including global logistics.

MET 427 (3) Quality Management Systems

This course is focused on quality assurance systems, management philosophies, methodology, function and impact of quality systems in manufacturing operations. Development and application of statistical process control tools.

Pre: Basic manufacturing and design knowledge for industry sector discipline and elementary statistics.

MET 488 (1) Senior Design Project I

An examination of manufacturing design and research. Students refine their design proposal and begin their senior design projects. This course also prepares the student for MET 489, Senior Design Project II, where the design proposal, design project, and final report are completed. This course should be taken in the fall semester of the senior year.

Coreq: STAT 154

MET 489 (2) Senior Design Project II

A continuation of MET 488.

Pre: MET 488, ENG 271

MET 492 (1-4) Seminar: Manufacturing

Selected manufacturing topics.

MET 497 (1-10) Internship: Manufacturing

Manufacturing work experience in an area pertinent to the student's objective. Consent of internship coordinator required prior to the beginning of employment and registration. Typically done between the junior and senior year.

Pre: 50% of major

MET 499 (1-4) Individual Study