**MANUFACTURING ENGINEERING (MFGE)**

**MFGE 2132. Manufacturing Processes Lab.**
Hands-on experience in variety of material removal processes such as turning, milling, drilling, and CNC machining; joining processes such as gas/arc welding, and soldering; metal casting, polymer and composite processing, and microelectronics manufacturing. Corequisite: MFGE 2332 with a grade of "D" or better.
1 Credit Hour. 0 Lecture Contact Hours. 2 Lab Contact Hours.
Grade Mode: Standard Letter

**MFGE 2332. Material Selection and Manufacturing Processes.**
Overview of material processing, material selection and process parameter determination. Processes covered include: material removal, forming, casting, polymer processing, semiconductor manufacturing and assembly processes. Laboratory activities provide opportunities for applying the design through manufacture activities of the product cycle. Corequisite: ENGR 2300 with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

**MFGE 3316. Computer Aided Design and Manufacturing.**
Topics include design process, description of wireframe/surface/solid models, transformation and manipulation of objects, finite element analysis, data exchange, process planning, machine elements, fundamentals of numerical control programming for turning and milling processes, fundamentals of CAD/CAM systems, CNC code generation by CAD/CAM software, waterjet, and plasma cutting. Prerequisites: ENGR 1313 and ENGR 2300 and MFGE 2332 all with grades of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

**MFGE 3355. Design of Machine Elements.**
This course will cover the general procedures in designing various machine elements. These elements include shafts and flexible elements, springs, welded/riveted/brazed joints, screw fasteners, rolling/sliding contact bearings, gears, cams, and followers. Emphasis will be placed on using standard design practices. Prerequisite: ENGR 3311 or TECH 2351 either with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

**MFGE 4357. Dynamics of Machinery.**
This course will cover kinematics and kinetics of particles; kinematics and kinetics of rigid bodies in two and three dimensions; application of dynamics to the analysis and design of machine and mechanical components; mechanical vibrations; linkages; gear trains; and balancing of machines. Prerequisite: ENGR 3375 and MATH 3323 both with grades of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

**MFGE 4363. Concurrent Process Engineering.**
Integrated design and development of products and processes; impact of ethical issues on design; the discussion of real-world engineering problems and emerging engineering issues with practicing engineers; preparation of reports; plans or specifications; cost estimation; project management, communication and the fabrication of an engineered product/system. (WI) Prerequisites: ENGR 3311 and MFGE 4365 both with grades of "D" or better. Corequisites: IE 3330 with a grade of "D" or better.
3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required|Writing Intensive
Grade Mode: Standard Letter

**MFGE 4365. Tool Design.**
Design of single and multi-point cutting tools, jig and fixture design, gage design, and the design of tooling for polymer processing and sheet metal fabrication. Laboratory projects will involve the use of computer aided design and rapid prototyping. Prerequisite: MFGE 3316 or TECH 2310 either with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

**MFGE 4367. Polymer Properties and Processing.**
Structure, physical & mechanical properties, design considerations and processing methods for polymer-based materials are presented. Processing methods include: injection molding, blow molding, thermoforming, compression molding, extrusion, filament winding, lay-up methods, vacuum bag molding and poltrusion. Prerequisite: MFGE 2332 or TECH 4362 either with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

**MFGE 4366. Control Systems and Instrumentation.**
The theory of automated control systems and its applications to manufacturing systems are covered in this course. Topics covered include: modeling of systems, time and frequency domain feedback control systems, stability analysis, transducer and sensor technology and digital control. Prerequisite: ENGR 2300 and PHYS 1430 and [EE 3370 or MFGE 2332 or TECH 4362] all with grades of "D" or better. Corequisite: MATH 3323 with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

**MFGE 4390. Manufacturing Engineering Design I.**
This course is the first of a two course sequence involving integrated design and development of products and processes; impact of ethical issues on design; the discussion of real-world engineering problems and emerging engineering issues with practicing engineers; preparation of reports, plans or specifications; cost estimation; project management, and communication. Prerequisites: ENGR 3311 and MFGE 4365 both with grades of "D" or better. Corequisite: IE 3330 with a grade of "D" or better.
3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Writing Intensive
Grade Mode: Standard Letter
MFGE 4391. Manufacturing Engineering Design II.
This course is the second of a two course sequence involving implementation of Integrated design and development of products and processes; impact of ethical issues; the discussion of real-world engineering problems and emerging engineering issues with practicing engineers; preparation of reports, plans and specifications; cost estimation; project management; and communication. Prerequisites: IE 3330 and MFGE 4390 both with grades of "D" or better.

3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Writing Intensive
Grade Mode: Standard Letter

MFGE 4392. Microelectronics Manufacturing I.
Provides an overview of integrated circuit fabrication including crystal growth, wafer preparation, epitaxial growth, oxidation, diffusion, ion-implantation, thin film deposition, lithography, etching, device and circuit formation, packaging and testing. The laboratory component involves production and testing of a functional semiconductor device. Prerequisites: CHEM 1141 and CHEM 1341 both with grades of "D" or better.

3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.

MFGE 4394. Microelectronics Manufacturing II.
Topics include: atomic models for diffusion, oxidation and ion implantation; topics related to thin film processes i.e. CVD, PVD; planarization by chemical-mechanical polishing and rapid thermal processing; and process integration for bipolar and MOS device fabrication. Students will design processes and model them using a simulation. Prerequisite: MFGE 4392 with a grade of "D" or better.

3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

This course is an overview of computer integrated manufacturing is presented. Topics include control strategies for manufacturing systems, automated material handling systems, production planning, shop floor control, manufacturing execution systems, manufacturing databases and their integration, data communication and protocols and man/machine interfaces. Prerequisite: MFGE 3316 with a grade of "D" or better. (WI).

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

MFGE 4396. Manufacturing Systems Design.
Applications of simulation modeling to the design and analysis of manufacturing systems are presented in this course. Topics covered include queuing theory and discrete event simulation methods. Design projects will involve the use of current simulation language for modeling and analysis of manufacturing systems. (WI) Prerequisite: IE 3320 with a grade of "D" or better.

3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

MFGE 4399A. Reverse Engineering and Rapid Prototyping.
In the course 3D scanning technology for design, analysis, and inspection, is covered. Also, applications of the 3D scanning in reverse engineering and different rapid prototyping processes in a hands-on approach will be explained in this course.

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MFGE 4399B. Introduction to Reinforced Polymer Nanocomposites in Industrial Applications.
Introductory course in reinforced polymer nanocomposites focusing on materials, manufacturing, characterization, and applications. Include, primarily nanoclay polymer matrix composites. Thrust will be the challenges in low-cost manufacturing for industrial applications, commercial successes, its impact on current material market, and future.

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MFGE 4399C. Introduction to Industrial Robotics.
This course will cover the basic principles and techniques involved in industrial robotics. Emphasis will be placed on industrial robot applications, analysis of robot manipulators, components of industrial robots, robot programming and control. Prerequisite: MFGE 4376 with a grade of "D" or better.

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

Topics include design process, mathematical presentation of wireframe/surface/solid modes, transformation and manipulation of objects, finite element analysis, data exchange, process planning, fundamentals of multi-axis NC programming for turning and milling processes, fundamentals of CAD/CAM systems, CNC code generation by CAD/CAM software for the CNC, and waterjet machines. Prerequisites: Instructor approval.

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5318. Additive Manufacturing.
The course covers theory, techniques, and applications of Advanced Reverse Engineering & Freedom Fabrication. Topics include reverse engineering generic process, reverse modeling, contact and noncontact scanning, point cloud, geometric modeling, data extraction, rapid prototyping processes, uniform and adaptive slicing, industrial and medical applications, hardware, and software. Prerequisite: Instructor approval.

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter
MFGE 5320. Polymer Nanocomposites.
This course covers polymer nanocomposites focusing on materials, manufacturing, characterization, and applications. The primary focus is on fiber reinforced polymer nanocomposites. Morphological, Thermal, Mechanical, and Electrical Characterization will be discussed in detail. Applications include fire-resistant, ablative, fatigue-resistant, impact-resistant, and bio-based composites. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 5326. Advanced Robotics in Manufacturing Automation.
This course covers principles and techniques involved in advanced robotics. Topics include introduction to robotics, industrial robotics, robot kinematics, path planning, robot dynamics, advanced control, force control, sensors and actuators, mobile robotics, and introduction to nanorobotics. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5328. Advanced Control Techniques.
This course covers advanced control techniques in manufacturing processes. Topics include modeling of dynamic systems, feedback control systems analysis, stability analysis, PID control, optimal control, programmable logic control, design of control systems, transducer and sensor technology, and digital control. Registration requires instructor's approval. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 5398A. Multiscale Manufacturing.
This course covers multiscale manufacturing processes, techniques, and applications. Topics include micro and nano-manufacturing, polymer and semiconductor fabrication, thin film technologies, bulk and surface micromachining, physics of multiscale manufacturing, microelectromechanical (MEMS) devices, and design issues for fabrication of micro and nano-systems. Prerequisites: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing Topics
Grade Mode: Standard Letter

MFGE 5398B. Advanced Composite Materials.
This course examines various aspects of fiber-reinforced polymeric composites. The topics covered include constituent materials (fibers and matrices), mechanics, performance, manufacturing, and introduction to nanocomposites. This course also provides introductory treatments concerning ceramic matrix composites, metal matrix composites, and carbon/carbon composites.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing Topics
Grade Mode: Standard Letter