MANUFACTURING ENGINEERING

Manufacturing Engineering is concerned with designing, building, planning, operating, and managing economical production systems for discrete manufacturing. Manufacturing engineers need to have a thorough knowledge of materials and manufacturing processes. They should also be able to design, operate and manage integrated systems that include people, materials, machine tools, material handling equipment, robots, quality measuring equipment, controls and computers.

Traditionally, there has been a strong division between manufacturing engineering and design engineering. Today, however, the boundary between these two functions is narrowing. Both groups work together in teams to assure soundness of design and manufacturability of the product. Manufacturing engineers must understand engineering materials and design besides having expertise in manufacturing tooling and processes, systems, and technology. They design and evaluate the capabilities of manufacturing tools and processes and interact with design engineers during the development of product specifications and tolerances.

Today's manufacturing equipment is becoming increasingly computer based. Manufacturing engineers must have a working knowledge of programmable equipment, as well as its interfaces with control hardware. They must understand the multi-layered control architecture of the integrated factory, and the computer-based technologies that enable it.

Undergraduate Degree Program

The Bachelor of Science in Manufacturing Engineering provides first a strong foundation in all of the basic ingredients of engineering: the natural and physical sciences, mathematics, socioeconomic-cultural background, the behavioral sciences and finally the basic engineering sciences that begin the development of problem-solving skills. Then, the program develops intermediate bases on which manufacturing engineering and systems are founded. This includes studies in engineering materials, manufacturing processes, probability and statistics, electronics, computers, human factors/ergonomics, and operations research. The program then provides for the detailed study of several advanced topics related to process, assembly, and product engineering; manufacturing productivity and quality; and manufacturing integration methods and system design. Excellent laboratory facilities are available for students to conduct experiments and measure process variables.

Finally, students are required to complete a project dealing with the design of a production system to manufacture a product. In the project, the students also address issues related to cost, aesthetics, feasibility, reliability, safety and ethics wherever applicable.

An opportunity is available to obtain considerable practical experience in the student's specialty for those who elect the cooperative education option.

Students who do well in their undergraduate program are encouraged to consider graduate work. Information and assistance regarding fellowships and assistantships for graduate studies may be obtained from the department chairperson.

The Bachelor of Science in Engineering in Manufacturing Engineering is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://www.abet.org/)

Program Educational Objectives

Consistent with providing a strong academic foundation in the field of Manufacturing Engineering, the program educational objectives for our graduates are:

- To remain gainfully employed in Manufacturing Engineering related fields,
- To continue develop professionally, and
- To serve in leadership roles.

Student Outcomes

To achieve the educational objectives, the graduates of the program will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Dearborn Discovery Core

Please see the Dearborn Discovery Core (General Education) (https://umdearborn.edu/dearborn-discovery-core/) webpage or additional information.

Foundational Studies

Writing and Communication (GEWO) – 6 Credits

Upper-Level Writing Intensive (GEWI) – 3 Credits

Quantitative Thinking and Problem Solving (GEQT) – 3 Credits

Critical and Creative Thinking (GECC) – 3 Credits

Areas of Inquiry

Natural Science (GENS) – 7 Credits

- Lecture/Lab Science Course
- Additional Science Course

Social and Behavioral Analysis (GESB) – 9 Credits

Humanities and the Arts (GEHA) – 6 Credits

Intersections (GEIN) – 6 Credits

Capstone

Capstone (GECE) – 3 Credits

Major Requirements

A candidate for the degree Bachelor of Science in Engineering (Manufacturing Engineering) is required to pursue scholastic quality and to complete satisfactorily the following program of study:

In addition to completion of the Dearborn Discovery Core, the following courses are required to earn a BSE degree in Manufacturing Engineering from UM-Dearborn.

Code	Title	Credit Hours
Prerequisite Courses		
COMP 270	Tech Writing for Engineers (Also fulfills 3 credits of DDC Written and Oral Communication)	3
ECON 201	Prin: Macroeconomics (ECON 201 or 202 also fulfill 3 credits of DDC Social and Behavioral Analysis)	3
or ECON 202	Prin: Microeconomics	
MATH 115	Calculus I	4
MATH 116	Calculus II	4
MATH 215	Calculus III	4
MATH 228	Diff Eqns with Linear Algebra	4
CHEM 134	General Chemistry IA	4
CHEM 136	General Chemistry IIA	4
PHYS 150	General Physics I	4
PHYS 151	General Physics II	4
ENGR 100	Introduction to Engineering and Engineering Design	3
ENGR 126	Engineering Computer Graphics	2
ENGR 250	Principles of Eng Materials	3
IMSE 255	Computer Programming for Eng	3
ME 230	Thermodynamics	4
ME 260	Design Stress Analyses	4
or ME 265	Applied Mechanics	
ECE 305	Intro to Electrical Eng	4
Manufacturing Engineering Major Core		
IMSE 317	Eng Probability and Statistics	3
IMSE 382	Manufacturing Processes	4
IMSE 421	Eng Economy and Dec Anlys	3
IMSE 440	Applied stat models in engin	3
IMSE 4425	Human Factors and Ergonomics	4
IMSE 4675	Six Sigma & Stat Proc Improv	4
IMSE 4795	Prod, Inven Control & Lean Mfg	4
IMSE 4825	Industrial Controls	4
or ME 442	Control Systems Analysis and Design	
IMSE 4835	Comp.-Aided Prcs Desgn & Mfg	4
IMSE 4951	Design Project I	2
IMSE 4952	Design Project II	2
Manufacturing Process Course - select one course from the following:		3-4
ENGR 350	Nanoscience and Nanotechnology	
IMSE 381	Industrial Robots	
IMSE 488	Metal Forming Processes	
ME 460	Design for Manufacturing	
ME 4191	Structural Mech & Design	
ME 4910	Degradation of Materials	
ME 4950	Digital Manufacturing and Product Innovation	
Technical Electives		
Select 11-12 hours of the following:		11-12
IMSE 3005	Intro to Operations Research	
IMSE 381	Industrial Robots	
IMSE 4555	Systems Engineering: Processes, Methods and Practice	
IMSE 4585	Simulation in Systems Design	
IMSE 4745	Facilities Design	
IMSE 477	Human Computer Interaction for UI & UX Design	
IMSE 488	Metal Forming Processes	
ME 345	Engineering Dynamics	
ME 3601	Design and Analysis of Machine Elements	
ME 4191	Structural Mech & Design	
ME 4500	Design of Automotive Chassis and Body Systems	
ME 460	Design for Manufacturing	
ME 4910	Degradation of Materials	
ME 4950	Digital Manufacturing and Product Innovation	
ENGR 350	Nanoscience and Nanotechnology	
ENGR 360	Design Thinking : Process, Method & Practice	
ENGR 400	Appl Business Tech for Engr	
ENGR 399	Experiential Honors Prof. Prac	
ENGR 492	Exper Honors Directed Research	
ENGR 493	Exper Hnrs Dir Dsgn	
General Electives		
Additional classes as needed with the approval of advisors such that the total credit hours is 128.		

Dual Degree in Industrial and Systems Engineering

Please see the requirements for the BSE, Industrial and Systems Engineering/Manufacturing Engineering in the Dual Degrees section of this catalog.

Learning Goals

1. Ability to design manufacturing processes that result in products that meet specific material and other requirements.
2. Ability to design products and the equipment, tooling, and environment necessary for their manufacturing.
3. Ability to create a competitive advantage through manufacturing planning.
4. Ability to analyze, synthesize, and control manufacturing operations using statistical methods.

IMSE 255 Computer Programming for Eng 3 Credit Hours
Intermediate topics in computer programming: arrays, files, structured data types, pointers, functions. Overview of digital computer hardware and system software components: machine architecture, operating systems, computer networks, data security, and performance evaluation. (F).
Prerequisite(s): ENGR 100* and (MATH 105 or Mathematics Placement with a score of 113)

IMSE 299 Internship/ Co-Op 1 Credit Hour
This is a Cooperative Education course. Students wishing to experience a work experience before graduation may elect to participate in the Cooperative Education Program (minimum of two terms). (F,W,S).
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

IMSE 3005 Intro to Operations Research 4 Credit Hours
This course introduces some basic techniques or operations research used in decision making and system performance evaluation in both deterministic and probabilistic environments. Topics in linear programming, especially the simplex method with duality theory and sensitivity analysis is included. Other topics include integer programming, deterministic dynamic programming, network problems, PERT-CPM, discrete-time and continuous-time Markov chain models of random processes, queuing theory and applications. (F, YR).
Prerequisite(s): (MATH 217 or MATH 227 or MATH 228) and IMSE 317*

IMSE 317 Eng Probability and Statistics 3 Credit Hours
An introduction to statistics and probability for engineers and scientists. Topics include descriptive statistics and data visualization, set theory, permutations and combinations, Bayes' theorem, independence, discrete and continuous random variables, conditional and joint probability, central limit theorem, point estimation, confidence intervals, hypothesis testing, and hands-on experience with analytics software. Three hours lecture. (F, W, S).
Prerequisite(s): MATH 116 or Mathematics Placement with a score of 215 or MATH 114

IMSE 334 Org of Hospital Systems 3 Credit Hours
The fundamental concepts of organizational behavior are explored. The interrelationships among personnel in an organization, and the functions and responsibilities of individuals are discussed. Topics studied include decision-making theory, organizational authority and adjunct responsibility, leadership and supervision. Particular emphasis is placed upon hospitals and the health care industry. Lectures are supplemented with actual case studies from the health care industry in which the student has the opportunity to apply problem-solving techniques to true-to-life situations. Three hours lecture.
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

IMSE 350 Data Structures 4 Credit Hours
This course focuses on data design and algorithm designs. Data design topics include object-oriented discussions of hashing, advanced tree structures, graphs and sets. Algorithm design topics include the greedy, divide-and-conquer, dynamic programming, backtracking, and branch-and-bound techniques. A significant discussion of algorithm complexity theory, including time and space trade-off and elementary computability theory is included.
Prerequisite(s): MATH 115 and (CIS 200 or IMSE 200) and CIS 275

IMSE 351 Data Struc & Algorithm Anlysis 3 Credit Hours
Object-oriented design, programming, and analysis techniques review; structured programming concepts; data structures; algorithm design and analysis; lists, stacks, and queues; heaps, sorting, trees, graphs, and algorithm development utilizing modern languages, such as C++, Java.
Prerequisite(s): IMSE 255 or CIS 150 or IMSE 150 or CCM 150

IMSE 381 Industrial Robots 4 Credit Hours
The course introduces students in engineering and computer science to fundamentals of robotics technology, programming and their applications in industrial environment. The emphasis will be on robotics anatomy and configurations, robotocs kinematics, end effectors, use of sensors in robotics, robotics programming, design of robot workcell, robotics applications to production problems, cost justifications and robotics safety, rather than on the extensive theory of robotics. Three-hour lecture and three-hour laboratory per week.
Prerequisite(s): MATH 115
Restriction(s):
Can enroll if Class is Junior or Senior

IMSE 382 Manufacturing Processes 4 Credit Hours
This course introduces the students to the fundamentals and principles of manufacturing processes for engineering materials. It seeks to transfer an understanding of the application of principles of engineering materials and their influence on manufacturing processes. Topics covered include structure and manufacturing properties of metals, casting, heat treatments, bulk deformation processes, sheet metal working processes, processing of polymers and composites, surfaces and coating, powder metallurgy, machining and joining. Case studies of design for manufacturing and measurement of product quality; economical aspects and cost considerations in manufacturing systems will be studied. Three lecture hours and three laboratory hours.
Prerequisite(s): ENGR 250 and (ME 265 or ME 260)
Corequisite(s): IMSE 382L

IMSE 390 Selected Topics I 3 Credit Hours
Study of topics selected from any of the areas of Industrial and Systems Engineering. May include design or laboratory research.

IMSE 391 Selected Topics II 3 Credit Hours
Study of Advanced topics selected from any of the areas of Industrial and Systems Engineering. May include design or laboratory research.

IMSE 398 Independent Study in IMSE 1 to 3 Credit Hours
Individual study design or laboratory in an area of interest to the student. Contents may be chosen from any of the areas of Industrial and Manufacturing Engineering. The student will submit a report on his or her project at the end of the term. Written permission of the instructor required. (F,W,S).
Restriction(s):
Cannot enroll if Class is Freshman or Sophomore or Graduate
Can enroll if College is Engineering and Computer Science

IMSE 399 Internship/ Co-Op 1 Credit Hour
A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with the classroom terms.
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

IMSE 400 Programming Languages 4 Credit Hours
Systematic study of programming languages with regard to their implementation, structures, and use. Languages are compared with regard to their various data types, data structures, operations, control structures, programming environments, and ease of use in solving various programming problems.
Prerequisite(s): IMSE 350 or CIS 350 or CCM 350
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 421 Eng Economy and Dec Anlys 3 Credit Hours
Study of the concepts involved in the analysis of engineering management decisions, both short and long term. Time valued investments and the effects of depreciation and taxes in comparing alternatives are discussed. Specific attention is devoted to deterministic and probabilistic replacement policies for single and chain replacements of equipment. Basic elements of utility theory are introduced. Applications of decisions under risk, uncertainty, and of game theory to capital investment, bidding, and to competitive decisions are included.
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

IMSE 437 Health Care Management 3 Credit Hours
This course is intended for those who have to deal with the administrative aspects of health care systems and not only the technical. The goal of the course is to provide the hospital staff member with an understanding of operations of the total hospital system. Topics covered include functions, problems, and organization of the medical agencies and their effect upon hospitals; methods of nursing staff organization; techniques of determining nursing staff levels; development of staff schedules; financial reimbursement and governmental regulations.
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

IMSE 440 Applied stat models in engin 3 Credit Hours
Full Course Title: Applied statistical models in engineering The course provides students with considerable experience to flexibly work with Linear Regression Models and Design of Experiments. With the growth of automated systems, data analysis became an essential tool in engineering. The first part of the course introduces students to Simple Linear Models, Multiple Linear Models, Model Evaluation, Model Diagnosis, Analysis of Variance, Residual Analysis, and Model Selection. The second part of the course introduces students to Design of Experiments and commonly used designs such as the Completely Randomized Design, Randomized Complete Block Design, and Latin Squares Design. The course also provides the students with experience handling data for engineering applications via in-class activities and assignments. Student teams complete a major data analysis project to answer a set of engineering questions and challenges. (YR)
Prerequisite(s): IMSE 317 or BENG 364 or ME 364
Restriction(s):
Can enroll if College is Engineering and Computer Science

IMSE 4425 Human Factors and Ergonomics 4 Credit Hours
The course integrates the elements of traditional methods of engineering and time-motion studies with ergonomics and human factors concepts. Methods improvement, work measurement, and work design, applied to manufacturing and service industries, so as to increase productivity and improve worker health and safety. The topics covered include: problem solving tools; operation analysis; time-motion analysis; work sampling; manual and cognitive work design; workplace, equipment, tool and work environment design; allowances; and lean manufacturing. Lectures and laboratory. (YR)
Prerequisite(s): IMSE 317 or BENG 364
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 450 Operating Systems 4 Credit Hours
Introduction to computer operating systems. Process management, CPU scheduling, memory management, file systems and I/O devices. Advanced topics, e.g., multiprogramming and multitasking, virtual memory, deadlock, I/O, job scheduling, and performance analysis using queueing models, will be introduced. Case studies of modern operating systems. A design project is required.
Prerequisite(s): CIS 310 or (CIS 350 or CIS 3501 or IMSE 350 or (ECE 370 and MATH 276) or (ECE 276 and ECE 370)) and IMSE 317*

IMSE 451 Computer Graphics 3 Credit Hours
Basic geometrical concepts: graphics output primatives, two-dimensional transformations, windowing and clipping, three-dimensional viewing, visible surface detection methods, and graphical user interfaces. (F).
Prerequisite(s): (MATH 217 or MATH 227 or MATH 228) and ((CIS 350 or CIS 3501 or IMSE 350) or (ECE 370 and MATH 276) or (ECE 370 and ECE 276))

IMSE 4545 Information Systems Design 4 Credit Hours
Role of information systems in organizations. Economic factors and social impact of information systems. Phases to design an information system: systems objectives and criteria establishment, fact investigation and analysis, feasibility study, output-input design, processing design, file and database design, safety and reliability considerations, detailed systems description, programming specifications, testing analysis and design skills will be assigned. A series of cases will be used in developing an information system. SQL will be used to develop data tables and access information. Three lecture hours and one three-hour laboratory. (W)
Prerequisite(s): IMSE 255 or CIS 205
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 4555 Systems Engineering: Processes, Methods and Practice 4 Credit Hours
This course focuses on the process of bringing systems into being. It introduces the concept of systems thinking and offers an examination of the principles of systems engineering and their application across the system life cycle. Special emphasis is given to systems engineering process, systems life cycle models, systems analysis and design evaluation, configuration management, the analysis of alternatives, costs analysis and project planning, risk analysis and models in decision making. Integration of engineering problem solving methodologies based on systems concepts are also covered in this class. Case studies are used throughout the course. Student teams work on product and service system design projects. (F, W).
Prerequisite(s): IMSE 3005
Corequisite(s): IMSE 4425, IMSE 4585
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 456 Intro to Data Base Systems 4 Credit Hours
An introduction to database system concepts and techniques. Topics covered include database environments, ER modeling, relational data model, object-oriented database, object-relational database, database design theory and methodologies, database languages, query processing and optimization, concurrency control, database recovery, and database security.
Prerequisite(s): CIS 350 or CIS 350A or IMSE 351 or (ECE 370 and MATH 276)

IMSE 457 Compiler Design 3 Credit Hours
The design and construction of compilers and programming systems. Lexical scan; parsing techniques; code generation and optimization. Run-time organization; storage allocation. Applications of formal language theory in compiler design. Translator writing systems; XPL. Three one-hour lectures.
Prerequisite(s): IMSE 350 or CIS 350 or CCM 350

IMSE 4585 Simulation in Systems Design 4 Credit Hours
This course introduces digital simulation as a design and modeling tool. The fundamental techniques of constructing a simulation model and evaluating the results are studied. A computer simulation software is used (such as ARENA, ProModel, Witness, Simul8). Topics include random number and random variate generation, input and output data analysis, design of experiments and optimization of simulated systems, verification and validation, discrete and continuous simulation models, comparison of simulation modeling software, and applications of simulation in different industries. Students are asked to select problems of interest and present final project reports. Four lecture hours. (YR)
Prerequisite(s): IMSE 317 and IMSE 255 and IMSE 3005*
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 4675 Six Sigma & Stat Proc Improv 4 Credit Hours
Review of graphical methods, probability theory and statistics (stem-and-leaf plots, histograms, scatter diagrams, counting methods, axioms of probability, common discrete and continuous probability models, expectation, linear combinations, estimation, sampling distributions, confidence intervals, hypothesis testing, and A vs. B type of experimentation for both unpaired and paired data); introduce quality terminology in manufacturing and service industry contexts, study the theory, design and application of common statistical process control models for variables and attributes; study process capability and gauge and measurement capability methods; study the design and analysis, both graphical and analytic, of statistically designed experiments (one-way completely randomized designs, and randomized, complete block designs); study the application and analysis of two-level, factorial and fractional factorial designs. Learn to apply and interpret analysis of variance to above situations. Extensive analytic homework and applications used throughout course to motivate material. Each student completes an individual project of his/her own design, subject to instructor approval, entailing a modeling application or controlled experiment where the student collects the data. Four hours lecture. (YR)
Prerequisite(s): IMSE 317
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 4745 Facilities Design 4 Credit Hours
Analysis, planning and design of physical facilities utilizing research, engineering and economic principles. Synthesis of physical equipment and workers into an integrated system for either service or manufacturing activities. Design of material handling and storage systems. Layout of lean manufacturing facilities. Design of atmospheric, electrical, lighting, and life safety systems for a facility. Students are required to select problems of interest and present design project reports. (F)
Prerequisite(s): IMSE 3005*
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 477 Human Computer Interaction for UI & UX Design 3 Credit Hours
This course introduces current theory and design techniques concerning how user interfaces (UI) and user experience (UX) should be designed and assessed to be easy to learn and use, in terms of human-centered design. The course includes four general modules: 1) Introduction of HCI & UX; 2) Interface/Interaction Design Strategy; 3) Advanced Issues in HCI; and 4) Evaluation Methods. (F).

IMSE 4795 Prod, Inven Control & Lean Mfg 4 Credit Hours
Study of concepts involved in forecasting demand, inventory control, MRP, JIT production, lean manufacturing, aggregate scheduling, and project management. The application of mathematical programming techniques, bottleneck analysis, and lean techniques such as value stream mapping, error proofing, cellular manufacturing, etc. are used in design and analysis of production systems. Use of the computer programs in the design and analysis of such systems. Students are asked to select problems of interest and present final project reports. (W).
Prerequisite(s): IMSE 317 or BENG 364 or ME 364
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 4815 Manufacturing Process II 4 Credit Hours
This course introduces the students to machining processes, metal forming processes and molding and forming of plastics. Metal cutting theory is emphasized including the mechanics of metal cutting, cutting tools, measurement of tool life, selection of cutting conditions, and chip control; theory and applications of non-traditional manufacturing processes. Metal forming theory is emphasized including formability of metals; analysis of bulk and sheet metal forming processes as applied to practical cases such as automobile manufacturing. Basic principles of plastic molding and forming processes of plastics, ceramics and composites. (W)
Prerequisite(s): IMSE 382 or ME 381
Corequisite(s): IMSE 4675
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 4825 Industrial Controls 4 Credit Hours
This course introduces the basics of calibration, error analysis, and dynamic response characteristics of instrumentation. Fundamentals of metrology include linear and angular measurements, standards, gauges, machine tool accuracy, and automation of inspection processes. The course also introduces the principle aspects of computers and their applications in system control, as well as principles of automation with emphasis on manufacturing industries. Discussion of the hardware and software associated with this task and other topics such as integrated systems modeling, sensor technologies, digital and analog signal processing and control, and information communication are also included. Laboratory exercises and projects are required. (F)
Prerequisite(s): ME 265
Corequisite(s): ECE 305
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

IMSE 4835 Comp.-Aided Prcs Desgn & Mfg 4 Credit Hours
This course focuses on the fundamentals of component and system designs through the use of Computer-Aided Design (CAD) tools. Issues related to the manufacture of molds, jigs and fixtures are also introduced and Computer-Aided Manufacturing (CAM) tools are used as means for the production of these machine components. The principles of design for manufacture and assembly as applied to tool and machine design are also discussed. Computer-Aided Process Planning (CAPP) tools, flexible manufacturing systems, and information flow in manufacturing systems are also presented. Hands-on experiments and course projects are required. (W)
Prerequisite(s): IMSE 382 or ME 381
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate

IMSE 484 CA Machine and Tool Design 3 Credit Hours
Study of the fundamentals of machine tool design, cutting tools, metal forming dies, and jig fixtures for practical applications in machining and assembly. Principles of design for manufacture and assembly as applied to tool and machine design. Laboratory exercises and projects are required using computer-aided design software. Two lecture hours and three laboratory hours.
Prerequisite(s): IMSE 382 or ME 381
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 486 Design for Assembly & Mfg 3 Credit Hours
This course will cover topics in manufacturing with emphasis on the parallel product design and selection of specifications for processes. Topics included are the principles of concurrent engineering, geometric dimensioning and tolerancing (GD&T), process engineering, process planning, cost estimating, and design for manufacturing. Projects using computer tools are required on a team-oriented basis.
Prerequisite(s): IMSE 382
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 488 Metal Forming Processes 3 Credit Hours
This course focus is on fundamentals of metal forming processes; mechanics of metal forming; formability of materials; tool and die design; design for manufacture; and economic aspect of the process. Emphasis is placed on analysis of bulk and sheet metal forming processes as applied to practical cases such as automobile manufacturing. Laboratory and course project are required.
Prerequisite(s): IMSE 382
Restriction(s):
Can enroll if Level is Undergraduate

IMSE 489 Robotics Systems Simulation 3 Credit Hours
The course emphasizes the fundamentals of the design of robotics systems with the aid of robot simulation technology; structure and basic components of robots and robotics manufacturing workcells; control, kinematics, and dynamics of robots and manufacturing devices; robot accuracy and calibration of robot motion; applications of robots in manufacturing such as spot welding, arc welding, machining, assembly and CMM; robot simulation software such as ROBCAD or IGRIP. Course project is required. Available for graduate credit. (YR)
Restriction(s):
Can enroll if Class is Senior or Graduate

IMSE 490 Selected Topics 3 Credit Hours
Individual or group study, design or laboratory research in a field of interest to the student. Topics may be chosen from any of the areas of industrial and systems engineering including management, work measurement, methods, organization, industrial sciences, industrial mathematics, systems and procedures. If preliminary arrangements are made, the work internship periods can be used to formulate the problem and gather data. Completion of the analysis and submission of a report shall be done during the academic periods under the supervision of a faculty member or members. The student should be prepared for both a written and oral presentation of the report. This course is highly recommended as a technical elective. Permission of department.

IMSE 491 Directed Studies in IMSE 1 to 3 Credit Hours
Group study of contemporary topics in industrial and systems engineering and general systems design. Course may be elected for credit more than once under different instructors. Permission of department.

IMSE 4951 Design Project I 2 Credit Hours
Design of a system to produce or service using knowledge gained in previous courses in the program. Two two-hour lecture/lab periods. (F, W).
Prerequisite(s): IMSE 421* and (IMSE 4795* or IMSE 4585* or IMSE 4835*) and (COMP 270* or COMP 106* or COMP 220*)
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science
Can enroll if Major is Industrial & Systems Engin, Manufacturing Engineering,

IMSE 4952 Design Project II 2 Credit Hours
Design of a system to produce or service using the knowledge gained in previous courses in the program. It is the continuation of the project started in Design Project I course. (F, W).
Prerequisite(s): IMSE 4951 and IMSE 4425* and IMSE 440* and IMSE 4675*
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science
Can enroll if Major is Industrial & Systems Engin, Manufacturing Engineering,

IMSE 4953 Design Project in Mfge 1 Credit Hour
Design of a manufacturing system to produce product using the knowledge gained in previous courses in the program. (F,W,S)
Prerequisite(s): IMSE 4795* or IMSE 4835* or IMSE 4425* or IMSE 4675*
Corequisite(s): ME 4671
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science
Can enroll if Major is Manufacturing Engineering, Mechanical Engineering

IMSE 498 Guided Study in IMSE 1 to 3 Credit Hours
Individual study, design, or laboratory research in a field of interest to the student. Content may be chosen from any of the areas on industrial and manufacturing engineering. The student will submit a report on his or her project at the close of the term. Permission of department. (F,W,S).
Restriction(s):
Cannot enroll if Class is Freshman or Sophomore
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

IMSE 499 Internship/ Co-Op 1 Credit Hour
A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with classroom terms.
Restriction(s):
Can enroll if Class is Senior
Can enroll if Level is Undergraduate

*An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally