Industrial & Manufacturing Engineering & Technology

The Department of Industrial & Manufacturing Engineering & Technology offers two graduate programs leading to the Master of Science degree: M.S.I.E. in industrial engineering and M.S.Mf.E. in manufacturing engineering.

These degree programs respond to a wide range of manufacturing and service industry needs.

Each program has a graduate coordinator. The admission requirements for each are stated in the following program statements.

Industrial Engineering

Fariborz Tayyari,
Graduate Program Coordinator

The Department of Industrial & Manufacturing Engineering & Technology offers a graduate program leading to the M.S.I.E. degree stressing the role of industrial engineers as problem solvers at managerial and staff levels in both manufacturing and service industries. The program offers students the opportunity to customize a plan of study, beyond an IE core, based on the student's educational background and career objectives. Courses will be drawn from such disciplines as engineering, science, mathematics, and business administration.

Admission is selective and is open to holders of an undergraduate degree in engineering, science or mathematics who meet Graduate School admission requirements. Students without an IE undergraduate degree may be required to make up undergraduate deficiencies. Those who do not have an engineering degree should have worked in an engineering environment for at least three years. International graduates of a non-ABET accredited program should have a TOEFL score of 550 for unconditional admission and a score of 52 on part 1 of the test. Both part-time and full-time students are welcome.

Degree Requirements

The total program is 30 semester hours of graduate level work of which a minimum of 18 hours must be taken from IME designated courses, including 3 semester hours of a project course to demonstrate ability to identify, define and solve unstructured IE related problems. Most entering students who do not have the undergraduate degree in IE must complete IME 500, Engineering Economy and Costs, and IME 503, Engineering Quantitative Analysis. Neither will count towards graduate credit. A 36-hour, non-project program is also available.

A course of study must be prepared by each student in consultation with the academic advisor and must be approved by the department as early as possible but not later than the beginning of the second semester of study at Bradley.

Manufacturing Engineering

Saeed Saboury,
Graduate Program Coordinator

The Department of Industrial and Manufacturing Engineering and Technology offers a graduate program leading to the Master of Science in Manufacturing Engineering. The objective of the program is to educate professionals who will design, build, operate, and control world-class manufacturing systems with enhanced productivity and competitiveness.

The program is structured with five interrelated areas: design, materials, processes, systems, and automation and integration.

Students applying for admission to the program must have a baccalaureate degree in engineering or science and must meet the grade point requirements of the Graduate School. Transcripts of all prior work at the college level and two letters of recommendation must accompany the application. All applicants will be considered on an individual basis. Successful applicants will have a background in the areas of processes, materials, mathematics, mechanics, computer science, and manufacturing systems. If a candidate does not have the required level or breadth of preparation in the areas specified above, the candidate may be admitted conditionally and will be advised of appropriate preparatory courses or conditions for full unconditional entrance to the program.

A total of 33 graduate credit hours is required to complete the program. Of the total credit hours:

A. A minimum of 15 semester hours must be taken from the list entitled Manufacturing Engineering Areas. At least one course must be taken from each of the five manufacturing engineering areas. Selected topic courses and professional projects do not fulfill this requirement.

B. Six semester hours should be devoted to thesis work. If a student elects not to undertake a thesis, a minimum of 3 semester hours must be devoted to project work.

C. A minimum of 3 semester hours will be taken in advanced mathematics.

D. A minimum of 6 semester hours must be taken outside of the program. A list of suggested courses is available from the graduate coordinator.

The student must file and secure approval for a plan of study with the manufacturing graduate advisory committee prior to completing 9 semester hours. Such a plan will specify the courses to be taken and the proposed thesis or project topic. In the event that a change in the plan is desired, such a change can be accomplished by filing a request for amendment with the advisory committee. This amendment must be approved prior to taking the alternative course. Candidates will be expected to demonstrate their capacity to draw upon and integrate their knowledge from all courses presented for their degree in a written comprehensive examination. Scheduling, grade reporting, and retakes will conform to the rules of the Graduate School.

Manufacturing Engineering Areas

Design
IME 590 Geometric Modeling
IME 591 Design for Manufacturability
IME 592 Tribology

Materials
IME 531 Nonmetallic Materials
IME 533 Composite Materials

Processes
IME 541 Forming Processes
IME 543 Materials Removal Processes
IME 545 Joining and Fabrication

Systems
IME 563 Process Engineering
IME 568 Introduction to Expert Systems and Artificial Intelligence
IME 583 Production Planning and Control

Automation and Integration
IME 553 Advanced Computer Aided Manufacturing
IME 555 Computer Integrated Manufacturing

Course Descriptions

IME 500 Engineering Economy and Costs
3 hrs.
Analysis of the economic aspects of engineering decisions including the time value of money and the techniques of obtaining cost data. Does not count toward MSIE. Prerequisite: graduate standing in engineering or consent of instructor.

IME 503 Engineering Quantitative Analysis
3 hrs.
Probability, random variables, distributions, inference, regression, linear programming, simulation. Does not count towards MSIE. Prerequisite: graduate standing in engineering or consent of instructor.

IME 511 Engineering Statistical Analysis
3 hrs.
Concepts in probability and statistics from practical and theoretical angles. Definition of probability, random variable, distribution, important discrete and continuous distributions, sampling distribution of X-bar, Central Limit Theorem, t, chi-squared and F distributions, estimation, hypothesis testing, regression analysis, and analysis of variance. Prerequisite: IME 503 or consent of instructor.

IME 512 Design and Analysis of Experiments
3 hrs.
Design and analysis of experiments in research, development, and production activities. Experimental designs for evaluating significance of main effects and interactions of several variables. Treatment of problems of measurement, planning, and evaluating programs. Prerequisite: two semesters of statistics or consent of instructor.

IME 514 Introduction to Operations Research
3 hrs.
Mathematical model building and use of deterministic and non-deterministic tools in problem solving. Problem solving structure, linear programming, transportation and assignment algorithms, game theory, networks, branch and bound algorithms, dynamic programming, deterministic and stochastic inventory models, markov chains, queueing theory and simulation. Prerequisite: IME 503 or consent of instructor.

IME 515 Linear Programming and Network Analysis
3 hrs.
Theoretical and computational aspects of linear programming; application to practical problems. Prerequisite: MTH 202; IME 117; consent of instructor.

IME 522 Manufacturing Quality Control
3 hrs.
Analysis of factors affecting product quality during manufacturing; process control charts; process capability studies; error of measurement; sampling plans; motivation programs; quality audit; organization. Prerequisite: one semester of statistics or consent of instructor.

IME 524 Advanced Quality Control
3 hrs.
Comparative study of philosophies of using quality as a business management tool, with special reference to Deming's Theory of control charts and a study of their strengths and weaknesses. Special control charts such as CUSUM chart, median chart, moving average chart, and their application. The latest published articles used to keep up-to-date in quality technology. Prerequisite: IME 522 or consent of instructor.

IME 526 Reliability Engineering
3 hrs.
Specification, prediction, and evaluation of product reliability and maintainability. Use of models for failure distribution–exponential, Weibull, lognormal–and analytical and graphical methods for failure data analysis. Test plans and accelerated testing models. Design methods for increasing reliability and maintainability. Prerequisite: IME 511 or consent of instructor.

IME 531 Non-metallic Materials
3 hrs.
Recent developments and applications of polymeric and ceramic materials. Selection and design criteria, material properties, process engineering, quality considerations, and failure prevention. Prerequisite: IME 331.

IME 533 Composite Materials
3 hrs.
Science and technology of modern composite materials: properties, design, toughening mechanisms, fabrication methods, evaluation, mechanisms of failure and quality assurance. Prerequisite: IME 331.

IME 541 Forming Processes
3 hrs.
Analytical methods in metal forming processes including slab approach, upper bound techniques, slip-line field and visio-plasticity methods. Forging, rolling, extrusion, drawing, sheet forming, near net-shape processes, and CAD/CAM. Prerequisite: IME 441.

IME 543 Material Removal Processes
3 hrs.
Current and future trends in: mechanics of chip generation; forces and energies in cutting and dynamometry; thermal aspects of machining; cutting tool materials; friction, wear, vibrations and tool life; applications of engineering fundamentals to design and analysis of machining operations with emphasis on computer control. Prerequisites: IME 441; IME 341.

IME 545 Joining and Fabrication
3 hrs.
Principles of advances in joining and fabrication of engineering materials including metallic, nonmetallic, and electronic materials. Process science and technology with emphasis on casting, welding, and microjoining of electronic components. Physical and mathematical modeling of various processes. Prerequisite: IME 331.

IME 553 Advanced Computer Aided Manufacturing
3 hrs.
Computer Aided Manufacturing (CAM) within the CAD/CAM and CIM contents. Computer Assisted Process Planning (CAPP), Computer Assisted Tool Design, Computer Assisted NC Programming (APT), Interactive Graphics, NC Programming, and the elements of computer control of manufacturing equipment (CNC). A semester project. Prerequisite: IME 445.

IME 555 Computer Integrated Manufacturing
3 hrs.
Computer Integrated Manufacturing (CIM); elements of hardware and software within the manufacturing automation environment. Islands of factory automation and their interactions, information flow and Local Area Networks within the CIM architecture, standardization of electronic data and interfaces. Prerequisite: IME 386.

IME 561 Simulation of Human/Machine Systems
3 hrs.
Procedures and rationale for planning, designing, and implementing computer simulation experiments used to analyze human-machine systems in engineering, business, and social sciences. Prerequisite: MTH 202, IME 117, IME 311.

IME 563 Process Engineering
3 hrs.
The process design function interaction with product design, and the responsibilities within a manufacturing organization. Selection and design of machinery, tools, and methods. Computer aided process design and interactive accessing of machining data and tooling element of group technology and expert systems. Prerequisites: IME 395; IME 443.

IME 566 Advanced Facility Planning
3 hrs.
Extension of IME 466. Facility design consideration of internal and external service functions; logistic concerns; design flexibility. Prerequisites: IME 383 or IME 386 or IME 500.

IME 568 Introduction to Expert Systems and Artificial Intelligence
3 hrs.
Knowledge-based systems design and implementation; expert system shells and programming environments; validation and implementation of expert systems; case studies/laboratories. Cross-listed as CIS 588. Prerequisites: two semesters of computer programming and one semester of statistics, or consent of instructor.

IME 570 Selected Topics in Industrial and Manufacturing Engineering
1-3 hrs.
Topics of special interest which may vary each time course is offered. Topic stated in current Schedule of Classes. May be repeated up to a maximum of 6 hrs. Prerequisite: consent of instructor. Combined credit for IME 590 and IME 570 may not exceed 6 hours.

IME 583 Production Planning and Control
3 hrs.
Analysis of production-inventory systems using common planning and scheduling techniques. Mathematical models for project planning, aggregate planning, master scheduling, and inventory analysis. Interface with quality control and computer systems. Prerequisites: IME 386; minimum grade of C in IME 311 and IME 313; or consent of instructor.

IME 584 Advanced Production Planning
3 hrs.
Planning methods for converting to or creating Just-in-Time and/or group technology systems. Analytical and behavioral aspects. Prerequisite: IME 564; consent of instructor.

IME 585 Human Factors Engineering
3 hrs.
Functional anatomy and physiology of muscle and skeletal systems and their relationship to work design. Work physiology, kinesiology, and anthropometry in relation to their application in work-place design and hand tool design. Utilization of physical work capacity and job demands for job design, personnel assignment, and assessment of work-rest scheduling. Prerequisites: IME 311, IME 386, CE 150.

IME 587 Occupational Safety and Health
3 hrs.
Occupational safety and health standards and regulations. Injury and illness statistics. Employer's responsibilities and bookkeeping requirements. Hazard analysis and systems safety, occupational and environmental hazards and controls. Prerequisite: consent of instructor.

IME 590 Geometric Modeling
3 hrs.
Computer-based representations of the shape and spatially dependent attributes of real or conceived physical objects. Techniques and concepts needed to couple the digital computer with the techniques of geometric modeling and graphics display for analysis and viewing. Prerequisite: IME 395; MTH 223.

IME 591 Design for Manufacturability
3 hrs.
The design process; interaction of materials, processes, and design; economic considerations; design considerations for machining, casting, forging, extrusion, forming, powder metallurgy; designing with plastics; design for assembly; projects and case studies. Prerequisites: IME 395; IME 341.

IME 592 Tribology
3 hrs.
An introduction to systems approach to tribology, surface topography, physical, chemical, and geometric nature of surfaces. Mechanics of contact between surfaces. Various theories of friction and wear, hydrodynamic, elastohydrodynamic, and boundary lubrication. Frictional instabilities. Rolling contact problems. Application of system methodology to tribological problems in engineering design and manufacturing. Prerequisites: IME 331 or ME 351 or consent of instructor.

IME 670 Independent Study
3 hrs.
Critical investigation and analysis in management systems design, facilities and/or process design, material selection, or industrial economics. Prerequisites: consent of instructor.

IME 691, 692 Research
0-3 hrs. (each)
Research project or professional problem to be selected by student and advisor. May be repeated to a maximum of 3 hours credit. Beyond initial enrollment the student must register for 0 hours. Prerequisite: unconditional graduate status; consent of instructor.

IME 699 Thesis
0-6 hrs.
Required of students choosing thesis option. Total of six hours to be taken; any semester after six hours, the student must register for zero hours to maintain progress. Prerequisites: unconditional status, consent of graduate coordinator.