

Industrial and Manufacturing Engineering (IME)

IME 111. Introduction to Industrial and Manufacturing Engineering. 3 Credits.

Overview of industrial engineering and manufacturing engineering professional careers and work environments. Basic skill acquisition using computer software tools to solve engineering problems, prepare reports, plan projects, deliver professional presentations, and manage data.

IME 194. Individual Study. 1-5 Credits.**IME 196. Field Experience. 1-15 Credits.****IME 199. Special Topics. 1-5 Credits.****IME 291. Seminar. 1-3 Credits.****IME 292. Study Abroad. 1-15 Credits.****IME 294. Individual Study. 1-5 Credits.****IME 299. Special Topics. 1-5 Credits.****IME 311. Work/Station Design and Measurement. 3 Credits.**

Analytical methods for measuring human performance in industrial, commercial and manufacturing settings. Development of work procedures and design of workstations. Considerations of ergonomics, safety, performance effectiveness and efficiency, interactions between workstations, information and data requirements, production throughput, training and skill requirements, and resources. Weekly laboratory. S.

IME 330. Manufacturing Processes. 3 Credits.

Traditional manufacturing processing methods as employed in contemporary practice. Includes properties of materials, machining, casting, forming, and fabrication techniques. Several experiments will be conducted on various manufacturing processes in the laboratory. Prereq: ME 212.

IME 335. Welding Technology. 3 Credits.

Study of arc and gas welding technology together with related metallurgy. Laboratory instruction in welding techniques and skills. 1 recitation, 1 two-hour laboratory. F.

IME 379. Study Tour Abroad. 1-6 Credits.**IME 380. CAD/CAM for Manufacturing. 3 Credits.**

Coverage of CAD, numerical control, and CAM software. Use of manufacturing standards for geometric dimensioning and tolerancing. Prereq: ME 212. F.

IME 391. Seminar. 1-3 Credits.**IME 392. Study Abroad. 1-15 Credits.****IME 394. Individual Study. 1-5 Credits.****IME 397. Fe/Coop Ed/Internship. 1-4 Credits.****IME 399. Special Topics. 1-5 Credits.****IME 411. Human Factors Engineering. 3 Credits.**

A survey of human factors engineering topics with an emphasis on optimizing person-machine and person-system interactions. Human physical and cognitive capabilities will be investigated to improve work design, interface design, and usability. Prereq: IME 311, IME 460. F/2 (even years) {Also offered for graduate credit - see IME 611.}.

IME 427. Packaging for Electronics. 3 Credits.

Processes and materials for packaging of electronic components and devices, including integrated circuit chips, chip packages, and board level packaged systems; boards and substrates technology; quality and reliability of electronic packages. Open to all engineering majors. Prereq: Junior standing. S/2 (odd years). Cross-listed with ECE 427. {Also offered for graduate credit - see IME 627.}.

IME 429. Introduction to IC Fabrication. 3 Credits.

This course examines issues about fabrication methods and procedures. Topics will include implantation, pattern transfer and process integration. Cross-listed with ECE 429. {Also offered for graduate credit - see IME 629.}.

IME 430. Process Engineering. 3 Credits.

Comprehensive analysis of selected manufacturing processes; development of process flow maps, schematic and mathematical modeling of process dynamics, and evaluation of processing alternatives. Design of effective and efficient processes for selected industrial products. Seminar/case study format. Prereq: IME 330. F {Also offered for graduate credit - see IME 630.}.

IME 431. Production Engineering. 3 Credits.

Design of a production system for selected manufactured products, development of production system flow maps and linked process dynamic models, evaluation of throughput and identification of constraints. Evaluation of alternative solutions for production constraints. Undergraduate: design of fixtures, dies and tooling for economical production. Graduate: In-depth analysis of contemporary production systems for selected manufactured products; development of production systems issues. Seminar/case study format. Prereq: IME 330. Recommended: IME 430/630. S {Also offered for graduate credit - see IME 631.}.

IME 432. Composite Materials Manufacturing. 3 Credits.

Processes for manufacturing products from fiber-reinforced composite materials. Analysis of tooling, process variables and quality management during processing. Design of processes for manufacture of selected composite parts. Weekly laboratory. Prereq: IME 330, ME 331. S.

IME 433. Additive Manufacturing. 3 Credits.

A synchronized approach considering functional design, analysis and manufacturing that support seamless integration of geometry with performance. The course will address additive manufacturing principles; scope of additive manufacturing; bio-manufacturing. Prereq: IME 330. {Also offered for graduate credit - see IME 633.}

IME 435. Plastics and Injection Molding Manufacturing. 3 Credits.

Product and process engineering for manufacturers of plastic products; material evaluation and selection, mold design, process design, quality evaluation of manufactured plastic parts. Cross-listed with ME 435. {Also offered for graduate credit - see IME 635.}

IME 437. Methods for Precision Manufacturing. 3 Credits.

Fundamental principles and applications of methods of precision micro- and nano-scale manufacturing of discrete parts and assembled products made of metallic and non-metallic engineering materials. Prereq: IME 430 and ME 331. {Also offered for graduate credit - see IME 637.}

IME 440. Engineering Economy. 2-4 Credits.

Capital investment decision foundation within the rules of general and project accounting. Analysis of benefits and returns against cost for engineering installation, operation, life cycle, and buy-rent-lease decisions. Prereq: Junior standing or IME major. {Also offered for graduate credit - see IME 640.}

IME 450. Systems Engineering and Management. 3 Credits.

Integration of technical disciplines through the stages of systems life cycle: needs and requirements determination, operating and support concepts, design and prototyping, test and evaluation, facilitation, manuals, training, and supportability. Prereq: Junior standing. F {Also offered for graduate credit - see IME 650.}

IME 451. Logistics Engineering and Management. 3 Credits.

This course emphasizes integrated logistics management methods to improve the effectiveness and efficiency of material flow, information flow and cash flow for the entire supply chains. Prereq: IME 470. Coreq: IME 450. F/2 (odd years) {Also offered for graduate credit - see IME 651.}

IME 452. Integrated Industrial Information Systems. 3 Credits.

Integration of technical, business, and operational information for status, progress, and decision making in product development, manufacturing, and logistical support of product and customers. Prereq: IME 450. S {Also offered for graduate credit - see IME 652.}

IME 453. Hospital Management Engineering. 3 Credits.

Survey of management engineering roles in the delivery of health care. Review of functional relationships present in health care delivery systems. Application of industrial engineering tools to solve health care delivery problems focused on cost reduction, process redesign, facility design, quality improvement, and systems integration. Prereq: Core IME courses. S/2 (even years) {Also offered for graduate credit - see IME 653.}

IME 455. Management of People Systems. 2 Credits.

Study of traditional management functions (planning, organizing, influencing, and controlling) in the context of engineering and management system interactions. Emphasis on communication skills, teaming, job design, leadership, facilitation, and improving employee productivity. Prereq: Junior standing. F {Also offered for graduate credit - see IME 655.}

IME 456. Program and Project Management. 3 Credits.

Integrated approaches to managing engineering, technology and business projects, addressing the project management lifecycle including initiating, planning, executing, controlling and closing. Additional topics include program management, portfolio management, and applying principles in a business environment. Prereq: Junior standing. S {Also offered for graduate credit - see IME 656.}

IME 460. Evaluation of Engineering Data. 3 Credits.

Design of engineering experiments and evaluations, curve fitting, regression, hypothesis testing, ANOVA, Taguchi methods in engineering design. Coreq: MATH 166. F, S {Also offered for graduate credit - see IME 660.}

IME 461. Quality Assurance and Control. 3-4 Credits.

Proactive and reactive quality assurance and control techniques; emphasis on quality planning, statistical process control, acceptance sampling, and total quality management. Issues in reliability and maintainability engineering. Prereq: IME 460. S {Also offered for graduate credit - see IME 661.}

IME 462. Total Quality In Industrial Management. 3 Credits.

The meaning and means for achieving 'total quality' in all dimensions of industrial activities and organizations. Topics include continuous improvement, statistical process control, leadership, and training. F/2 (even years) {Also offered for graduate credit - see IME 662.}

IME 463. Reliability Engineering. 3 Credits.

Study and application of statistical models and methods for defining, measuring and evaluating reliability of products, processes and services: life distributions, reliability functions, reliability configurations, reliability estimation, parametric reliability models, accelerate life testing, reliability improvement. Prereq: IME 460. S/2 (odd years) {Also offered for graduate credit - see IME 663.}

IME 464. Reliability Analysis. 3 Credits.

System modeling and analysis, designing for reliability, reliability testing, reliability in manufacturing, and reliability management, fault tree analysis, RBD, and cut sets are covered along with sneak circuits, time-on-test plots and acceptance testing. Prereq: IME 460 and IME 463. {Also available for graduate credit - See IME 664.}

IME 470. Operations Research I. 3 Credits.

Techniques to optimize and analyze industrial operations. Use of linear programming, transportation models, networks, integer programming, goal programming, dynamic programming, and non-linear programming. Prereq: MATH 129. Co-req: IME 460. S {Also offered for graduate credit - see IME 670.}.

IME 472. Simulation of Business and Industrial Systems. 3 Credits.

Development of the fundamentals and techniques of simulating business and industrial systems. Monte-Carlo techniques and computer usage. Prereq: IME 460, high-level computer language. S {Also offered for graduate credit - see IME 672.}.

IME 480. Production and Inventory Control. 3 Credits.

Planning and controlling of industrial production and inventory: demand forecasting, master scheduling, materials requirements planning, job scheduling, assembly line balancing, and just-in-time production. Prereq: IME 460. F {Also offered for graduate credit - see IME 680.}.

IME 482. Automated Manufacturing Systems. 3 Credits.

Design of integrated production systems including flexible, programmed automatic control for fabrication, assembly, packaging, movement, and storage. Numerical control, flexible manufacturing systems, and computer integrated manufacturing. 2 recitations, 1 three-hour laboratory. Prereq: IME 311, IME 330, PHYS 252. F {Also offered for graduate credit - see IME 682.}.

IME 485. Industrial and Manufacturing Facility Design. 3 Credits.

Capstone integration of analysis and design tools to convert product design into production plans and plants. Prereq: Senior standing. S {Also offered for graduate credit - see IME 685.}.

IME 489. Industrial and Manufacturing Engineering Capstone. 3 Credits.

Capstone experience. Student projects in design, analysis, and experimental investigation related to industrial and manufacturing engineering. Prereq: Senior standing. S.

IME 491. Seminar. 1-5 Credits.**IME 492. Study Abroad. 1-15 Credits.****IME 493. Undergraduate Research. 1-5 Credits.**

Student research, scholarly project or creative investigation completed under the guidance of a faculty mentor. Directed independent project, collaborative work or ongoing participation in faculty research should culminate in a presentation, article or scholarly project.

IME 494. Individual Study. 1-5 Credits.**IME 496. Field Experience. 1-15 Credits.****IME 499. Special Topics. 1-5 Credits.****IME 611. Human Factors Engineering. 3 Credits.**

A survey of human factors engineering topics with an emphasis on optimizing person-machine and person-system interactions. Human physical and cognitive capabilities will be investigated to improve work design, interface design, and usability. F/2 (even years) {Also offered for undergraduate credit - see IME 411.}.

IME 627. Packaging for Electronics. 3 Credits.

Processes and materials for packaging of electronic components and devices, including integrated circuit chips, chip packages, and board level packaged systems; boards and substrates technology; quality and reliability of electronic packages. Open to all engineering majors. S/2 (odd years). Cross-listed with ECE 627. {Also offered for undergraduate credit - see IME 427.}.

IME 629. Introduction to IC Fabrication. 3 Credits.

This course examines issues about fabrication methods and procedures. Topics will include implantation, pattern transfer and process integration. Cross-listed with ECE 629. {Also offered for undergraduate credit - see IME 429.}.

IME 630. Process Engineering. 3 Credits.

Comprehensive analysis of selected manufacturing processes; development of process flow maps, schematic and mathematical modeling of process dynamics, and evaluation of processing alternatives. Design of effective and efficient processes for selected industrial products. Seminar/case study format. F {Also offered for undergraduate credit - see IME 430.}.

IME 631. Production Engineering. 3 Credits.

Design of a production system for selected manufactured products, development of production system flow maps and linked process dynamic models, evaluation of throughput and identification of constraints. Evaluation of alternative solutions for production constraints. Undergraduate: design of fixtures, dies and tooling for economical production. Graduate: In-depth analysis of contemporary production systems for selected manufactured products; development of production systems issues. Seminar/case study format. Recommended: IME 630. S {Also offered for undergraduate credit - see IME 431.}.

IME 633. Additive Manufacturing. 3 Credits.

A synchronized approach considering functional design, analysis and manufacturing that support seamless integration of geometry with performance. The course will address additive manufacturing principles; scope of additive manufacturing; bio-manufacturing. {Also offered for undergraduate credit - see IME 433.}.

IME 635. Plastics and Injection Molding Manufacturing. 3 Credits.

Product and process engineering for manufacturers of plastic products; material evaluation and selection, mold design, process design, quality evaluation of manufactured plastic parts. Cross-listed with ME 635. {Also offered for undergraduate credit - see IME 435.}.

IME 637. Methods for Precision Manufacturing. 3 Credits.

Fundamental principles and applications of methods of precision micro- and nano-scale manufacturing of discrete parts and assembled products made of metallic and non-metallic engineering materials. {Also offered for undergraduate credit - see IME 437.}.

IME 640. Engineering Economy. 2-4 Credits.

Capital investment decision foundation within the rules of general and project accounting. Analysis of benefits and returns against cost for engineering installation, operation, life cycle, and buy-rent-lease decisions. Prereq: Junior standing or IME major. {Also offered for undergraduate credit - see IME 440.}.

IME 650. Systems Engineering and Management. 3 Credits.

Integration of technical disciplines through the stages of systems life cycle: needs and requirements determination, operating and support concepts, design and prototyping, test and evaluation, facilitation, manuals, training, and supportability. F {Also offered for undergraduate credit - see IME 450.}.

IME 651. Logistics Engineering and Management. 3 Credits.

This course emphasizes integrated logistics management methods to improve the effectiveness and efficiency of material flow, information flow and cash flow for the entire supply chains. F/2 (odd years) {Also offered for undergraduate credit - see IME 451.}.

IME 652. Integrated Industrial Information Systems. 3 Credits.

Integration of technical, business, and operational information for status, progress, and decision making in product development, manufacturing, and logistical support of product and customers. S {Also offered for undergraduate credit - see IME 452.}.

IME 653. Hospital Management Engineering. 3 Credits.

Survey of management engineering roles in the delivery of health care. Review of functional relationships present in health care delivery systems. Application of industrial engineering tools to solve health care delivery problems focused on cost reduction, process redesign, facility design, quality improvement, and systems integration. Prereq: Core IME courses. S/2 (even years) {Also offered for undergraduate credit - see IME 453.}.

IME 655. Management Of People Systems. 2 Credits.

Study of traditional management functions (planning, organizing, influencing, and controlling) in the context of engineering and management system interactions. Emphasis on communication skills, teaming, job design, leadership, facilitation, and improving employee productivity. Prereq: Junior standing. F {Also offered for undergraduate credit - see IME 455.}.

IME 656. Program and Project Management. 3 Credits.

Integrated approaches to managing engineering, technology and business projects, addressing the project management lifecycle including initiating, planning, executing, controlling and closing. Additional topics include program management, portfolio management, and applying principles in a business environment. S {Also offered for undergraduate credit - see IME 456.}.

IME 660. Evaluation of Engineering Data. 3 Credits.

Design of engineering experiments and evaluations, curve fitting, regression, hypothesis testing, ANOVA, Taguchi methods in engineering design. F, S {Also offered for undergraduate credit - see IME 460.}.

IME 661. Quality Assurance and Control. 3-4 Credits.

Proactive and reactive quality assurance and control techniques; emphasis on quality planning, statistical process control, acceptance sampling, and total quality management. Issues in reliability and maintainability engineering. Prereq: IME 660. S {Also offered for undergraduate credit - see IME 461.}.

IME 662. Total Quality In Industrial Management. 3 Credits.

The meaning and means for achieving 'total quality' in all dimensions of industrial activities and organizations. Topics include continuous improvement, statistical process control, leadership, and training. F/2 (even years) {Also offered for undergraduate credit - see IME 462.}.

IME 663. Reliability Engineering. 3 Credits.

Study and application of statistical models and methods for defining, measuring and evaluating reliability of products, processes and services: life distributions, reliability functions, reliability configurations, reliability estimation, parametric reliability models, accelerated life testing, reliability improvement. Prereq: IME 660. S/2 (odd years) {Also offered for undergraduate credit - see IME 463.}.

IME 664. Reliability Analysis. 3 Credits.

System modeling and analysis, designing for reliability, reliability testing, reliability in manufacturing, and reliability management, fault tree analysis, RBD, and cut sets are covered along with sneak circuits, time-on-test plots and acceptance testing. Prereq: IME 660 and IME 663. {Also available for undergraduate credit - See IME 464.}.

IME 670. Operations Research I. 3 Credits.

Techniques to optimize and analyze industrial operations. Use of linear programming, transportation models, networks, integer programming, goal programming, dynamic programming, and non-linear programming. S {Also offered for undergraduate credit - see IME 470.}.

IME 672. Simulation of Business and Industrial Systems. 3 Credits.

Development of the fundamentals and techniques of simulating business and industrial systems. Monte-Carlo techniques and computer usage. Prereq: IME 660, high-level computer language. S {Also offered for undergraduate credit - see IME 472.}.

IME 680. Production and Inventory Control. 3 Credits.

Planning and controlling of industrial production and inventory: demand forecasting, master scheduling, materials requirements planning, job scheduling, assembly line balancing, and just-in-time production. Prereq: IME 660. F {Also offered for undergraduate credit - see IME 480.}.

IME 682. Automated Manufacturing Systems. 3 Credits.

Design of integrated production systems including flexible, programmed automatic control for fabrication, assembly, packaging, movement, and storage. Numerical control, flexible manufacturing systems, and computer integrated manufacturing. 2 recitations, 1 three-hour laboratory. F {Also offered for undergraduate credit - see IME 482.}.

IME 685. Industrial and Manufacturing Facility Design. 3 Credits.

Capstone integration of analysis and design tools to convert product design into production plans and plants. Prereq: Senior standing. S {Also offered for undergraduate credit - see IME 485.}.

IME 690. Graduate Seminar. 1-3 Credits.**IME 696. Special Topics. 1-5 Credits.****IME 711. Advanced Human Factors Engineering. 3 Credits.**

Research-based study of current human factors engineering problems. Students will review current human factors topics, design and conduct research studies, and produce technical papers reporting results. Prereq: IME 611 and IME 660. F/2 (odd years).

IME 720. Surface Engineering. 3 Credits.

Engineering surfaces: structure and properties. Tribology: surface contacts, friction and wear. Surface heat treatment. Solid, liquid and vapor phase deposition processes for tribological coatings. Emerging processes: nano-engineered and diamond-based coatings. Evaluation and characterization of tribological coatings. Prereq: Graduate standing in engineering or science. F (odd years).

IME 740. Advanced Engineering Economy. 3 Credits.

Advanced topics in engineering economy including replacement analysis, capital budgeting, income tax effects on equipment selection, probabilistic models, and manufacturing costing. Prereq: IME 640. F/2 (odd years).

IME 761. Quality Engineering. 3 Credits.

Study and application of advanced statistical tools and techniques for defining, monitoring and improving quality of products, processes and services: statistical control charts, process capability analysis, acceptance sampling of variables and attributes, application of design-of-experiments for product and process optimization, response surface methodology, Taguchi methods. Prereq: IME 661. F/2 (odd years).

IME 765. Data Analysis. 3 Credits.

Applications oriented. Topics include: statistical estimation, hypothesis testing, non-parametric methods, design of experiments, factorial experiments, response surface methodology, regression analysis, time series analysis and forecasting, multivariate methods, statistical control charts. Prereq: IME 660.

IME 766. Robust Design Methods. 3 Credits.

Robust design, principles of quality engineering, experimental methods, probabilistic and statistical analysis, product development process, identification of critical design parameters, and optimization methods for product/process design in manufacturing and service industries. Prereq: IME 765.

IME 770. Quantitative Modeling. 3 Credits.

Applications modeling and optimization methods. Domains: transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Decision models: linear programming and sensitivity analysis, transportation and assignment, network models and algorithms, and integer, dynamic and nonlinear programming. Cross-listed with ENGR 770.

IME 771. Probabilistic and Deterministic Methods. 3 Credits.

Applications modeling. Domains include transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Quantitative models and tools include Markov chains, stochastic processes, queuing, deterministic and stochastic decision analysis, time series, forecasting, and regression modeling. Prereq: IME 660. Cross-listed with ENGR 771.

IME 772. Advanced Simulation. 3 Credits.

In-depth study of special purpose simulation languages to model, analyze, and design industrial and engineering systems. Stochastic and deterministic methods are included. Prereq: IME 672. S (even years).

IME 773. Advanced Operations Research Topics. 3 Credits.

Study of the theory and applications of linear programming, network flows, and nonlinear programming. Prereq: IME 670. F/2 (odd years).

IME 774. Neural Networks. 3 Credits.

Introduction to the parallel processing paradigms that have been developed recently including neuronetworks and genetic algorithms. Students will work on projects using these tools. Prereq: CSCI 724. Cross-listed with PSYC 774 and CSCI 735.

IME 780. Advanced Production and Inventory Control. 3 Credits.

Study of the theory and applications of production scheduling, inventory management, production planning, just-in-time production, and materials requirement planning. Prereq: IME 680. F (even years).

IME 782. Robotics/CAD/CAM/Control Systems. 3 Credits.

Study of automation, integration of fabrication, and assembly systems. Includes automated material handling and intelligent control systems. Prereq: IME 682. S/2 (odd years).

IME 784. Computer Integrated Manufacturing. 3 Credits.

Study of the continuum of integrated manufacturing processes where computer technology is incorporated in the conception, design, planning, and fabrication of a good or service. The study of philosophy and methods of systematically building flexible and efficient production systems. Prereq: IME 682. S/2 (even years).

IME 785. Facilities Location. 3 Credits.

Theory and methods of locating facilities. Domains include plant and warehouse siting, emergency service sites, vehicle and hazardous material routing, distribution systems design. Topics include planar single and multi-facility models, network location problems, cyclical networks. Prereq: IME 670 or ENGR 770.

IME 786. Manufacturing Systems Analysis. 3 Credits.

Comprehensive analysis of complex issues in the technology and management of modern manufacturing systems and enterprises. Technological issues will impinge on product realization, production of goods, and manufacturing equipment and facilities; management issues addressed will be those drawn from operation of global production enterprises. Seminar format. Prereq: IME 630 or IME 631 (both preferred). S.

IME 790. Graduate Seminar. 1-3 Credits.

IME 791. Temporary/Trial Topics. 1-5 Credits.

IME 793. Individual Study/Tutorial. 1-5 Credits.

IME 795. Field Experience. 1-15 Credits.

IME 796. Special Topics. 1-5 Credits.

IME 797. Master's Paper. 1-3 Credits.

IME 798. Master's Thesis. 1-10 Credits.

IME 899. Doctoral Dissertation. 1-15 Credits.