IME - Industrial and Manufacturing Engineering

Please note that for all graduate programs in ISME, some IME courses may require programming skills as a prerequisite, and some IME courses may require Linear Algebra or Calculus III as a prerequisite.

Courses numbered 500 to 799 = *undergraduate/graduate*. (Individual courses may be limited to undergraduate students only.) Courses numbered 800 to 999 = *graduate*.

IME 524. Descriptive Analytics (3).
A study of confidence interval, regression analysis, analysis of variance, correlation analysis and design of experiments emphasizing applications to engineering. For undergraduate students only. Prerequisite: IME 254.

IME 549. Industrial Ergonomics (3).
A systematic approach to the optimization of the human-task-environment system. Includes work space design, manual materials handling, work related musculoskeletal disorders and environmental factors. Emphasizes applications in industry. Prerequisite: IME 254 or departmental consent.

IME 550. Operations Research I (3).
Covers deterministic models and methods in operations research including linear programming, integer programming, and network optimization to aid in the analysis and solution of complex, large-scale decision problems. Prerequisite: MATH 511.

IME 553. Production Systems (3).
Quantitative techniques used in the analysis and control of production systems. Includes forecasting, inventory models, operation planning and scheduling. Prerequisite: IME 254. Pre- or corequisite: IME 255.

IME 554. Statistical Quality Control (3).
A study of the measurement and control of product quality using statistical methods. Includes acceptance sampling, statistical process control and total quality management. Pre- or corequisite: IME 254.

IME 556. Information Systems (3).
Provides a basic understanding of information systems in a modern enterprise, including database design, information technology and ethics using hands-on activities and directed classroom discussion. For ISME undergraduates students only. Prerequisite: CS 211 or MIS 310 or MATH 451.

IME 557. Safety Engineering (3).
Environmental aspects of accident prevention, industrial compensation and safety legislation. Fundamental concepts of occupational health and hygiene. Prerequisite: IME 254.

IME 558. Manufacturing Methods and Materials II (4).
3 Classroom hours; 2 Lab hours. Covers theoretical and practical aspects of manufacturing processes, including material properties and behavior as influenced by the manufacturing process. In-depth study of such manufacturing processes as casting heat treatment, bulk forming, sheet metal forming, metal cutting, nontraditional machining and process monitoring through measurement of manufacturing process variables. Also includes laboratory experience and plant tours. Prerequisites: IME 258, ME 250. Corequisite: IME 558L.

IME 563. Facilities Planning and Design (3).
Quantitative and qualitative approaches to problems in facilities planning and design, emphasizing activity relationships, space requirements, materials handling and storage, and plant layout. Quantitative and qualitative approaches to selection of material handling devices and design of storage systems, and introduction to concepts of supply chain. Prerequisites: IME 452, 550, 553.

IME 565. Systems Simulation (3).
The design of simulation models and techniques for use in designing and evaluating discrete systems, including manufacturing systems too complex to be solved analytically. Emphasizes general purpose computer simulation languages. Prerequisite: computer programming competency. For ISME undergraduate students only. Pre- or corequisites: IME 553, 524.

IME 590. Industrial Engineering Design I (3).
An industry-based team design project using industrial engineering and manufacturing engineering principles; performed under faculty supervision. May not be counted toward graduate credit. Prerequisites: IME 553; must be within two semesters of graduation or departmental consent.

IME 625. Product Performance Evaluation using CAE (3).
Covers the application of analysis and simulation methods and tools to evaluate product designs for strength, life and robustness. Includes a lab experience and a design project aimed at developing proficiency in virtual product evaluation. Prerequisites: AE 333 and IME 425.

IME 650. Operations Research II (3).
The second of a two-course sequence on models and solution approaches commonly used in the analysis of decision-making problems. Familiarizes students with nonlinear deterministic as well as probabilistic models in operations research and their applications. In particular, upon completion of this course, students develop an understanding of how to model and analyze systems that show nonlinear and probabilistic behavior. Moreover, students learn how to use state-of-the-art optimization solvers. Topics include nonlinear programming, decision making under uncertainty, game theory, Markov chains, queuing theory and dynamic programming. Prerequisite: IME 550 or instructor's consent.

IME 664. Engineering Management (3).
Introduction to the design and control of technologically-based projects. Considers both the theoretical and practical aspects of systems models, organizational development, project planning and control, resource allocation, team development and personal skill assessment. Prerequisites: IME 255, (IME 254 or ENGT 354), all with a C or better.

IME 676. Aircraft Manufacturing and Assembly (3).
Covers key aspects of assembly design for aircraft structures. First module covers design of jigs and fixtures to locate parts and machine features to tolerance, and the effect of part and tool stiffness on the tolerances. Second module covers gage design and gage studies, and geometric dimensioning and tolerancing. Third module covers assembly planning and best practices for aircraft assembly. Laboratory experiments and case studies are used to understand issues related to aircraft assembly. For ISME undergraduate students only. Prerequisite: IME 258.

IME 690. Industrial Engineering Design II (3).
Continuation of the design project initiated in IME 590 or the performance of a second industrial engineering design project; an industry-based team design project using industrial and manufacturing engineering principles; performed under faculty supervision. May not be counted toward graduate credit. Prerequisites: IME 590 and departmental consent.

IME 724. Statistical Methods for Engineers (3).
For graduate students majoring in engineering. Students study and model real-life engineering problems and draw reliable conclusions through applications of probability theory and statistical techniques. Not available for undergraduate credit. Prerequisite: MATH 243.

IME 740. Analysis of Decision Processes (3).
Decision analysis as it applies to capital equipment selection and replacement, process design and policy development. Explicit consideration of risk, uncertainty and multiple attributes is developed and applied using modern computer-aided analysis techniques. Prerequisites: IME 254, 255.

IME 749. Ergonomic Assessment Methods (3).
Covers current and commonly used risk and exposure assessment methods used for musculoskeletal disorders in the workplace. Students develop an understanding and working knowledge of how to evaluate and control the risk of work-related musculoskeletal disorders in the design of workplaces. Critical assessments and discussions of risk and exposure assessment techniques are performed relative to the strengths and weaknesses of each technique as well as the evidence for risk control and validity of the various methods. Prerequisite: IME 549 or instructor's consent.

IME 753. Advanced Linear Programming (3).
Linear and integer programming formulations, simplex method, geometry of the simplex method, sensitivity and duality, interior point methods. Prerequisite: IME 550 or instructor's consent.

IME 754. Reliability and Maintainability Engineering (3).
Studies problems of quantifying, assessing and verifying reliability. Presents various factors that determine the capabilities of components emphasizing practical applications. Examples and problems cover a broad range of engineering fields. Prerequisite: IME 524 or 724.

IME 755. Design of Experiments (3).
Application of analysis of variance and experimental design for engineering studies. Includes general design methodology, single-factor designs, randomized blocks, factorial designs, fractional replication and confounding. Prerequisite: IME 524 or 724.

IME 758. Analysis of Manufacturing Processes (3).
Introduces students to plasticity and builds upon their knowledge of mechanics and heat transfer in order to analyze various manufacturing processes. Numerical techniques (mainly finite element analysis) as well as theoretical methods are introduced and applied to analysis of processes such as open and closed die forging, superplastic forming, machining, grinding, laser welding, etc. The effect of friction, material properties and process parameters on the mechanics of the processes and process outputs is the main focus of study. Prerequisite: AE 333.

IME 759. Ergonomic Interventions (3).
Provides an understanding and working knowledge of how to evaluate and control the risk of musculoskeletal disorders in the design of workplaces and processes. Scientific aspects of intervention design and effectiveness assessment are discussed, including an assessment of the strengths and weaknesses of the intervention research literature. Prerequisite: IME 549 or instructor's consent.

IME 760. Ergonomics Topics (3).
New or special courses on topics in ergonomics and human factors engineering. Repeatable for credit with a change of content. Prerequisite: departmental consent.

IME 764. Systems Engineering and Analysis (3).
Presentation of system design process from the identification of a need through conceptual design, preliminary design, detail design and development, and system test and evaluation. Studies operational feasibility, reliability, maintainability, supportability and economic feasibility. Prerequisites: IME 254, 255.

IME 767. Lean Manufacturing (3).
Introduces lean concepts as applied to the manufacturing environment. Deals with the concepts of value, value stream, flow, pull and perfection. Includes waste identification, value stream mapping, visual controls and lean metrics. Prerequisite: IME 553.

IME 775. Computer Integrated Manufacturing (3).
A study of the concepts, components and technologies of CIM systems; enterprise modeling for CIM, local area networks, CAD/CAM interfaces, information flow for CIM, shop floor control and justification of CIM systems. Prerequisites: knowledge of a programming language, IME 558.

IME 777. IME Colloquium (0).
Presentations and discussions of industrial engineering problems, research methods, and case analyses for graduate students. Repeatable for credit.

IME 780. Topics in Industrial Engineering (3).
New or special courses are presented under this listing. Repeatable for credit when subject matter warrants.

IME 780AK. Advanced Industrial Information Systems (3).
Utilize database and analytical software to develop advanced industrial information systems. Topics include: advance Microsoft Access for end-users, Logic-based systems, Analytics in Microsoft Excel, data modeling, and data analytics.

IME 780AL. Energy Analytics & Management (3).
Covers topics on energy auditing, rate structures, economic evaluation techniques, analysis of opportunities in energy systems including but not limited to lighting, compressed air, process heating, steam, and other process-based energy systems. Also covers multiple software programs used by energy auditing professionals. Prerequisites: EE 282 or instructor’s approval.

IME 780AM. Advanced Cyber-Physical Systems (3).
A cyber-physical system is a set of interconnected digital computing devices that interact with physical world through sensors and actuators in a feedback control loop. The course outlines the basic principles of design, modeling, and analysis of cyber-physical systems with the use of mathematical abstractions, control theories, data communication, and distributed algorithms. The course also explains some of the Industry-4.0 technologies, such as cognitive robotics and Industrial Internet of Things (IIoT), with some hands-on lab activities.

IME 780AN. Big Data Analytics in Engineering (3).
Provides a graduate-level introduction to methods in data science and big data analytics with engineering applications. Specifically, examines some widely used statistical methods and machine learning tools for big data (data with high volume, velocity and variety). A variety of up-to-date industrial engineering topics are covered as application examples. Prerequisites: basic engineering statistics and programming skills.

IME 780AO. Robot Programming and Application (3).
Covers the broad interdisciplinary topic of industrial robotics. Discusses path planning and programming of robot manipulators, collaborative robots and mobile robots. Also covers the use of feedback sensors. Both theoretical and practical approaches are discussed to facilitate a smooth transition from theories to applications. Practical applications are facilitated by robot simulation software. Upon successful completion of the course, the student is able to use advanced methods for robot programming and gains basic familiarization with robot simulation software.

IME 780AP. Neural Networks and Machine Learning (3).
Introduces the theory and practical applications of artificial neural networks and machine learning. Covers several network paradigms, emphasizing the use of neural networks as a solution tool for industrial problems which require pattern recognition, predictive and interpretive models, pattern classification, optimization and clustering. Covers machine learning. Presents examples and discusses them from a

variety of areas including quality detection, process monitoring, robotics, simulation metamodeling, diagnostic models, combinatorial optimization and machine vision. For students from a variety of disciplines.

IME 781. Cooperative Education (1-8).
A work-related placement with a supervised professional experience to complement and enhance the student's academic program. Intended for master's level or doctoral students in IME. Repeatable for credit. May not be used to satisfy degree requirements. Prerequisites: departmental consent, graduate GPA of 3.000 or above.

IME 781P. Cooperative Education (1).
Introduces the student to professional practice by working in industry in an academically-related job and provides a planned professional experience designed to complement and enhance the student's academic program. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Students must enroll concurrently in a minimum of 6 hours of coursework including this course in addition to a minimum of 20 hours per week at their co-op assignment. Graded Cr/NCr unless student has received permission before enrolling for course to be used as an elective. Repeatable for credit. For graduate students.

IME 783. Supply Chain Management (3).
Quantitative and qualitative techniques used in the design and management of the supply chain. Includes distribution management, multi-plant coordination, optimal design of the logistics network, adequate safety stock levels and the risk pooling concept, and integrating decision support systems (DDS) in the management of the supply chain. Prerequisite: IME 553.

IME 825. Enterprise Engineering (3).
How to design and improve all elements associated with the total enterprise through the use of engineering and analysis methods and tools to more effectively achieve its goals and objectives. Deals with the analysis, design, implementation and operation of all elements associated with an enterprise. Includes business process re-engineering, graphical enterprise modeling tools and architectures, and enterprise transformation. Prerequisite: IME 553.

IME 835. Applied Forecasting Methods (3).
A study of forecasting methods, including smoothing techniques, time series analysis, and Box-Jenkins models. Prerequisite: IME 724 or instructor's consent.

IME 850. Discrete Optimization (3).
Modeling with integer variables, various applications of discrete optimization in industry, service and science, enumeration and cutting plane methods, branch and bound methods, decomposition algorithms, computational and software issues (AMPL and CPLEX), and dynamic programming. Prerequisite: IME 550 or instructor's consent.

IME 851. Stochastic Modeling and Analysis (3).
Discusses stochastic processes and their application to modeling and analysis of systems that involve uncertainty in engineering and management sciences. Topics include review of probability concepts and random variables, discrete-time Markov chains, Poisson processes, continuous-time Markov processes, renewal theory, and basic queueing models. Prerequisite: IME 550 or instructor's consent.

IME 854. Quality Engineering (3).
A broad view of quality tools and their integration into a comprehensive quality management and improvement system. Covers the theory and approaches of the major quality leaders such as Deming, Juran and Crosby. Explores off-line and online quality engineering techniques, including cost of quality, the seven old and seven new tools, Quality Function Deployment, and statistical process control methods. Explores design of engineering experiments, including Taguchi's methods. Prerequisite: IME 554 or instructor's consent.

IME 858. Nonlinear Finite Element Analysis of Metal Forming (3).
Introduces the use of an LS-DYNA software package for metal forming simulations and discusses the theoretical foundation necessary to understand the physics and mechanics behind some of the options that need to be used to ensure solution accuracy in FEA of metal forming. Prerequisite: AE 722 or ME 650K or IME 780K.

IME 864. Risk Analysis (3).
Provides a set of methods that have been widely used to evaluate and void the risk of technological systems and devices in engineering applications. The methods introduced are multi-disciplinary in terms of the scope of the methodology and the concepts that are being applied in many industries. Students are expected to have an engineering background and the capability of using statistics and operations research tools. Prerequisite: IME 724 or 754 or instructor's consent.

IME 865. Modeling and Analysis of Discrete Systems (3).
Covers analytical and experimental techniques for the modeling and analysis of discrete systems with a focus on discrete event simulation of terminating and nonterminating systems. Course material includes some discussion of Markov Chains and Queuing Theory as they pertain to systems simulation. Systems applications come from the manufacturing and service sectors. Students investigate issues through readings, lectures and hands-on projects. Prerequisites: IME 553, 724, or instructor's consent.

IME 872. Applied Learning Project in Industrial, Systems, and Manufacturing Engineering (1).
Incorporates an industry-based project conducted under the supervision of departmental graduate faculty. Satisfies the applied learning requirement for MS-level students in the department. Requires a written report and an oral presentation on the project. Prerequisite: instructor’s consent.

IME 874. MSIE Graduate Seminar (1).
Seminar course performed under faculty supervision, related to a topic of research interest to both the faculty and the student. Repeatable for credit. Prerequisite: faculty consent.

IME 876. Thesis (1-6).
Repeatable for credit. Prerequisite: consent of thesis advisor.

IME 877. Foundations of Neural Networks (3).
For students from a variety of disciplines. Introduces the theory and practical applications of artificial neural networks. Covers several network paradigms, emphasizing the use of neural networks as a solution tool for industrial problems which require pattern recognition, predictive and interpretive models, pattern classification, optimization and clustering. Presents examples and discusses them from a variety of areas including quality detection, process monitoring, robotics, simulation metamodeling, economic and finance analysis, diagnostic models, combinatorial optimization, and machine vision. Prerequisite: IME 724 or instructor's consent.

IME 878. Master's Directed Project (1-3).
A project conducted under the supervision of an academic advisor for the directed project option. Requires a written report and an oral presentation on the project. Prerequisite: consent of academic advisor.

IME 880. Topics in Industrial Engineering (3).
New or special courses are presented under this listing on sufficient demand. Repeatable for credit when subject matter warrants.

IME 880Y. Forecasting and Analytics (3).
Covers topics on time series regression models, forecasting and smoothing, exploratory data analytics, predictive analytics and

modeling, and ARIMA models. Students will use R program to model predictive analytics problems. Prerequisites: IME 524 and IME 724 or instructor’s approval.

IME 883. Supply Chain Analytics (3).
Uses operations research and analytics to provide state-of-the-art mathematical models, concepts and solution methods important in the design, control, operation and management of global supply chains by emphasizing a quantitative analytical approach. Prerequisites: IME 550 and IME 553; or instructor's consent.

IME 890. Independent Study in Industrial Engineering (1-3).
Analysis, research and solution of a selected problem. Prerequisite: instructor's consent.

IME 930. Multiple Criteria Decision Making (3).
An extensive treatment of techniques for decision making where the multiple criteria nature of the problem must be recognized explicitly. Prerequisite: IME 550.

IME 960. Advanced Selected Topics (3).
New or special courses on advanced topics presented under this listing on sufficient demand. Prerequisite: instructor's consent.

IME 960F. Statistical Process Control (3).
Studies the measurement and control of product quality using statistical methods. Includes total quality management, statistical process control and acceptance sampling. Prerequisite: IME 254 or IME 724.

IME 976. PhD Dissertation (1-12).
Repeatable for credit. Prerequisite: admission to doctoral aspirant status.

IME 990. Advanced Independent Study (1-3).
Arranged individual, independent study in specialized content areas. Repeatable for credit toward the PhD degree. Prerequisites: advanced standing and departmental consent.