

INDUSTRIAL ENGINEERING AND MANAGEMENT

Industrial engineering and management focuses on production systems that produce goods or provide services for customers. Industrial engineers define, design, build, operate and improve production processes that convert resources to high quality products or services effectively, efficiently and safely.

People are the fundamental component of production systems. People provide the creativity and leadership essential to make things happen. Hence, industrial engineering is the most people-oriented discipline within the engineering family. Industrial engineers are trained to think in both broad and specific terms. Practicing industrial engineers understand business parameters as well as physical and social parameters within production systems. This breadth allows industrial engineers to function effectively in a wide spectrum of activities ranging from strategic business planning to detailed task design. The wide-angle vision of industrial engineering provides career flexibility, leading to high-level leadership or specialized technical responsibilities.

Industrial engineers are employed in manufacturing organizations (e.g., automotive, electronics, food, and medical manufacturers), service enterprises (e.g., airlines, banks, consulting groups, hospitals, retail companies, transportation companies) and governmental organizations (e.g., public service and regulatory organizations).

Vision

IEM's vision is to place industrial engineers in a wide variety of industries including manufacturing, service, energy, healthcare, humanitarian and others, so that our society at large can benefit from systems that efficiently produce goods or provide services, effectively use an optimal set of resources and enrich the quality of life for all.

Mission

The School of Industrial Engineering and Management's mission is to develop professionals and leaders in industrial engineering and management by being a leader in education, research and outreach.

Core Values

Faculty, students and staff work together to build and maintain a learning/mentoring environment where:

- Innovative practices are developed, tested and validated.
- Knowledge and practices are shared.
- Each individual develops to his/her full potential.
- Professional ethics are practiced at all times.

Educational Objectives and Outcomes

Within a few years after graduation, Industrial Engineering program graduates will become professionals, managers or leaders in a wide variety of industries and apply discovery, problem-solving, leadership and management skills for the benefit of their organization and society at large.

Student Learning Outcomes

Graduating baccalaureate students possess an understanding of fundamental industrial engineering and management concepts, methodologies and technologies as demonstrated by:

- an ability to apply knowledge of mathematics, science and engineering,
- an ability to design and conduct experiments, as well as to analyze and interpret data,
- an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability,
- an ability to function on multidisciplinary teams,
- an ability to identify, formulate and solve engineering problems,
- an understanding of professional and ethical responsibility,
- an ability to communicate effectively,
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context,
- a recognition of the need for, and an ability to engage in life-long learning,
- a knowledge of contemporary issues, and an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

The curriculum consists of three primary parts:

1. general studies,
2. core engineering, and
3. professional school topics.

General studies consist of courses such as mathematics, statistics, chemistry, physics, English, behavioral science, history, humanities and arts. Core engineering courses consist of engineering sciences such as materials, statics, electrical circuits, fluid mechanics and thermodynamics. Professional school courses consist of topics such as systems thinking and analysis in engineering, economic analysis, manufacturing processes, computer-aided modeling, work analysis, operations research, quality control, experimental design, facility location and layout, management and leadership, production control, system simulation modeling, information systems, ergonomics and human factors, and energy and water management. A capstone design experience, working with a real-world organization, integrates classroom and lab work together in the senior year. Details regarding degree requirements are available in the Undergraduate Programs and Requirements publication.

The IEM program is accredited by the Engineering Accreditation Commission of ABET under the industrial engineering criteria.

Each IEM student, along with the faculty adviser, develops an individual plan of study that guides the student through the curriculum. Coursework is sequenced and interrelated to provide theoretical and applied knowledge, along with hands-on laboratory and project experience. Students work as individuals and as teams to integrate and apply mathematical, scientific, and engineering knowledge and concepts in order to address both traditional academic questions as well as open-ended design and analysis challenges. Instruction in experimental methods is integrated in the curriculum through the design, execution, analysis and interpretation of experiments. Project work is used to

develop both technical and communications skills. Technical skills are used to identify, formulate and address engineering problems, both simple and complex. Communications skills are developed and practiced in written, oral and team interaction formats.

The means to define and design detailed solutions to address customer needs from a system-wide perspective is introduced in the sophomore year, and reinforced through the capstone senior design project. Additionally, global perspectives or production systems are introduced and emphasized in the sophomore year so that students understand the nature of global customer bases as well as global competition early in their studies. The curriculum is continually updated to assure that contemporary issues, thinking and tools are integrated in course content as well as instructional delivery. Professional responsibility and ethical behavior are introduced and reinforced throughout the curriculum. Additionally, the need for life-long learning after graduation is stressed.

Students are offered opportunities to enhance their classroom and laboratory experiences through student organizations such as the student chapter of APICS, the Institute of Industrial and Systems Engineers, the Institute for Operations Research and the Management Sciences, and the American Society for Quality. Outstanding scholars are recognized by Alpha Pi Mu, the national honor society for industrial engineering students. Additionally, opportunities for internship and co-op experiences are offered to IEM students so that they can gain professional experience during their collegiate program. Please visit our Internet site <http://iem.okstate.edu> for more information.

Courses

IEM 2903 Introduction to Manufacturing and Service Systems

Prerequisites: ENGR 1111; MATH 2144.

Description: Introduction to definition, design, operation, and improvement of systems that produce goods and services. Case studies featuring classical and contemporary issues in industrial engineering and management. Issues include system effectiveness and efficiency in meeting customer needs, demands and expectations. Introduction to computer-aided tools useful in documentation, analysis, and modeling within contemporary organizations.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 3103 Probability and Statistics for Engineers I

Prerequisites: MATH 2153.

Description: An introduction to key concepts and results in probability, random variables, discrete and continuous distributions, mathematical expectations, and joint probability distributions that support applications in industrial engineering and management.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 3303 Manufacturing Processes

Prerequisites: ENGR 1322 and ENSC 3313.

Description: Manufacturing processes used to transform new materials including metals and non-metals into finished goods. Traditional and nontraditional manufacturing processes. Introduction to CAD/CAM. Basic process selection. Metrology and measurement fundamentals.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 3

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Industrial Engr & Mgmt

IEM 3403 Collaborative Engineering Project Management

Prerequisites: Junior standing.

Description: Engineering management and group issues involved in project planning, implementation and topics addressed include project management methodologies and software; teamwork structures, processes, and collaborative technologies; process management, leadership and other team roles.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 3503 Engineering Economic Analysis

Prerequisites: MATH 2153.

Description: Development and use of time value of money models. Bases for comparison of alternatives, including present worth, annual worth, rate of return and payout period methods. Decision-making among independent, dependent, capital-constrained and unequal-life projects. Replacement, breakeven and minimum cost analyses. Depreciation and depletion methods and their effect on corporate income taxes, leading to after-tax cash flow analysis. Introduction to financial reports.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 3513 Economic Decision Analysis

Prerequisites: MATH 2123.

Description: Quantitative evaluation of investment alternatives for non-engineering majors. The role of interest in economic equivalence and in formulating economic comparisons based on present worth, annual equivalent, rate of return and payout criteria. Accounting, depreciation and income tax considerations. Benefit-cost and cost-effectiveness analysis. Cost estimation and allowance for variance in estimates. Not available for credit in industrial engineering curriculum.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 3523 Engineering Cost Information and Control Systems**Prerequisites:** MATH 2144.**Description:** Introduction to basic accounting concepts and operating characteristics of accounting systems relevant to engineering analysis and decision making. Principles of financial and managerial accounting, activity based costing, taxes and depreciation. Emphasis on interpretation and use of accounting information for decision-making.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 3703 Probability and Statistics for Engineers II****Prerequisites:** IEM 3103.**Description:** An introduction to key concepts and results in statistics, including confidence intervals and hypothesis tests for the mean and the variance, analysis of variance, linear regression, correlation, goodness of fit tests and categorical data analysis that support applications in industrial engineering and management.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 3813 Work Design, Ergonomics, and Human Performance****Description:** Evaluation and design of work systems and processes employing humans. Emphasis on simultaneously achieving high productivity and employee health, safety and satisfaction.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 3**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Industrial Engr & Mgmt**IEM 4010 Industrial Engineering Projects****Prerequisites:** Consent of school head.**Description:** Special undergraduate projects and independent study in industrial engineering. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.**Credit hours:** 1-3**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 4013 Operations Research****Prerequisites:** MATH 3013.**Description:** Introduction to operations research, analytics, and mathematical optimization with an emphasis on topics in linear, integer, and network optimization. Effective model formulation and software solution of strategic, tactical and operational problems encountered in manufacturing, and service industries. Covers the simplex method, duality theory, sensitivity analysis, branch-and bound, network simplex, and Dijkstra's algorithm. Previously offered as IEM 4014.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4020 Undergraduate Engineering Practicum****Prerequisites:** Consent of IEM adviser, admission to the Professional School of Industrial Engineering and Management and satisfactory completion of at least 12 hours of IEM 3000- or IEM 4000-level courses.**Description:** Professionally supervised experience in real life problem solving involving industrial projects for which the student assumes a degree of professional responsibility. Activities approved in advance by the instructor. May consist of full- or part-time engineering experience, on-campus or in industry, or both, either individually or as a responsible group member. Periodic reports both oral and written required as specified by the adviser. Offered for variable credit, 1-3 credit hours, maximum of 4 credit hours.**Credit hours:** 1-3**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 4103 Quality Control****Prerequisites:** IEM 3703.**Description:** Performance excellence in an enterprise, including relationships between industrial engineering and quality control. Statistical quality control concepts to measure, monitor, diagnose, and improve performance at the enterprise level, the operational level, and the project level. Quantitative and qualitative quality tools to solve problems and capture opportunities for improvement.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4113 Industrial Experimentation****Prerequisites:** IEM 3703.**Description:** Analytical methods for the purpose of process improvement. Experimental designs including single, blocked and multiple factors. Introduction to fractional factorial designs, central composite designs, and Taguchi robust designs. Data collection, analysis, and interpretation, including graphical methods, confidence intervals, and hypothesis tests. Multiple linear regression analysis methods. Industrial applications.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4163 Service Systems and Processes****Prerequisites:** IEM 3103, IEM 3503, IEM 4613.**Description:** Design and analysis of service systems and processes from the perspective of industrial engineering and engineering management. Application of basic industrial engineering principles and tools applied to service systems. Basics of service quality and productivity, including metrics, measurement and improvement.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt

IEM 4203 Facilities and Material Handling System Design**Prerequisites:** IEM 4713.**Description:** Design principles and analytical procedures for determining facility location and location of physical assets within a facility. Introduction to material-handling concepts, technologies and methods. Considerations include production processes, product volume, material flow and information flows.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4413 Industrial Organization Management****Prerequisites:** IEM 2903, Senior standing.**Description:** Issues, concepts, theories and insights of engineering management and applications emphasizing effective performance.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4613 Production Planning and Control Systems****Prerequisites:** IEM 4013.**Description:** Concepts of planning and control for production and control systems. Design of operation planning and control systems. Techniques used in demand forecasting, operations planning, inventory control, scheduling, and progress control.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4623 Supply Chain Management****Prerequisites:** IEM 4013.**Description:** Introducing basic concepts and methods in supply chain management. Developing managerial insights into supply chain strategies in the global economy. Measuring supply chain performance under dynamic market conditions. May not be used for graduate credit with IEM 5763.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4713 Systems Simulation Modeling****Prerequisites:** IEM 3703 and IEM 4013.**Description:** Simulation of discrete-event systems, including problem formulation, translation to a computer model, and use of a model for problem solution as well as concepts of random variable selection and generation, model validation and statistical analysis of results.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Industrial Engr & Mgmt**IEM 4723 Information Systems Design and Development****Description:** Information systems development methodologies, modeling methods and software tools for the design and development of information systems. Different phases of system design and implementation. Data modeling using entity-relationship diagrams and process modeling using data flow diagrams, IDEF0 and IDEF3. Introduction to enterprise resource planning systems and their use within different enterprise functional units.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4913 Senior Design Projects****Prerequisites:** Terminal semester only; IEM majors only.**Description:** Student teams work on professional-level engineering projects selected from a wide range of participating organizations. Projects are equivalent to those normally experienced by beginning professionals and require both oral and written reports. Normally taken during student's last semester of undergraduate work. Additional flat fee of \$80.00 applies.**Credit hours:** 3**Contact hours:** Lecture: 1 Lab: 4**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Industrial Engr & Mgmt**IEM 4931 Industrial Engineering and Management Seminar****Prerequisites:** Senior standing.**Description:** Designed to orient seniors to their professional work environment. Topics include placement procedures, resume construction, interviewing skills, professional dress, graduate school, professional societies and registration, personal management of time and money, and job-related expectations. Taught by senior faculty; utilizes outside speakers.**Credit hours:** 1**Contact hours:** Lecture: 1**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 4953 Industrial Assessment and Improvement****Prerequisites:** Senior standing and consent of instructor.**Description:** Plant assessment and improvement-based concepts, strategies, and tools for manufacturing operations. Emphasis is on small to medium-sized manufacturing operations. Issues include energy, water, waste, quality, and productivity analysis across the organization from a systems perspective. Justification of improvement projects and measurement of results.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt

IEM 4990 Selected Topics in Industrial Engineering and Management**Prerequisites:** Consent of instructor.**Description:** Study of selected contemporary topics in industrial engineering and management, including operations research; quality; manufacturing systems; engineering management; enterprise systems and supply chains; facilities, energy, and environmental management. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 5000 Master's Research and Thesis****Prerequisites:** Approval of major adviser.**Description:** Research and thesis for master's students. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 5003 Probability and Statistics for Engineers****Prerequisites:** STAT 4033 or IEM 3103.**Description:** Probability and statistical topics and methods used in various areas of industrial engineering including random numbers, probability theory, conditional probabilities, parameter estimation, confidence intervals, hypothesis testing, and regression models.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5010 Industrial Engineering Projects****Prerequisites:** Consent of school head and approval of major adviser.**Description:** Special graduate projects and independent study in industrial engineering. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 5013 Introduction to Optimization****Prerequisites:** IEM 4013 or equivalent.**Description:** Introduction to mathematical optimization with an emphasis on linear, integer, network, and convex optimization. Effective formulation techniques, basic mathematical and algorithmic concepts, and software solution of large-scale problems arising in the practice of operations research, industrial and systems engineering, management sciences, and analytics.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5020 Graduate Engineering Practicum****Prerequisites:** Consent of IEM adviser and satisfactory completion of 12 hours of IEM 5000- or IEM 6000-level courses.**Description:** Professionally supervised experience in real-life problem solving involving projects for which the student assumes a degree of professional responsibility. Activities approved in advance by the instructor and must reflect graduate level analysis. May consist of full or part-time engineering experience, on-campus or in industry, or both, either individually or as a responsible group member. Periodic reports, both oral and written, required as specified by the adviser. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.**Credit hours:** 1-3**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 5030 Engineering Practice****Prerequisites:** Approval of adviser.**Description:** Professionally supervised experience in a real-life problem involving authentic projects for which the student assumes a degree of professional responsibility. Activities must be approved in advance by the student's adviser. May consist of full or part-time engineering experience, on-campus or in industry, or both, either individually or as a responsible group member. Periodic reports, both oral and written, required as specified by the adviser. Offered for variable credit, 1-9 credit hours, maximum of 12 credit hours.**Credit hours:** 1-9**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 5063 Network Optimization****Prerequisites:** IEM 5013 or equivalent.**Description:** Network flows and combinatorial optimization models and algorithms with an emphasis on mathematical and algorithmic fundamentals. Covers basics of graph theory, algorithmic analysis, and complexity theory. Covers Classical Algorithms for shortest paths, minimum spanning trees, max-flow and min-cut, min-cost flows; P versus NP; traveling salesman problem, local search, metaheuristics, Christofides algorithm. Previously offered as IEM 6013.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5103 Breakthrough Quality****Prerequisites:** IEM 4103, IEM 4113 and IEM 5003.**Description:** Structured, systematic approach and advanced statistical and modeling tools to achieve breakthrough improvement across all areas of an enterprise. Rigorous application, integration, and betterment of strategies and tools for improving or redesigning products and processes such that performance gains are noticeably higher or quicker than those achieved under traditional incremental improvement approaches.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt

IEM 5113 Strategic Quality Leadership**Prerequisites:** STAT 4013 and IEM 5003.**Description:** Quality-related strategies. Critical elements that differentiate high performing organizations from their competitors. Delivering value to customers. Quality leadership, strategic planning, customer value, learning organizations, knowledge management, quality systems and business results.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5123 Service Quality****Prerequisites:** STAT 4013 or equivalent.**Description:** Theory and application of service quality, including characteristics of services (intangibility, heterogeneity, perishability and inseparability of production and consumption), dimensions of service quality, measurement methodologies for service quality and improvement methodologies for service quality. Certification and accreditation processes for service industries.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5133 Stochastic Processes****Prerequisites:** MATH 2233, MATH 3013, and IEM 5003 or STAT 5123.**Description:** Definition of stochastic processes, probability structure, mean and covariance function, the set of sample functions. Renewal processes, counting processes, Markov chains, birth and death processes, stationary processes and their spectral analyses. Same course as STAT 5133 & MATH 5133.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5143 Reliability and Maintainability****Prerequisites:** STAT 4033 and IEM 5003.**Description:** Probabilistic failure models of components and systems. Detailed study of reliability measures, and static and dynamic reliability models. Classical and Bayesian reliability testing for point and interval estimation of exponential and Weibull failures. Reliability optimization through allocation and redundancy. Fundamentals of maintainability. Previously offered as IEM 6113.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5203 Facility Location, Warehousing and Freight Transportation****Prerequisites:** IEM 4013, IEM 4203 and IEM 5003.**Description:** Analytical models for single and multi facility location problems. Algorithms for network location problems including the median, center and covering problems. A discussion of storage location policies such as dedicated, randomized and class-based and their relationship to the warehouse layout problem. Analysis and design of warehouse material handling systems. Introduction to warehouse management systems, freight movement modeling and transportation infrastructure planning.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5350 Industrial Engineering Problems****Prerequisites:** IEM 4413 or equivalent industrial experience.**Description:** A detailed investigation into one area of industrial engineering with a required written report. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 5413 Managing the Engineering and Technical Function****Prerequisites:** IEM 4413 or equivalent industrial experience.**Description:** Advanced study of engineering entrepreneurship in the technical organization including: new product evaluation and selection, technology commercialization process, business plan preparation, intellectual property, patent search and discovery, new enterprise development, market analysis, and capital investment procurement strategies.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 5503 Financial and Advanced Capital Investment Analysis****Prerequisites:** IEM 3503, IEM 4013, STAT 4033 or IEM 3103 or equivalent.**Description:** An understanding of financial concepts and markets, and an advanced treatment of proper methods of capital project selection under risk and uncertainty. Decision making under capital rationing. Financial environment and valuing securities, representing cash flows, selecting investments, avoiding common pitfalls, evaluating timing consideration, depreciation and corporate taxation, replacement analysis, and incorporating risk and uncertainty.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt

IEM 5603 Project Management

Prerequisites: IEM 4413 or equivalent.

Description: A systems approach to planning, organizing, scheduling and controlling projects. The behavioral and quantitative aspects of project management. Importance of working with personnel as well as technology. Project management software utilized.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5613 Integrated Manufacturing Control Systems

Prerequisites: IEM 4613.

Description: Advanced treatment of planning and control philosophies and techniques for manufacturing and production systems. Approaches focusing on demand-driven control and achieving competitive advantage through manufacturing. Material requirements planning, capacity planning, shop floor control, master scheduling, production planning and demand management. Just-in-time and the theory of constraints.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5633 Advanced Production and Inventory Control

Prerequisites: IEM 5013 and IEM 5763.

Description: Advanced concepts and quantitative techniques used in production planning and inventory control, including static and dynamic scheduling of machines and cells, deterministic and stochastic inventory control, multi-echelon supply chain management, demand forecasting, and revenue management.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5703 Discrete System Simulation

Prerequisites: IEM 5003.

Description: Discrete-event systems via computer simulation models. Model building and the design and analysis of simulation experiments for complex systems. Application to a variety of problem areas. Use of simulation languages and related software tools.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5723 Data, Process and Object Modeling

Prerequisites: Graduate standing or consent of instructor.

Description: Logical and physical models in the analysis, design and improvement of enterprise systems. Structured and object-oriented analysis and design techniques. Data modeling using entity-relationship diagrams and IDEF1x. Data normalization techniques. Process modeling using data flow diagrams, IDEF0, IDEF3, and Petri nets. Object modeling using the unified modeling language (UML).

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5743 Information Systems and Technology

Prerequisites: Graduate standing or consent of instructor.

Description: For current and potential engineering and technology managers. Knowledge of information systems and technology to lead the specification, selection, implementation, and integration of information technology in manufacturing and service organizations. Management issues involved in the use of information technology in organizations.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5763 Supply Chain Strategy

Prerequisites: IEM 4613 or equivalents.

Description: Supply chain strategy including the philosophical base of business practice and the analytical base of modeling. Supply chain strategy, including key objectives and financial considerations, supply chain dynamics, supply chain performance measurement, supply chain integration, characteristics of different supply chains and supply chain performance modeling.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5813 Performance Measurement Systems

Prerequisites: IEM 3813, IEM 4413 or equivalents.

Description: Strategies and methods to define, measure, and apply individual, group- and organizational-level performance metrics in a variety of service and production contexts. Implementation and effective use of metrics. Measurement's role in a management system, managerial decision styles and preferences, operational definitions of performance, processes for identifying and applying metrics, performance measurement tools and techniques, data collection, portrayal of quantitative and qualitative information, and the role of computer technology in measurement system application.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5953 Industrial Assessment and Improvement

Prerequisites: Senior standing and consent of instructor.

Description: Plant assessment and improvement-based concepts, strategies, and tools for manufacturing operations. Small to medium-sized manufacturing operations. Energy, water, waste, quality, and productivity analysis across the organization from a systems perspective. Justification of improvement projects and measurement of results.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Industrial Engr & Mgmt

IEM 5990 Special Topics in Industrial Engineering and Management**Prerequisites:** Consent of instructor.**Description:** Study of selected contemporary topics in industrial engineering and management including operations research; quality and reliability; manufacturing systems; engineering management; enterprise systems and supply chains; facilities, energy, and environmental management. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 6000 Doctoral Research and Dissertation****Prerequisites:** Approval of major adviser and advisory committee.**Description:** Independent research for PhD dissertation requirement under direction of a member of the Graduate Faculty. Offered for variable credit, 1-15 credit hours, maximum of 30 credit hours.**Credit hours:** 1-15**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 6033 Linear Optimization****Prerequisites:** Concurrent Prerequisite IEM 5013 or consent of instructor.**Description:** Mathematical theory of linear optimization and the implications for algorithm development. Fundamentals of convex analysis, polyhedral sets, development of the simplex method, Farkas' lemma, development of duality theory, sensitivity analysis, Dantzig-Wolfe decomposition, Benders decomposition, interior point algorithms. Previously offered as IEM 5033.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 6043 Nonlinear Optimization****Prerequisites:** IEM 6033 or consent of instructor.**Description:** Mathematical foundations of nonlinear optimization theory and algorithms. Introduction to convex analysis, local/global optima, optimality conditions, and their implications for model and algorithm development. Convex functions and generalizations, Fritz John and Karush-Kuhn-Tucker optimality conditions, constraint qualifications, Lagrangian duality and saddle point optimality conditions, gradient-based and quasi-Newton methods for unconstrained optimization. Previously offered as IEM 5043.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 6053 Integer and Combinatorial Optimization****Prerequisites:** Concurrent prerequisites. IEM 5063, IEM 6033, or consent of instructor.**Description:** Theory, algorithms, and applications of discrete optimization. Binary, pure, and mixed-integer linear optimization formulations, relaxations; preprocessing, branch and bound, formulation strength, polynomial equivalence of separation and optimization; theory of polyhedra, convex hulls and facets, valid inequalities for pure and mixed-integer problems, lifting, perfect formulations, extended formulations. Previously offered as IEM 6023.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 6063 Optimization Under Uncertainty****Prerequisites:** IEM 5013, IEM 6033, IEM 5003 or consent of instructor.**Description:** Introduction to concepts, principles, and techniques for optimization under uncertainty. Formulating two-stage stochastic linear and integer programs; sample average approximation and decomposition methods; conditional value-at-risk and chance-constrained optimization; robust linear optimization, robust conic optimization, and robust multi-stage optimization; distributionally robust and data-driven optimization.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt**IEM 6110 Special Problems in Industrial Engineering****Prerequisites:** Consent of school head and approval of major adviser.**Description:** Special problems in industrial engineering and management under supervision of a member of the Graduate Faculty. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Industrial Engr & Mgmt**IEM 6123 Queuing Systems: Theory and Manufacturing Applications****Prerequisites:** IEM 5003, STAT 5133 or consent of instructor.**Description:** Review of probability, stochastic processes, and Markov chains. Single-server and multi-server exponential queuing models. Queuing models with Poisson arrivals and general service times. Product form queuing network models: open and closed network models, mean value analysis algorithms for closed models, and single class and multiclass models. Approximations for general single server queues and non-product form networks. Applications of queuing models in the performance analysis of transfer lines, automatic assembly systems, and flexible manufacturing systems.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Industrial Engr & Mgmt

IEM 6903 IEM Doctoral Seminar

Description: The IE&M Doctoral Seminar is designed to train the doctoral student in the doctoral dissertation research process and is normally taken in the first year of the student's program. The course involves significant work outside the classroom, under the supervision of the student's research advisor. The class meetings will be used for some formal instruction on research methods/process, discussion of current research in IEM lead by select faculty, guest speakers, and presentations by students.

Credit hours: 3

Contact hours: Lecture: 1 Other: 2

Levels: Graduate

Schedule types: Independent Study, Lecture, Combined lecture & IS

Department/School: Industrial Engr & Mgmt

IEM 6990 Advanced Topics in Industrial Engineering and Management

Prerequisites: Consent of instructor.

Description: Advanced and emerging topics of interest to PhD-level students in Industrial Engineering and Management are discussed. Offered for variable credit, 1-6 credit hours, maximum of 18 credit hours.

Credit hours: 1-6

Contact hours: Other: 1

Levels: Graduate

Schedule types: Independent Study

Department/School: Industrial Engr & Mgmt

Undergraduate Programs

- Industrial Engineering and Management, BSIE (<http://catalog.okstate.edu/engineering-architecture-technology/industrial-engineering-management/bsie>)

Graduate Programs

The School of Industrial Engineering and Management offers graduate programs leading to the Master of Science Industrial Engineering and Management degree and the Doctor of Philosophy degree.

The Master of Science degree is characterized by a higher degree of technical specialization in a particular field of study (beyond a BS degree). This degree program is designed to prepare students for professional practice that may include research or consulting components. The Master of Science degree is especially attractive to industrial engineering graduates, engineering graduates from other disciplines, and many science majors. The MS degree includes a strong technical component and an orientation to business and engineering management that is complementary to a technical background.

The Doctor of Philosophy degree is designed to position the student on the leading edge of knowledge in the profession of industrial engineering and engineering management. It is intended to prepare students for highly specialized positions, such as research and consulting in industry, government and service organizations, and for teaching or research positions in colleges and universities.

The basic consideration in graduate education in industrial engineering and management is effective and efficient utilization of human, physical and economic resources. Instruction in management embraces both qualitative and quantitative concepts, including analytical methodologies and social considerations pertinent to organizations.

Advanced degree programs are designed with major emphasis in fields of interest such as engineering management, manufacturing systems, operations research, quality and reliability, facilities and energy-

management, and enterprise systems and supply chains. Students may complement industrial engineering and management courses with work in other branches of engineering, as well as economics, business administration, computer science, statistics, mathematics, psychology and sociology.

Admission Requirements

Admission to the Graduate College is required of all students pursuing the MS or PhD degree. Graduation from an industrial engineering curriculum with scholastic performance distinctly above average qualifies the student for admission to the School of Industrial Engineering and Management as a candidate for the master's and doctorate degrees. Graduates from related disciplines may be admitted if an evaluation of their transcripts and other supporting materials by the School of Industrial Engineering and Management indicates that they are prepared to take graduate-level course work in industrial engineering, or can be expected to do so after a reasonable amount of prerequisite work.

All applicants must submit GRE scores. In addition, the Graduate College may require certain international applicants to submit TOEFL scores.

Degree Requirements

The Master of Science degree in industrial engineering and management may be earned by one of two plans as follows:

Plan I—coursework with thesis. Minimum 30 credit hours consisting of 24 hours of coursework and 6 hours of research with a grade of "SR."

Plan II—coursework without thesis. Minimum of 33 credit hours. May include no more than three hours of independent study project.

The Doctor of Philosophy degree requires the completion of at least 90 credit hours beyond the bachelor's degree or 60 credit hours beyond the master's degree; including a minimum of 18 credit hours of dissertation research and a minimum of 30 credit hours of course work beyond the master's degree.

The School of Industrial Engineering and Management also participates in the Master of Science in Engineering and Technology Management program. Current IE&M program information can be found on the School website <http://iem.okstate.edu>.

Faculty

Sunderesh S. Heragu, PhD—Regents Professor and Head, Donald and Cathey Humphreys Chair

Professor: Manjunath Kamath, PhD

Associate Professor and Wilson Bentley Chair: Balabhaskar Balasundaram, PhD

Associate Professors: Terry Collins, PhD, PE; Camille F. DeYong, PhD; Tieming Liu, PhD

Jim and Lynne Williams Assistant Professor: Austin Buchanan, PhD

Assistant Professors: Juan Borrero, PhD; Kalyani Nagaraj, PhD; Farzad Yousefian, PhD, Chaoyue Zhao, PhD

Lecturers: Tim Hardin, PhD; Jennifer Glenn, PhD