Industrial and Systems Engineering

Shih-Ming Lee, *Chairperson and Associate Professor*
Martha A. Centeno, *Associate Professor*
Chin-Sheng Chen, *Professor*
Ronald Giachetti, *Associate Professor*
Mario Sanchez, *Lecturer and Advisor*

Industrial and Systems Engineering is involved with design and operations of efficient and effective systems. An industrial and systems engineer takes an integrated approach to the design and management of an enterprise system so that it operates at optimal efficiency, quality and productivity. Industrial and Systems Engineers may be found in different industrial sectors ranging from manufacturing to service including production, transportation, government, financial service, and health care.

Course Descriptions

Description of Prefixes
EGN-Engineering, General EIN-Engineering, Industrial; ESI-Engineering Systems Industrial; TCN-Telecommunications.
F-Fall semester offering; S-Spring semester offering; SS-Summer semester offering.

EGN 5435 Product Modeling (3). Life cycle product data, geometry and form features, product information models and modeling techniques, product modeling systems, and product data standards. Prerequisites: EGN 3123 or equivalent.

EGN 5520 Enterprise Systems Configuration (3). Enterprise systems overview; major enterprise functions; standard operation procedures; system configuration and parameters; master data; user interfaces and reports; and hands-on experience. Prerequisite: Permission of the instructor.

EGN 5621 Enterprise Systems Collaboration (3). Collaborative engineering and environment; decision processes; changes management; virtual enterprise operation systems; and hands-on experience with a commercial enterprise operation system. Prerequisite: EGN 5622.

EGN 5622 Enterprise Systems Integration (3). Enterprise architectures; work flow modeling and design; systems integration methodology; vertical and horizontal integration; master data analysis and integration; and hands-on experience. Prerequisite: EGN 5520.

EGN 6436 Manufacturing Process Design (3). Resources modeling, process plan modeling, and planning methodologies for process selection, operations selection, machining parameters selection, setup planning, and inspection planning. Prerequisite: EGN 5842.

EGN 6437 Manufacturing Systems Design (3). System design for production and process planning, resource management, material handling, process control, and quality control. Prerequisite: Permission of the instructor.

EGN 6438 Manufacturing Engineering (3). Manufacturing functions, product and process design, material processing and control, systems design and operations, resource and technology management, and analytical tools for manufacturing. Prerequisites: EIN 3390 or equivalent. (F)

EGN 6971 Master's Project (1-3). Individual work culminating in a professional practice-oriented report suitable for the requirements of the Master of Science in Manufacturing Engineering program.

EIN 5106 Regulatory Aspects of Engineering (3). A survey of the legal and regulatory requirements encountered by engineers. Included will be OSH Act, NIOSH, ADA, EEOC, Worker's Compensation and Product Liability.

EIN 5226 Total Quality Management for Engineers (3). Fundamentals of TQM and its historical development. Integration of QC and management tools, QFD, benchmarking, experimental design for scientific management. (F,S)

EIN 5244 Cognitive Engineering (3). Advanced topics in human factors and cognitive engineering. Theoretical aspects of applied situation awareness and decision making, and applications in a variety of engineering domains. Prerequisite: EIN 4243.

EIN 5249 Occupational Biomechanics (3). Study of the theoretical fundamentals for the mechanics of the body. The link system of the body and kinematic aspects of body movement including applications of biomechanics to work systems. Prerequisites: EIN 4314 Work Design and Industrial Ergonomics or equivalent. (S)

EIN 5256 Usability Engineering (3). The usability aspects of software systems design and testing. The theory of interface design for usability and the methods and techniques for designing and testing technology interfaces. Prerequisite: Permission of Instructor.

EIN 5322 Engineering Management (3). Organization of engineering systems including production and service organizations. Inputs of human skills, capital, technology, and managerial activities to produce useful products and services. (F,S)

EIN 5332 Quality Engineering (3). This course examines quality control from an engineering standpoint. It covers ways to meet the challenge of designing high-quality products and processes at low cost. Prerequisites: EIN 3331 or equivalent. (S)

EIN 5346 Logistics Engineering (3). Concepts and tools for effective design and management of supply chain systems. Includes logistics strategies, inventory management, customer service, supply chain integration and logistics network design. Prerequisite: Permission of the instructor.

EIN 5359 Industrial Financial Decisions (3). The use of financial techniques and data in planning, controlling and coordinating industrial activities. This course will familiarize the student with accounting concepts and analytical methods. Prerequisite: EIN 3354. (SS)

EIN 5367 Design of Production Systems (3). The design of an industrial enterprise including feasibility, plant layout, equipment specifications, auxiliary services, economics and scheduling. Prerequisite: EIN 3365. (SS)

EIN 5605 Robotic Assembly Cell (3). Concepts of robot manipulation and sensing, part design for robotic assembly, planning manipulator trajectories, machine vision, robot programming language, cell control, and material transfer. Prerequisite: EIN 3600. (S)

EIN 6105 Technology Policies and Strategies (3). Strategies and policies for managing all aspects of technology. Includes value chain integration, intellectual property, and internal processes and systems.

EIN 6117 Advanced Industrial Information Systems (3). Review of the fundamental and theoretical foundation of industrial information systems. Application of the system design process and information system concepts to develop integrated engineering systems. (F,S)

EIN 6131 e-Systems Design (3). The study and application of engineering analysis and design methods for Internet-based systems. The integration of Internet technologies and applications into engineering information systems. Prerequisites: ESI 5602, EIN 6117.

EIN 6132 Collaborative Engineering (3). Product data management, visualization, collaboration, collaborative product commerce, document management, component supplier management, configuration management, enterprise application integration. Prerequisite: Permission of the instructor.

EIN 6133 Enterprise Engineering (3). Enterprise processes and functions, enterprise engineering methodology and techniques, enterprise scalability, systems and vertical integration, systems design and implementation. Prerequisite: Permission of Instructor.

EIN 6160 Management of Innovation and Technology (3). The course provides an integrated view of management of technology. The combination of theory and practice addresses the challenges of globalization, time compression, and technology integration. Prerequisite: Permission of instructor.

EIN 6246 Advanced Human-Machine Interaction Design (3). The application of human factors analysis and design methods to complex system interaction. Interface design for technological systems in workplace and consumer domains. Prerequisites: EIN 4243 or equivalent.

EIN 6248 Advance Ergonomics (3). Analysis of human factors in the design of engineering systems, with emphasis on the interphase of man-machine-media and human limitations in relation to equipment design and work environments. Prerequisites: EIN 4314, EIN 4243, and PCB 3702 or equivalent. (F)

EIN 6258 Ergonomic Design of Aerospace Systems (3). Application of ergonomic criteria in design of civil and military aircraft cockpits and control systems. Ergonomic consideration in design of outer space vehicles, stations, and systems. Prerequisite: EIN 6248.

EIN 6259 Usability Engineering in E-commerce (3). This advanced course applies usability engineering theories and methods to models of e-commerce. Usability models are presented and evaluated using case studies. Prerequisite: EIN 5256.

EIN 6319 Advanced Work Design (3). Study of the various human physiologic systems and their responses as it relates to occupational work including endurance, fatigue, recovery, and energy cost of work. Prerequisite: EIN 6248. (S)

EIN 6324 Technology Entrepreneurship (3). Entrepreneurial process, evaluation of technology, startup operations and strategy, business plans and venture capital, intellectual property and rights, growth and technology management.

EIN 6325 Business Plan Development (3). This course deals with the critical decisions and action steps that entrepreneurs must make in both planning and executing a new venture. It also covers how to develop an effective written plan. Prerequisite: Permission of advisor.

EIN 6327 Entrepreneurship and New Venture Initiation (3). It covers critical factors of initiating new ventures: entrepreneurial networks, venture creation, strategies, evaluation, financing, legal considerations, market strategies, and feasibility analysis.

EIN 6329 Advanced Engineering Business Plan Development (3). This course takes students through the process of writing a plan for a new business venture through to implementation. Heavy emphasis placed on research and case analysis. Prerequisites: EIN 6324 or MAN 6805.

EIN 6336C Advanced Production Planning and Control (3). Analytical and algorithmic planning methodologies, planning and scheduling technologies, sequencing rules, control strategies, and line balancing methods. Prerequisite: EIN 4334.

EIN 6345 Inventory Control Systems (3). Design of non-traditional inventory control systems. Development of several inventory system models. Exploration of methods of collecting appropriate demand and cost data for effective systems analysis. Prerequisite: ESI 3314.

EIN 6357 Advanced Engineering Economy (3). Review of engineering economy and the evaluation of advanced manufacturing systems. Evaluation of alternative capital investments considering income taxes, depreciation, inflation, risk and uncertainty. Prerequisite: EIN 3354. (SS)

EIN 6392 Product Design for Manufacturability and Automation (3). Overview and integration of the design-material-manufacture process. Design considerations for manufacturability, assembly, and economical production. Concurrent engineering systems. Prerequisite: EIN 4395. (S)

EIN 6393 Design and Implementation of Discrete Manufacturing Systems (3). Methodology and techniques for design, planning and implementation of discrete production systems including process/machine selections, material handling and inspection technologies, cell control, etc. Prerequisites: Graduate or seniors with EIN 3365, EIN 3390, and ESI 3523 or equivalent.

EIN 6397 Advanced Topics in Manufacturing Automation (3). Overview of manufacturing systems; evolution of controls and AI, material handling, automation clamps, jigs, and fixtures, cutting sensors, machine vision and autonomous manufacturing. Prerequisites: EIN 6392 and EIN 6398.

EIN 6398 Advanced Manufacturing Process Engineering (3). Non-traditional manufacturing processes. Tool selection, jig and fixture design, material

handling, tolerance and dimensioning. Product assembly engineering economics, and manufacturing process planning. Prerequisite: EIN 3390. (F)

EIN 6603 Applied AI/Expert Systems in Industrial Engineering (3). Application of artificial intelligence and expert systems as engineering tools. Exploring the use of PCs and symbolic machine with various AI/Expert Systems software. Several projects are required. Prerequisite: CAP 5680.

EIN 6606 Robotic Systems (3). Basic robotic system principles, functional requirements of robotic systems, simulation of system preliminary design, and physical experimentation of robotic systems.

EIN 6908 Independent Study (1-3). Individual supervised study by a faculty. A study plan and a final report are work required. Prerequisite: Departmental approval. (F,S,SS)

EIN 6910 Supervised Research (1-9). Advanced research credits under the supervision of the dissertation advisor.

EIN 6932 Graduate Seminar (0). An examination of recent technical findings in selected areas of concern. Emphasis is placed on presentations (oral and written), research activities, readings and discussions among participants. (F,S)

EIN 6936 Design of Industrial Engineering Systems (3). Overview of systems theories. Systems design process including: Problem definition, analysis, generation of alternatives, systems evaluation, selection of preferred system, and implementation. Prerequisites: EIN 6345, ESI 6316, and ESI 6524.

EIN 6940 Industrial and Systems Engineering Internship (1-3). To provide graduate students with work experience under approved industrial supervision. Prerequisite: Permission of department chairperson.

EIN 6950 Engineering Management Masters Project (1-3). Individual work culminating in a professional practice-oriented report suitable for the requirements of the Master of Science in Engineering Management program. Prerequisite: Permission for the advisor.

EIN 6971 Master's Thesis (1-3). The students following the thesis option should work on his/her thesis through this course. (F,S,SS)

EIN 7980 Ph.D. Dissertation (1-12). Doctoral research leading to Ph.D. dissertation in Industrial and Systems Engineering. Prerequisites: Doctoral Candidacy and permission of Graduate Director.

ESI 5456 Productivity Management in the Global Organization (3). Analysis of productivity management strategies. Major issues in performance and productivity management, domestic and global outsourcing, international labor standards and trade policies. Prerequisites: EIN 4214 or equivalent.

ESI 5522 Simulation Models of Engineering Systems (3). Simulation Methodology; design and implementation of models of engineering systems using computer software; case studies. Prerequisite: STA 3033 or EIN 3235 or equivalent and COP 3175 or equivalent.

ESI 5602 Engineering Data Representation and Modeling (3). The course will cover the life cycle of designing, developing, and implementing engineering database systems by applying the IDEFLx methodology. Prerequisite: Permission of Instructor.

ESI 5603 Advanced Software Tools for ISE (3). Algorithms and principles to integrate heterogeneous tools. Principles of XML, ASP, and other tools. Development of programming projects.

ESI 6316 Applications of OR in Manufacturing (3). Overview of OR techniques. Manufacturing system and product selection. Shop loading, resource allocation, production scheduling, job sequencing, and plant layout problems. System performance evaluation. Prerequisite: ESI 3314. (F)

ESI 6319 Operations Research and Information Technology (3). Principles and paradigms for the design and implementation of OR models, which may be integrated into an organization's existing information system and technologies. Prerequisite: ESI 6316.

ESI 6440 Integer Programming (3). Formulating and solving decision-making problems with discrete decision variables. Methods to solve large-scale integer/mixed-integer models. Prerequisite: ESI 6316.

ESI 6455 Advanced Engineering Project Management (3). This course covers entire phases of project management including selection, planning, budgeting, scheduling, monitoring, and control. It focuses on the management of engineering projects through case studies and independent research assignment. Prerequisite: Permission of the instructor. (S,SS)

ESI 6460 Methods for Algorithm Development for Industrial Engineering Applications (3). Methods for algorithm development for Industrial Engineering applications, with emphasis on powerful optimization techniques and analysis tools. Prerequisites: ESI 3314 or permission of instructor.

ESI 6470 Stochastic Optimization (3). Formulating and solving decision-making models with uncertain data. Exact and approximation techniques for large-scale stochastic models. Prerequisite: ESI 6316.

ESI 6524 Advanced Industrial Systems Simulation (3). Advanced simulation techniques with a focus on practical systems modeling using several user-oriented simulation languages. Projects involving design of high-performance simulation programs are required. Prerequisite: ESI 5522 or equivalent. (S)

ESI 6528 Advanced Topics in Simulation Modeling (3). An examination of the role of artificial intelligence, object oriented programming, and databases as enabling technologies in the simulation modeling process. Review of the literature and case studies. Prerequisites: ESI 6524 or equivalent.

ESI 6546 Network Flow Analysis (3). Deterministic and stochastic network flow analysis; minimal cost flow, shortest route, max-flow, and out-of-kilter algorithms; constrained network analysis; and stochastic queuing networks. Prerequisite: ESI 3314.

ESI 6547 Stochastic Models of Industrial Systems (3). Applications of models from gaming, decisions analysis, queueing, inventory and scheduling to assess the

performance level of industrial systems operating under random conditions. Prerequisite: ESI 6316.

ESI 6601 Data Warehousing and Mining (3). Knowledge discovery for effective design of data storage. Discussion of the difficulties associated with data warehousing and mining. Literature review and case studies.

TCN 5640 Telecommunications Enterprise Planning and Strategy (3). Methodologies for re-engineering, project management, strategic planning, change management, RFPs, and life-cycle management within the telecommunications and IT arena. Prerequisite: Permission of the instructor.

TCN 6420 Modeling and Performance Evaluation of Telecommunications Networks (3). Covers methods and research issues in the models and performance evaluation of high-speed and cellular networks. Focuses on the tools from Markov queues, queuing networks theory and applications. Prerequisites: TCN 5030 or equivalent.

TCN 6430 Networks Management and Control Standards (3). Protocols for management of telecom networks, including Simple Network Management Protocol and Common Management Information Protocol. Extension of protocols to optimize network performance. Prerequisites: TCN 5030 or equivalent.

TCN 6820 Industrial Development of Telecommunications (3). This course, from a management perspective, addresses the evolution of the telecom industry, the impact it has on reshaping our world, and the importance of management decisions in telecom.

TCN 6880 Telecommunications Public Policy Development and Standards (3). A concept-oriented examination of the domestic and international telecommunications policy processes and standards setting environment. Prerequisite: Permission of the instructor.