M. S. in Industrial & Systems Engineering

Student Guide

San José State University

Department of Industrial and Systems Engineering

Major Code (09131)

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INDUSTRIAL AND SYSTEMS ENGINERING

Industrial engineers are the efficiency and quality engineers of an organization. They measure, design and improve production and service systems to maximize the efficiency and quality of semi-conductor chip design and manufacturing (e.g., Intel and AMD), semi-conductor equipment design and manufacturing (e.g., Applied Materials and Lam Research), design and manufacturing of communication network devices (e.g., Cisco), computer and consumer-electronics assembly (e.g., Flextronics and Solectron), automobile parts-manufacturing and assembly (e.g., New United Motor Manufacturing, Inc. – NUMMI - in Fremont), design and manufacturing of satellite and defense systems (e.g., Lockheed-Martin and United Defense), biomedical-device design and manufacturing (e.g., Siemens Medical Solutions, Boston Scientific, Johnson and Johnson), bio-engineering design and manufacturing (e.g., Genetech), overnight-air and freight operations for enterprise logistics and supply chains (e.g., FedEx and UPS), aircraft maintenance operations (e.g., United Airlines maintenance facility as SFO), airline passenger operations, bank operations, warehouse operations and many other industrial or business activities. Systems engineers understand and integrate human and machine components into large-scale systems, e.g., enterprise system for product architecturing, product design, new production introduction, supply chains, mass-production, after-sale services, disposal, etc.; air traffic control systems; airport security systems, etc.

THE GRADUATE PROGRAM IN INDUSTRIAL AND SYSTEMS ENGINEERING

The goal of ISE is to ensure that a manufacturing or service organization's systems are efficient, effective, safe, and well designed against cumulative injury, and that the systems incorporate the right tools and equipment. Types of activity involved in ISE include (a) developing quality metrics for the organization's products or services and performance measures for its internal operations, (b) collecting data to measure and monitor the quality and performance, (c) improving the performance and hence the quality, and (d) utilizing the latest computer-based analytical, modeling and design technologies. The MS curriculum prepares engineers for these activities and helps achieve the goal of ISE in a manufacturing or service organization. The curriculum prepares students to bridge the gap between operations and management with courses ranging from operations planning and control, quality assurance and reliability, operations research, financial methods for engineers, information engineering, human factors and ergonomics, and human-machine interaction, to organizational improvement and total quality management.

CAREER OPPORTUNITIES FOR ISE WITH AN M.S. DEGREE

An industrial and systems engineer may be employed in almost any type of organization and for any type of activity identified above. Note that the graduates may be expected to perform technical work as well as management duties. At the technical level, they are expected to have in-depth knowledge as well as hands-on know-how; at the management level, they are expected to measure the organizations' current performance, identify opportunities for improvement, develop improvement plans, implement the plans and assess the effectiveness of the plans.

A TEN-COURSE PROGRAM WITH FOUR SPECIALTY AREAS

MS-ISE is basically a ten-course program, including nine graduate courses and an M.S. thesis/project or a written comprehensive examination. Four specialty areas are offered: (a) Production and Quality Assurance, (b) Systems and Information Modeling, (c) Human Factors, and (d) Supply Chain Engineering.

Further information may be obtained by calling or visiting the Graduate Advisor of the Industrial & Systems Engineering Department. The SJSU catalog can be found on the internet at http://info.sjsu.edu/home/catalog.html,; other information about SJSU can be found at http://www.sjsu.edu. Specific information about the College of Engineering can be found at http://www.engr.sjsu.edu. Details about

the Department of Industrial and Systems Engineering or about the Master of Science Program in Industrial and Systems Engineering (MS-ISE) can be found at http://www.engr.sjsu.edu/ise.

AN EVENING PROGRAM TAILORED FOR SILICON VALLEY PROFESSIONALS

SJSU is at the heart of the Silicon Valley. The MS-ISE program is essentially an “evening" program, with almost all graduate classes taught between 5:30PM and 8:30 PM. Many MS-ISE students have full-time jobs in the Valley while attending the program; some of them are managers having hiring responsibilities. MS-ISE students’ course loads vary from three units per semester to twelve units.

ADMISSION REQUIREMENTS

Basic Admission Requirements

A. A bachelor's degree in Industrial or Systems Engineering from an accredited university; or,
B. A bachelor's degree in another engineering or science discipline from an accredited university plus up to three undergraduate ISE courses specified by the Graduate Advisor to prepare for graduate work in the Department; or,
C. A bachelor's degree in a related field plus successful completion of the Engineer-in-Training (EIT) exam plus courses specified by the Graduate Advisor to prepare for graduate work in the Department.

Requirements for Admission to Classified Standing

Applicants for classified standing will ordinarily be expected to have completed work for the BS degree in industrial engineering (or its equivalent) at San Jose State University or at another university with an accredited curriculum, with a grade point average of 3.0 (B) or better in the upper division work.

Admission to Conditionally Classified Standing

If student's preparation for advanced graduate work is inadequate, he may be admitted to conditionally classified standing, and be required to take necessary preparatory courses before becoming classified. Such courses will not ordinarily count as part of the Master's degree program requirements. Students who are admitted on a conditionally classified basis must complete a "Change of Classification in Master’s Program" petition as early as possible upon completion of specified conditions. While in the conditionally classified standing, the student can take any graduate ISE courses that do not require any prerequisites not yet completed.

THE APPLICATION PROCESS

General Information

Please visit the website at http://www2.sjsu.edu/gradstudies/ for general information regarding graduate admission at SJSU. All applicants, domestic or international, should apply online.

Applications found to meet the University admission standards are referred to the Industrial and Systems Engineering Department, where one of the following decisions is made:
— clear admission to the SJSU MS-ISE Program (as a “classified” graduate student);
— conditional admission to the SJSU MS-ISE Program (as a “conditionally classified” graduate student; to be reclassified as a “classified” graduate student upon successful completion of specified course requirements; or
— denial.

An Important Note for International Applicants

The universities of some countries, e.g., India and China (i.e., People’s Republic of China), do NOT state on the transcript whether a degree has been conferred to the student and on which date the degree was conferred.

Graduate Studies and Research of SJSU requires that all applicants from these countries submit a certified copy of their degree certificate (certified by the degree-conferring university). Please note that although it may be stated on the transcript issued by universities of these countries that all degree requirements have been fulfilled, you still must submit a certified copy of the degree certificate. If you do not have an official degree certificate yet either because you have not graduated or because you have not received it, you should obtain a Provisional Degree Certificate issued by the degree-conferring university and send a copy to Graduate Studies and Research.

PROGRAM REQUIREMENTS

The general requirements for the Master of Science degree in Industrial and Systems Engineering include the completion of at least 30 semester-units of approved work, with a minimum of 24 units earned in 200-level Industrial and Systems Engineering courses. All students are required to complete a Master's project, complete a Master's Thesis, or pass a written comprehensive examination during their final term of graduate study. The student's actual program should be developed with the Graduate Advisor. The program requirements are summarized below.

Course Requirements

I. **Industrial and Systems Engineering Graduate Courses (27-30 Units).** The student must complete a minimum of 27 units of 200-level courses in the Department. This minimum consists of three core ISE courses plus Master's Thesis/Project or Examination, four courses in a specialty area, and two electives.

The four core courses are Financial Methods in Engineering, Quality Assurance and Reliability, Advanced Operations Research, and Master's Thesis/Project or Examination. The Department offers five specialty areas: (a) Systems and Information Modeling, (b) Production and Quality Assurance, (c) Human Factors, (d) Supply Chain Engineering and (e) Service Systems Engineering.

The minimum course requirements are detailed as follows.

FIVE ISE SPECIALTY AREAS

THREE CORE PREREQUISITES OR EQUIVALENTS, IF NOT COMPLETED YET:
ISE 130 – Engineering Probability and Statistics, or Equivalent (Not for Graduate Credit)
ISE 140 – Operations Planning and Control, or Equivalent (Not for Graduate Credit)
ISE 167 – System Simulation, or Equivalent

FOUR CORE COURSES (Three Lecture Courses Plus a Project, a Comprehensive Exam. or a Thesis):
ISE 200 – Financial Methods in Engineering
ISE 230 - Advanced Operations Research
ISE 235* - Quality Assurance and Reliability
ISE 298 - M.S. Project or Comprehensive Exam. or ISE 299 – MS Thesis

FOUR SELECTED COURSES IN ONE OF FIVE ISE SPECIALTY AREAS:

Specialty Area 1: Production and Quality Assurance (Four out of Six Courses)
ISE 202* – Design and Analysis of Engineering Experiments
ISE 241 - Advanced Operations Planning and Control
ISE 245 – Advanced Supply Chain Engineering
ISE 250* - Leading the Six Sigma Improvement Projects
ISE 251* - Managing the Lean Enterprise Improvement Program
ISE 265 - Advanced System Simulation

Specialty Area 2: Supply Chain Engineering (Four out of Seven Courses)
Two Required Courses:
ISE 245 – Advanced Supply Chain Engineering
ISE 241 - Advanced Operations Planning and Control
Two out of the Following Five Courses:
ISE 247 – Logistics for Supply Chain
ISE 250* - Leading the Six Sigma Improvement Projects
ISE 251* - Managing the Lean Enterprise Improvement Program
ISE 265 - Advanced System Simulation
ISE 270 - Information Engineering

Specialty Area 3: System and Information and Modeling (Four out of Six Courses)
ISE 222 – Advanced Systems Engineering
ISE 241 - Advanced Operations Planning and Control
ISE 242 – Advanced Service Systems Engineering and Management
ISE 245 – Advanced Supply Chain Engineering
ISE 265 - Advanced System Simulation
ISE 270 - Information Engineering

Specialty Area 4: Human Factors (Four out of Six Courses)
Required Course:
ISE 210 – Human Factors/Ergonomics (including Design of Work Methods)
Three out of the Following Five Courses
ISE 202* - Design and Analysis of Engineering Experiments
ISE 212 – Human Factors Experiments
ISE 215 – Usability Evaluation and Testing
ISE 217 – Human Computer Interaction
ISE 219 – Research in Human Computer Interaction

Specialty Area 5: Service Systems Engineering (Four out of Six Courses)
Two Required Courses:
ISE 242 – Advanced Service Systems Engineering and Management
BUS 297D - Special Topics in Business Administration – Service Strategy
Two out of the Following Four courses:
ISE 265 – Advanced System Simulation
ISE 250* – Leading the Six Sigma Improvement Projects
ISE 222 - Advanced Systems Engineering
ISE 270 - Information Engineering

ELECTIVES: Two ISE elective courses from the following: ISE 202*, ISE 251*, ISE 245, or ISE 247

*NOTE:ISE 202, 235, 250, 251 also fulfill the course requirements for the Six Sigma Black Belt in Service Quality.

SJSU TECHNIICAL-WRITING REQUIREMENT (ISE 270; ISE 212 after ISE 210; or Others)

Note: The program of an individual student may deviate from the above specification to suit clear and promising individual career objectives. Discussion with and prior approval by the Graduate Advisor are required.

Note: SJSU Requirement of Competency in Written English (See III below.)

Note: Thesis vs. Examination/Project Options

The thesis and project/examination options are summarized below.

i. Those students selecting the THESIS option must enroll in ISE 299 for up to 6 units of Thesis credit. Before enrolling in ISE 299, the student must: a) meet the University's Competency-in-Written-English Requirement, b) identify a SJSU Faculty member as the Thesis Advisor, c) obtain the approval of the

Thesis Advisor on the subject area and detailed work plan of the thesis, and d) arrange for a Thesis committee with three members: the Thesis Advisor, one or two SJSU faculty members, and at most one person from industry. At the end of ISE 299, the student must a) orally present the content of the Thesis, b) meet all written thesis requirements established by Office of Graduate Studies and Research, and c) submit three bound copies of the Thesis to the Office of Graduate Studies and Research for approval and cataloging.

ii. For those students selecting the EXAMINATION option, 2 options are provided. 1) Written Comprehensive Examination. Each student must enroll in ISE 298 (1 unit) during the final semester. This exam covers six general areas of Industrial Engineering knowledge: a) statistics, b) operations research, c) engineering economics and cost control, d) systems engineering and computer-based applications, e) Manufacturing engineering and f) methods analysis/operations planning. Students are expected to pass all the areas. In addition to the (1-unit) written Comprehensive Exam, students selecting this option are expected to complete a 2-unit one-semester project under the direction of an ISE faculty member to assist the faculty member in instruction or research. 2) Project and Oral Examination. Student may elect to design and complete an application-oriented (non-research) project that is problem solving in nature. Following completion of the project report, students will be required to pass an oral exam related to the project topic. The oral exam will include questions on academic subject related to the project. Students electing to pursue this option must: a) define a topic for study, b) obtain the agreement of an ISE faculty member to serve as Committee Chair. (The Committee contains a minimum of 2 members.) The plan for the project must be in writing and signed by both the faculty advisor and the student, c) register for ISE 298 (3 units).

II. **Approved Courses Related to ISE (0-3 units).** Up to 3 units of other coursework may be taken to complete the degree requirements. These should, in general, be graduate-level units but some of these units may be upper-division undergraduate. Courses in this category must be selected to form a coherent program of study and must be approved by the Graduate Advisor. .

III. **The Graduation Writing Assessment Requirement (GWAR), also known as the Requirement for Competency in Written English.** All SJSU graduate students must successfully demonstrate their competency in written English as a requirement for graduation. The University policy requires that such competency shall be a requirement of classified graduate students as a condition for advancement to candidacy for the award of the master's degree. The requirement and five ways to satisfy the requirement are outlined in the University Bulletin. Note: ISE 270 - Information Engineering has been approved by the Office of Graduate Studies and Research of SJSU as a course whose completion in or beyond Fall 2006 with a grade of C or better can be used by an MS-ISE student to satisfy this University requirement of Competency in Written English or GWAR. Inquiry should be made to the ISE Department staff.

Requirements for Advancement to Candidacy

Students seeking Master of Science degrees in the School of Engineering must meet the general university requirements for candidacy as outlined in the Academic Requirements Section of The University Bulletin, including successful completion of the Competency-in-Written-English Requirement (i.e., the Graduation Writing Assessment Requirement - GWAR). Admission to candidacy and approval of degree program will be handled by the Graduate Advisor. All classified graduate students must apply for admission to candidacy after completing the Competency-in-Written-English Requirement and a minimum of nine units of graduate work. All MS-ISE students are encouraged to apply for advancement to candidacy as soon as they have completed three graduate courses and the Competency-in-Written-English Requirement. The currently required lead time between this advancement and graduation is nine months; this required lead time is a University requirement and hence is beyond the control of the Department.

GPA Requirement

All MS-ISE students, either classified or conditionally classified, must maintain a grade point average of 3.0 (B) or better in all work taken in the graduate program, including prerequisite courses and courses taken to meet the minimum 30 semester units of approved graduate work.

GRADUATE COURSES

200. **Financial Methods in Engineering.** A survey of current methods for the evaluation of capital investment alternatives including multiple alternative problems with finite and continuous variables; economy problems relating to systems; decisions under risk; simulated decision-making. Prerequisites: ISE 102 and ISE 105. 3 units.
202. **Design and Analysis of Engineering Experiments.** Review of statistical interface and tests of hypotheses. Introduction to analysis of variance and covariance. Theory and applications of experimental designs for engineering problems. Random and systematic designs. Randomized blocks. Latin squares. Factorial and fractional factorial designs. Taguchi methods. Prerequisites: ISE 130. 3 units.
210. **Human Factors/Ergonomics.** Analysis and evaluation of work systems in terms of the capabilities and limitations of human participants. Person as a system component. Emphasis is on evaluation of how work affects people and how people affect the work. Prerequisites: Graduate standing. 3 units.
212. **Human Factors Experiments.** Research and experimentation on specific aspects of the person as a system or in systems. Particular emphasis is placed on in-depth studies of unique human factors. Prerequisites: ISE 210 or instructor consent. 3 units.
215 **Usability Engineering.** This seminar is designed to provide students with a comprehensive overview of usability testing methods, as applied to systems products and software/web applications. The course will address testing methods, processes and marketing justification for usability testing. Prerequisite: ISE 130 or instructor consent. 3 units.
217. **Human Computer Interaction.** Human performance characteristics, computational tools, and HCI applications. How to access/evaluate HCI requirements, to design HCI requirements, to assess the impact of design on performance, and to generalize the design implication to system function. Prerequisites: ISE 210. 3 units.
219. **Research in Human Computer Interaction.** Concepts of Human and Computer Information Processing to support research, design and analysis of the effectiveness of human/machine systems in meeting performance objectives. Review of important and recent research in a broad range of HCI topics. Prerequisites: ISE 217. 3 units.
222. **Advanced Systems Engineering.** Comparison of different kinds of systems; unique characteristics. Mathematical models for the description, analysis and design of systems. Synthesis and analysis of systems of various types. Theory of organizations, information theory and control theory applied to problems in system design. Prerequisites: ISE 170. 3 units. (Take ENGR 202 – Systems Engineering, offered by the MSE Program administered by the College of Engineering, in place of ISE 222.)
230. **Advanced Operations Research.** Advanced operations research techniques and topics. Practical considerations in understanding and utilizing operations research methods. Critical analysis of case studies. Prerequisites: ISE 170. 3 units.

232. **Industrial Systems Seminar**. Familiarization with library resources and research techniques in industrial and systems engineering. The broad range of literature studies will develop the student's ability to solve practical engineering problems in areas not previously encountered. Prerequisites: Instructor consent. 3 units.

235. **Quality Assurance and Reliability.** Selection of adequate variables to monitor a manufacturing/service process; quality improvement through process design, vendor management, customer feedback and product development; use of statistical control charts, the Pareto principle, PDCA, process capability; design for reliability, statistical techniques for analysis of reliability and reliability growth. Prerequisites: ISE 130 (or equivalent). 3 units.

240. **Mathematical Models in Systems Engineering.** A rigorous study of the formulation and analysis of mathematical models used in operations research. Markov chains. Algorithms for solution of discrete optimization problems. Integer and Evolutionary programming. Sequential search minimization problems. Prerequisites: ISE 170. 3 units.

241. **Advanced Operations Planning and Control**. Design, implementation and evaluation of production and service systems; manufacturing strategy, choice of processes, resources planning, production and procurement control, forecasting methods, scheduling considerations and decision-making techniques. Prerequisites: ISE 140 or instructor consent. 3 units.

242 **Advanced Service Systems Engineering and Management.** Advanced studies of operational productivity, operational quality, strategy and information technology applications in the service sector through the use of tools, techniques and case studies. Current literature review of issues related to service sector productivity, quality and value. Prerequisites: Graduate Standing. 3 Units.

245. **Advanced Supply Chain Engineering**. Supply chain concepts and strategies with emphasis on the analytical tools necessary to solve supply chain problems. Fundamentals of supply chain modeling of inventory, transportation, and location and facility planning problems. Information sharing and risk pooling. Mechanisms for increasing profits. ISE 140 or equivalent. 3 units

247 **Logistics in Supply Chain.** An exploration of logistics for entire supply chain system from inbound movement through material management to physical distribution to customers. Topics include packaging and material handling, material management, transportation and traffic management, facility location and global logistics. Prerequisite: Graduate Standing. 3 units.

250. **Organizational Improvement Capabilities and Skills.** The "what" and "why" of organizational improvement, understanding organizational improvement capabilities and human effectiveness skills, systems thinking, the Malcolm Baldridge Award, work environment and paradigm shifts, change readiness, leadership, teamwork, customer focus, cost of quality, interpersonal communications, capability-based competition. Prerequisites: Instructor consent. 3 units.

251. **Leading Organizational Improvement.** Organizational vision and purpose, identifying improvement initiatives, employee support for improvement, improvement planning, "learning by doing," the learning cycle, improvement process design, measurement and assessment, improvement tools and methods,

nurturing the change process. Prerequisites: ISE 250 or instructor consent. 3 units.

265. **Advanced System Simulation.** Use of computerized simulation and modeling techniques to conduct experiments, evaluate the costs of a process, evaluate alternative inspection policies and determine effects of JIT management models for shop setting. Prerequisites: ISE 167 or instructor consent. 3 units.
270. **Information Engineering.** Technologies, strategies and systems for planning, analyzing, designing and implementing data resources in order to ensure and continuously improve processes in the enterprise; object-oriented development, Computer-Aided software/Systems Engineering (CASE); information superhighway, client/server computing and distributed database management systems. Prerequisites: ISE 165 or instructor consent. 3 units
290. **Human Factors & Ergonomics Professional Seminar.** Real world skills necessary to start your professional HR/Ergo career, i.e. public presentation, terminology, field evaluations, current research and industry issues in human factors and ergonomics. Prerequisite: Graduate standing. 2 units
297. **Special Topics in Industrial Engineering.** Special topics to augment regularly-scheduled courses. Prerequisites: Graduate standing in Industrial Engineering. 1-4 units.
298. **Special Problems.** Advanced individual work in industrial engineering. Prerequisites: Instructor consent. C/NC. 1-4 units.
299. **Master's Thesis.** Prerequisites: Admission to candidacy for the master's degree and approval of the thesis advisor. C/NC. 1-4 units

FULL-TIME FACULTY

Dessouky, Yasser M.
***Ph.D.**, Arizona State University, Industrial and Management Systems Engineering.*

Freund, Louis E.
***Ph.D.**, University of Michigan, Industrial Engineering*

Patel, Minnie
***Ph.D.**, Georgia Institute of Technology, Industrial Engineering*

Tsao, H.-S. Jacob
***Ph.D.**, University of California, Berkeley, Operations Research*

Unwin Ernest
Ph.D., *University of Arizona, Systems Engineering.*

ADJUNCT FACULTY

Dr. Anthony D. Andre
Ph.D., University of Illinois at Urbana-Champaign, Engineering Psychology
Principal, Interface Analysis Associates (www.interface-analysis.com)

Dr. Hee-Man Bae
Ph.D., University of Oklahoma, Industrial Engineering

Dr. Jennifer Gille
NASA/Ames Research Center

Dr. Rajiv Kapur
Ph.D., University of Texas – Arlington, Industrial & Systems Engineering

Dr. Steve Kennedy
Ph.D., Cornell University, Operations Research
B.S., Northwestern University, Industrial Engineering & Management Science

Marc L. Komrosky
M.S., San Jose State University, Industrial & Systems Engineering

David Krack
M.S., California State University, Northridge, Environmental and Occupational Health

Dr. Abbas Moallem
Ph.D., University of Paris Nord (XIII), Paris, France, Ergonomics/Human Factors

Dr. Ammar Rayes
Ph.D, Washington University, Electrical and Computer Engineering

Dr. Baruch (Barry) I. Saeed
Ph.D, University of California, Berkeley, Industrial Engineering & Operations Research

David Steele
M.S. San Jose State University, Industrial & Systems Engineering

Dr. Wenbin Wei
Ph.D., University of California, Berkeley, Civil and Environmental Engineering
Assistant Professor, Department of Aviation & Technology ,San Jose State University

Ilana Westerman
M.S. Northwestern University, Learning Science