

Colorado State University – Pueblo

Master of Science  
In Industrial and Systems Engineering  
Department of Engineering

**Graduate Student Handbook**

March 1, 2004

Dear graduate student,

In many engineering circles today a prevailing opinion is that the Master's degree should be the first professional engineering degree. So, the question is not *whether to earn a Master's degree* but *when and where to get it*. Thank you for choosing a Master of Science degree in Industrial and Systems Engineering (MSISE) at Colorado State University – Pueblo. Usually, our students choose the MSISE program at CSU-Pueblo because:

- Industrial and Systems Engineering is a strong and growing profession in the USA offering excellent career opportunities;
- Industrial and Systems Engineering graduates have diverse career options compared to other engineering disciplines;
- The MSISE curriculum at CSU-Pueblo provides students with a strong engineering education needed in industry today;
- CSU-Pueblo's low faculty-to-student ratio allows close student interactions with faculty and professionals in the Pueblo area;
- CSU-Pueblo was named among the top “real world” colleges by author Michael Viollt in his book “201 Colleges for the Real World,” and
- CSU-Pueblo is located in Pueblo, Colorado, a place averaging 320 sunny days a year.

If you have a degree in any quantitative major, our MSISE program can add valuable skills you can use to improve organizations and businesses. Our graduates work for manufacturing, distribution, health care, and telecommunications companies as well as for governmental and educational institutions.

At CSU-Pueblo, the university environment is created to support your learning. Our exceptional faculty members are dedicated to help you achieve your educational goals. The fellow students will make this a life-long experience. If I can be of service to you in any way please contact me. We are here to help you determine and reach your educational, your career and your life goals.

Sincerely,

Nebojsa I. Jaksic, Ph.D., P.E.  
MSISE Program Director  
Department of Engineering  
(719) 549-2112  
[n.jaksic@colostate-pueblo.edu](mailto:n.jaksic@colostate-pueblo.edu)  
<http://ceeps.colostate-pueblo.edu/inde>



## ***Colorado State University – Pueblo***

Colorado State University – Pueblo, located in Pueblo, Colorado, is accredited at the master's level by the Higher Learning Commission of the North Central Association of Colleges and Schools (<http://www.ncacihe.org>). As an accredited, regional, comprehensive university, Colorado State University – Pueblo has the following missions:

- To display excellence in teaching and learning;
- To emphasize professional, career-oriented, and applied programs, at the undergraduate and graduate levels;
- To maintain strong programs in the liberal arts and sciences;
- To function as the major educational resource for economic growth, cultural enrichment, and social development to enhance the quality of life throughout the southeastern Colorado region;
- To be distinguished by excellence, diversity, access, and opportunity;
- To exercise the commitment to service and outreach, and
- To collaborate and partner with CSU-Fort Collins and other higher education institutions.

## ***The City of Pueblo, Colorado***

This historically and culturally rich city of 100,000 is located approximately 100 miles (160 km) south of Denver and 40 miles (64 km) south of Colorado Springs. With approximately 320 days of sunshine annually, Pueblo has become a recreational and cultural center for the region.

The city has 73 public parks, 76 tennis courts, one private and three public golf courses, water-skiing, fishing, boating, hiking and a semi-pro baseball team. It is also located near the Greenhorn Mountains (about 37 miles or 60 km from the Rocky Mountains) in the colorful Pikes Peak region of Southern Colorado. Pueblo's altitude is 4,695 feet (1,431 meters).

For more information about Pueblo, contact:

The Greater Pueblo Chamber of Commerce  
302 N. Santa Fe Ave.  
Pueblo, CO 81003  
(719) 542-1704 or 1-800-233-3446  
[www.pueblo.org](http://www.pueblo.org)

*We invite and welcome your interest.*

## **Master of Science in Industrial and Systems Engineering**

### ***The Degree***

Industrial and Systems Engineering (ISE) deals with the design and analysis of complex human/machine systems. Industrial engineers, with their “big picture” or systems viewpoint, serve as management and operations analysts, focusing on the people, materials, equipment, and procedures needed for the most efficient and effective systems performance. Industrial and systems engineers analyze and evaluate systems against specified performance criteria, such as quality, before new systems are created or old ones are modified. ISE techniques can be applied in manufacturing and service industries, health care systems, governmental agencies, and non-profit organizations.

The master of science in industrial and systems engineering degree program at CSU-Pueblo provides students with practical knowledge in areas such as facilities planning, operations planning and control, economic and decision analysis, and project management. Methodologies employed by industrial and systems engineers include probability and statistics, mathematical programming, computer simulation, and human performance studies.

### ***Admission Requirements***

The MSISE program is open to applicants with quantitatively-based baccalaureate degrees from accredited colleges or universities. A completed application for admission to graduate programs and a \$35 application fee must be sent to the Colorado State University – Pueblo Office of Admissions. This fee is non-refundable and is not applicable toward tuition.

Official transcripts of all college and university work must be sent directly to the Office of Admissions by each institution attended. Records received directly from students cannot be accepted except for advisement purposes. The records of students who previously attended will be obtained from the registrar and do not require a student request.

Submit application materials to:

Office of Admissions  
Colorado State University – Pueblo  
2200 Bonforte Blvd.  
Pueblo, CO 81002-4901  
(719) 549-2461 or 1-877-872-9653

### ***Graduate Admission Tests***

All students must submit the score from the aptitude portion of the Graduate Record Examination (GRE) by the end of their first semester of study. A total GRE score of 1000 is the minimum required for admission to regular status.

An English language proficiency test (test of English as a Foreign Language Proficiency – TOEFL) is required for students whose native language is not English. A minimum score of 500 (TOEFL- paper based), 173 (TOEFL – computer based), or 80 (Michigan) is required for admission. Level 6 proficiency from the American Language Academy will also be accepted. Students who complete an undergraduate degree at an institution in the United States are exempt from this requirement.

### ***Admission Status***

All graduate students are admitted with regular, conditional, or non-degree status, as determined by specific criteria.

#### **Regular Status:**

Regular status admission will be given to students who hold a baccalaureate degree from an accredited university or college with an undergraduate GPA of at least 2.8, who submitted an acceptable Graduate Record Examination (GRE) score (above 1000 total), who have a completed admissions file, and who have complied with any additional requirements from the MSISE Program Director.

#### **Conditional Status:**

Conditional status admission may be assigned to students whose undergraduate GPA is above 2.5 yet below 2.8, provided the recommendations and GRE score indicate the applicant has the potential to complete graduate work satisfactorily. A student may also be conditionally admitted while completing the prerequisite courses (see Prerequisite Requirements – page 4). Students must complete all prescribed prerequisites as determined by the MSISE Program Director before completing 12 semester hours of graduate coursework.

#### **Non Degree Status:**

Non-degree status may be assigned to students desiring graduate coursework for professional development. Non-degree students will document prerequisite background for graduate courses in which they enroll for professional purposes.

Non-degree status may also be assigned when the student's record shows that he/she does not meet the qualifications for admission to a degree program with conditional or regular status. In this case, with the approval of the MSISE Program Director, the Director of Admissions will notify the student of the deficiency, the

procedure to follow to become qualified, and the name of the MSISE Program Director who can assist the student. The director will be sent a copy of the notification.

A student with non-degree status who has completed 12 hours approved by the MSISE Program Director with a 3.0 GPA or better at Colorado State University – Pueblo may petition the Program Director for a change to the regular degree-seeking status. A maximum of 12 hours taken in non-degree status may be applied toward a degree. Their inclusion requires the approval of the MSISE Program Director. Although non-degree students may claim a maximum of 12 semester hours of graduate coursework earned while holding non-degree status, a GRE score needs to be received before permission will be given to enroll in MSISE courses for a second semester.

## **Program of Study**

A graduate degree program involves specialized study in a planned, coherent framework. Each MSISE student selects an advisor in the first semester of study and works with that advisor to develop a plan of study meeting the requirements below. The plan of study must be approved by the student's advisor and the MSISE Program Director before the beginning of the student's second semester in the program. The plan of study can be changed. The changes must be approved by the advisor and the MSISE Program Director.

1. *Introduction to study for the MSISE.* Every MSISE program of study must include EN 593 (2 credits, Fall semester). In this seminar, the students are exposed to different areas of ISE, to the nature of graduate education and thesis research, and to the specialty areas of each professor. The seminar helps the student select a faculty advisor and to decide whether to do a thesis.
2. *Core knowledge in ISE.* Every MSISE graduate must demonstrate knowledge of material in these core MSISE courses.  
EN 520 (4 credits, Spring semester) Simulation Experiments  
EN 571 (4, Fall) Operations Research  
EN 575 (3, Fall) Facility Planning and Design  
EN 577 (3, Spring) Operations Planning and Control

Students with an undergraduate degree in industrial engineering may have the equivalent of some courses, but exemption from these courses is not automatic.

*Graduate level work in engineering.* Since each student will receive a graduate degree in Industrial and Systems Engineering, each program of study must include at least 21 credit hours of graduate engineering courses; the 21 credit hours may include graduate projects (EN 588), special projects (EN 590), and thesis (EN 599) hours.

The total program must be at least 36 credit hours. Note that no more than 15 hours may be outside of engineering.

*Thesis.* Each student selects either the General Emphasis Option or the Thesis Option. The General Emphasis Option does not require a thesis. The Thesis Option

requires the completion of a research thesis for six semester hours. While it is not required, all students are encouraged to choose the thesis option. A graduate student who selects the Thesis Option may repeat thesis hours beyond the minimum 36 hours required. Enrollment for thesis research credit is required for any academic term during which university resources (e.g., faculty time, computer use, library, etc.) are used towards writing a thesis. The thesis advisor should be an engineering faculty member. The thesis committee should include at least one additional member with PhD. Additional thesis committee members are allowed. A student who does a thesis must take at least 6 credits of EN 599; no more than 6 hours of EN 599 can be counted toward the required 36 credit hours. A thesis student must be registered for at least 1 credit of EN 599 in the semester the thesis is defended. A student who intends to study for a Ph.D. is strongly encouraged to do a thesis.

At most 12 credit hours of selected undergraduate courses may be included in the program of study:

- EN 439 (2, Fall) Human Performance Engineering
- EN 440 (3, Spring) Safety Engineering
- EN 441 (4, Spring) Engineering of Manufacturing Processes
- EN 443 (3, Spring) Quality Control and Reliability
- EN 473 (3, Fall) Computer Integrated Manufacturing

The program of study may include at most 9 credit hours of graduate level work at another institution.

3. *Focus area or track.* In consultation with his or her advisor, the student selects at least 9 credit hours in a track: Industrial and Systems Engineering, Information Systems, or Engineering Management. Students can also select an individualized track, designed in consultation with the student's advisor.
4. *Coherence.* As a whole, the program of study should be a coherent plan that prepares the student for thesis work, for future employment, or for career advancement.

### ***Tracks***

Some courses are offered only every other year.

*Industrial and Systems Engineering (ISE) Track.* Select at least 9 hours from

- EN 503 (3, Fall) Ergonomics
- EN 504 (3, Spring) Scheduling and Sequencing
- EN 530 (2, Fall) Project Planning and Control
- EN 540 (3, Spring) Advanced Engineering Economics
- EN 588 (3) Graduate Projects, with appropriate topic
- EN 590 (1-3 VAR) Special Projects, with appropriate topic
- EN 591 (1-3 VAR) Special Topics, with appropriate topic

*Information Systems (IS) Track.* Select at least 9 hours from

- CIS 591 (3, Fall) IT Strategy and Infrastructure (required for track)

- CIS 591 (3, Spring) Software Development & IT Implementation (required for track)
- CIS 591 (3) Emerging Technologies
- CIS 520 (3, Fall) Knowledge Based Systems
- CIS 550 (3, Fall) Data Base Systems
- EN 588 (3) Graduate Projects, with appropriate topic
- EN 590 (1-3 VAR) Special Projects, with appropriate topic
- EN 591 (1-3 VAR) Special Topics, with appropriate topic

*Engineering Management Track.* Select a coherent program of at least 9 hours from any MBA classes, that is, any 500 level classes in ACCTG, BUSAD, ECON, FIN, MGMT or MKTG. MGMT 585 is available only to MBA students. Three areas, FIN, MGMT, and MKTG, have 1-credit 500 level Fundamentals courses. If you have not had an undergraduate course in one of these 3 areas, you must take the 500 Fundamentals course before taking any other courses in that area. For accounting and economics, students who have not had an undergraduate class must complete ACCTG 201 or ECON 202 before taking 500 level courses in these areas. The 500 level Fundamentals course can count toward your MSISE program, but 400 level courses cannot. Completing this track is not equivalent to getting an MBA, which involves 36 credit hours in graduate business courses.

**Students are encouraged to include EN 588, Graduate Projects, and EN 590, Special Projects, in any track.** A Graduate Project is the application of what you have learned in classes, usually to a project involving a real application in some organization. A Special Project is course work under the direct supervision of a faculty member, including directed reading, laboratory work, and other work. For 3 credits, the student is expected to meet at least 1 hour per week with the faculty member and to spend at least 10 total hours a week on the project. Since Engineering faculty have special expertise in certain tracks and since many students have specific knowledge they want for professional progress, a Graduate Project or a Special Project involving a match between faculty expertise and student desire for knowledge presents an opportunity for a highly individualized learning experience.

### **Dual Degree Credit**

Students may receive dual credit for all common degree requirements in more than one graduate program if degree plans are filed for both programs. In addition, up to six semester hours of elective credit may be applied to more than one graduate program if approved by the MSISE Program Director and the registrar.

### **Prerequisites Requirements**

Students will be required to demonstrate preparation for graduate study of ISE by completing prerequisite background courses in engineering, computer programming, and mathematics, or by documenting previous equivalent course of experiential work. Students who do not possess the specified prerequisite background may be admitted conditionally but will be required to complete prescribed prerequisites. Courses used as

prerequisites for required graduate courses must be taken for credit and do not count in the MSISE program of study. Note that some courses in some tracks may have other undergraduate level prerequisites.

<b>Prerequisites</b>	(CSU-Pueblo course equivalents):
Computer Programming	(EN 101)
Engineering Economics	(EN 343)
Calculus Based Probability and Statistics	(EN 365)

## **Graduation Requirements**

Degree candidates must:

- Have regular student status.
- Complete 36 semester hours of approved course work.
- Submit a graduation planning sheet to the MSISE Program Director prior to the semester in which graduation is to occur (deadline for submission is published in the semester schedule of courses).
- Earn a cumulative grade-point average (GPA) of 3.0 or better at graduation. A maximum of six semester hours of course work at the grade of C may apply toward graduation. A minimum of 27 semester hours in the approved degree plan must have been earned at CSU-Pueblo.
- When completing a thesis, submit a sufficient number of approved copies of the thesis to the Library for binding. The bound thesis will be distributed to each of the following: one to the MSISE Program Director, two to the University Library, one to each committee member, and one to the department.

### ***Additional information may be obtained from:***

MSISE Program Director  
Department of Engineering  
Colorado State University – Pueblo  
2200 Bonforte Blvd.  
Pueblo, CO 81001-4901  
Voice: (719) 549-2112  
Fax: (719) 549-2519  
E-mail: [n.jaksic@colostate-pueblo.edu](mailto:n.jaksic@colostate-pueblo.edu)  
Web page: <http://ceeps.colostate-pueblo.edu/inde/>

### ***Graduate Assistantships***

Full-time students admitted to the program with regular status are eligible to apply for graduate assistantships. Graduate assistants may get additional assistance to pay tuition and fees. Full-time assistantships require students to work an average of 12 hours per week and carry a stipend. Students awarded full-time positions are required to choose the thesis option unless excused by the MSISE Program Director. Half-time

assistantships require students to work an average of 6 hours per week and carry a stipend. The stipend amount varies. Assistantships are renewable for a second academic year provided students perform satisfactorily in assistantship assignments, remain in good academic standing, and make satisfactory progress toward the completion of their degree programs. An application for assistantship consists of a letter of interest and résumé, addressed to the department chair. The deadline for applications is April 1 for the following academic year.

## Financial Support

### *Financial Aid*

Financial aid in the form of other assistantships, scholarships, fellowships, grants, and loans are available from a variety of sources including the National Science Foundation, NASA, and the Society of Women Engineers. Deadlines and applications may be obtained from the CSU-Pueblo Foundation at (719) 549-2380. The Department of Engineering serves as another source of information on these programs and additional grant-supported assistantships (for which qualifications may vary from the CSU-Pueblo assistantships, described in Graduate Assistantships), as well as job opportunities. In addition, the university offers the following scholarships:

#### ***Frank J. Helwig Memorial Scholarship:***

Graduate students in ISE who are U.S. citizens, meet the academic criteria, and demonstrate financial need are eligible. The scholarship provides the equivalent of Colorado resident tuition and fees for up to two years.

#### ***Lindsey Education for Science and Technology Scholarship:***

The scholarship is for exceptional students in financial need. The graduate student must be a full-time student, have received a degree from an accredited baccalaureate institution, and have a minimum GPA of 3.4. The scholarship is \$1,000.

#### ***Crane Scholarship:***

The scholarship is based on financial need and pays tuition and fees. Applicants must be U.S. citizens. The scholarship is renewable.

## Research Facilities

### ***Laboratories***

#### ***Automation Facility***

The college has a computer integrated manufacturing (CIM) laboratory which includes the following major items: CRS-PLUS, Adept, Mitsubishi, Motoman industrial servo robots, Rhino-XR and SERPENT education robots, two conveyors, HERCUS CNC mill, two AB programmable logic controllers and one vibratory bowl feeder. This equipment is operated by five PCs. Machine vision capability through a CCD Pulnix camera is also available to serve as a sensor for project work. These capabilities support

thesis research in automation, machine vision, and general manufacturing in conjunction with the traditional machining lab also located at the college.

***Human Performance Engineering Laboratory:***

Ergonomics or human factors research is supported by equipment, which provides the capability to measure the work environment and the human senses to help analyze and develop user-friendly designs.

***Microcomputer Laboratory:***

Microcomputers for classes and student use are available during open lab hours. Simulation program and other specialized software are available in this lab.

***Network Laboratory:***

This computer network lab is used for classroom instruction in designing and developing networks through hands-on demonstrations. Other classes also benefit from the ability to transfer information from the instructor's computer to the students and vice versa.

***University Computing Facilities:***

The university maintains four general computer labs for students' use. The labs provide programming languages, statistical packages, spreadsheets, database packages, and word-processing.

***Other Laboratories:***

The college provides additional laboratory facilities that provide support for classes and individual projects as needed. These include welding and metal shops, a machine shop, a foundry, automotive labs, materials testing, electronics labs, and additional computer facilities, including computer-aided design.

## **Course Descriptions**

The semester the course is offered is indicated with F for fall, S for spring, and SS for summer; \* indicates that the class is offered on demand.

Due to the evolving nature of the ISE program, discrepancies may exist between these course descriptions and those in the university catalog. This document may include proposed changes that, if approved, will undergo phased implementation.

**ACCTG 510 – Managerial Accounting**

Accounting concepts and methods utilized in managerial planning, budgeting, controlling, and evaluating to optimize decision making. (SS)

**CIS 520 – Knowledge Based Systems**

Prerequisites: CIS 240, MGMT 365, MGMT 565 or permission of instructor.

Expert systems and their applications. Knowledge based problem solving including heuristic classification, knowledge engineering, rule based expert systems, analogy, symbolic processing and causal models. (F)

### **CIS 550 – Data Base Systems**

Prerequisites: CIS 240 or MGMT 365 or MGMT 565 or permission of instructor.

Design implementation and use of database management systems. Comparison of available software packages. Discussion of query languages, security, and recovery. (F)

### **CIS 591 – Special Topics**

Prerequisites: graduate standing and permission of instructor.

Study of new and emerging topics and technologies in the computing field. May be repeated for credit. (F,S,SS)

### **ECON 510 – Economics for Managers**

Provides the macro- and micro-economic understanding managers will use throughout their careers. Topics include demand estimation, pricing, decisions under uncertainty, domestic monetary policy, and international economics. (\*)

### **EN 101 Problem Solving for Engineers**

Writing computer programs to solve real-world problems in engineering and science. (S).

### **EN 343 – Engineering Economy**

Prerequisite: MATH 121.

Modeling, analysis and decision making involving time value of money, depreciation, income taxes, and replacement analysis. (F)

### **EN 365 – Stochastic Systems Engineering**

Prerequisite: MATH 126.

Probability modeling and statistical analysis of industrial engineering systems containing elements of uncertainty. (F)

### **EN 439 – Human Performance Engineering**

Corequisites: EN 215; EN 365.

Principles and techniques of methods analysis and work measurement, human performance in human-machine systems. (F)

### **EN 440 – Safety Engineering**

Prerequisites: EN 343; EN 439.

Occupational safety and health in different industrial environments. Theories of accident causation, government regulation, mechanical, electrical and environmental hazards, protective equipment, hazard analysis, safety programs design and administration, systems safety, etc. (S)

### **EN 441 – Engineering of Manufacturing Processes**

Prerequisite: EN 211.

Materials and processes for manufacturing including machining, casting, and forming processes: design, modeling and control. (S)

#### **EN 443 – Quality Control and Reliability**

Prerequisite: EN 365.

Principles and methods of quality control and improvement. Quality management strategy: design and implementation of quality programs in organizations, problem solving techniques, quality improvement tools, etc. Statistical quality control: control charts, process capability evaluation, acceptance sampling procedures, etc. (S)

#### **EN 473 – Computer Integrated Manufacturing**

Prerequisites: EN 101; EN 231; EN 231L; EN 441

Engineering design, modeling and applications in production: automation, flowlines, robotics, numerical control, and computer usage in manufacturing. (F)

#### **EN 500 – Logistics, Maintainability and Life-Cycle Support**

Application of management systems and analysis to problems of system maintainability and maintenance. Models of repair and failure, wear-out processes, maintenance and inspection policies and spare parts policies. (\*)

#### **EN 501 – Software Systems Engineering**

Software systems development and life cycles to include applications development strategy, system development life cycle and phases, system development management, group dynamics in the development process, user requirements determination, and analysis and logical specification of the system. Cost forecasting of the engineering design through modeling. (\*)

#### **EN 503 – Ergonomics**

Theory and practice of human performance measurement and human factors engineering. Study of human sensory, perceptual, mental, psychomotor, and other characteristics applied to the design of man-machine systems for performance effectiveness, productivity, and safety. (F)

#### **EN 504 – Scheduling and Sequencing**

Prerequisites: EN 101; EN 571 or permission of instructor.

Theory of determining scheduling and sequencing with stochastic extensions. An introduction to the complexity of computations in systems varying from single machine to job shop. (S)

#### **EN520 – Simulation Experiments**

Prerequisite: EN 365 and graduate standing.

Design and statistical analysis of experiments using discrete event simulation models. (S)

#### **EN 530 – Project Planning and Control**

Engineering project management including project selection, organization, planning, budgeting, scheduling and resource allocation, tracking and control, and evaluation. (F)

**EN 540 – Advanced Engineering Economics**

Prerequisites: EN 101, EN 343, EN 365 or permission of instructor.

Advanced topics in engineering economy featuring income tax considerations, treatment of inflation, risk and uncertainty models, cost effectiveness concepts and project comparison methods. (S)

**EN 556 – Design and Analysis of Experiments**

Prerequisites: MATH 256; MATH 356.

Foundations of experimental design, outline efficient methods to implement experiments, develop statistical methods to sort signal from noise, and analyze information derived from the experiment. (\*)

**EN 565 – Stochastic Systems Engineering**

Prerequisites: EN 365 or equivalent.

Analysis and design of systems containing elements of uncertainty in demand and performance capability. Time varying measures and approximations are emphasized. (\*)

**EN 571 – Operations Research**

Prerequisites: MATH 224 and graduate standing.

Techniques for analysis and solution of problems in industrial and management systems. Linear programming, duality theory, sensitivity analysis, and network analysis techniques. (F)

**EN 575 – Facilities Planning and Design**

Prerequisites: EN 101, EN 365 Corequisite: EN 571

Application of ISE techniques to problems related to an organization's physical resources. Facilities planning and plant layout, material handling, site selection and facilities location. (F)

**EN 577 – Operations Planning and Control**

Prerequisites: EN 101, EN 365, EN 571

Techniques for analysis and management of manufacturing operations and production with emphasis on inventory systems and forecasting. (F)

**EN 587 – Career Success in Engineering**

Prerequisite: graduate standing.

Topics related to identifying an appropriate career path, finding a job, and planning for graduate school. (\*)

**EN 588 – Graduate Projects**

Prerequisites: EN 520; EN 571; EN 575; EN 577.

Application of graduate industrial engineering principles to a capstone design project. (\*)

**EN 590 – Special Projects**

Prerequisites: Advisor approval.

Individual project selected, outlined and pursued by student. May be repeated. (\*)

**EN 591 – Special Topics**

Selected topics in ISE. Topics range from heuristic design to expert systems, advanced topics to multi-criteria decision analysis, engineering design optimization to reliability, robotics to nanotechnology, experimental design to analytical facility location and site selection models. Not every topic offered each year. May be repeated. (S)

**EN 593 – Graduate Seminar**

Seminar for students entering the ISE program. Philosophical, methodological and ethical issues in ISE are discussed (S/U grading). (F)

**EN 598 – Internship**

Field work in a company or organization, with written reports (S/U grading). (\*)

**EN 599 – Thesis Research**

Prerequisites: Advisor approval.

Preparation of thesis to meet degree requirements. Arranged with major advisor. May be repeated (S/U grading). (\*)

**MATH 350 – Probability**

Prerequisite: MATH 325.

Introduction to probability theory and stochastic processes. Probability spaces, random variables and their distributions, exponential and Poisson processes, limit theorems and applications. (S)

**MATH 521 – Intermediate Analysis**

Prerequisite: Permission of instructor

Point set theory, including the Bolzano-Weierstrass and the Heine-Borel theorems, theory of differentiation and Riemann integration, and sequences and series of functions. (\*)

**MATH 541 – Computers**

Prerequisites: Permission of instructor

The use of the computer in mathematical investigations, including sophisticated comprehensive computer programs such as Mathematica. (\*)

**MATH 544 – Mathematical Methods of Applied Science**

Prerequisite: Permission of instructor

Topics in applied mathematics, including deterministic and stochastic models, programming, optimization, networks, and simulation. (F)

**MGMT 565 – Management Information Systems**

The development of a framework for understanding and analyzing use of information by organizations through computer-based systems and this framework's potential for enhancing effectiveness of managerial decision making. (\*)

## Testimonials

*“The master’s degree in ISE is an excellent way to put yourself in a position to confront almost any challenge and integrate the latest technologies in supporting industrial systems. I’ve found that there is a whole new realm of possibilities for those with this type of education. Moreover, graduates of this program find themselves in an excellent position to study for their Ph.D. at major universities.”*

Dr. Brad Decker, BS ’91, MSISE ’95  
Industrial Engineer  
Jeppesen Sanderson, Inc., Denver, CO

*“After completing my bachelor degree in mechanical engineering, I was looking for a graduate program that would enhance my analytical skills and broaden my vision in the engineering field. The M.S. degree in ISE at USC has given me exactly what I wanted and much more. As I was near completion of the program, I knew I have had enough training and was ready to serve the industry.”*

Suriya Ruangpattana, MSISE ’98  
Ph.D. student  
Purdue University

## Faculty

**Hector R. Carrasco**, P.E., Professor and Dean

*Education:*

Ph.D., Industrial Engineering, Texas A&M University

M.S., Industrial Engineering, University of Texas at El Paso

B.S., Mechanical Engineering, University of Texas at El Paso

*Research and teaching interests:*

Engineering economy, project management, quality improvement through design of experiments, justification of new technology, manufacturing systems, Taguchi techniques, system design, and energy conservation.

**Jude L. DePalma**, Associate Professor

*Education:*

Ph.D., Electrical Engineering, Colorado State University

M.S., Electrical Engineering, Purdue University

B.S., Electrical Engineering, University of Florida

*Research and teaching interests:*

Biomedical signal processing, modeling of biological systems, electrical engineering

**Jane M. Fraser**, Professor and Chair

*Education:*

Ph.D., M.S., Industrial Engineering/Operations Research, University of California, Berkeley

B.A., Mathematics, Swarthmore College

*Research and Teaching Interests:*

Decision analysis, engineering economy, information and communication technology, engineering education.

**Nebojsa I. Jaksic**, P.E., Associate Professor and MSISE Program Director

*Education:*

Ph.D., M.S., Industrial and Systems Engineering, Ohio State University

M.S., Electrical Engineering, The Ohio State University

B.S., Electrical Engineering, Belgrade University

*Research and teaching interests:*

Nanotechnology, automation, robotics, computer-integrated manufacturing

**J.P. Purswell**, P.E., Adjunct Assistant Professor

*Education:*

Ph.D., Industrial and Systems Engineering, Virginia Polytechnic Institute and State University

M.S., Industrial Engineering, The University of Oklahoma

B.S., Chemistry and Biology, Oklahoma Baptist University

*Research and teaching interests:*

Ergonomics, safety, hazard analysis, development of warnings and instructions.

**Hüseyin Sarper**, P.E., Professor

*Education:*

Ph.D., M.S., Industrial Engineering/Operations Research, Virginia Polytechnic Institute and State University

B.S., Industrial Engineering, The Pennsylvania State University

*Research and teaching interests:*

Reliability, applied operations research, simulation, manufacturing, space policy and engineering applications.

**E. Keith Sinkhorn**, Visiting Assistant Professor

*Education:*

Ph.D., Industrial Engineering, University of Louisville

M.A., Applied Mathematics, University of Louisville

B.S., Applied Mathematics, Brescia College

*Research and teaching interests:*

Operations research, logistics, vehicle routing, material handling, stochastic transportation systems.