

INDUSTRIAL & SYSTEMS

ISE OVERVIEW • PROGRAMS AVAILABLE
COURSES OF INSTRUCTION • FLOWCHARTS

Industrial and Systems engineers use engineering and business principles to formulate rigorous approaches to problem solving. They are productivity catalysts, minimizing waste of physical and human resources. These engineers are involved in developing manufacturing systems to help companies compete in today's global marketplace.

The Industrial and Systems engineer's task is to take limited resources and maximize their use by integrating people and technology to reach productivity goals and maintain high standards of quality. The Information Systems option gives extra emphasis to programming, software and multimedia.

The undergraduate ISE curriculum prepares students for careers in a wide range of industries, consulting, or professional practice. It is also an excellent intellectual foundation for advanced degrees in fields as diverse as Engineering, Business Administration, Law or Public Policy.



PROGRAMS AVAILABLE

- Industrial and Systems Engineering
Bachelor of Science
128 units
- Industrial and Systems Engineering
(Information Systems Engineering)
Bachelor of Science
128 units
Optional Tracks in Computers,
Operations Management
- Engineering Management
minor

See pages 81-83 for the curriculum of the B.S. in ISE programs listed above.

See page 84 for information on minor programs offered by the USC Viterbi School of Engineering.

COURSES OF INSTRUCTION

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

INDUSTRIAL AND SYSTEMS ENGINEERING (ISE)

ISE 105 Introduction to Industrial and Systems Engineering (2, FaSp) A combination of plant tours, laboratory experiences, and lecture are used to introduce the philosophy, subject matter, aims, goals, and techniques of industrial and systems engineering.

ISE 220 Probability Concepts in Engineering (3, Fa) Techniques for handling uncertainties in engineering design: discrete and continuous random variables; expectations, probability distributions and transformations of random variables; limit theorems; approximations and applications. *Corequisite*: MATH 226.

ISE 225 Engineering Statistics I (3, Sp) Sampling distributions; parameter estimation, hypothesis testing; analysis of variance; regression; nonparametric statistics. *Prerequisite*: ISE 220.

ISE 232L Manufacturing Processes (3, Fa)

Basic manufacturing processes including casting, machining, forming and welding; current trends in manufacturing processes including polymer, ceramic and composite material processing, and electronic device fabrication; introduction to numerical control and computer integrated manufacturing. *Recommended preparation*: MASC 110L or CHEM 105aL or CHEM 115aL.

ISE 310L Production I: Facilities and Logistics (4, Sp)

Facilities layout and design; material handling and transportation; site selection and sourcing; supply chain management. *Prerequisite*: ISE 330; *corequisite*: ISE 460.

ISE 330 Introduction to Operations Research: Deterministic Models (3, Fa)

Introduction to linear programming; transportation and assignment problems; dynamic programming; integer programming; nonlinear programming. *Prerequisite*: MATH 225.

ISE 331 Introduction to Operations Research: Stochastic Models (3, Sp)

Stochastic processes; Markov chains; queueing theory and queueing decision models; probabilistic inventory models. *Prerequisite*: ISE 220; *recommended preparation*: ISE 330.



ISE 344 Engineering Team Management (3) Examine team formation and team dynamics including organizational behavior, group dynamics, psychology, and business management, all in the context of engineering development; decision-making and negotiation. Open only to juniors and seniors.

ISE 370L Human Factors in Work Design (4, Fa) Physiological systems and psychological characteristics; ergonomics; anthropometry; effects of the physical environment on humans; occupational safety and health; work methods. *Prerequisite:* ISE 225.

ISE 382 Database Systems: Concepts, Design and Implementation (3, Sp) Concepts in modeling data for industry applications. Designing and implementing robust databases. Querying databases to extract business intelligence; Global Enterprise Resource Planning with databases. *Prerequisite:* CSCI 101L.

ISE 390 Special Problems (1-4) Supervised, individual studies. No more than one registration permitted. Enrollment by petition only.

ISE 410 Production II: Planning and Scheduling (3, Fa) Production planning, forecasting, scheduling, and inventory; computer integrated decision systems in analysis and control of production systems. *Corequisite:* ISE 330.

ISE 415 Industrial Automation (3, Irregular) Traditional (automobile) and modern (computer based) concepts in Industrial Automation. Computer control concepts (sensors, actuators), robotics, flexible manufacturing systems. *Prerequisite:* senior level status.

ISE 422L Configuring Enterprise Resource Planning Systems (3, FaSp) (Enroll in ITP 422L)

ISE 426 Statistical Quality Control (3, Fa) Quantitative aspects of statistical quality control (process control, acceptance sampling by attribute and by variable, rectifying inspection), quality assurance and the management of QC/QA functions. *Prerequisite:* ISE 225.

ISE 435 Discrete Systems Simulation (3, Fa) Model design to simulate discrete event systems with basic input and output analysis using high order languages, applied to industrial systems analysis and design problems. *Prerequisite:* ISE 220, CSCI 101L; *corequisite:* ISE 225.

ISE 440 Work, Technology, and Organization (3, Sp) Impact of technology on work and organizational design; effects of automation; design of improvement programs; information infrastructures; teams; individual behavioral outcomes. Upper division standing.

ISE 455Lx Enterprise Information Portals (3, Sp) (Enroll in ITP 455Lx)

ISE 460 Engineering Economy (3, FaSpSm) Utilizing principles of economic analysis for choice of engineering alternatives and engineering systems. Pre-tax and after-tax economy studies. Upper division standing.

ISE 470 Human/Computer Interface Design (3, Sp) Essentials of human factors and computer interface for the design, development, implementation, and evaluation of integrated media systems.

ISE 482L Engineering Database Applications (3) (Enroll in ITP 482L)

ISE 490x Directed Research (2-8, max 8, FaSp) Individual research and readings. Not available for graduate credit.

ISE 495abx Senior Design Project (2-2 FaSp) a: Preparation and development of the senior project proposal. Not available for graduate credit. Senior standing in industrial and systems engineering. *Corequisite:* ISE 225, ISE 310; ISE 382 or IOM 435. b: Group work on an industrial engineering design problem in an organization. Not available for graduate credit. Senior standing in industrial and systems engineering. *Corequisite:* ISE 370 or ISE 470; ISE 435.

ISE 499 Special Topics (2-4, max 8) Course content to be selected each semester from recent developments in industrial and systems engineering and related fields.

GRADUATE COURSES

ISE 502 Construction Accounting and Finance (3) (Enroll in CE 502)

ISE 507 Six-Sigma Quality Resources for Health Care (3, Fa)

ISE 508 Health Care Operations Improvement (3, Sp)

ISE 510 Advanced Computational Design and Manufacturing (3)

ISE 511L Computer Aided Manufacturing (3, Fa)

ISE 512 Software Management and Economics (3, Fa) (Enroll in CSCI 510)

ISE 513 Inventory Systems (3, Sp)

ISE 514 Advanced Production Planning and Scheduling (3, FaSm)

ISE 515 Engineering Project Management (3, FaSpSm)

ISE 516 Facilities Location and Layout (3)

ISE 517 Modern Enterprise Systems (3, FaSp)

ISE 520 Optimization: Theory and Algorithms (3, Fa)

ISE 525 Design of Experiments (3, FaSp)

ISE 527 Quality Management for Engineers (3, FaSp)

ISE 528 Advanced Statistical Aspects of Engineering Reliability (3)

ISE 530 Introduction to Operations Research (3, Sp)

ISE 532 Network Flows (3, Sp)

ISE 535 Continuous Systems Simulation (3)

ISE 536 Linear Programming and Extensions (3, Fa)

ISE 538 Elements of Stochastic Processes (3, Sp)

ISE 539 Stochastic Elements of Simulation (3, Sp)

ISE 543 Case Studies in Systems Engineering (3, FaSp) (Enroll in SAE 543)

ISE 544 Management of Engineering Teams (3, FaSp)

ISE 545 Technology Development and Implementation (3, Fa)

ISE 549 Systems Architecting (3, FaSp) (Enroll in SAE 549)

ISE 555 Invention and Technology Development (3, Sp)

ISE 556 Stochastic Systems and Finance (3, Sp) (Enroll in EE 556)

ISE 560 Analysis of Algorithms (3, FaSp) (Enroll in CSCI 570)

ISE 561 Economic Analysis of Engineering Projects (3, FaSp)

ISE 562 Value and Decision Theory (3, Fa)

ISE 563 Financial Engineering (3, Sp)

ISE 564 Performance Analysis (3)

ISE 565 Law and Finance for Engineering Innovation (3)

ISE 566 Financial Accounting Analysis for Engineering (3, Sp)

ISE 567 Collaborative Engineering Principles and Practice (3, Sp)

ISE 570 Human Factors in Engineering (3, Fa)



ISE 571 Human Factors Issues in Integrated Media Systems (3)

ISE 573 Work Physiology (3)

ISE 575 Topics in Engineering Approaches to Music Cognition (3, max 6)

ISE 576 Industrial Ecology: Technology-Environment Interaction (3)

ISE 580 Advanced Concepts in Computer Simulation (3, Sp)

ISE 582 Web Technology for Industrial Engineering (3, Fa)

ISE 583 Enterprise Wide Information Systems (3, FaSp)

ISE 585 Strategic Management of Technology (3, FaSp)

ISE 587 Risk Analysis (4) (Enroll in PPD 587)

ISE 589 Port Engineering: Planning and Operations (3, Fa) (Enroll in CE 589)

ISE 590 Directed Research (1-12)

ISE 594abz Master's Thesis (2-2-0)

ISE 599 Special Topics (2-4, max 9, Fa)

ISE 645 Uncertainty Modeling and Stochastic Optimization (3, Sp) (Enroll in CE 645)

ISE 650abcd Seminar in Industrial Engineering (1/2, 1/2, 1/2, 1/2, FaSp)

ISE 670 Advanced Analysis of Algorithms (3, Fa) (Enroll in CSCI 670)

ISE 690 Directed Research (1-4, max 8, FaSpSm)

ISE 790 Research (1-12, FaSpSm)

ISE 794abcdz Doctoral Dissertation (2-2-2-2-0)



ISIS TRACK: COMPUTERS (128 UNITS)

freshman	(16 units)	<u>GE Cat. VI (4)</u> <<writ 140>>	<u>WRIT 140 (4)</u> <<ge cat. vi>>	MATH 125 (4)	ISE 105 (2)	ENGR 102 (2)
	(15 units)	GE Cat. I (4)	CHEM 105aL or MASC 110L (4)	<u>MATH 126 (4)</u> math 125	CSCI 101L (3)	
sophomore	(16 units)	IOM / ITP ELECTIVE (2)	<u>PHYS 151L (4)</u> math 125	<u>MATH 226 (4)</u> math 126	<u>ISE 220 (3)</u> [math 226]	<u>CSCI 102L (3)</u> csci 101L
	(17 units)	FREE ELECTIVE (3)	<u>PHYS 152L (4)</u> phys 151L, [math 226]	<u>MATH 225 (4)</u> math 126	<u>ISE 225 (3)</u> ise 220	<u>CSCI 200L (3)</u> csci 102L
junior	(16 units)	<u>CSCI 201L (3)</u> csci 102L	<u>WRIT 340 (3)</u> writ 140	<u>ISE 330 (3)</u> math 225	ISE 460 (3)	GE Cat. V (4)
	(17 units)	FREE ELECTIVE (3)	GE Cat. II (4)	CSCI ELECTIVE (3)	<u>ISE 310L (4)</u> ise 220, [460]	<u>ISE 382 (3)</u> csci 101L
senior	(16 units)	GE Cat. IV (4)	ITP/IOM ELECTIVE (4)	<u>ISE 495ax (2)</u> [ise 225, 310, 382 or iom 435]	<u>ISE 435 (3)</u> ise 220, [225], csci 101L	<u>ISE 410 (3)</u> [ise 330]
	(15 units)	FREE ELECTIVE (4)	TECH. ELEC. (3)	<u>ISE 495bx (2)</u> ise 495ax, [ise 370 or 470, 435]	ISE 470 (3)	ISE 440 (3)
<p>KEY: <i>prerequisite</i> <i>[co-requisite]</i> <<concurrent enrollment>></p>						

Mathematics (16 units)

MATH 125	Calculus I
MATH 126	Calculus II
MATH 225	Linear Algebra and Diff. Equations
MATH 226	Calculus III

Physics (8 units)

PHYS 151L	Mechanics and Thermodynamics
PHYS 152L	Electricity and Magnetism

Chemistry / Materials Science (4 units)

CHEM 105aL*	General Chemistry
or	
MASC 110L	Materials Science

General Education (27 units)

WRIT 140**	Writing and Critical Reasoning
WRIT 340	Advanced Writing
GE Cats. I, II, V, VI	
GE Cat. IV***	

Engineering (63 units)

CSCI 101L	Fund. of Comp. Programming
CSCI 102L	Data Structures
CSCI 200L	Object Oriented Programming
CSCI 201L	Prin. of Software Development
ENGR 102	Engineering Freshman Academy
ISE 105	Intro. to Industrial Engineering
ISE 220	Probability Concepts in Engr.
ISE 225	Engineering Statistics
ISE 310L	Prod. I: Facilities & Logistics
ISE 330	Intro. to Operations Research I
ISE 382	Database Systems
ISE 410	Prod. Planning and Scheduling
ISE 435	Discrete Systems Simulation
ISE 440	Work, Technology and Organization
ISE 460	Engineering Economy
ISE 470	Human/Computer Interface Design
ISE 495ab	Senior Design Project
CSCI Elective	(see **** below)
Technical Elective	(see ***** below)
ITP/IOM Elective	(see ***** below)

Other Courses (10 units)

Free Electives

* Advanced students with departmental approval have the option of completing CHEM 115aL in place of CHEM 105aL.

** Concurrent enrollment in a Social Issues GE Course is required.

*** May take Category I, II, IV or VI GE class.

**** CSCI Elective options: CSCI 351, 377, 485 or EE 450.

***** Any of the following courses not specifically required in a student's program may be selected. AME 341a, 341B, CE 408, 460, 471, ISE 331, 426, 470, ITP 482. For additional courses, please check with the ISE department. Substitutions of a graduate level ISE course will be considered upon petition.

***** ITP/IOM Elective options: ITP 215, 320, 321, 325, 454, 457, 486, 487 and IOM 428

ISIS TRACK: OPERATIONS MGMT. (128 UNITS)

freshman	(16 units)	<u>GE Cat. VI (4)</u> <<writ 140>>	<u>WRIT 140 (4)</u> <<ge cat. vi>>	<u>MATH 125 (4)</u>	<u>ISE 105 (2)</u>	<u>ENGR 102 (2)</u>
	(15 units)	<u>GE Cat. I (4)</u>	<u>CHEM 105aL or MASC 110L (4)</u>	<u>MATH 126 (4)</u> math 125	<u>CSCI 101L (3)</u>	
sophomore	(18 units)	<u>FREE ELECTIVE (3)</u>	<u>PHYS 151L (4)</u> math 125	<u>MATH 226 (4)</u> math 126	<u>ISE 220 (3)</u> [math 226]	<u>GE Cat. V (4)</u>
	(17 units)	<u>ITP / IOM ELECTIVE (2)</u>	<u>PHYS 152L (4)</u> phys 151L, [math 226]	<u>MATH 225 (4)</u> math 126	<u>ISE 225 (3)</u> ise 220	<u>FREE ELECTIVE (4)</u>
junior	(17 units)	<u>FREE ELECTIVE (4)</u>	<u>WRIT 340 (3)</u> writ 140	<u>ISE 330 (3)</u> math 225	<u>ISE 460 (3)</u>	<u>IOM 431 (4)</u>
	(16 units)	<u>ITP / IOM ELECTIVE (4)</u>	<u>GE Cat. II (4)</u>		<u>ISE 310L (4)</u> ise 220, [460]	<u>IOM 435 (4)</u>
senior	(14 units)	<u>ITP 482L (3)</u> ise 382 or iom 435	<u>IOM 433 (3)</u>	<u>ISE 495ax (2)</u> [ise 225, 310, 382 or iom 435]	<u>ISE 435 (3)</u> ise 220, [225], csci 101L	<u>ISE 410 (3)</u> [ise 330]
	(15 units)	<u>GE Cat. IV (4)</u>	<u>TECH. ELEC. (3)</u>	<u>ISE 495bx (2)</u> ise 495ax, [ise 370 or 470, 435]	<u>ISE 470 (3)</u>	<u>ISE 440 (3)</u>
<p>KEY: <i>prerequisite</i> <i>[co-requisite]</i> <<concurrent enrollment>></p>						

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General Education (27 units)

WRIT 140**	Writing and Critical Reasoning
WRIT 340	Advanced Writing
GE Cats. I, II, V, VI	
GE Cat. IV***	

Information and Operations Mgmt. (12 units)

IOM 431	Computer Based Business Sys.
IOM 433	Bus. Info. Sys. Analysis and Design
IOM 435	Business Database Systems

Engineering (51 units)

CSCI 101L	Fund. of Comp. Programming
ENGR 102	Engineering Freshman Academy
ISE 105	Intro. to Industrial Engineering
ISE 220	Probability Concepts in Engr.
ISE 225	Engineering Statistics
ISE 310L	Prod. I: Facilities & Logistics
ISE 330	Intro. to Operations Research I
ISE 410	Prod. Planning and Scheduling
ISE 435	Discrete Systems Simulation
ISE 440	Work, Technology and Organization
ISE 460	Engineering Economy
ISE 470	Human/Computer Interface Design
ISE 495ab	Senior Design Project
ITP 482L	Engr. Database Applications
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Technical Elective	(see ***** below)

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