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 including consulting, technology development, software, supply chain manufacturing, engineering management and many related areas.

MAJORS & AREAS OF EMPHASIS

- Industrial and Systems Engineering
- Industrial and Systems Engineering Emphasis in Information Systems Engineering
- Optional Tracks in Computers, Operations Management

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

ISE 404 Business and Intellectual Property Law for Engineers (3) (Enroll in CE 404)

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 infrastructure; 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 487Lx Data Warehouses and Business Intelligence (3) (Enroll in ITP 487Lx)

ISE 488x Managing Supply Chains with Advanced Planning and Optimization (3) (Enroll in ITP 488x)

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)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISE 565</td>
<td>Law and Finance for Engineering Innovation</td>
<td>(3)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 566</td>
<td>Financial Accounting Analysis for Engineering</td>
<td>(3, Sp)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 567</td>
<td>Collaborative Engineering Principles and Practice</td>
<td>(3, Sp)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 570</td>
<td>Human Factors in Engineering</td>
<td>(3, Fa)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 571</td>
<td>Human Factors Issues in Integrated Media Systems</td>
<td>(3)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 573</td>
<td>Work Physiology</td>
<td>(3)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 575</td>
<td>Topics in Engineering Approaches to Music Cognition</td>
<td>(3, max 6)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 576</td>
<td>Industrial Ecology: Technology-Environment Interaction</td>
<td>(3)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 580</td>
<td>Advanced Concepts in Computer Simulation</td>
<td>(3, Sp)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 582</td>
<td>Web Technology for Industrial Engineering</td>
<td>(3, Fa)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 583</td>
<td>Enterprise Wide Information Systems</td>
<td>(3, FaSp)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 585</td>
<td>Strategic Management of Technology</td>
<td>(3, FaSp)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 587</td>
<td>Risk Analysis</td>
<td>(4)</td>
<td>Fall (Enroll in PPD 587)</td>
</tr>
<tr>
<td>ISE 589</td>
<td>Port Engineering: Planning and Operations</td>
<td>(3, Fa)</td>
<td>Fall (Enroll in CE 589)</td>
</tr>
<tr>
<td>ISE 590</td>
<td>Directed Research</td>
<td>(1-12)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 594abz</td>
<td>Master’s Thesis</td>
<td>(2-2-0)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 599</td>
<td>Special Topics</td>
<td>(2-4, max 9, Fa)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 645</td>
<td>Uncertainty Modeling and Stochastic Optimization</td>
<td>(3, Sp)</td>
<td>Fall (Enroll in CE 645)</td>
</tr>
<tr>
<td>ISE 650abc</td>
<td>Seminar in Industrial Engineering</td>
<td>(1/2, 1/2, 1/2, 1/2, FaSp)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 670</td>
<td>Advanced Analysis of Algorithms</td>
<td>(3, Fa)</td>
<td>Fall (Enroll in CSCI 670)</td>
</tr>
<tr>
<td>ISE 690</td>
<td>Directed Research</td>
<td>(1-4, max 8, FaSpSm)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>ISE 790</td>
<td>Research</td>
<td>(1-12, FaSpSm)</td>
<td>Fall</td>
</tr>
<tr>
<td>ISE 794abcdz</td>
<td>Doctoral Dissertation</td>
<td>(2-2-2-2-0)</td>
<td>Fall, Spring</td>
</tr>
</tbody>
</table>
INDUSTRIAL & SYSTEMS (128 UNITS)

(16 units)
freshman
- GE Cat. VI (4)
- WRIT 140 (4)
- MATH 125 (4)
- ISE 105 (2)
- ENGR 102 (2)

(15 units)
- GE Cat. I (4)
- CHEM 105aL or MASC 110L (4)
- MATH 126 (4)
- CSCI 101L (3)

(17 units)
sophomore
- FREE ELEC. (3)
- ISE 220 (3)
- MATH 226 (4)
- PHYS 151L (4)
- ISE 232L (3)

(15 units)
- ECON 203 (4)
- ISE 225 (3)
- MATH 225 (4)
- PHYS 152L (4)

(17-18 units)
junior
- GE Cat. V (4)
- ISE 330 (3)
- AME 341aL (3)
- ISE 370L (4)
- ISE 460 (3)

(17 units)
- WRIT 340 (3)
- ISE 382 (3)
- ISE 331 (3)
- ISE 310L (4)

(15 units)
- ACCT 410x (4)
- ISE 435 (3)
- ISE 410 (3)
- ISE 426 (3)
- ISE 495ax (2)

(17 units)
- FREE ELEC. (4)
- TECH. ELEC. (3)
- ISE 440 (3)
- ISE 495bx (3)
- GE Cat. IV (4)

KEY: prerequisite [co-requisite] <<concurrent enrollment>>

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 Cat. I, II, V, VI
- GE Cat. IV***

Economics and Accounting (8 units)
- ECON 203 Principles of Microeconomics
- ACCT 410x Account. for Non-Bus. Majors

Engineering (55-59 units)
- CSCI 101L Fund. of Comp. Programming
- AME 341aL Mechatronics Laboratory I or EE 326Lx Essentials of Electrical Engr.
- ENGR 102 Engineering Freshman Academy
- ISE 105 Intro. to Industrial Engineering
- ISE 225 Engineering Statistics I
- ISE 232L Manufacturing Processes
- ISE 310L Prod. I: Facilities & Logistics
- ISE 330 Intro. to Operations Research I
- ISE 331 Intro. to Operations Research II
- ISE 370L Human Factors in Work Design
- ISE 382 Database Systems
- ISE 410 Prod. II - Planning, Scheduling & Control
- ISE 426 Statistical Quality Control
- ISE 435 Discrete Systems Simulation
- ISE 440 Work, Technology and Organization
- ISE 460 Engineering Economy
- ISE 495ax Senior Design Project
- ISE 495bx Senior Design Project
- Technical Elective (see *** below)

Other Courses (7 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.
**** Any of the following courses not specifically required in a student’s program may be selected: AME 341aL, 341bL, CE 408, 460, 471, ISE 331, 426, 470, ITP 432L. For additional courses, please check with the ISE department. Substitutions of a graduate level ISE course will be considered upon petition. Students who choose to complete EE 326Lx are only required to complete 2 units of Technical Elective credit.
ISIS TRACK: COMPUTERS (128 UNITS)

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 225 Engineering Statistics I
- 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 Electives (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 430.
***** Any of the following courses not specifically required in a student's program may be selected:
- AME 341a, 341b, CE 407, 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 and ITP 428

---

82
## ISIS Track: Operations Mgmt. (128 Units)

### Freshman Year (15 units)
- **Mathematics (16 units)**
  - MATH 125: Calculus I
  - MATH 126: Calculus II
- **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***
- **Information and Operations Mgmt. (12 units)**
  - IOM 431: Managing the Digital Rev. for your Bus.
  - IOM 435: Business Database Systems

### Sophomore Year (17 units)
- **Mathematics (16 units)**
  - MATH 125 (4)
  - MATH 126 (4)
  - MATH 225 (4)
  - MATH 226 (4)
- **Physics (8 units)**
  - PHYS 151L (4)
  - PHYS 152L (4)
- **Chemistry / Materials Science (4 units)**
  - CHEM 105aL*
  - MASC 110L
  - GE Cat. V (4)
- **General Education (27 units)**
  - WRIT 140**: Writing and Critical Reasoning
  - WRIT 340: Advanced Writing
  - GE Cats. I, II, V, VI

### Junior Year (16 units)
- **Mathematics (16 units)**
  - MATH 125 (4)
  - MATH 126 (4)
  - MATH 225 (4)
  - MATH 226 (4)
- **Physics (8 units)**
  - PHYS 151L (4)
  - PHYS 152L (4)
- **Chemistry / Materials Science (4 units)**
  - CHEM 105aL*
  - MASC 110L
  - GE Cat. V (4)
- **General Education (27 units)**
  - WRIT 140**: Writing and Critical Reasoning
  - WRIT 340: Advanced Writing
  - GE Cats. I, II, V, VI

### Senior Year (15 units)
- **Mathematics (16 units)**
  - MATH 125 (4)
  - MATH 126 (4)
  - MATH 225 (4)
  - MATH 226 (4)
- **Physics (8 units)**
  - PHYS 151L (4)
  - PHYS 152L (4)
- **Chemistry / Materials Science (4 units)**
  - CHEM 105aL*
  - MASC 110L
  - GE Cat. V (4)
- **General Education (27 units)**
  - WRIT 140**: Writing and Critical Reasoning
  - WRIT 340: Advanced Writing
  - GE Cats. I, II, V, VI

### Other Courses (10 units)
- Free Electives

---

**KEY:** prerequisite [co-requisite] <<concurrent enrollment>>

* 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.

**** Any of the following courses not specifically required in a student's program may be selected: AME 340a, 340b, 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.

***** Any of the following courses not specifically required in a student's program may be selected: AME 340a, 340b, 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.

---

** USC Viterbi School of Engineering **

2011/12 Curriculum Flowchart