

INDUSTRIAL ENGINEERING (IE)

Subject-area course lists indicate courses currently active for offering at the University of Louisville. Not all courses are scheduled in any given academic term. For class offerings in a specific semester, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>).

500-level courses generally are included in both the undergraduate- and graduate-level course listings; however, specific course/section offerings may vary between semesters. Students are responsible for ensuring that they enroll in courses that are applicable to their particular academic programs.

Course Fees

Some courses may carry fees beyond the standard tuition costs to cover additional support or materials. Program-, subject- and course-specific fee information can be found on the Office of the Bursar website (<http://louisville.edu/bursar/tuitionfee/>).

IE 240. Fundamentals of Industrial Engineering 3 Units

Term Typically Offered: Fall Only

Description: An introduction to the analysis and design of industrial systems; emphasis upon appropriate analytical and computer-based techniques and their applications to industrial systems. Topics introduced include: Quality Control/Management, Product/Service Design, Facility Design, Project Management, Supply Chains and Distribution, Forecasting, Inventory Planning, Scheduling, Six Sigma/Lean Basics, and the Code of Ethics for Engineers.

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IE 250. Data Management and Spreadsheet Modelings for Industrial Engineering 3 Units

Term Typically Offered: Fall Only

Description: This course will develop analytical and modeling skills using Excel spreadsheets. Students will develop skills needed to analyze data in Excel and to build mathematical models in Excel. The course is divided into two parts. The first part is devoted to data analysis and management. Students will learn a comprehensive set of spreadsheet skills and tools, including how to design, build, test, and use a spreadsheet for data analysis. The second part of the course provides and introduction to the concepts and methods of Decision Science, which involves the application of mathematical modeling and analysis to management problems, with a focus on optimization models. It also provides a foundation in modeling with spreadsheets.

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IE 288. Industrial Engineering Cooperative Education Seminar 0 Units

Grading Basis: Pass/Fail

Term Typically Offered: Fall, Spring, Summer

Prerequisite(s): CHEM 201, ENGL 101, ENGR 102, ENGR 110, PHYS 298, student must be in Good Standing with GPA of 2.25 or higher; IE 240.

Corequisite(s): IE 240.

Description: Discussion of the policies and procedures for cooperative education and instruction in self-directed job search techniques, including interviewing skills, resume preparation, and guidelines for the co-op report. This is a prerequisite for each cooperative education term. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

IE 289. Industrial Engineering Cooperative Education I 1 Unit

Grading Basis: Pass/Fail

Term Typically Offered: Fall, Spring, Summer

Prerequisite(s): IE 288.

Fee: An additional \$300.00 is charged for this course.

Description: Full-time technical work experience related to the student's academic program.

Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

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IE 320. Manufacturing Processes 4 Units

Term Typically Offered: Spring Only

Prerequisite(s): CHE 253.

Description: Principles of materials processing used in manufacturing; casting, forming, machining, welding, and related techniques such as numerical and computer control. Laboratory includes plant visits.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

IE 360. Probability and Statistics for Engineers 3 Units

Term Typically Offered: Fall, Spring, Summer

Prerequisite(s): ENGR 102.

Description: Engineering applications using probability, random variables, distribution functions, confidence intervals, estimation and hypothesis testing.

Note: Students cannot receive credit for both IE 360 and IE 560.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

- IE 361. Developing Decision Support Systems with Excel** 3 Units
Term Typically Offered: Spring Only
Prerequisite(s): IE 250.
Description: This course teaches the fundamentals of computer programming using Excel's macro language, Visual Basic for Applications (VBA), as the language of instruction. The course starts by teaching students to simplify and extend code generated by Excel's macro recorder and then builds on that base toward developing applications that analyze information and enhance decision making. This course also provides an introduction to the concepts and methods of Decision Science, which involves the application of mathematical modeling and analysis to management problems. It also provides a foundation for modeling with VBA in Excel.
Note: Students may NOT receive credit for both IE 361 and IE 561.
- For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 370. Engineering Economic Analysis** 3 Units
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): ENGR 101.
Description: Methods for economic evaluation of engineering projects including, time value of money, equivalence, cost estimation, selection of alternatives, effects of depreciation, taxes and inflation, replacement analysis, sensitivity analysis, capital budgeting.
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 380. Work Design** 3 Units
Term Typically Offered: Fall Only
Description: Work measurement as a basis for the industrial engineering profession. Engineering principles of work measurement, analysis and design. Methods engineering and time study. Predetermined motion time systems. Work sampling and standards. Computerized work measurement systems: ADAM and MOST. Job design and standardization of production.
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 389. Industrial Engineering Cooperative Education II** 1 Unit
Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): IE 289.
Fee: An additional \$300.00 is charged for this course.
Description: Full-time work experience related to the student's academic program.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.
- For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 393. Independent Study in Industrial Engineering** 1-6 Units
Term Typically Offered: Fall, Spring, Summer
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 400. Introduction to Additive Manufacturing** 3 Units
Prerequisite(s): IE 320 or equivalent course in general introduction to manufacturing processes.
Description: This course is designed to provide an overview to additive manufacturing processes (a.k.a. 3D printing) to upper-level undergraduate students and graduate students, with a specific focus on the manufacturing aspects (e.g. process fundamentals, typical applications, general characteristics). An overview of the processes will be taught using lectures. Virtual tours, assignments and literature review-based learning will be used to develop in-depth knowledge in various specific characteristics and applications of additive manufacturing. For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 421. Facility Location and Layout** 3 Units
Term Typically Offered: Fall Only
Prerequisite(s): IE 240.
Description: Design and layout of industrial facilities, facility location, space requirements, flow charts, relationship diagrams, material handling, quantitative layout techniques, production line balancing, and computer programs for layout planning. Students cannot receive credit for both IE 421 and IE 621.
For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 425. Production and Inventory Control** 3 Units
Term Typically Offered: Spring Only
Prerequisite(s): IE 240 and IE 360.
Description: Topics include the context of inventory management and production planning decisions, economic order quantities, heuristics and models for probabilistic and time-varying demand patterns, coordinated replenishment systems, and aggregate planning.
Note: Students cannot receive credit for both IE 425 and IE 625.
Note: Cross-listed with IE 625.
- For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)
- IE 430. Quality Control** 3 Units
Term Typically Offered: Spring Only
Prerequisite(s): IE 360 and major in the IE department OR instructor permission.
Description: Developing an effective total quality control (TQC) system: integrating the quality development, maintenance, and improvement efforts of an organization; control charts, process capability, value engineering, product liability prevention, and computer control.
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IE 455. Supply Chain Engineering 3 Units**Prerequisite(s):** IE425.

Description: This course is designed to offer a balanced coverage on concept survey, analytics and modeling for operations and engineering in supply chain and logistics systems. Emphasis will be on analysis of strategic, tactical and operational supply chain problems including inventory decisions, revenue operations & modeling, distribution & network design, supply contracts and coordination among supply chain partners. Other related topics to be covered include various critical concepts and strategies such as risk pooling, information sharing, and the role of information systems in supply chain engineering.

Note: Students may not receive credit for both IE 455 and IE 655.

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IE 462. Predictive Analytics for Decision Making I 3 Units**Prerequisite(s):** IE 360 (Probability and Statistics) or similar course.

Description: This course will prepare students with various predictive analytics methods for manufacturing, healthcare, etc., which will be illustrated in examples. Different data types from real-world examples will be shown. Subsequently, it will be demonstrated how the predictive analytics methods can be used for better decision making. The methods will be implemented in non-programming based ? standard software such as Matlab, Excel, and Minitab.

Note: Students may not receive credit for both IE 462 and IE 662.

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IE 463. Predictive Analytics for Decision Making II 3 Units**Prerequisite(s):** IE 462 or IE 662 or similar; Experience with Python; IE 560 (Prob&Stats) or similar course.

Description: This course provides an introduction to several classical and state-of-the-art machine learning methods and their applications for engineers. Fundamentals of linear model and shallow neural networks, multilayer perceptrons, and deep neural networks will be covered. Modern convolutional neural networks (CNN, including AlexNet, NiN, GoogleNet, ResNet, DenseNet), recurrent neural networks (RNN, including GRU, LSTM, Bi-LSTM, Transformer), and optimization techniques will be discussed with engineering examples implemented in Python.

Note: Students cannot receive credit for both IE 463 and IE 663.

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IE 482. Quality of Care and Patient Safety 3 Units

Description: This course provides students an overview of the healthcare system and the different types of healthcare delivery, as well as factors that determine quality of care. This course also exposes students to tenets of patient safety from a human factors engineering perspective. Students will learn models of patient safety and incident analysis tools, including Root Cause Analysis (RCA) and Healthcare Failure Mode and Effects Analysis (HFMEA).

Note: Students cannot receive credit for both IE 482 and IE 682.

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IE 484. Health IT and Clinician Support 3 Units

Description: This course provides students an overview of various types of health information technology (IT) systems, as well as strategies, methods, and tools used to support the work and health of clinicians. This course also exposes students to applied tools and guidelines of the design and evaluation of health IT systems. Students will learn to use software to prototype high-fidelity, interactive user interfaces, and to conduct human factors evaluation on health IT systems based on the FDA guidelines. Documentation of such design and evaluation process will also be practiced with the semester project.

Note: Students cannot receive credit for both IE 484 and IE 684.

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IE 489. Industrial Engineering Cooperative Education III 1 Unit**Grading Basis:** Pass/Fail**Term Typically Offered:** Fall, Spring, Summer**Prerequisite(s):** IE 288 and IE 389.**Fee:** An additional \$300.00 is charged for this course.

Description: Full-time technical work experience related to the student's academic program.

Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

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IE 499. IE Capstone Design - CUE 3 Units**Term Typically Offered:** Fall, Spring**Prerequisite(s):** IE 380, IE 421, IE 425, IE 430, or Department Chair Permission.

Description: This course requires the solution of a real-world design problem in industrial engineering. It uses the design and analysis tools learned in previous coursework and emphasizes teamwork, documentation and presentation skills.

Course Attribute(s): CUE - This course fulfills the Culminating Undergraduate Experience (CUE) requirement for certain degree programs. CUE courses are advanced-level courses intended for majors with at least 90 earned credits/senior-level status., CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

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IE 515. Operations Research Methods 3 Units**Term Typically Offered:** Fall Only**Prerequisite(s):** ENGR 330 or MATH 325.

Description: Formulation and solution of basic models in operations research. Topics to be covered include applications of linear, integer and nonlinear programming; transportation and assignment problems, and network flows models.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

IE 516. Stochastic Operations Research Term Typically Offered: Spring Only Prerequisite(s): IE 360 or equivalent. Description: A selection of the probabilistic topics of operations research are included: queuing, renewal and Markov processes, simulation, decision analysis. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	IE 561. Developing Decision Support Systems with Excel Term Typically Offered: Fall, Spring Prerequisite(s): IE 250. Description: This course teaches the fundamentals of computer programming using Excel's macro language, Visual Basic for Applications (VBA), as the language of instruction. The course starts by teaching students to simplify and extend code generated by Excel's macro recorder and then builds on that base toward developing applications that analyze information and enhance decision making. This course also provides an introduction to the concepts and methods of Decision Science, which involves the application of mathematical modeling and analysis to management problems. It also provides a foundation for modeling with VBA in Excel. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
IE 525. Project Management Term Typically Offered: Fall, Spring, Summer Prerequisite(s): Admission in IE or EM program or instructor permission. Description: Use of CPM, PERT, precedence diagramming, resource allocation heuristics, and other techniques for planning, managing, and controlling engineering projects involving research and development, production, maintenance, and construction. Computer procedures and codes for analyzing complex project networks will be covered. Note: Cross-listed with EM 525. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	IE 563. Experimental Design in Engineering Term Typically Offered: Spring, Summer Prerequisite(s): IE 360. Description: Design of engineering experiments and projects using theory of least squares, analysis of variance, randomized blocks, factorial experiments, nested designs, split plot designs and logistic regression techniques. Covers a combination of analysis by hand and using Minitab statistical software. Note: Students may not obtain credit for both IE 563 and Me 611; or for IE 563 and EM 661. Note: Cross-listed with CSE 563. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
IE 540. Robots and Manufacturing Automation Term Typically Offered: Fall, Spring, Summer Prerequisite(s): IE 360. Description: Computer aided manufacturing; robot programming, implementation, application, and computer control; research trends; social impacts. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	IE 580. Introduction to Human Factors Engineering and Ergonomics Term Typically Offered: Fall Only Description: The main goal of this course is to introduce students to the study of human cognitive and physical abilities and limitations, and application of that knowledge to engineering design. This course will demonstrate how the application of the human factors and ergonomics principles can improve the design of systems involving the interaction of humans with tools, technology, and the work environment. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
IE 541. Simulation Term Typically Offered: Fall Only Prerequisite(s): IE 240, IE 250, and IE 360. Description: The use of discrete event simulation to analyze systems. Topics include Monte Carlo techniques, sampling from and identifying stochastic distributions, estimating performance measures from simulation outputs, validation methods, and SIMIO simulation language. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units	IE 581. Advanced Topics in Human Factors Engineering Term Typically Offered: Fall, Spring, Summer Prerequisite(s): IE 580. Description: The main goal of this course is to learn and apply advanced methods in human factors engineering, as well as newer models, theories, and frameworks related to the field. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units
IE 560. Probability and Statistics for Engineers Term Typically Offered: Fall, Spring, Summer Prerequisite(s): ENGR 102 OR (Calc I AND graduate status). Description: Engineering applications using probability, random variables, distribution functions, confidence intervals, estimation and hypothesis testing. Note: Students cannot receive credit for both IE 360 and IE 560. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)	3 Units		

IE 585. Usability Engineering 3 Units

Term Typically Offered: Spring Only

Description: This course exposes students to the constructs of usability, usefulness, user-centered design, and user-experience (UX) and their relation to engineering design. The course covers an interactive evaluation-centered user experience (UX) lifecycle as a template intended to be instantiated in many different ways to match the constraints of a particular development project. The UX lifecycle, sketching, conceptual design, and formative UX evaluation.

For class offerings for a specific term, refer to the Schedule of Classes (<http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm>)

IE 590. Special Topics in Industrial Engineering 1-6 Units

Term Typically Offered: Fall, Spring, Summer

Description: A theoretical and/or experimental investigation of an industrial engineering design topic.

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