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 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 3 Units
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)

IE 525. Project Management 3 Units
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)

IE 540. Robots and Manufacturing Automation 3 Units
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)

IE 541. Simulation 3 Units
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)

IE 560. Probability and Statistics for Engineers 3 Units
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)

IE 561. Developing Decision Support Systems with Excel 3 Units
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 Excels 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)

IE 563. Experimental Design in Engineering 3 Units
Term Typically Offered: Spring, Summer
Prerequisite(s): IE 360 OR IE 560.
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. Cross-listed with CSE 563.
Note: Students may not obtain credit for both IE 563 and ME 611; or for IE 563 and EM 661.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)
### IE 580. Introduction to Human Factors Engineering and Ergonomics

**Term Typically Offered:** Fall Only  
**Description:** The course introduces students to the field of human factors engineering, emphasizing the development of products and services that are appropriate and consistent with the needs of users. Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

**Prerequisite(s):** Admission to Graduate Study, Permission of Department Chair, and Permission of Director of Career Services.

**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.

**Grading Basis:** Pass/Fail

**Credit:** 1 Unit

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

### IE 581. Advanced Topics in Human Factors Engineering

**Term Typically Offered:** Fall, Spring, Summer  
**Description:** This course exposes students to the important topics in human factors and ergonomics, such as human-computer interaction, usability engineering, and human-systems integration. The course provides a comprehensive overview of the field, including theoretical foundations and practical applications.

**Prerequisite(s):** IE 580.

**Credit:** 3 Units

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

### IE 585. Usability Engineering

**Term Typically Offered:** Spring Only  
**Description:** This course introduces students to the field of usability engineering, including human factors, user-centered design, and user-experience (UX) design. The course covers theoretical foundations and practical applications, including methods for usability testing and design.

**Credit:** 3 Units

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

**Term Typically Offered:** Fall, Spring, Summer  
**Description:** A theoretical and/or experimental investigation of an industrial engineering design topic. The course covers advanced topics in industrial engineering, such as operations research, optimization, and systems engineering.

**Credit:** 1-6 Units

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

### IE 600. Additive Manufacturing Processes

**Term Typically Offered:** Fall Only  
**Prerequisite(s):** IE 320 or Graduate Standing  
**Description:** This course introduces students to the field of additive manufacturing, also known as rapid prototyping or 3D printing. The course provides an overview of all additive manufacturing processes and applications. Students will be assigned projects that require developing designs for additive manufacturing, with an emphasis on practical applications.

**Credit:** 3 Units

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

### IE 601. Additive Manufacturing Structure Design

**Term Typically Offered:** Fall Only  
**Description:** This course focuses on the overview of design issues in additive manufacturing (AM), covering the design of structures, materials and processes. Students will develop in-depth understanding of the design issues with current AM technologies. Hands-on projects will be assigned that gives the students the opportunity to understand the design issues and apply the knowledge to the design of functional parts and assemblies.

**Credit:** 3 Units

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

### IE 602. Graduate Internship in Industrial Engineering

**Term Typically Offered:** Fall Only  
**Description:** This course provides the structure and focus for the supervised professional experience in industry at the graduate level. This course provides the structure and focus for the supervised professional experience in industry at the graduate level. The course includes a community-based learning (CBL) component, where students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

**Grading Basis:** Pass/Fail

**Credit:** 1 Unit

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

### IE 610. Foundations of Optimization I

**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** IE 515.  
**Description:** Formulation and solution of applicable optimization models for linear, integer, and network problems. Efficient algorithmic methods and use of computer modeling languages and systems.

**Credit:** 3 Units

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

### IE 611. Discrete Optimization

**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** IE 515.  
**Description:** A study of the techniques and applications of discrete optimization, especially as related to integer and dynamic programming.

**Credit:** 3 Units

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

### IE 614. Foundations of Optimization II

**Term Typically Offered:** Fall, Spring, Summer  
**Prerequisite(s):** ENGR 330 and IE 610.  
**Description:** Formulation and solution of applicable optimization models for nonlinear, stochastic programming, robust optimization and convex problems. Efficient algorithmic methods and use of computer modeling languages and systems.

**Credit:** 3 Units

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)
IE 615. Exact and Heuristic Algorithms for Optimization 3 Units

Term Typically Offered: Fall Odd Years

Prerequisite(s): IE 240 and IE 360.

Description: This course is a survey of the most common search methods for optimization problems. We will focus on exact methods (including: Exhaustive Search, Branch and Bound, Column Generation, Decomposition methods), and on heuristic methods (including, Random search, Greedy Search, Local Search, Simulated Annealing (SA), Greedy Randomized Adaptive Search (GRASP), Genetic Algorithms (GA)). Both combinatorial and continuous optimization problems will be considered, with emphasis on combinatorics.

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

IE 621. 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 requirement, flow charts, relationships diagrams, material handling, quantitative layout techniques, production line balancing, and computer programs for layout planning.

Note: Cross-listed with IE 421.

Note: Students cannot receive credit for both IE 621 and IE 421.

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

IE 625. 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: Cross-listed with IE 425.

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

IE 629. Quality Control 3 Units

Term Typically Offered: Spring Only

Prerequisite(s): IE 240 and IE 360.

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.

Note: Cross-listed with IE 430.

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

IE 630. Advanced Production Systems Design 3 Units

Prerequisite(s): IE 421, IE 425, IE 430.

Description: This course is organized around the principles of Lean Manufacturing Engineering. Topics include lean manufacturing, including value, value stream, flow, pull and continuous improvement. Improvement and efficiency are facilitated through a study of factory dynamics, the influence of variability, and "Push and Pull" production systems.

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

IE 631. Advanced Quality Control 3 Units

Description: Advanced techniques for quality improvement and process control are investigated; these include advanced techniques of SPC, trouble shooting and diagnostics and Taguchi methods of experimental design.

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

IE 634. Case Studies in Production and Industrial Engineering 3 Units

Prerequisite(s): IE 425, IE 515, IE 541.

Description: Case studies illustrate the application of industrial engineering techniques to the design of production systems, the control of construction projects, and health care delivery systems.

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

IE 640. Applied Systems Analysis 3 Units

Prerequisite(s): IE 360, IE 370, IE 515.

Description: Problem formulation, data collection, alternative design generation, design evaluation, specification, and implementation for large scale systems.

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

IE 642. Statistical Methodology in Simulation 3 Units

Prerequisite(s): IE 360 and IE 541.

Description: Discrete simulation modeling, input probability distributions, random variate generators, output data analysis, validation, variance reduction, experimental design and optimization.

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

IE 643. Analysis for Decision Making 3 Units

Prerequisite(s): IE 360 and IE 515.

Description: The role of decision analysis in design; techniques for multicriteria decision analysis; systematic creativity in design.

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

IE 650. Material Flow Systems Design 3 Units

Prerequisite(s): IE 515.

Description: Material handling and equipment concepts; computerized plant layout; problem formulation; requirements definition; queuing; location analysis; conveyor theory; simulation; developing and evaluating alternative systems; systems implementation.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)
IE 655. Supply Chain Engineering  3 Units
Term Typically Offered: Fall Only
Prerequisite(s): IE 425 or IE 625.
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 cannot receive credit for both IE 655 and IE 455.

For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 657. Models for Design and Analysis of Logistical Systems  3 Units
Prerequisite(s): IE 425, IE 515.
Description: This modeling oriented course for the design, analysis
and operation of logistical systems includes topics such as inventory
control, transportation, distribution network design, and supply chain
management. Both deterministic as well as stochastic models are studied.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 660. Reliability and Maintainability  3 Units
Prerequisite(s): IE 360.
Description: Design, development, and test techniques required to assure
the reliability and maintainability of new systems. Design of maintenance
programs for new and existing systems.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 662. Predictive Analytics for Decision Making  3 Units
Term Typically Offered: Fall Only
Prerequisite(s): IE 560 (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 software such as
Matlab, Excel, and Minitab.
Note: Students cannot receive credit for both IE 662 and IE 462.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 670. Advanced Engineering Economy  3 Units
Prerequisite(s): IE 370.
Description: Inflation; cost of capital; revenue requirements; uncertainty
and risk; propagation of errors; Hillier's results; simulation; capital
budgeting.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 662. Quality of Care and Patient Safety  3 Units
Term Typically Offered: Fall Only
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 682 and IE 482.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 690. Master of Science Thesis in Industrial Engineering  1-6 Units
Grading Basis: Pass/Fail
Prerequisite(s): Department Chair permission required.
Description: Research on MS thesis project. Grade shall be deferred
by the major professor until evaluation of the thesis by the student's
committee. Grade on pass-fail basis by the examining committee.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 693. Independent Study in Industrial Engineering  1-12 Units
Description: Opportunity for the student, under the supervision of a
sponsoring faculty member, to pursue individualized study related
to research or practice that is not included in regular courses in the
curriculum.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 694. Advanced Topics in IE  1-6 Units
Prerequisite(s): Consent of instructor.
Description: An advanced course in Industrial Engineering topics not
covered by regularly scheduled courses.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
setupSearchClassSchedule.cfm)

IE 697. MEng Thesis in Industrial Engineering  1-8 Units
Description: A candidate for the Master of Engineering degree,
specializing in the field of industrial engineering, is required to perform
a study, design, or investigation under the direction of a faculty member.
A written thesis is required to be presented orally and submitted to the
faculty for approval.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
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IE 699. Industrial Engineering Master's Degree Project  3 Units
Prerequisite(s): Instructor permission required.
Description: The Industrial Engineering MEng or MS student carries out
an engineering project under the supervision of a faculty mentor, prepares
an acceptable written report, and presents a seminar on the project.
Note: Cross-listed with EM 699.
For class offerings for a specific term, refer to the Schedule
of Classes (http://htmlaccess.louisville.edu/classSchedule/
setupSearchClassSchedule.cfm)
IE 700. Dissertation Research in Industrial Engineering 1-18 Units

Grading Basis: Pass/Fail

Prerequisite(s): Department Chair permission required.

Description: Research on dissertation project. Grade will be deferred by the major professor until evaluation of the dissertation by the student's committee. Graded on a Pass/Fail basis by the examining committee.

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