



**ISE 361. Decision Support Systems**
**3 Units**
**Term Typically Offered:** Spring Only

**Prerequisite(s):** ISE 250.

**Description:** This course introduces students to optimization problems, algorithm design, and problem-solving techniques. The course focuses on developing pseudocode and practical algorithmic solutions for real-world decision problems, such as traveling salesman, bin packing, and knapsack problems. Students will explore how to address optimization challenges by analyzing the search space, identifying feasible solutions, and applying criteria for optimality, with clear, non-mathematical explanations. We will focus on Local Search, Carousel Greedy, Randomized Adaptive Search (GRASP), Genetic Algorithms (GA). The course also covers the fundamentals of coding languages, specifically Python, to support the implementation of algorithms.

**Note:** Students may NOT receive credit for both ISE 361 and ISE 561.

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

**ISE 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>)

**ISE 380. Work and Systems Design**
**3 Units**
**Term Typically Offered:** Fall Only

**Description:** Overview of work and systems design and its significance for the industrial engineering profession. Engineering principles of work measurement, analysis and design. Methods engineering and time study. Techniques for assessing worker performance and incorporating allowances for various work conditions. Predetermined time systems: MTMs and MOST. Work sampling and standards. Design principles to improve productivity and ergonomics. Human mechanical constraints and capabilities in the workplace. Systematic approaches to managing workplace safety. Methods to identify and mitigate system hazards in the workplace.

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**ISE 389. Industrial Engineering Cooperative Education II**
**1 Unit**
**Grading Basis:** Pass/Fail

**Term Typically Offered:** Fall, Spring, Summer

**Prerequisite(s):** ISE 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.

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**ISE 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>)

**ISE 400. Additive Manufacturing Processes**
**3 Units**
**Term Typically Offered:** Fall Only

**Prerequisite(s):** ISE 240 or permission from the instructor.

**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.

**Note:** Students cannot receive credit for both ISE 400 and ISE 600.

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

**ISE 419. Digital and Advanced Manufacturing Systems**
**3 Units**
**Term Typically Offered:** Fall Only

**Prerequisite(s):** ISE 320, ISE 360 or equivalent course related to general manufacturing process principles, or instructor approval.

**Description:** This course deals with some of the contemporary aspects of digital manufacturing and industry 4.0 manufacturing systems, which is highly disciplinary and of great interest to today's manufacturing industries. In particular, the course focuses on the fusion between manufacturing technologies and systems, smart manufacturing hardware, and data science. A range of topics including manufacturing sciences/engineering, industrial automation control, product conceptualization and prototyping, smart manufacturing, data analytics and quality modeling. While the discussions into most of these topics will be relatively brief, the emphasis is to establish a perspective of the relationships and interplay of the different areas in digital manufacturing. Throughout the course, 4-5 labs/projects are anticipated. In addition, assignments such as individual homework will be employed as additional learning tools for necessary knowledge for solving manufacturing-related engineering problems.

**Note:** Students may not receive credit for both ISE 419 and ISE 619.

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

**ISE 421. Facility Location and Layout**
**3 Units**
**Term Typically Offered:** Fall Only

**Prerequisite(s):** ISE 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:** Students cannot receive credit for both ISE 621 and ISE 421.

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

**ISE 425. Production and Inventory Systems****3 Units****Term Typically Offered:** Spring Only**Prerequisite(s):** ISE 240 and ISE 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 ISE 425 and ISE 625.

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

**ISE 430. Quality Control****3 Units****Term Typically Offered:** Spring Only**Prerequisite(s):** ISE 360 and major in the ISE 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.

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

**ISE 445. Systems Simulation****3 Units****Term Typically Offered:** Spring Only**Prerequisite(s):** ISE 360 and Undergraduate standing in the JB Speed School of Engineering.**Description:** The goal of this course is to give the student a basic working knowledge of the concepts of simulation modeling and analysis, especially as applied in the design and operation of both manufacturing-oriented and service-oriented systems. Following this course, students should be able to build and experiment with simulation models of manufacturing/service systems and interpret the output of these models as an aid in the design and operation of these systems**Note:** Students may not receive credit for both ISE 445 and ISE 645.

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**ISE 446. Operations Research Methods****3 Units****Term Typically Offered:** Fall Only**Prerequisite(s):** ENGR 307 or MATH 407, and undergraduate standing in the JB Speed School of Engineering.**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.**Note:** Students may not receive credit for both ISE 445 and ISE 645.

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

**ISE 455. Supply Chain Engineering****3 Units****Term Typically Offered:** Fall Only**Prerequisite(s):** ISE 425 and Undergraduate standing in the JB Speed School of Engineering.**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 ISE 455 and ISE 655.

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**ISE 462. Predictive Analytics for Decision Making I****3 Units****Term Typically Offered:** Occasionally Offered**Prerequisite(s):** ISE 360 and Undergraduate standing in the JB Speed School of Engineering.**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 ISE 462 and S662.

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**ISE 463. Predictive Analytics for Decision Making II****3 Units****Prerequisite(s):** ISE 462 or ISE 662 or similar; Experience with Python; ISE 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 ISE 463 and ISE 663.

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**ISE 464. Experimental Design in Engineering****3 Units****Term Typically Offered:** Spring Only**Prerequisite(s):** ISE 360 and Undergraduate standing in the JB Speed School of Engineering.**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 only receive credit for one of the following: ISE 464, ISE 664, ME 611, and EM 661.

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**ISE 469. Introduction to Human Factors Engineering and Ergonomics****3 Units****Term Typically Offered:** Fall Only**Prerequisite(s):** Undergraduate standing in the JB Speed School of Engineering.**Description:** Human factors engineering is the study of human cognitive and physical abilities and limitations, and applying that knowledge to engineering design. "Ergonomics" typically relates to physical abilities and limitations. This course will provide a broad coverage of human factors and ergonomics and show how the application of human factors and ergonomics principles can improve the design of systems involving the interaction of humans with technology.**Note:** Students may not receive credit for both ISE 469 and ISE 669.

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**ISE 471. Advanced Topics in Human Factors Engineering****3 Units****Term Typically Offered:** Spring Only**Prerequisite(s):** ISE 469.**Description:** Human factors engineering is the study of human cognitive and physical abilities and limitations, and applying that knowledge to engineering design. 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. This course is restricted to students admitted to the J.B. Speed School of Engineering.**Note:** Students may not receive credit for both ISE 471 and ISE 671.

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

**ISE 475. Usability Engineering****3 Units****Term Typically Offered:** Spring Only**Prerequisite(s):** Undergraduate standing in the JB Speed School of Engineering.**Description:** Although the title of this course is 'Usability Engineering', the traditional concept of usability is expanded to a broader notion of user experience, including usability, usefulness, and emotional impact. The course will present an iterative evaluation-centered user experience (UX) lifecycle as a lifecycle template intended to be instantiated in many different ways to match the constraints of a particular development project. The UX lifecycle activities we will cover include contextual inquiry and analysis, requirements extraction, design-informing models, design thinking, ideation, sketching, conceptual design, and formative UX evaluation. It is a goal of this course to help students realize that UX engineering is an ongoing process throughout the full product life cycle, and developing the human-computer interface is not something to be done at the last minute, when the "rest of the system" is finished.**Note:** Students may not receive credit for both ISE 475 and ISE 675.

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**ISE 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 ISE 482 and ISE 682.

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

**ISE 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 ISE 484 and ISE 684.

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<p><b>ISE 489. Industrial Engineering Cooperative Education III</b> <b>1 Unit</b></p> <p><b>Grading Basis:</b> Pass/Fail</p> <p><b>Term Typically Offered:</b> Fall, Spring, Summer</p> <p><b>Prerequisite(s):</b> ISE 288 and ISE 389.</p> <p><b>Fee:</b> An additional \$300.00 is charged for this course.</p> <p><b>Description:</b> Full-time technical work experience related to the student's academic program.</p> <p><b>Course Attribute(s):</b> 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.</p>	<p><b>ISE 540. Robots and Manufacturing Automation</b> <b>3 Units</b></p> <p><b>Term Typically Offered:</b> Fall, Spring, Summer</p> <p><b>Prerequisite(s):</b> ISE 360.</p> <p><b>Description:</b> Computer aided manufacturing; robot programming, implementation, application, and computer control; research trends; social impacts.</p> <p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p> <p><b>ISE 499. ISE Capstone Design - CUE</b> <b>3 Units</b></p> <p><b>Term Typically Offered:</b> Spring Only</p> <p><b>Prerequisite(s):</b> ISE 380, ISE 421, ISE 425, or Department Chair Permission.</p> <p><b>Description:</b> 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.</p> <p><b>Course Attribute(s):</b> 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.</p>	<p><b>ISE 560. Probability and Statistics for Engineers</b> <b>3 Units</b></p> <p><b>Term Typically Offered:</b> Fall, Spring, Summer</p> <p><b>Prerequisite(s):</b> ENGR 102 OR (Calculus I AND graduate status).</p> <p><b>Description:</b> Engineering applications using probability, random variables, distribution functions, confidence intervals, estimation and hypothesis testing.</p> <p><b>Note:</b> Students cannot receive credit for both ISE 360 and ISE 560.</p> <p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p> <p><b>ISE 516. Stochastic Operations Research</b> <b>3 Units</b></p> <p><b>Term Typically Offered:</b> Spring Only</p> <p><b>Prerequisite(s):</b> ISE 360 or equivalent.</p> <p><b>Description:</b> A selection of the probabilistic topics of operations research are included: queuing, renewal and Markov processes, simulation, decision analysis.</p> <p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>	<p><b>ISE 561. Decision Support Systems</b> <b>3 Units</b></p> <p><b>Term Typically Offered:</b> Spring Only</p> <p><b>Prerequisite(s):</b> Graduate Standing in the JB Speed School of Engineering.</p> <p><b>Description:</b> This course introduces students to optimization problems, algorithm design, and problem-solving techniques. The course focuses on developing pseudocode and practical algorithmic solutions for real-world decision problems, such as traveling salesman, bin packing, and knapsack problems. Students will explore how to address optimization challenges by analyzing the search space, identifying feasible solutions, and applying criteria for optimality, with clear, non-mathematical explanations. We will focus on Local Search, Carousel Greedy, Randomized Adaptive Search (GRASP), Genetic Algorithms (GA). The course also covers the fundamentals of coding languages, specifically Python, to support the implementation of algorithms.</p> <p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
<p><b>ISE 525. Project Management</b> <b>3 Units</b></p> <p><b>Term Typically Offered:</b> Fall, Spring, Summer</p> <p><b>Prerequisite(s):</b> Admission in ISE or EM program or instructor permission.</p> <p><b>Description:</b> 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.</p> <p><b>Note:</b> Cross-listed with EM 525.</p>	<p><b>ISE 590. Special Topics in Industrial Engineering</b> <b>1-6 Units</b></p> <p><b>Term Typically Offered:</b> Fall, Spring, Summer</p> <p><b>Description:</b> A theoretical and/or experimental investigation of an industrial engineering design topic.</p> <p>For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</p>
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