### Industrial Engineering

**IE 598  Special Topics**  credit: 1 TO 4 hours.

Subject offerings of new and developing areas of knowledge in industrial engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. Approved for letter and S/U grading. May be repeated in the same or separate terms if topics vary.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>66173</td>
<td>Lecture</td>
<td>ET</td>
<td>06:00 PM - 09:00 PM</td>
<td>R</td>
<td>A - Illini Center</td>
<td>Lane, M</td>
</tr>
<tr>
<td>67121</td>
<td>Lecture</td>
<td>JS2</td>
<td>09:30 AM - 10:50 AM</td>
<td>TR</td>
<td>106B3 - Engineering Hall</td>
<td>Sirignano, J</td>
</tr>
<tr>
<td>67120</td>
<td>Lecture</td>
<td>KC</td>
<td>11:00 AM - 12:20 PM</td>
<td>TR</td>
<td>105 - Talbot Laboratory</td>
<td>Chandrasekaran, K</td>
</tr>
<tr>
<td>60582</td>
<td>Lecture</td>
<td>LM</td>
<td>08:00 AM - 09:20 AM</td>
<td>TR</td>
<td>1103 - Siebel Center for Comp Sci</td>
<td>Marla, L</td>
</tr>
</tbody>
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**Credit Hours: 4 hours**

Electronic Trading
Restricted to MS: Financial Engineering.
Prerequisites: IE 522 and IE 523. The purpose of this course is to investigate the exact nature of order matching and routing at the compute-packet level in most exchanges. Not knowing the nature the interfaces has led to many "good fit" predictive models. However, they are often, predicting the past! Analyses need to adjust for speed and time-stamps. The course will address these issues. However, it should be stressed that the course does not purport nor intend to examine nor propose "trading strategies."

**Credit Hours: 4 hours**
Deep Learning II
Instructor Approval Required
Restricted to Graduate - Urbana-Champaign.
Prerequisites: IE 598 Deep Learning or equivalent. Students should contact the instructor, Justin Sirignano (jasirign@illinois.edu), if interested in enrolling in this course. This is a project course. Students will work in small teams on deep learning applications in (1) reinforcement learning, (2) image recognition, or (3) high-frequency models of financial markets. The course will provide an introduction to distributed training of neural networks and Distributed TensorFlow. GPU hours will be provided to the class.

**Credit Hours: 4 hours**
Combinatorial Optimization
Restricted to Graduate - Urbana-Champaign.
Prerequisites: Working knowledge in Linear Programming, Graph Theory, Linear Algebra. This course will cover a series of topics in combinatorial optimization. The emphasis will be on polyhedral theory and structural results. Specific topics to be covered include: Matchings, b-matchings, T-joins, Branchings, Matroids, Matroid Intersections, Polymatroids, Submodular Functions, Directed Cuts, Multi-flows.

**Credit Hours: 4 hours**
Large-scale Ntwrk Optimization
Restricted to Graduate - Urbana-Champaign.
Prerequisites: Knowledge in linear programming duality is required. Description: Shortest paths on acyclic networks, labeling algorithms; Generalized shortest paths and labeling algorithms; Multi-commodity flows (and differences from the minimum-cost network flow problem), branch-and-price and cut; Lagrangean relaxation, formulations and solution techniques; Airline Schedule Planning models – Set-covering and set-partitioning problem formulations; composite variable modeling (Case studies on Crew Scheduling and Airline Fleet Assignment); Combining multiple multi-commodity flow formulations; Data-driven Modeling, Simulation-optimization frameworks (Case study: Ambulance Allocation); Large-Scale neighborhood search (Case study: Vehicle routing...
and metaheuristics); Stochastic modeling in large-scale integer programs (Case study: Stochastic Crew Scheduling); Robust Optimization for integer programs; Operational Learning (Case study: Big Data Newsvendor problem). The course will present the concepts through real-world case-studies drawn from airline schedule planning, freight and last-mile logistics, emergency systems, vehicle routing and newsvendor problems.

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<th>Time</th>
<th>Instructor</th>
<th>Location</th>
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<tbody>
<tr>
<td>67114</td>
<td>Lecture</td>
<td>NH</td>
<td>04:00 PM - 05:20 PM</td>
<td>MW</td>
<td>203 - Transportation Building</td>
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Credit Hours: 4 hours
Big Data Optimization
Restricted to students in the Industrial & Enterprise Sys Eng department.
Restricted to Graduate - Urbana-Champaign.
Students are expected to have strong working knowledge of linear algebra, real analysis, and probability theory. Some prior exposure to optimization and algorithms at a graduate level is preferred. The course will cover a variety of advanced topics in optimization theory, algorithms and applications in machine learning. The key aim of this course is to expose students to modern algorithmic developments in convex optimization (smooth, non-smooth, deterministic, stochastic, and online) and bring them near the frontier of current research in large-scale optimization and machine learning.

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<tr>
<td>64238</td>
<td>Lecture - Discussion</td>
<td>XCD</td>
<td>05:00 PM - 06:20 PM</td>
<td>TR</td>
<td>204 - Transportation Building</td>
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Credit Hours: 4 hours
Dynamic Optimization
Restricted to Graduate - Urbana-Champaign.
Prerequisites: IE 411, IE 410 or equivalent courses on stochastic processes and deterministic optimization. The course covers the basic modeling and solution techniques for sequential decision making problems under uncertainty including dynamic programming and stochastic programming modeling, theory, algorithms and approximations. Applications are drawn from economics, finance, operations management and engineering.