Industrial and Systems Engineering Master of Science Program
Supply Chain Management and Production Systems

Department of Integrated Systems Engineering
The Ohio State University

The supply chain is the network of resources, people and activities that take part in the manufacture and delivery of a service or product. It includes the purchasing and shipping of raw materials, intermediate storage, production and distribution of finished and partially-finished goods. Supply Chain Management designs, controls, and maintains the effective and efficient flow of resources, service, manufactured goods, personnel, and information. This scientific field is important for organizations to effectively compete in the global market place. It is also valuable for managing government projects, military operations, and humanitarian relief efforts.

In the next ten years, the US Bureau of Labor and Statistics estimates that employment in this area will increase by over 20%. Consequently, the prospect of having a satisfying and fulfilling career in this area is bright.

The Industrial Engineer typically focuses on certain aspects of the supply chain. These include:
- Transportation of raw materials to the manufacturer.
- Handling and storage of raw materials.
- Production and storage of goods.
  - Scheduling and control of jobs and activities.
  - Management of the labor force.
- Warehousing of finished goods.
- Delivery of product to the customer.
- Design of various portions of the supply chain that include raw material and distribution networks, production and warehouse facilities.
- Design and control of information flow.

Each of these areas requires specialized methods for developing and creating effective and efficient solutions, which are usually based on mathematical theories and methods. The faculty and students in ISE are involved in research and application of most of these areas. The ISE Master's Program in Supply Chain Management and Production Systems is designed to provide students with a strong background in optimization methods and knowledge of the entire supply chain. Additional electives are also recommended in Business, Computer Science Engineering, Industrial Engineering, and Statistics.

Admission Requirements. Prior to admission, students interested in admission to this Masters Program should be proficient in the following areas[1]:

Vector calculus   Computer programming (e.g., C, C++, Java)
Calculus-based probability   Probability-based statistics
Linear algebra

Graduation Requirements. All Analytics Graduate Students must satisfy degree requirements defined in the Industrial and Systems Engineering Graduate Student Handbook (www.ise.osu.edu/docpdf/ISEGradHandbook.pdf).

To complete the ISE Master's Program in Supply Chain Management and Production Systems, students must complete a minimum of 33 graduate credit hours. The course work consists of:

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[1] Students without evidence of this material on their transcripts will have to demonstrate proficiency with the subject matter. This can be accomplished via appropriate coursework, at either the undergraduate or graduate level, to be determined in consultation with the academic advisor.

- 18 semester hours of ISE Optimization courses, 6 semester hours of Supply Chain Management courses, and 3 semester hours of Accounting/Finance.
- 2 semester hours of ISE 7883 (Department Seminar)
- 1 5000-level or higher ISE course in manufacturing or human factors in order to meet the ISE secondary sub-discipline breadth requirement.
- 4 hours for a statistics course in regression analysis.
- At least one elective course from the recommended list of elective courses in Optimization, Supply Chain Management, and Statistics.
- A project, exam or Masters thesis designed to meet the exit requirements of the ISE MS Program:
  1. M.S. students must meet the exit requirement by satisfying at least one of the following:
     a) Writing a Master's thesis.
     b) Earning a B+ or higher in a 6000 or higher level elective course that is at least 2 units and has a project requirement[2].
     c) Passing the M.S. Exit Examination.
  2. The M.S. Exit Examination is administered annually during the week after Spring final examinations have been completed. Any ISE graduate student who achieves an overall GPA (including all graduate courses taken at OSU) of 3.00 is eligible to take the exam. Those students who are planning to graduate in Fall should take the exam the preceding Spring semester. The process to sign-up for the exam will be announced during Spring semester. Students intending to take the exam must sign-up before the announced deadline, so there is sufficient time to check that the grade eligibility requirement is satisfied.
     - The intent of the exam is to verify that students are sufficiently well grounded in the "fundamentals of OR." For example, the exam might cover the following topics:
       Optimization: Integer and Linear Programming Formulations and Solution Methods; Linear Programming Theory and Duality; Complexity Theory; Convexity
       Stochastic Processes: Random Variables; Probability Distributions; Conditional Probability and Expectations; Random Number Generation; Simulation Theory
       Statistics: Parametric and Non-Parametric Hypothesis Testing; Distribution Fitting; Regression
- After the exams have been completed, the OR Faculty meets to discuss each student's performance on the exam and performance in classes taken. Based on this, the faculty determine whether each student has "passed" or "failed" the examination.

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[2] The elective course can be any course from the "Recommended Elective Courses" or "Other Candidate Elective Courses" that has a project requirement. Students should check with the advisory committee and instructor to identify a suitable elective course that has a project.

- A student, who has failed the examination, may be deemed eligible to retake it. Students who are deemed eligible to retake the exam must do so the next time that it is offered. No student will be eligible to take the exam more than twice.

The following course requirements focusing on logistics and supply chain optimization.

Required Courses (18 credit hours)
- ISE 5110 Design of Engineering Experiments (3)
- ISE 5200 Linear Optimization (3)
- ISE 7250 Operations Research Models and Methods (3)
- ISE 6300 Performance Modeling and Simulation (3)
- 2 semester hours of ISE 7883 (Department Seminar) (1 credit per offering)
- Stat 6450 Applied Regression Analysis (4)

Courses in Supply Chain Management (6 credit hours from the following list)
- ISE 5410 Quantitative Models in Production and Distribution Logistics (3)
- ISE 5430 Warehouse and Facility Design (3)
- ISE 5450 Industrial Ecology (3)
- ISE 5810 Lean Sigma Foundations (4)
- ISE 7120 - Advanced Quality Control and Improvement (3)

ISE Secondary Sub-Discipline Breadth Requirement (3 credit hours from the following list)
- ISE 5682 Fundamentals of Product Design Engineering (4)
- ISE 5600 Principles of Occupational Biomechanics and Industrial Ergonomics (3)
- ISE 5700 Cognitive Systems Engineering (3)
- Advanced course in human systems integration or manufacturing (with permission of Graduate Studies Committee)

Finance/Accounting Requirement (3 credit hours)
- ACCTMIS 5000 Accounting & Cost Analysis or equivalent course (3)

Additional Electives (minimum 3 credit hours from the following list)
- Elective Logistics and Supply Chain Optimization Courses:
  - ISE
        ISE 5220 Complementarity Theory & Applications (3)

ISE 5350 Probabilistic Models and Methods in Operations Research (3)
ISE 5410 Quantitative Models in Production and Distribution Logistics (3)
ISE 5830 Decision Analysis (3)
ISE 5840 Market Engineering and Applications (3)
ISE 6290 Stochastic Optimization (3)
ISE 6210 Integer Optimization (3)
ISE 7200 Advanced Nonlinear Optimization (3)
ISE 7100 Advanced Simulation (3)
ISE 7210 Large Scale Optimization (3)
ISE 5760 Visual Analytics and Sense Making (3) (Prerequisite: ISE 5700)

- CSE (some of these courses may have prerequisites)
CSE 5241 Introduction to Database Systems (3)
CSE 5441 Introduction to Parallel Computing (3)
CSE 5523 Machine Learning and Statistical Pattern Recognition (3)
CSE 5321 Foundations I: Discrete Structures (2)

- STAT (some of these courses may have prerequisites)
Stat 6201 Mathematical Statistics (4)
Stat 6730 Introduction to Computational Statistics (2)
Stat 6550 Statistical Analysis of Time Series (2)
Stat 6560 Applied Multivariate Analysis (3)
Stat 6740 Data Management and Graphics for Statistical Analyses (3)

- Business (Fisher)
BUSMGT 7223 Project Management (3)