

## **Industrial Engineering – Graduate Courses**

The following shows four recommended areas of emphasis that are designed to guide IE graduate students to take courses.

- (1) Systems optimization
- (2) Manufacturing engineering design
- (3) Enterprise and production control
- (4) Quality engineering

Core courses that need to be taken by all students in the MS in IE program

### **IME 465 DESIGN AND CONTROL OF QUALITY SYSTEMS.**

(Same as STAT 488). Quality design by experimental design, determination of process capability, quality control using statistical control charts, acceptance sampling. Prerequisite: 365 or STAT 380 or consent of instructor.

### **IME 483 PRODUCTION PLANNING AND CONTROL.**

(2 hours lecture, 2 hours laboratory). Development and applications of models and techniques for designing integrated production systems to manage material, service, and information flows in response to fluctuating market demands. Prerequisites: senior standing in industrial or manufacturing engineering or consent of instructor.

### **IME 515 ENGINEERING OPTIMIZATION MODELS.**

Linear and nonlinear optimization models for IME applications. Principles of engineering optimization: modeling, formulation, solution and verification. A taxonomy of optimization problems and solution methods. Convex sets, convex functions and convex optimization. Duality. Unconstrained and Constrained optimization. Computational complexity and NP-completeness. Applications to engineering design.

### **IME 576 ADVANCED COMPUTER INTEGRATED MANUFACTURING SYSTEMS.**

Advanced topics in system integration, optimization, data collection, device monitoring, and software development for automated systems. Prerequisites: 476 or consent of instructor.

## **Recommended courses for core areas of emphasis**

### **(1) Systems optimization**

#### **IME 531 ENGINEERING PROJECT MANAGEMENT.**

Applying industrial and manufacturing engineering skills to industry-based team-oriented problems involving cost estimating, planning, scheduling, and implementation using advanced techniques such as CPM, PERT, GERT, etc. Student learn project management skills and experience in managing and executing a group project. Prerequisite: Graduate standing

#### **IME 568 ADVANCED COMPUTER SIMULATION.**

Advanced techniques of computer simulation and their applications to real-world projects for production, manufacturing, and service industries, discrete-event and continuous simulation, simulation optimization, output analyses. Prerequisite: 468 or equivalent or consent of instructor

**IME 583 SUPPLY CHAIN LOGISTICS SYSTEMS.**

Design and management of integrated production systems based on modern perspectives pertaining to the strategic role of the supply chain logistics to enterprise-wide performance measurement and analysis involving distribution planning, vehicle routing, demand management, replenishment management and real-time control issues. Prerequisites: 483 or equivalent or consent of instructor.

**IME 527 INTELLIGENT ENGINEERING SYSTEMS.**

(Same as CE 597, ECE 587, and ME 587) Designing intelligent systems solving complex engineering problems through implementing knowledge-based systems using a hybrid architecture comprising expert systems, artificial neural networks, and optimization approaches. Prerequisite: 427 or equivalent or consent of instructor.

**IME 530 MANAGING ENGINEERING AND TECHNOLOGY.**

(Same as CE 595) Management functions of planning, organizing, motivating and controlling, and analysis of application of these functions in engineering research, design, production, technical marketing, and project management.

**IME 595 SPECIAL PROJECTS.**

Independent study in focus area. May be used as a paper for MS degree in IE. Prerequisite: consent of research adviser.

**IME 599 THESIS.**

Directed research to satisfy thesis requirement. May be repeated to a maximum of 6 hours. Prerequisite: written consent of thesis adviser.

**(2) Manufacturing engineering design****IME 437 NUMERICAL CONTROL OF MANUFACTURING PROCESSES.**

Fundamental theory and application of computer numerical controlled machine tools from the viewpoint of design principles, machine structural elements, control systems, and programming. Projects include manual and computer assisted part programming and machining.

**IME 482 MANUFACTURING ENGINEERING DESIGN.**

Topics include tolerancing, material selection, cost estimation, process planning, product fabrication, and the activities required to bring a product from conceptual design through manufacture. Prerequisites: 345 (or concurrent and 370 or consent of instructor).

**IME 557 VALUE ENGINEERING.**

Introduction and application of effective and practical techniques to improve the overall performance and outcome of design projects in various industries—highlighting the application of value methodology to streamline current day operations, lean production management, strategic planning, and everyday business decisions in the private sector. Prerequisites: 451, 470 or their equivalents or consent of instructor.

**IME 570 ASSEMBLY ENGINEERING.**

Covers topics including statistical and traditional tolerancing methods, cost/tolerance relationships, design for assembly, part count reduction techniques, assembly tooling, and inspection for assembly components. Prerequisites: 482 or consent of instructor.

**IME 575 ADVANCED CAD/CAM/CAE.**

Advanced techniques of CAD/CAM/CAE and their applications to real-world projects, introduction to other state-of-art information technologies used for product lifecycle management. Prerequisite: 475 or consent of instructor

**IME 576 ADVANCED COMPUTER INTEGRATED MANUFACTURING SYSTEMS.**

Advanced topics in system integration, optimization, data collection, device monitoring, and software development for automated systems. Prerequisites: 476 or consent of instructor.

**IME 577 ADVANCED ENGINEERING MATERIALS.**

Examination of engineering materials with emphasis on selection, application, fabrication, and testing of materials in industrial applications. Prerequisite: 370 or consent of instructor.

**+IME 584 DESIGN AND EVALUATION OF MATERIAL HANDLING SYSTEMS.**

Material handling and Automatic Storage & Retrieval systems. Vehicle alternatives, sorting systems and distribution. Warehousing, order picking, pallet storage and retrieval, receiving and supply, bar coding, benchmarking, case picking, slotting, radio frequency, cross docking, work measurement, warehouse layout,. Case studies of various progressive material handling systems and warehouses.

**IME 595 SPECIAL PROJECTS.**

Independent study in focus area. May be used as a paper for MS degree in IE. Prerequisite: consent of research adviser.

**IME 599 THESIS.**

Directed research to satisfy thesis requirement. May be repeated to a maximum of 6 hours. Prerequisite: written consent of thesis adviser.

**(3) Enterprise and production control****IME 445 ECONOMIC DECISION ANALYSIS.**

Advanced engineering economy topics including economic optimization under constraints, risk, and uncertainty, formalized sensitivity analysis and expected value decisions, foundations of utility theory, and decision tree analysis. Prerequisites: 345, 365 or their equivalents or consent of instructor.

**IME 482 MANUFACTURING ENGINEERING DESIGN.**

Topics include tolerancing, material selection, cost estimation, process planning, product fabrication, and the activities required to bring a product from conceptual design through manufacture. Prerequisites: 345 (or concurrent and 370 or consent of instructor).

**IME 527 INTELLIGENT ENGINEERING SYSTEMS.**

(Same as CE 597, ECE 587, and ME 587) Designing intelligent systems solving complex engineering problems through implementing knowledge-based systems using a hybrid architecture comprising expert systems, artificial neural networks, and optimization approaches. Prerequisite: 427 or equivalent or consent of instructor.

**IME 530 MANAGING ENGINEERING AND TECHNOLOGY.**

(Same as CE 595) Management functions of planning, organizing, motivating and controlling, and analysis of application of these functions in engineering research, design, production, technical marketing, and project management.

**IME 531 ENGINEERING PROJECT MANAGEMENT.**

Applying industrial and manufacturing engineering skills to industry-based team-oriented problems involving cost estimating, planning, scheduling, and implementation using advanced techniques such as CPM, PERT, GERT, etc. Student learn project management skills and experience in managing and executing a group project. Prerequisite: Graduate standing

**IME 557 VALUE ENGINEERING.**

Introduction and application of effective and practical techniques to improve the overall performance and outcome of design projects in various industries—highlighting the application of value methodology to streamline current day operations, lean production management, strategic planning, and everyday business decisions in the private sector. Prerequisites: 451, 470 or their equivalents or consent of instructor.

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**IME 599 THESIS.**

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**(4) Quality engineering**

**IME 467 TOTAL QUALITY AND TAGUCHI METHODS.**

Apply concepts and methods of quality improvement including total quality, quality function deployment, design of experiments, quality loss function, etc. Case studies and software tools. Prerequisite: IME 465 or consent of instructor.

**IME 463 RELIABILITY ENGINEERING.** (Same as STAT 484)

Probabilistic models for the reliability of coherent systems. Statistical models for lifetimes of components and repairable systems. Reliability estimation and prediction. MIL standards. Prerequisite: STAT 480a,b, or IME 365.

**IME 557 VALUE ENGINEERING.**

Introduction and application of effective and practical techniques to improve the overall performance and outcome of design projects in various industries—highlighting the application of value methodology to streamline current day operations, lean production management, strategic planning, and everyday business decisions in the private sector. Prerequisites: 451, 470 or their equivalents or consent of instructor.

**IME 580 ADVANCED MEASUREMENT SYSTEMS.**

Advanced topics associated with dimensional measurement, inspection, measurement systems analysis, and measurement of other physical parameters. Emphasis is placed on automated and precision measurement techniques. Prerequisites: IME 476 or consent of instructor.

**IME 566 STATISTICAL COMPUTING.** (same as STAT 575)

Numerical methods for statistical analysis. Numerical linear algebra for multiple regression. Unconstrained optimization for approximation of maximum likelihood estimates. Numerical integration and function approximation. Prerequisites: IME 465 or consent of instructor

**IME 563 RELIABILITY THEORY.** (same as STAT 584)

Reliability of complex systems. Statistical analysis of methods for reliability. Statistical analysis of models for repairable systems, including the nonhomogeneous Poisson process. Accelerated life testing. Prerequisites: IME 463

**IME 565 ADVANCED QUALITY CONTROL.** (same as STAT 588) Concepts of quality, models for production processes, analysis and application of control charts, acceptance sampling. Prerequisite: IME 465 or consent of instructor.

**IME 595 SPECIAL PROJECTS.**

Independent study in focus area. May be used as a paper for MS degree in IE. Prerequisite: consent of research adviser.

**IME 599 THESIS.**

Directed research to satisfy thesis requirement. May be repeated to a maximum of 6 hours. Prerequisite: written consent of thesis adviser.