

INDUST/MANUFCTRNG ENGRG (IME)

IME-100 Interdisciplinary Design and Manufacturing 4 Credits

Prerequisites: None

This introductory class exposes students to basic design principles, the materials of manufacture, their structure and properties, and methods of processing them into everyday products. The laboratory provides hands-on experience in many of these processes, as well as electromechanical design and computer-aided manufacturing.

Lecture: 2, Lab 4, Other 0

IME-200 Introduction to Industrial Engineering 4 Credits

Prerequisites: None

This course introduces students to industrial engineering and provides students with foundational tools used in the profession. The course is intended to prepare students for co-op experiences in industrial engineering by exposing them to tools and concepts that are often encountered in practice. The course covers specific tools and their applications, including systems design and integration. The course uses a combination of lecture and active learning. Projects and group exercises will be used to cover hands-on applications and problem solving related to topics covered in lectures.

Lecture: 4, Lab 0, Other 0

IME-211 Algorithms and Computer Programming 4 Credits

Prerequisites: None

This course introduces students to application-oriented algorithm development and structured programming using python and visual basic. Students will be exposed to various programming methodologies, IDEs, input/output scripting, and data structures with a focus on designing, developing, testing, and implementing algorithms to solve problems in operations and supply chain, intelligent manufacturing, and other industrial engineering disciplines.

Lecture: 3, Lab 2, Other 0

IME-300 Manufacturing Processes 4 Credits

Prerequisites: IME-100

This introductory course in manufacturing processes and analysis. Topics include engineering drawing with CAD/CAM, material properties, casting, metal forming, polymer processing, welding, and machining. This course aims to explore conventional manufacturing processes and an introduction to advanced techniques, such as additive manufacturing and nontraditional machining, and Industry 4.0. The laboratory component further enhances learning by providing hands-on experience, where students collaborate in teams to utilize these processes for manufacturing parts.

Lecture: 3, Lab 2, Other 0

IME-321 Operations Research - Deterministic Models 4 Credits

Prerequisites: IME-200

This course introduces the students to mathematical modeling and quantitative methods and techniques for effective decision-making. In this course, the students learn how to formulate, analyze, and solve mathematical models that represent real-world problems. Topics include deterministic systems optimization; review of linear algebra, linear programming, sensitivity analysis, transportation network models, assignment problems, integer programming, and introductory topics in nonlinear programming.

Lecture: 4, Lab 0, Other 0

IME-332 Engineering Statistics 4 Credits

Prerequisites: MATH-258

Minimum Class Standing: Sophomore 2

This course introduces the students to statistics applications in engineering. Topics include exploratory data analysis, sampling methods, inferential statistics for one and two population cases, goodness of fit tests, regression analysis and non-parametric statistics. Statistical software such as Minitab is used throughout the course.

Lecture: 4, Lab 0, Other 0

IME-351 Engineering Economics 4 Credits

Prerequisites: MATH-101 or MATH-101X

Minimum Class Standing: Sophomore

This is an introductory course on economic and financial analysis to assist engineers in making fiscally sound decisions. Topics include time value of money and financial measures such as return on investment, break-even analysis, replacement analysis, inflation, depreciation, and taxes.

Lecture: 4, Lab 0, Other 0

IME-361 Lean Work Design 4 Credits

Prerequisites: MATH-258

Minimum Class Standing: Sophomore

Teams of students design and implement a complex assembly production system. Through application of lecture concepts in the "Lego Lab", a fundamental understanding of work design and performance improvement concepts, tools, and techniques is provided. Topics covered include applied anthropometry, charting techniques, work methods and waste analysis, performance measurements and learning curves, workplace organization and visual controls, work standards, and human factors issues related to manual assembly systems.

Lecture: 3, Lab 2, Other 0

IME-403 Computer Numerical Control Machining 4 Credits

Prerequisites: IME-100

Minimum Class Standing: Junior 2

This course introduces the fundamentals of computer numerical control (CNC) programming and computer-aided manufacturing (CAM) are introduced. The fundamental theoretical and operational concepts of machining are also presented. The course focuses on the programming of cutting operations; tool materials, selection, and uses. Topics include G-code programming, Introduction to CAM software, Taylor's tool life model, Criteria for tool selection, and the Orthogonal Cutting Model. Laboratories use CNC machine tools for programming and cutting, and are designed to illustrate theoretical concepts and methods for solving practical engineering machining problems.

Lecture: 3, Lab 2, Other 0

IME-408 Industrial Robotics 4 Credits

Prerequisites: MECH-100 and IME-100

Minimum Class Standing: Junior 2

Basic concepts of robotic system theory and applications are presented. Human and robotic system interface with diverse real environments are discussed. Human and robotic safety is stressed. Advantages, limitations, business case justifications of investment, and benefits of robotic systems for lean and quality operations are emphasized. Flexible manufacturing operations, work cell design, cycle time, work path, end-effectors, and collaborative robots are covered. Both hands-on and simulation of industrial robotic systems are included.

Lecture: 3, Lab 2, Other 0

IME-412 Applied Control Systems Design 4 Credits

Prerequisites: IME-100 and (IME-211 or ECE-101 or CS-101)

Minimum Class Standing: Junior 2

A course designed to introduce students to various computer-controlled systems used for industrial automation including data collection, analysis and reporting. Various hardware, software, sensors, and human resources required to implement effective control systems will be studied. Students will be engaged in hands-on laboratory exercises requiring them to configure and write programs and design systems to solve various assigned problems through individual and/or group efforts. Modern techniques for Industry 4.0 such as data management for predictive maintenance and artificial intelligence will also be explored.

Lecture: 3, Lab 2, Other 0

IME-414 Design for Manufacturing and Assembly 4 Credits

Prerequisites: IME-300

This course aims to provide an in-depth understanding of the complex interrelationships between design and manufacturing. It covers essential topics, principles, and practices of Design for Manufacturability and Assembly, with a focus on the product development process, customer requirements, design requirements, robust design, manufacturability, assembly, and design for Misc (DOX), as well as designed experiments (DOE) and GD&T. In DFMA, the students will learn about assembly documentation, constraint analysis, variation, sequence analysis, concurrent engineering, and how to efficiently model assembly systems. Students will be expected to work in small teams, apply methods they learn, and present results and conclusions based on assigned work to practice being part of a project team.

Lecture: 4, Lab 0, Other 0

IME-422 Simulation 4 Credits

Prerequisites: MATH-258

This course covers modeling of dynamic systems and uses virtual and discrete event simulation (DES) to analyze engineering design problems. Students use modern simulation software to practice the applications in production/manufacturing/service and other areas related to Industrial and Manufacturing Engineering.

Lecture: 4, Lab 0, Other 0

IME-452 Production System Design 4 Credits

Corequisites: IME-351

Prerequisites: IME-321 and MATH-258

Minimum Class Standing: Junior

Students gain an understanding of the application of industrial engineering theory and practice to the area of operations management and production planning/control. Topics include analysis and understanding of demand forecasting, aggregate planning, operations strategy, capacity planning, materials requirement planning, inventory management, scheduling, and sequencing.

Lecture: 4, Lab 0, Other 0

IME-453 Supply Chain Design 4 Credits

Prerequisites: IME-452

This course introduces principles of supply chain and logistics network from an engineering perspective. Students gain an understanding of the decision-making process required to design and manage the global supply chain. The key concepts such as inventory planning, warehousing, logistics and distribution networks, facility location planning, probabilistic project management, and sustainability are covered in this course.

Lecture: 4, Lab 0, Other 0

IME-454 Senior Design Project 4 Credits

Prerequisites: None

Minimum Class Standing: Senior II

This course provides the student with the challenge of integrating and synthesizing general engineering knowledge, particularly in industrial and manufacturing disciplines. Students apply the engineering design process to creatively solve real-world, open-ended problems in a team setting. The course is intended to be taken in the students' final term on campus.

Lecture: 2, Lab 4, Other 0

IME-462 Ergonomics 4 Credits

Prerequisites: MECH-210 and MATH-258

Human factors and ergonomics concepts for design of work. Topics include functional anatomy, bio-mechanical analysis of physical work, work physiology, manual material handling, cumulative trauma disorders, hand tool design, and human factors related to applied job design.

Lecture: 3, Lab 2, Other 0

IME-463 Safety and Human Factors 4 Credits

Prerequisites: None

Minimum Class Standing: Junior

An introduction to occupational safety; including injury statistics, mandatory and voluntary specification and performance regulations, standards, and guidelines. Electrical, machine, fire and life safety, confined spaces, and fall hazards (among others) are discussed in the context of traditional safety and human factors engineering. Students apply systems safety analysis methods in real-world hazard analysis and control projects.

Lecture: 4, Lab 0, Other 0

IME-464 Cognitive Work 4 Credits

Prerequisites: LA-201

This course is designed to serve as an introduction to the field of Cognitive Psychology/Cognitive Work. It will introduce students to methods and applications that have been used to investigate brain processes and their functions. It will address concepts, theories, methods, and researching findings in human information processing, particularly as they relate to attention, perception, memory, problem solving, decision making, language, and reasoning.

Lecture: 4, Lab 0, Other 0

IME-465 Human-Computer Interaction and Interface Design 4 Credits

Prerequisites: None

Minimum Class Standing: Junior

This multidisciplinary course provides theoretical and practical skills that are needed to design, develop, and evaluate human interaction with computer and machine interfaces and virtual environments. Course topics are anchored around fundamental cognitive human capabilities and their relationship to product design and testing. Example topics include human psychological capabilities, rapid prototyping, usability testing, and experimental evaluation of input devices. Students employ the user-centered design process with hands-on experimentation and evaluation in a term design project. This course is multidisciplinary, so students from all majors are encouraged to participate and programming skills are not required.

Lecture: 4, Lab 0, Other 0

IME-471 Quality Control 4 Credits

Prerequisites: MATH-258

Minimum Class Standing: Junior

The basics of modern methods of quality control and improvement that are used in the manufacturing and service industries are covered in this course. It includes quality philosophy and fundamentals, statistical methods of quality improvement, concept of variation and its reduction, control charts, and Statistical Process Control (SPC). Deming's quality and management concepts will also be discussed.

Lecture: 4, Lab 0, Other 0

IME-473 Design of Experiments 4 Credits

Prerequisites: MATH-258

Minimum Class Standing: Junior

The objective of the course is for students to develop the skills necessary to plan an experiment, collect the data, and analyze the results to improve quality, efficiency, and/or performance of working systems/products.

Variable selection process, ANOVA, factorial designs, fractional factorial designs, blocking, and response surface methodology are covered.

Statistical software such as Minitab is used extensively throughout the course.

Lecture: 4, Lab 0, Other 0

IME-476 Lean Six Sigma 4 Credits

Prerequisites: MATH-258

Minimum Class Standing: Senior

Techniques to maximize production efficiency and maintain control over each step in the process are examined in this course. The structured problem-solving methodology DMAIC (Define-Measure-Analyze-Improve-Control) will provide the framework for the course. This course provides a strong foundation for future Six Sigma certifications.

Lecture: 4, Lab 0, Other 0

IME-498 Industrial Engineering Study Abroad 4 Credits

Prerequisites: None

Advanced Topics in Industrial Manufacturing Engineering. This is a course taken as part of Kettering's Study Abroad Program.

Lecture: 4, Lab 0, Other 0

IME-499 Industrial Engineering Independent Study 4 Credits

Prerequisites: None

This course facilitates depth and breadth of study in a particular area of Industrial Engineering. Students must request and receive approval of the independent study topic with the instructor.

Lecture: 4, Lab 0, Other 0

IME-564 Ethics and Practice of Engineering 4 Credits

Prerequisites: None

Minimum Class Standing: Senior

The professional and ethical consideration of an engineer in contemporary society is covered in this course. Discussions include the code of ethics for engineers, case studies on conflict of interest, team, engineering/management responsibilities, environmental considerations and professional registration. This class requires live weekly discussion.

Lecture: 4, Lab 0, Other 0