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. A laboratory experience provides hands-on experience in many of these processes. A second laboratory provides experience in mechanical design and electrical and computer 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 course is designed to expand upon previous courses and allow students to demonstrate knowledge of Manufacturing Processes and Systems. Students will learn the fundamentals of conventional manufacturing processes and advanced processes such as additive manufacturing, micro/nano manufacturing, nontraditional machining processes, and automation technologies for manufacturing systems. Laboratory provides a hands-on experience for the students working in a team to use many of these processes to manufacture parts.
Lecture: 3, Lab 2, Other 0

IME-321 Operations Research I - Deterministic Models 4 Credits
Prerequisites: IME-200
Deterministic Systems Optimization; Review of linear algebra, linear programming, sensitivity analysis, transportation problems, assignment problems, transshipment problems, network models, and integer programming.
Lecture: 4, Lab 0, Other 0

IME-332 Engineering Statistics I - Statistical Inference and Regression 4 Credits
Prerequisites: MATH-258
Minimum Class Standing: Sophomore 2
Introduction to Applied Engineering Statistics. Basic concepts in statistics, exploratory data analysis, different sampling methods, descriptive statistics, 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 engineering managers in making fiscally sound decisions. Topics include financial measures such as Return On Investment, Break-even Analysis, Replacement Analysis, Depreciation and Taxes, and Multiple-criteria Decision Making.
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. Significant 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, collaborative robots are covered. Robotic computer model simulation is included in the course. Hands-on labs are included.
Lecture: 3, Lab 2, Other 0

IME-409 Computer Integrated Manufacturing 4 Credits
Prerequisites: MECH-100
Minimum Class Standing: Junior 2
Study the current status of CIM, with definition, case studies, citing obstacles and future trends and development. Some key components of CIM and hierarchy of operation in a manufacturing facility are studied and correlated. They include CAD-CAM link, numerical control, automation, production and manufacturing control, control through proper communication and computer supervisory control, robotics control, process planning. Short summary of planning, implementation, and managing of a CIM environment will also be covered. The students will conduct experiments and projects on creating a CIM environment using computer supervisory control.
Lecture: 3, Lab 2, Other 0

IME-412 Applied Control Systems Design 4 Credits
Prerequisites: MECH-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-422 Simulation 4 Credits
Prerequisites: MATH-258
An understanding and need for simulation in practice will be developed. The course will focus on basic and advanced concepts in simulation including comparing the simulated results with analytical results, and successfully develop simulation models useful in production/ manufacturing, supply chains, transportation, and other areas related to Industrial and Manufacturing Engineering. Simulation package such as ARENA will be integrated and used throughout the course.
Lecture: 4, Lab 0, Other 0

IME-423 Operations Research II - Stochastic Models 4 Credits
Prerequisites: IME-321
Minimum Class Standing: Junior 2
Topics include: Stochastic models in operations research; review of basic probability, discrete time Markov chains; continuous time Markov chains; discrete and continuous phase type distributions; birth-and-death processes; elementary queuing models involving Poisson arrivals and exponential service times; advance queuing models; basic concepts in simulation and simulation of various processes.
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 decision-making tools necessary to design value in the global supply chain from concept to customer. Quantitative methods are employed to aid the decision-making process of demand forecasting and enterprise planning for the purpose of increased profit and value to stakeholders. Basic concepts in strategy, forecasting, demand planning, inventory control and value stream mapping will be taught and utilized to enable the decision-making process to be based on quantitative metrics.
Lecture: 4, Lab 0, Other 0

IME-453 Tools for Managing the Supply Chain 4 Credits
Prerequisites: IME-452
Students gain an understanding of the decision-making process required to design and manage the global supply chain. This course covers basic principles of supply chain management and provides techniques used to analyze various aspects of logistics systems. Key concepts such as warehousing, distribution, facility location planning, and probabilistic project management and resource scheduling are examined as an integral part of modern business. The course address insights, concepts, and practical tools that are important for the effective management of the supply chain.
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, into creatively solving real-world, open-ended problems in a team setting. This requires defining a project work plan, developing the problem statement, objectives and evaluation criteria; data collection; selection of appropriate analytical and production techniques; developing and integrating recommendations; justifications of recommended course of action; and written and oral presentation of results. The project could involve production systems or product design where the planning can extend to product realization. This 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-465 Human-Computer Interaction and Interface Design 4 Credits
Prerequisites: None
Minimum Class Standing: Junior
New technology is increasingly being integrated into our minute-to-minute lives. 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 fundamentals of physical and cognitive human capabilities and their relationship to product design and testing. Example topics include human psychological and physical capabilities, cognition and models of interaction, heuristic evaluation. Rapid prototyping, usability testing, experimental evaluation of input devices and peripherals, haptics, virtual and augmented reality, and brain interfaces. Topics are reinforced through readings, guest lectures, hands-on experimentation and evaluation, current research trends, and 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 Assurance 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, statistical process control, acceptance sampling, designed experiments in quality improvements, and quality in the service sector. Deming's quality concepts will also be discussed.
Lecture: 4, Lab 0, Other 0

IME-472 Introduction to Reliability and Maintainability 4 Credits
Prerequisites: MATH-258 or MATH-330
Minimum Class Standing: Junior II
Basic knowledge and skills of reliability techniques that can be used by practicing engineers is provided in this course. The primary emphasis is on the problem of quantifying reliability in product design and testing. The topics include reliability definition and concepts, life testing and data analysis, system reliability models, and repairable systems reliability. Accelerated life testing will also be discussed.
Lecture: 4, Lab 0, Other 0

IME-473 Design of Experiments 4 Credits
Prerequisites: None
Minimum Class Standing: Junior
Advanced topics in Applied Engineering Statistics. Introduction to linear regression analysis, simple linear models, multiple linear models, residual analysis, indicator variables, variable selection process, ANOVA, introduction to DOE, basic designs, factorial designs, fractional factorial designs, blocking, and response surface methodology. Extensive use of statistical software such as Minitab throughout the course.
Lecture: 4, Lab 0, Other 0

IME-474 Design for Manufacture and Assembly 4 Credits
Prerequisites: MECH-307
Minimum Class Standing: Senior 2
This course develops skills needed to prepare a product functional specification for an existing product, at the product subfunctional group and individual part levels. The development and application of a function structure diagram is developed for a product. Creative concepts generation tools are learned to generate alternate mechanisms to generate the functions of a product. The PUGH concept selection method is utilized to select top ideas in each subfunctional group. New product level concepts are generated by combining the best concepts in each subfunctional group. The BDI Design for Assembly method is applied to existing products to determine a path for part consolidation. The DFA Redesign Concept Matrix is used to create novel assembly concepts. Concepts in the course are taught through lecture and facilitated practicum.
Lecture: 3, Lab 2, Other 0

IME-476 Lean Six Sigma 4 Credits
Prerequisites: MATH-258
Minimum Class Standing: Senior
Techniques to maximize production efficiency and to 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.
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