INDUSTRIAL AND MANUFACTURING ENGINEERING (IME)

IME 501 - Engineering Cost Analysis (3.0 hours)
Economic aspects of engineering decisions including techniques of obtaining cost data, cost allocation and product costing, break-even analysis, financial analysis, and investment market. Cross listed with IME 401.
Prerequisite: Consent of instructor. Not open to students with credit in IME 401.

IME 511 - Probability and Statistics for Analytics (3.0 hours)
Theory and application of probability and statistics. Probability, random variable, distributions, sampling distributions, Central Limit Theorem, descriptive statistics, confidence interval, and hypothesis testing with various applications from business, engineering and science.
Prerequisite: Consent of instructor.

IME 512 - Design and Analysis of Experiments (3.0 hours)
Experimental design, analysis of variance and regression. Topics include the strategy of experimentation, factorials, blocking and confounding, fractional factorials, response surfaces, and nested and split-plot designs. Cross listed with IME 412.
Prerequisite: IME 311 or IME 511 or one semester of statistics or consent of instructor. Not open to students with credit in IME 412.

IME 514 - Introduction to Operations Research (3.0 hours)
Mathematical model building and use of deterministic and non-deterministic tools in problem solving. Problem solving structure, linear programming, transportation and assignment algorithms, game theory, networks, branch and bound algorithms, dynamic programming, deterministic and stochastic inventory models, markov chains, queueing theory and simulation.
Prerequisite: Consent of instructor. Not open to students with credit in IME 313 and 314.

IME 515 - Linear Programming and Extensions (3.0 hours)
Theoretical and computational aspects of linear programming and its extensions in integer programming, nonlinear programming, dynamic programming, and network analysis; application to practical problems including production planning and supply chain optimization.
Prerequisite: Consent of instructor

IME 522 - Manufacturing Quality Control (3.0 hours)
Analysis of factors affecting product quality during manufacturing; process control charts; process capability studies; error of measurement; sampling plans; motivation programs; quality audit; organization. A research paper required. Cross listed with IME 422
Prerequisite: One semester of statistics or consent of instructor. Not open to students with credit in IME 422

IME 524 - Six Sigma Theory and Methodologies (3.0 hours)
Comparative study of philosophies of using quality as a business management tool, with special reference to Deming's Theory of control charts and a study of their strengths and weaknesses. Special control charts such as CUSUM chart, median chart, moving average chart, and their application. The latest published articles used to keep up-to-date in quality technology.
Prerequisite: IME 522 or consent of instructor.

IME 526 - Reliability Engineering (3.0 hours)
Specification, prediction, and evaluation of product reliability and maintainability. Use of models for failure distribution exponential, Weibull, lognormal and analytical and graphical methods for failure data analysis. Test plans and accelerated testing models. Design methods for increasing reliability and maintainability.
Prerequisite: IME 511 or consent of instructor.

IME 531 - Polymer and Ceramic Materials and Processing (3.0 hours)
Recent developments and applications of polymeric and ceramic materials. Selection and design criteria, material properties, process engineering, quality considerations and failure prevention.
Prerequisite: IME 331

IME 533 - Composite Material and Manufacturing (3.0 hours)
Science and technology of modern composite materials: properties, design, toughening mechanisms, fabrication methods, evaluation, mechanisms of failure, and quality assurance.
Prerequisite: IME 331

IME 541 - Advanced Forming Processes (3.0 hours)
Analytical methods in metal forming processes including slab approach, upper bound techniques, slip-line field and visio-plasticity methods. Forging, rolling, extrusion, drawing, sheet forming, near net-shape processes, and CAD/CAM.
Prerequisite: IME 441 or consent of Instructor

IME 543 - Advanced Material Removal Processes (3.0 hours)
Current and future trends in: mechanics of chip generation; forces and energies in cutting and dynamometry; thermal aspects of machining; cutting tool materials; friction, wear, vibrations and tool life; applications of engineering fundamentals to design and analysis of machining operations with emphasis on computer control.
Prerequisite: IME 441

IME 545 - Advanced Joining and Fabrication (3.0 hours)
Principles of advances in joining and fabrication of engineering materials including metallic, non-metallic, and electronic. Process science and technology with emphasis on casting, welding, and micro-joining of electronic components. Physical and mathematical modeling of various processes.
Prerequisite: IME 331

IME 553 - Advanced Computer Aided Manufacturing (3.0 hours)
Computer Aided Manufacturing (CAM) within the CAD/CAM and CIM contents. Computer Assisted Process Planning (CAPP), Computer Assisted Tool Design, Computer Assisted NC Programming (APT), Interactive Graphics, NC Programming, and the elements of computer control of manufacturing equipment (CNC). A semester project.
Prerequisite: IME 445.

IME 555 - Computer Integrated Manufacturing (3.0 hours)
Computer Integrated Manufacturing (CIM); elements of hardware and software within the manufacturing automation environment. Islands of factory automation and their interactions, information flow and Local Area Networks within the CIM architecture, standardization of electronic data and interfaces.
Prerequisite: IME 386.

IME 560 - Principles of Robotic Programming (3.0 hours)
Programming of industrial robotic manipulators with external inputs, tactile sensing and vision sensing. A design project is required. Cross-listed as ME 560.
Prerequisite: graduate or senior standing in engineering or computer science.

IME 561 - Simulation of Manufacturing & Service Systems (3.0 hours)
Procedures and rationale for planning, designing, and implementing computer simulation experiments used to analyze manufacturing and service systems in engineering, business, and social sciences. Use of a 3D state-of-art simulation software tool. Research projects required. Cross listed with IME 461.
Prerequisite: IME 511 or equivalent

IME 563 - Process Engineering (3.0 hours)
The process design function interaction with product design, and the responsibilities within a manufacturing organization. Selection and design of machinery, tools, and methods. Computer aided process design and interactive accessing of machining data and tooling element of group technology and expert systems.
Prerequisite: IME 395, 443.

IME 566 - Advanced Facility Planning (3.0 hours)
Physical organization of work places and departments to optimize objectives such as material movement, safety, and worker satisfaction. Review of IE methods of work place design and productivity measurement and economic decision making. Computer solutions for layout problems and mathematical models for location problems. A research project is required. Cross listed with IME 466.
Prerequisite: IME 386 or IME 500 or consent of instructor

IME 568 - Engineering Analytics 1 (3.0 hours)
Theoretical background of descriptive, predictive and prescriptive analytics methods and their applications to engineering. Various artificial intelligence techniques for data mining and expert system design and implementation. Computing foundations for data management and data analytics. Applications to Production Planning and Control and Inventory Management. Cross-listed with IME 468.
Prerequisite: One semester of computer programming and one semester of statistics, or consent of instructor.

IME 570 - Selected Topics in Industrial & Manufacturing Engineering (1.0-3.0 hours)
Topics of special interest which may vary each time course is offered. Topic stated in current Schedule of Classes. May be repeated up to a maximum of 6 hrs. Combined credit for IE 590 and IME 570 may not exceed six hours.
Prerequisite: Consent of instructor.

IME 578 - Engineering Analytics 2 (3.0 hours)
Combination of machine learning theory with the hands-on practice of solving modern industry problems with an emphasis on optimization or intelligent control via data mining approaches. Topics include Fuzzy Logic, Neural Networks, Neuro-Fuzzy, and Genetic Algorithm for optimization or for intelligent control. The course uses Python as the primary language, although later projects can include R and other languages. Cross listed with IME 478. Not open to students with credit in IME 478.
Prerequisite: IME 468 or IME 568

IME 581 - Cellular Lean Manufacturing Systems (3.0 hours)
This course reviews the principles and concepts required for integrated production System in order to meet customer demand in production, quality, on-time delivery, and continuously reducing manufacturing cost. Emphasis is placed on applying lean manufacturing principles, simulation techniques, and Kaizen methodologies through hands-on projects. A research paper is required. Cross listed as IME 481.
Prerequisite: IME 566, or consent of instructor. Not open to students with credit in IME 481.

IME 583 - Production Planning and Control (3.0 hours)
Analysis of Service-Production-Inventory systems using common planning and scheduling techniques. Mathematical models for project planning, aggregate planning, master scheduling and inventory analysis. Interface with quality control and computer systems. A research paper is required. Cross listed as IME 483.
Prerequisite: IME 386, minimum grade of C in IME 511, IME 514 or consent of instructor. Not open to students with credit in IME 483

IME 585 - Occupational Ergonomics (3.0 hours)
Functional anatomy and physiology of muscle and skeletal systems and their relationship to work design. Work physiology, kinesiology, and anthropometry in relation to their application in work-place design and hand-tool design. Utilization of physical work capacity and job demands for job design, personnel assignment, and assessment of work-rest scheduling. Research projects required. Cross listed as IME 485.
Prerequisite: Graduate Standing and Consent of instructor. Not open to students with credit in IME 485.

IME 586 - Logistics & Supply Chain Systems (3.0 hours)
Logistics terms and definitions; logistics as a design process; supply chain concepts, analyzing, designing and implementing logistics and supply chain systems. A research paper is required. Cross listed as IME 486.
Prerequisite: Consent of instructor. Not open to students with credit in IME 486.

IME 587 - Occupational Safety and Health (3.0 hours)
Occupational safety and health standards and regulations. Injury and illness statistics. Employer's responsibilities and bookkeeping requirements. Hazard analysis and systems safety, occupational and environmental hazards and controls. Research projects required. Cross listed with IME 487.
Prerequisite: Graduate Standing and Consent of instructor. Not open to students with credit in IME 487.

IME 590 - Geometric Modeling (3.0 hours)
Computer-based representations of the shape and spatially dependent attributes of real or conceived physical objects. Techniques and concepts needed to couple the digital computer with the techniques of geometric modeling and graphics display for analysis and viewing.
Prerequisite: IME 395; MTH 223.

IME 592 - Tribology (3.0 hours)
An introduction to systems approach to tribology, surface topography, physical, chemical, and geometric nature of surfaces. Mechanics of contact between surfaces. Various theories of friction and wear, hydrodynamic, elastohydrodynamic, and boundary lubrication. Frictional instabilities. Rolling contact problems. Application of system methodology to tribological problems in engineering design and manufacturing.
Prerequisite: IME 331 or ME 351 or consent of instructor.

IME 595 - Design for Manufacturability (3.0 hours)
The design process; interaction of materials, processes, and design; economic considerations; design considerations for machining, casting, forging, extrusion, forming, powder metallurgy; designing with plastics; design for assembly; A research paper required. Cross listed with IME 495.
Prerequisite: IME 341; IME 395, or equivalences. Not open to students with credit in IME 495 or IME 591.

IME 670 - Independent Study (3.0 hours)
Critical investigation and analysis in management systems design, facilities and/or process design, material selection, or industrial economics.
Prerequisite: Consent of instructor.

IME 690 - Engineering Data Analytics Capstone (3.0 hours)
The course provides students with the opportunity to integrate and apply the algorithms, methodologies, and analytical tools learned in the earlier coursework to solve engineering-related real-world data analysis problems. Students will conduct a team-based project that emphasizes the key aspects of data analytics using machine learning processes and will submit a consolidated report and present the results at the conclusion of the project. In addition to learning how to work in teams, participate in project planning and scheduling, write reports, give presentations, and interpret results, students will also gain an understanding of the fundamentals of data analytics project management.
Prerequisite: Graduate Standing in Data Science and Analytics - Engineering Analytics concentration (DSA-EA), or consent of instructor. Taken in the last semester of enrollment.

IME 691 - Research (0.0-3.0 hours)
Research project or professional problem to be selected by student and advisor. May be repeated to a maximum of 3 hours credit. Beyond initial enrollment the student must register for 0 hours.
Prerequisite: Unconditional graduate status, minimum GPA of 3.2 after 15 hours of graduate work, and consent of instructor

IME 699 - Thesis (0.0-6.0 hours)
Required of students choosing thesis option. Total of six hours to be taken; any semester after six hours, the student must register for zero hours to maintain progress.
Prerequisite: Unconditional status, 3.25 GPA with at least 15 hours earned, and consent of graduate coordinator