INDUSTRIAL AND MANUFACTURING ENGINEERING (IME)

IME Courses

IME 101. Introduction to Industrial and Manufacturing Engineering. 1 unit
Term Typically Offered: F
Introduction of major topics in industrial and manufacturing engineering.
Time management, study skills and class scheduling necessary for
academic success. University services. Professional ethics. Career
opportunities review. 1 laboratory.

IME 130. Technical Foundations. 2 units
CR/NC
Term Typically Offered: TBD
Introduction to visualization, sketching, and drafting. Basic hand-tools,
shop practices, and materials. Clearances and fits, threads and fasteners.
Safety. Open to all majors. Credit/No Credit grading only. 1 lecture, 1
laboratory.

IME 140. Graphics Communication and Modeling. 2 units
Term Typically Offered: F
Introduction to computer-aided drafting and modeling of solid objects.
Visualization and sketching for engineers. Communication of design
information to manufacturing using pictorials, orthographic projection,
section views, and auxiliary views. Manufacturing tolerances. 1 lecture, 1
laboratory.

IME 141. Manufacturing Processes: Net Shape. 1 unit
Term Typically Offered: F,W,SP,SU
Metal casting as a net shape process in manufacturing. Properties
of molding materials and methods of casting. Introduction to rapid
prototyping. Pattern and casting design principles. 1 laboratory.

IME 142. Manufacturing Processes: Materials Joining. 2 units
Term Typically Offered: F,W,SP,SU
Theory and application of metal cutting and welding processes. Includes
shielded metal arc, flux cored arc, submerged arc, gas metal arc, gas
tungsten arc, brazing, resistance, and oxy-acetylene processes. Bonding
theory, joint design, codes and testing. Introduction to adhesive bonding.
Open to all majors. 1 lecture, 1 laboratory.

IME 143. Manufacturing Processes: Material Removal. 2 units
Term Typically Offered: F, W, SP
Uses, capabilities, and theoretical and operational characteristics of
Lathe and milling machine tools, including conventional, automatic and
numerical control. Cutting tool characteristics, machining parameters,
quality control, and production methods. Design considerations for
manufacturing. Introduction to robotics and automation. Open to all
majors. 1 lecture, 1 laboratory.

IME 144. Introduction to Design and Manufacturing. 4 units
Term Typically Offered: F,W,SP, SU
Recommended: IME 140 or ME 129.
Supplemental review of visualization, sketching, and drafting
fundamentals. Computer-aided solid modeling of parts and assemblies.
Introduction to conventional machining processes on lathes and mills,
computer numerical control, quality control, production methods, and
design for manufacturing. Open to all majors. 2 lectures, 2 laboratories.

IME 156. Basic Electronics Manufacturing. 2 units
Term Typically Offered: F, W, SP
Practical electronics manufacturing knowledge expanded through
concepts such as CAD/CAM design, Design for Manufacture (DFM),
documentation requirements, prototyping and production planning.
Hands-on techniques learned for project planning, soldering, automation,
hand tool usage and production methods. 1 lecture, 1 laboratory.

IME 157. Electronics Manufacturing. 4 units
Term Typically Offered: TBD
Printed circuit board assembly; printed circuit board fabrication process;
electronics packaging; overview of semiconductor manufacturing;
design, documentation and fabrication of electronic units with emphasis
on CAD/CAM. Open to all majors. 2 lectures, 2 laboratories.

IME 200. Special Problems for Undergraduates. 1-2 units
Term Typically Offered: TBD
Prerequisite: Consent of department chair.
Individual investigation, research, studies, or surveys of selected
problems. Total credit limited to 4 units, with a maximum of 2 units per
quarter.

IME 223. Process Improvement Fundamentals. 4 units
Term Typically Offered: F, W, SP
Prerequisite: MATH 141. Recommended: IME 101.
Principles of work simplification and motion analysis. Recording of work
flow and methods. Process improvement through work measurement
and standards, time study, synthetic data, predetermined time systems
and work sampling. Allowances and performance rating, productivity
measures. Introduction to lean manufacturing principles. Client based
project. 3 lectures, 1 laboratory.

IME 239. Industrial Costs and Controls. 3 units
Term Typically Offered: F, W, SP
Prerequisite: IME 223.
Estimation of manufacturing costs for production planning, cost analysis,
and cost control. Planning, budgeting, and control processes. Costs,
accounting data and analysis of variances for managerial control,
inventory valuation, and decision making. Techniques of pricing, cost
estimating and cost reduction, and activity-based costing. 3 lectures.

IME 240. Additional Engineering Laboratory. 1-2 units
Term Typically Offered: TBD
Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 or
2 laboratories.
IME 270. Selected Topics. 1-4 units
Term Typically Offered: TBD
Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

IME 301. Operations Research I. 4 units
Term Typically Offered: F, W, SP
Prerequisite: MATH 244.

Systems modeling methodology, mathematical model formulations, linear programming, graphical and simplex methods. Sensitivity analysis. Integer and binary programming. Transportation, transshipment, assignment, and other network optimization models. Computer applications. 3 lectures, 1 activity.

IME 303. Project Organization and Management. 4 units
Term Typically Offered: F, W, SP
Prerequisite: Junior standing, IME 314 or equivalent.

Design and implementation of a major industrial/business systems project. Project planning considerations. Motivational and influence techniques used in project management. Scheduling techniques with risk assessment. Resource leveling and management under constraints. Reducing project duration. Monitoring progress with earned value analysis. Project audit and closure. Planning and implementation of a project. Application of project management software. 3 lectures, 1 laboratory.

IME 305. Operations Research II. 4 units
Term Typically Offered: F, W, SP
Corequisite: IME 301 or STAT 321.


IME 312. Data Management and System Design. 4 units
Term Typically Offered: F, W, SP
Prerequisite: CSC 232.

Design and management of industrial databases and reporting systems. Relationships of financial accounting databases and production systems. Efficient data entry and reports, queries, macro function, and Internet based database applications. 3 lectures, 1 laboratory.

IME 314. Engineering Economics. 3 units
Term Typically Offered: F,W,SP,SU
Prerequisite: MATH 241.


IME 319. Human Factors Engineering. 3 units
Term Typically Offered: F, W, SP
Prerequisite: PSY 201 or PSY 202, and junior standing.

Analysis of factors influencing the efficiency of human work. Data on the physical and mental capacities of persons, the physical environment, work organization, and the problem of aging. Design of machines, operations, human computer interface and work environment to match human capacities and limitations, including the handicapped. Multidisciplinary team project. 3 lectures.

IME 320. Human Factors and Technology. 4 units
GE Area F
Term Typically Offered: F
Prerequisite: Junior standing and completion of GE Area B requirements.

Analysis of cognitive, sensory and physical limitations and capabilities of operators and users of technology, both hardware and software, in working and living environments. Analysis of pertinent databases for a proactive approach to designing user-centered industrial products / systems, consumer products, and work environment. 4 lectures. Fulfills GE Area F.

IME 322. Leadership and Project Management. 2 units
Term Typically Offered: TBD
Prerequisite: Junior standing in an engineering program.

Theory and practice in leadership and project management skills for engineering design teams. Basic issues related to, and tools used for, managing projects and concepts comprising project management. Emphasis on situations requiring resolutions and management decisions by groups representing various elements of an enterprise. 2 lectures. Crosslisted as HNRS/IME 322.

IME 326. Engineering Test Design and Analysis. 4 units
Term Typically Offered: F, W, SP
Prerequisite: STAT 321 with a grade of C- or better.

Data gathering and statistical testing applied to industrial engineering and manufacturing fields. Experimental methods for product and process evaluation and comparisons; interpretation of engineering data. Engineering experimental design, linear and nonlinear regression, ANOVA, and multifactor ANOVA. Utilization of existing computer software. 4 lectures.

IME 327. Test Design and Analysis in Manufacturing Engineering. 4 units
Term Typically Offered: F, SP
Prerequisite: STAT 321 with a grade of C- or better or consent of instructor; or ME 236.

Sampling and descriptive statistics. Central limit theorem. Hypothesis testing for means and variances. Analysis of variance (ANOVA) and factorial design. Applications in engineering design, reliability manufacturing, and inspection. Design projects. 3 lectures, 1 laboratory.
IME 330. Fundamentals of Manufacturing Engineering. 4 units
Term Typically Offered: F, W
Prerequisite: IME 141 or ITP 341; IME 142; CE 204; MATE 210; MATE 215; IME 144 or IME 143 and ME 251.

Engineering analysis of manufacturing processes for casting, molding, forming, joining, and machining. Design for manufacturability and estimation of production costs. Process design strategies. Setup and operation of processing equipment; inspection methods. Field trip to manufacturing center. 3 lectures, 1 laboratory.

IME 335. Computer-Aided Manufacturing I. 4 units
Term Typically Offered: F, W, SP
Prerequisite: MATH 244; IME 144 or IME 143 and ME 251; and CSC 101, CSC 231, CSC 232 or CSC 234.

Use of the computer to communicate design information to manufacturing. Computer Numerical Control (CNC) programming. Use of CAD/CAM software. Overview of manufacturing systems in an automated environment, including cellular manufacturing and computer-aided process planning. 3 lectures, 1 laboratory.

IME 336. Computer-Aided Manufacturing II. 4 units
Term Typically Offered: W
Prerequisite: IME 335, ME 212, MATH 244, or consent of instructor.


IME 342. Manufacturing Systems Integration. 4 units
Term Typically Offered: W
Prerequisite: MATH 241 and IME 223. Recommended: STAT 321.

Analysis and design tools for production planning, control, and simulation of manufacturing systems. Use of systems modeling software. Overview of ergonomics and facilities design. 3 lectures, 1 laboratory.

IME 351. Advanced Material Removal Process Design. 4 units
Term Typically Offered: TBD
Prerequisite: IME 330.

Advanced turning and milling processes; grinding and non-traditional processes. Thread and gear manufacturing, producibility, machinability, part and tool materials, cutting fluids, and tool life testing. Finishes and measurement of surface roughness. Process design projects. 3 lectures, 1 laboratory.

IME 356. Manufacturing Automation. 4 units
Term Typically Offered: W, SP
Prerequisite: EE 321.

Computers in the factory automation environment. Basic control theory including feedback. Programming and use of programmable logic controllers (PLC), human-machine interface (HMI), and industrial control systems. Interfacing of electro-mechanical systems; analog and digital inputs, output; programmable controllers. Computer process control. 3 lectures, 1 laboratory.

IME 400. Special Problems for Advanced Undergraduates. 1-4 units
Term Typically Offered: F,W,SP,SU
Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limit to 4 units.

IME 401. Sales Engineering. 2 units
Term Typically Offered: F, SP
Prerequisite: Senior standing in engineering.

Concepts and principles of engineering in sales. Role of the professional engineer in the analysis, design, development, production, and final application of a product or system required by the buyer. 2 seminars.

IME 408. Systems Engineering. 3 units
Term Typically Offered: F
Prerequisite: CSC 232.


IME 409. Economic Decision Systems. 3 units
Term Typically Offered: TBD
Prerequisite: IME 239, IME 314, and IME 305.

Economic evaluation of information for complex decisions. Analysis of risks and uncertainties. Bayes theory and models. Decision theory, sequential decisions, and value of information applied to financial evaluation and control. Major project justification procedures. 3 lectures.

IME 410. Production Planning and Control Systems. 4 units
Term Typically Offered: F, W, SP
Prerequisite: IME 342 or IME 305.

Building blocks of manufacturing resource planning (MRP II). Demand forecasting, production planning, master scheduling development. BOM and inventory files. MRP computations and operational challenges. Capacity analysis and production control in push and pull systems. Enterprise Resource Planning (ERP). Principles of JIT and lean manufacturing. Not open to students with credit in IME 580. 3 lectures, 1 laboratory.

IME 416. Automation of Industrial Systems. 3 units
Term Typically Offered: F
Prerequisite: IME 356, ME 305 or equivalent.

Automation in manufacturing and warehousing. Economic selection of automation systems. Projects in automation. 2 lectures, 1 laboratory.

IME 417. Supply Chain and Logistics Management. 4 units
Term Typically Offered: F, W, SP
Prerequisite: IME 342 or IME 410.

Overview of key logistics and supply chain management concepts. Models and solution methods for the design, control, operation, and management of supply chains. Techniques that are used to analyze supply chains. Team projects in partnership with industry sponsors. 4 lectures.
IME 418. Product-Process Design. 4 units
Term Typically Offered: W
Prerequisite: Senior standing in engineering or graduate standing. Recommended: IME 450.

Innovative new product design and creative development process. Design for manufacturability. Study of constraints for prototyping, design, testing, processing, quality, and customer satisfaction. Lifecycle analysis. Examination of relevant environmental and ethical issues. Design projects using real world problems. 3 lectures, 1 laboratory.

IME 420. Simulation. 4 units
Term Typically Offered: F, W, SP
Prerequisite: IME 305; IME 326 or IME 327; or graduate standing.

Queueing systems. Design and analysis of production and service systems using the simulation technique. System modeling. Random number and function generators, programming, and characteristics of simulation languages. Design projects using real world problems. 3 lectures, 1 laboratory.

IME 421. Manufacturing Organizations. 3 units
Term Typically Offered: F
Prerequisite: KINE 250, PSY 201, or PSY 202; junior standing. Recommended: IME 314.


IME 424. Industrial Engineering in Healthcare. 4 units
Term Typically Offered: W
Prerequisite: IME 223.

Industrial engineering applications in healthcare industry. Background on healthcare reform. Simulation, operations research, supply chain, facility engineering, process improvement case studies. Emerging topics in industrial engineers in healthcare, change management, patient flow, Lean Six Sigma, nursing, patient safety, and decision-making. 4 lectures.

IME 428. Engineering Metrology. 4 units
Term Typically Offered: F
Prerequisite: IME 143 or IME 144; and IME 326, IME 327, IME 503 or STAT 312.

Measurement of attributes and variables; standards, accuracy and precision; mechanical, electronic and optical/laser measurement systems. Contact and non-contact measurement; straightness, flatness and squareness; GDT (Geometric Dimensioning and Tolerancing); CMM (Coordinate Measurement Machines); surface roughness; metrology for electronic products. 3 lectures, 1 laboratory.

IME 429. Ergonomics Laboratory. 1 unit
Term Typically Offered: F, W, SP
Prerequisite: IME 319; and IME 326 or IME 327.

Investigation of various physiological, sensory, and cognitive capabilities and limitations of people in work and living environments through laboratory data collection, design of experiments and statistical analysis. 1 laboratory.

IME 430. Quality Engineering. 4 units
Term Typically Offered: F,W,SP,SU
Prerequisite: IME 326, IME 327, IME 503, STAT 302 or STAT 312.


IME 432. Additive Manufacturing. 4 units
Term Typically Offered: W
Prerequisite: IME 144 or ME 251; and MATE 210. Recommended: IME 330.

Engineering principles, materials, equipment, design for manufacturing, process flow, post processing, and applications of additive manufacturing processes, including: photopolymerization, powder bed fusion, extrusion, direct energy deposition, printing, binder jetting, and sheet lamination. Process selection, environment considerations, safety, and cost analysis for manufacturing. 3 lectures, 1 laboratory.

IME 435. Reliability for Design and Testing. 3 units
Term Typically Offered: TBD
Prerequisite: IME 326, IME 327, IME 503 or STAT 312.

Reliability concepts and mathematical models, mechanical device reliability, electrical device reliability, systems reliability and maintainability, reliability data, assurance program elements. Not open to students with credit in IME 542. Course may be offered in classroom-based or online format. 3 lectures.

IME 441. Engineering Supervision I. 1 unit
Term Typically Offered: F,W,SP,SU
Prerequisite: Consent of instructor.

Theory and principles of supervision. Application of fundamental concepts and techniques of supervision provided by assignment in engineering laboratories. 1 laboratory each.

IME 442. Engineering Supervision II. 1 unit
Term Typically Offered: F,W,SP,SU
Prerequisite: Consent of instructor.

Theory and principles of supervision. Application of fundamental concepts and techniques of supervision provided by assignment in engineering laboratories. 1 laboratory each.

IME 443. Facilities Planning and Design. 4 units
Term Typically Offered: F, W, SP
Prerequisite: IME 144; IME 223; IME 314; and either IME 305 or IME 342. Recommended: IME 319 and IME 420.

Design concepts and input requirements in planning and design of new or renovation of existing manufacturing systems. Product, process, and flow and activity analysis techniques. Flow lines and buffering techniques. Computer-aided layout design and evaluation. Design of handling systems. Math models of location problems. Multidisciplinary team project. 3 lectures, 1 laboratory.
IME 450. Manufacturing Process and Tool Engineering. 4 units  
Term Typically Offered: SP  
Prerequisite: MATH 244, IME 330. Recommended: IME 335.  
Engineering design of fixtures and tools for manufacturing processes.  
Interpretation of engineering design specifications. Analysis of cost,  
quality, productivity, and safety in tool design. Mechanical analysis  
of tool design. Detailed process design for net shape production and  
component design for manufacture. Process and tool design projects. 3  
lectures, 1 laboratory.

IME 451. Radio Frequency Identification System Design. 4 units  
Term Typically Offered: W  
Prerequisite: EE 201 or IME 156 or ITP 150.  
Radio frequency identification (RFID) and its role in asset and inventory  
management, facility access, payment transaction systems, and  
other applications. Physics and types of RFID. Economic analysis.  
Multidisciplinary project teams design RFID systems for real-world  
applications. 2 lectures, 2 laboratories.

IME 457. Advanced Electronic Manufacturing. 4 units  
Term Typically Offered: TBD  
Prerequisite: EE 201, IME 156 or IME 157.  
Design and fabrication of commercial electronic products; PCB layout  
design, bill of material analysis and component purchasing, production  
planning and scheduling, programming automated surface-mount  
assembly line, marketing of products. Multidisciplinary project teams  
exposed to real-world challenges of electronics manufacturers. 2  
lectures, 2 laboratories.

IME 458. Microelectronics and Electronics Packaging. 4 units  
Term Typically Offered: SP  
Prerequisite: EE 112 or EE 201. Recommended: MATE 210.  
Materials, processes, and reliability of microelectronics and electronics  
packaging, surface mount assembly and printed circuit board fabrication.  
Organic substrates and ceramic substrates. Mechanical design, thermal,  
and electrical considerations in electronic packaging. Design for  
manufacturability. Overview of optoelectronics packaging and other  
emerging technologies in microelectronics and electronics packaging.  
Project on design and manufacture of an electronic device. 3 lectures, 1  
laboratory. Crosslisted as CPE 488/IME 458/MATE 458.

IME 460. Introduction to Value Chain Analysis. 3 units  
Term Typically Offered: SP  
Prerequisite: IME 223 or ITP 303; and senior standing.  
Introduction to value chain concepts and their application to the analysis  
and improvement of business operations. Application of lean principles  
to optimize the value chain. 3 lectures.

IME 470. Selected Advanced Topics. 1-4 units  
Term Typically Offered: TBD  
Prerequisite: Consent of instructor.  
Directed group study of selected topics for advanced students. Open  
to undergraduate and graduate students. Class Schedule will list topic  
selected. Total credit limited to 8 units. 1-4 lectures.

IME 471. Selected Advanced Laboratory. 1-4 units  
Term Typically Offered: TBD  
Prerequisite: Consent of instructor.  
Directed group laboratory study of selected topics for advanced students.  
Open to undergraduate and graduate students. The Schedule of Classes  
will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

IME 481. Senior Design Project I. 2 units  
Term Typically Offered: F, W, SP  
Prerequisite: Senior standing in major and consent of instructor.  
Culminating design project typical of problems faced in professional  
practice. Individual or group projects typically involve system design,  
modeling, analysis and testing. Project method includes costs, planning,  
scheduling, appropriate research methodology and formal reports.  
Professional ethics. 1 lecture, 1 laboratory.

IME 482. Senior Design Project II. 3 units  
Term Typically Offered: F, W, SP  
Prerequisite: IME 481.  
Continuation of IME 481. Involves research methodology: problem  
statement, method, results, analysis, synthesis, project design,  
construction (when feasible), and evaluation/conclusions. Project results  
presented in thesis-like formal reports suitable for reference library and  
formal oral presentations. Professional ethics. 1 lecture, 2 laboratories.

IME 495. Cooperative Education Experience. 4-12 units  
CR/NC  
Term Typically Offered: F,W,SP,SU  
Prerequisite: Sophomore standing and consent of instructor.  
Full-time work experience in business, industry, government, and other  
areas of student career interest. Positions are paid and usually require  
relocation and registration in course for two consecutive quarters. A  
formal report and evaluation by work supervisor required. Credit/No  
Credit grading only. No major credit allowed; total credit limited to 24  
units.

IME 500. Individual Study. 1-4 units  
Term Typically Offered: F, W, SP  
Prerequisite: Consent of department chair and supervising faculty  
member.  
Advanced study planned and completed under the direction of a member  
of the department faculty. Open only to students who have demonstrated  
ability to do independent work.

IME 503. Applied Statistical Methods in Engineering. 4 units  
Term Typically Offered: F  
Prerequisite: Graduate standing.  
Application of important statistical distributions in engineering and  
management. Coverage of sampling distributions and their roles in  
design of experiments. Applications of hypothesis testing, ANOVA,  
analysis of covariance, multiple and nonlinear regressions in industry  
and service systems. Introduction to nonparametric analysis. 3 lectures, 1  
laboratory.
IME 507. Graduate Seminar. 2 units
Term Typically Offered: F
Prerequisite: Graduate standing.

Seminars in industrial engineering, integrated technology management, and engineering management by researchers and practitioners from academia and industry. Preparation for conducting research. Presentation of student research projects. Overview of graduate education requirements. Ethics issues in research. 1 seminar, 1 laboratory.

IME 510. Systems Engineering I. 4 units
Term Typically Offered: W
Prerequisite: Graduate standing or consent of instructor.


IME 511. Systems Engineering II. 4 units
Term Typically Offered: TBD
Prerequisite: AERO 510 or IME 510, graduate standing or consent of instructor.

Risk management. Design strategies to meet system/mission requirements. Design for supportability, manufacturability, reliability, etc. Quality function development and quality control concepts. 4 lectures. Crosslisted as AERO/IME 511.

IME 520. Advanced Information Systems for Operations. 4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing or consent of instructor. Recommended: IME 410.

Advanced information systems (IS) applications in manufacturing and service operations. Introduction of common IS applications, such as manufacturing execution systems; reporting systems; capacity planning systems; scheduling systems; and customer inquiry systems. Industry-specific analysis of IS requirements and availability. 4 seminars.

IME 527. Design of Experiments. 4 units
Term Typically Offered: W
Prerequisite: IME 326 or IME 327 or IME 503 or STAT 312.

Experimental design principles. Comparative experiments for population parameters. ANOVA and randomized block design. Factorial designs, the 2^k factorial designs, and factorial designs with blocks. Fractional factorial designs. Response surface methodology. Fitting regression models. Design projects using real world problems. Substantial use of statistical software. 3 lectures, 1 laboratory. Formerly IME 427.

IME 541. Advanced Operations Research. 4 units
Term Typically Offered: SP
Prerequisite: Graduate standing and consent of instructor.


IME 542. Applied Reliability Engineering. 4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing. Recommended: IME 326 or IME 327 or IME 503 or STAT 312.

Reliability terminology and bathtub curve. Failure distributions: Exponential, Lognormal, and Weibull. Probability plotting. Reliability of systems. Maintainability and availability. Reliability in design; Load-strength analysis; Failure modes and effects analysis; Fault tree analysis. Reliability testing; Reliability management. Not open to students with credit in IME 435. 3 lectures, 1 laboratory.

IME 543. Applied Human Factors. 4 units
Term Typically Offered: W
Prerequisite: Graduate standing or consent of instructor. Recommended: IME 326 or IME 327 or IME 503.

Human factors/ergonomics analysis and evaluation of automation, mobile communication technology, and interface design for Internet websites. Usability analysis of current hardware/software products with an emphasis on a user-centric design approach. Team-based projects. 3 seminars, 1 laboratory.

IME 544. Advanced Topics in Engineering Economy. 4 units
Term Typically Offered: W
Prerequisite: Graduate standing. Recommended: Undergraduate course in engineering economy.


IME 545. Advanced Topics in Simulation. 4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing. Recommended: IME 420.

Validation of simulation models. Statistical techniques for variance reduction. Experimental design and optimization. Comparison of attributes of simulation languages. Review of current manufacturing and service industry applications. Case studies. 3 lectures, 1 laboratory.

IME 556. Technological Project Management. 4 units
Term Typically Offered: SP
Prerequisite: Graduate standing or consent of instructor.

Projects in industrial organizations and enterprises. Emerging technologies and project management. Relationship to strategic plans and managing change in organizations. Formulating, selecting, structuring, and planning projects. Project organization and control. Overcoming barriers. Application of project management software. 3 seminars, 1 laboratory.

IME 570. Selected Advanced Topics. 1-4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing.

Directed group study of selected topics for advanced students. Open to graduate students and selected seniors. Topic lists will be provided with class schedule outlines. 1-4 seminars.
IME 571. Selected Advanced Laboratory. 1-4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

IME 577. Engineering Entrepreneurship. 4 units
Term Typically Offered: F
Prerequisite: Graduate standing or consent of instructor.

The special requirements of entrepreneurship in a high-tech environment. Guest lectures, focused seminar topics, a business plan project, and case studies provide the tools to evaluate and pursue technology-based business opportunities. 4 lectures.

IME 580. Manufacturing Systems. 4 units
Term Typically Offered: SP
Prerequisite: Graduate standing.

Modern approaches in production and inventory planning and control to support large-scale manufacturing systems, material requirements planning (MRP I), manufacturing resource planning (MRP II), and just-in-time (JIT) manufacturing systems. Enterprise resource planning (ERP) and integration with financials. Information requirements, operational issues, and policy matters. Not open if credit in IME 410. 4 seminars.

IME 596. Graduate Project/Internship. 1-5 units
Term Typically Offered: F,W,SP,SU
Prerequisite: Graduate standing and consent of instructor.

Integrative learning experience through internship and project. Focus on a significant industrial or research problem in an engineering field. Project involves student(s), faculty, and sponsoring representative(s) in a collaborative learning environment, and culminates in a comprehensive written report. Total credit limited to 5 units.

IME 599. Thesis. 1-9 units
Term Typically Offered: F,W,SP,SU
Prerequisite: Graduate standing and consent of instructor.

Systematic study of a significant problem under faculty supervision. Both a written thesis and an oral defense are required. Total credit limited to 9 units.