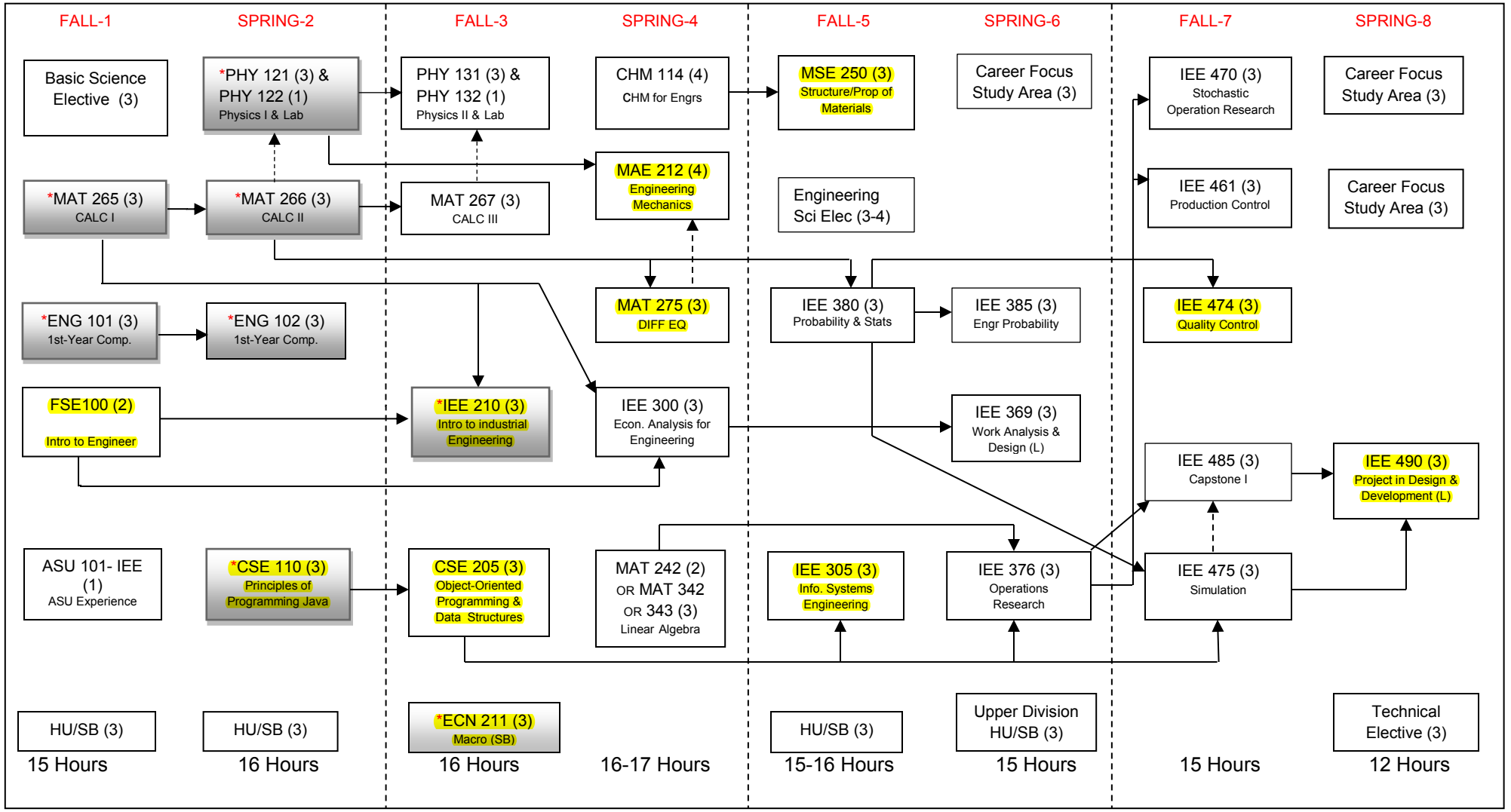
Industrial Engineering, BSE
Bachelor of Science in Engineering, 2013-2014 Catalog Year
ESIEEBSE

ARIZONA STATE

Contact CIDSE Advising with questions about critical requirements, elective courses, and Technical Elective and Career Focus Study Area course options.



*Designates critical requirements for IE admits in the 2013-2014 academic year. Minimum 'C' grade required in all IEE-prefix courses.

Pre-requisite ——————→ Pre- or co- requisite - - - - - - - - - - - - - - - - →

Term 1

ENG 101: First-Year Composition

MAT 265: Calculus for Engineers I-Limits and continuity, differential calculus of functions of one variable, introduction to integration. Not open to students with credit in MAT 270.

ASU 101-IEE: The ASU Experience

FSE 100: Introduction to Engineering-Introduces the engineering design process; working in engineering teams; the profession of engineering; engineering models, written and oral technical communication skills.

Basic Science Elective: choose one of the following-BIO 181, BIO 182, BME 111, GLG 101, GLG 102, or GLG 110

HU/SB: Humanities, Fine Arts & Design or Social & Behavioral Sciences

Term 2

ENG 102: First-Year Composition

CSE 110: Principles of Programming with Java -Concepts of problem solving using Java, algorithm design, structured programming, fundamental algorithms and techniques, and computer systems concepts. Social and ethical responsibility.

MAT 266: Calculus for Engineers II -Methods of integration, applications of calculus, elements of analytic geometry, improper integrals, Taylor series

PHY 121/122: University Physics I: Mechanics and laboratory- Kinematics; Newton's laws; work, energy, momentum, conservation laws; dynamics of particles, solids, and fluids. Both PHY 121 and PHY 122 must be taken to secure SQ General Studies credit.

HU/SB: Humanities, Fine Arts & Design or Social & Behavioral Sciences

Term 3

ECN 211: Macroeconomic Principles- Basic macroeconomic analysis. Economic institutions and factors determining income levels, price levels, and employment levels.

IEE 210: Introduction to Industrial Engineering- History of IE: IE career paths; ethical, social, and contemporary issues; introduces IE techniques, methods, and their application; case studies.

CSE 205: Object-Oriented Programming & Data Structures-Problem solving by programming with an object-oriented programming language. Introduces data structures. Overview of computer science topics.

MAT 267: Calculus for Engineers III -Vector-valued functions of several variables, partial derivatives, multiple integration.

PHY 131/132: University Physics II: Electricity and Magnetism and laboratory- Electric charge and current, electric and magnetic fields in vacuum and in materials, and induction. AC circuits, displacement current, and electromagnetic waves. Both PHY 131 and PHY 132 must be taken to secure SQ General Studies credit.

Term 4

CHM 114: General Chem for Engineers or CHM 116: General Chem II(pre-req is CHM 113)

IEE 300: Economic Analysis for Engineers-Economic evaluation of alternatives for engineering decisions, emphasizing the time value of money.

MAE 212: Engineering Mechanics- Force systems, resultants, moments and equilibrium. Kinematics and kinetics of particles, systems of particles and rigid bodies. Energy and momentum principles.

MAT 242: Elementary Linear Algebra-Introduces matrices, systems of linear equations, determinants, vector spaces, linear transformations, and eigenvalues. Emphasizes development of computational skills.

MAT 275: Modern Differential Equations- Introduces differential equations, theoretical and practical solution techniques. Applications. **Problem solving using MATLAB**.

Term 5

IEE 380: Probability and Statistics for Engineering Problem Solving-Applications-oriented course with **computer-based experience using statistical software** for formulating and solving engineering problems

IEE 305: Information Systems Engr-Overview of computer and information systems applications. Topics include client/server; distributed computing; networks; process modeling; e-commerce; enterprise applications; Internet.

MSE 250: Structure and Properties of Materials- Basic concepts of material structure and its relation to properties. Application to engineering problems.

Engineering Science Elective: (depends on Focus area)

HU/SB: Humanities, Fine Arts & Design or Social & Behavioral Sciences

Term 6

IEE 385: Engr Statistics - Probability- Conditional probability, common probability models, Goodness-of-fit tests and reliability models.

IEE 376: Operations Research Deterministic Techniques/Applications- Industrial systems applications with deterministic operations research techniques. Resource allocation, product mix, production, transportation, task assignment, networks.

IEE 369: Work Analysis and Design(L)-Planning, analysis, and design of methods of accomplishing work. Emphasizes human factors, work planning, methods analysis and design, and work measurement. Applications in diverse fields.

Upper Division Career Focus Area Elective (depends on Focus area)

Upper Division HU/SB: Humanities or Social and Behavioral Science

Term 7

IEE 475: Simulating Stochastic Systems- Analyzes stochastic systems using basic queuing networks and discrete event simulation. Basic network modeling, shared resources, routing, assembly logic.

IEE 461: Production Control-Techniques for the planning, control, and evaluation of production systems. Forecasting, inventory control, scheduling, enterprise requirements planning, supply chain design, and coordination.

IEE 470: **Stochastic Operations Research-** Modeling and analysis with emphasis on stochastic operations research. Models for stochastic processes, including Markov chains, queuing and decision analysis.

IEE 474: Quality Control- Basic statistical process control techniques, capability analysis, design of experiments, and acceptance sampling plans.

IEE 485: Systems Design Capstone I- Senior capstone project provides students with the skills required to effectively complete a capstone project in design and development.

Term 8

IEE 490: Project in Design and Development(L)-Individual or team capstone project in creative design and synthesis.

Upper Division IEE Technical Elective (depends on Focus area)

Upper Division Career Focus Area Elective (depends on Focus area)

Upper Division Career Focus Area Elective (depends on Focus area)

ARIZONA STATE

CAL POLY
SAN LUIS OBISPO

B.S. in INDUSTRIAL ENGINEERING
Suggested 4-Year Academic Flowchart

2013-15 Catalog

Updated 08 21 2013

FRESHMAN			SOPHOMORE			JUNIOR			SENIOR		
Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring
Intro to IME **IME 101 (1)**	*Basic Electronics Manufacturing* **IME 156 (2) or IME 157 (4)**	*Intro. To Design & Mfg.* **IME 144 (4)** (Recommended: IME 140, ME 151, or equiv.)	*Process Improv. Fundamentals* **IME 223 (4)** (MATH 141, Recommend: IME 101)	*Industrial Costs & Controls* **IME 239 (3)** (IME 223)	*Engr. Economics* **IME 314 (3)** (MATH 241)	*Operations Research I* **IME 301 (4)** (MATH 244)	*Human Factors* **IME 319 (3)** (PSY 201/202 & Instr. consent & Jr. Standing)	*Data Management & System Design* **IME 312 (4)** (CSC 232)	*Op. Research II* **IME 405 (4)** (IME 301, STAT 321 or instr. consent)	*Simulation* **IME 420 (4)** (IME 326, 405 or instr. consent	*Fac. Planning/Des.* **IME 443 (4)** (IME 144, 223, 405 or 342, 314, or equiv.; Recommended: IME 319 & 420)
Mfg. Processes **IME 141 (1)**	*Physics I* **PHYS 141 (4)** (MATH 141 w/ > C- MATH 142†)	*Physics II* **PHYS 132 (4)** (PHYS 141)	*Physics III* **PHYS 133 (4)** (PHYS 141, MATH 142)	*Computer Programming* **CSC 232 (3)** (MATH 118 or equiv.)	*Life Sci. for Engr.* **BIO/ENGR 213 (2/2)** (MATH 142, Recommend: CHEM 124)	*Project Org. & Management* **IME 303 (4)** (IME 314 & Jr. Standing)	*Eng. Test Design & Analysis* **IME 326 (4)** (STAT 321 w/C- or better)	**Approved Technical Elective (3)** ***	*Quality Eng.* **IME 430 (4)** (IME 326)	*Senior Project* **IME 481 (2)** (Sr. Standing in major & instr. consent)	*Senior Project* **IME 482 (3)** (IME 481)
Graphics Comm. & Modeling **IME 140 (2)**	[Add'l Area B]		[B2]								
Calculus I **MATH 141 (4)** * [B1]	*Calculus II* **MATH 142 (4)** (MATH 141 w/ > C-) [B1]	*Calculus III* **MATH 143 (4)** (MATH 142 w/ > C-) [Add'l Area B]	*Calculus IV* **MATH 241 (4)** (MATH 143)	*Linear Analysis I* **MATH 244 (4)** (MATH 143)	*Engr. Dynamics* **ME 212 (3)** (ME 211 & MATH 241)	*Electric Circuit Theory* **EE 201/251 (3/1)** (MATH 244 & PHYS 133)	*Electronics* **EE 321 (3)** (EE 201)		*Ergonomics Lab* **IME 429 (1)** (IME 319 & IME 326)	*Production Planning & Control Systems* **IME 410 (4)** (IME 405 or 342)	*Supply Chain & Logistics Management* **IME 417 (4)** (IME 342 or 410 or instr. consent)
Psychology **PSY 201/202 (4)** [D4]	*Gen. Chem.* **CHEM 124 (4)** [B3/B4]	**GE (4)** **		*Engr. Statics* **ME 211 (3)** (PHYS 141, MATH 241†)	*Prob. & Statistics* **STAT 321 (4)** (MATH 142) [B6]	*Mech. of Matr. I* **CE 204 (3)** (ME 211)	*Materials Engr.* **MATE 210/215 (3/1)** (CHEM 124 or 127) **or** *Thermo* **ME 302 (3)** (PHYS 132, ME 212 or CHEM 128)	**Approved Technical Elective (4)** ***	**Approved Technical Elective (2-4)** ***		
Expository Writing **ENGL 133/134 (4)**** [A1] Can be taken anytime during Freshman Year				**GE (4)** **			**GE (4)** **	**GE (4)** **	**GE (4)** **	**GE (4)** **	**GE (4)** **
Oral Communication **COMS 101/102 (4)**** [A2] Can be taken anytime during Freshman Year											
Technical Writing **ENGL 149 (4)** [A3] (Completion of GE A1 with a C- or better, Recommended: Completion of GE A2) Can be taken anytime between Winter of Freshman and Winter of Sophomore Years											
						Graduation Writing Requirement **GWR*** (Can be taken any time after 90 earned units)					
16	18-20	16	16	17	14	15	17-18	15	15-17	14	15
										TOTAL:	190

Notes:

MOST GENERAL EDUCATION COURSES CAN BE TAKEN IN ANY ORDER AS LONG AS PREREQUISITES ARE MET

* Refer to current catalog for prerequisites.

** One course from each of the following GE areas must be completed: A1, A2, C1, C2, C3, C4, D1, D2, D3. C4 should be taken only after Junior standing is reached (90 units).

Refer to online catalog for GE course selection, United States Cultural Pluralism (USCP) and Graduation Writing Requirement (GWR).

USCP requirement can be satisfied by some (but not all) courses within GE categories: C3, C4, D1, or D3.

*** Technical elective form required and should be submitted prior to junior year. Technical elective units must total 11, unless IME 157 is taken then only 9 units of technical electives are required.

† Course can be taken previously or concurrently.

Legend:

Course Title
Course # (Units)
(Pre-Requisite)
[GE Area]

Major (80)

Support (74)

General Ed. (36)

2011-13 Cal Poly Catalog

Industrial & Manufacturing Engineering Department

IME–INDUSTRIAL and MANUFACTURING ENGINEERING

IME 101 Introduction to Industrial and Manufacturing Engineering (1)

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) (CR/NC)

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)

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)

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)

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)

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)

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. ~~Prerequisite: IME 130 or IME 140 or consent of instructor.~~ Recommended: IME 140, ME 151, or equivalent. *Change effective Spring 2012*

IME 156 Basic Electronics Manufacturing (2)

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)

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)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of department chair.

IME 223 Process Improvement Fundamentals (4)

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. Prerequisite: MATH 141. Recommended: IME 101.

IME 239 Industrial Costs and Controls (3)

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 forecasting, pricing, cost estimating and cost reduction. 3 lectures. Prerequisite: IME 223.

IME 240 Additional Engineering Laboratory (1–2)

Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 or 2 laboratories.

IME 241 Manufacturing Process Design I (4)

Economic and engineering analysis of manufacturing processes. Cost estimation for production planning, analysis, and control. Analysis of machining process inputs and mechanisms as an example process. Test report writing, documentation, and inspection methods. Field trips to manufacturing centers. 3 lectures, 1 laboratory. Prerequisite: IME 143 or IME 144, PHYS 141.

IME 251 Introduction to Manufacturing Engineering Analysis (4)

State of the art methods and processes in mechanical and electronic manufacturing. Selection of materials for manufacturing. Product design and manufacturability. Specifications and metrology in manufacturing. Continuous improvement strategies, such as automation, group technology, value analysis, and flexible system design. 2 lectures, 2 laboratories. Prerequisite: IME 143 or IME 144, PHYS 131, CHEM 124.

IME 270 Selected Topics (1–4)

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Open to undergraduate students and consent of instructor.

IME 301 Operations Research I (4)

Systems modeling methodology, mathematical model formulations, linear programming, graphical and simplex methods. Duality and sensitivity analysis. Transportation, transshipment and assignment models. Introduction to goal programming and elastic constraints. Computer applications. 3 lectures, 1 activity. Prerequisite: MATH 244.

IME 303 Project Organization and Management (4)

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. Prerequisite: Junior standing, IME 314 or equivalent.

IME 312 Data Management and System Design (4)

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. Prerequisite: CSC 232.

IME 313 Introduction to Information Systems Engineering (4)

Practical approach to use of modern information technologies related to industrial and manufacturing engineering. Use of networking and application software, including theory and practice. 3 lectures, 1 laboratory. Prerequisite: CSC 232.

IME 314 Engineering Economics (3)

Economic analysis of engineering decisions. Determining rates of return on investments. Effects of inflation, depreciation and income taxes. Sensitivity, uncertainty, and risk analysis. Application of basic principles and tools of analysis using case studies. 3 lectures. Prerequisite: MATH 241.

IME 319 Human Factors Engineering (3)

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. Prerequisite: PSY 201 or PSY 202 or consent of instructor, and junior standing.

IME 320 Human Factors and Technology (4) GE Area F

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. Prerequisite: Junior standing and completion of GE Area B requirements. Fulfills GE Area F.

IME 322 Leadership and Project Management (2)

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. Prerequisite: Junior standing in an engineering program or consent of instructor. *Crosslisted as HNRS/IME/MATE 322.*

IME 326 Engineering Test Design and Analysis (4)

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. Prerequisite: STAT 321 with a grade of C- or better, or consent of instructor.

IME 334 CAD/CAM (3)

Identification and study of the individual techniques of CAD/CAM as being practiced in modern industry. Total credit limited to 6 units. 2 lectures, 1 laboratory. Prerequisite: IME 144 or consent of instructor.

IME 335 Computer-Aided Manufacturing I (4)

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. Prerequisite: IME 144, CSC 232, or consent of instructor.

IME 336 Computer-Aided Manufacturing II (4)

Advanced Computer Numerical Control (CNC) programming and machine tool control. Machining center operation. Parametric representation of curves and surfaces. Computation of tool paths. Product and process design for CNC machining. CNC machine tool dynamics. Introduction to flexible manufacturing systems and robotics. Design and fabrication projects. 3 lectures, 1 laboratory. Prerequisite: IME 335, ME 212, MATH 244, or consent of instructor.

IME 341 Tool Engineering (4)

Engineering design of fixtures and tools for manufacturing processes. Interpretation of engineering design specifications. Material selection. Analysis of cost, quality, productivity, and safety in tool design. The role of tooling in manufacturing competitiveness. Design projects. 3 lectures, 1 laboratory. Prerequisite: IME 241, CE 204, MATH 244, MATE 210, or consent of instructor.

IME 342 Manufacturing Systems Integration (4)

Analysis and design tools for production planning, control, and simulation of manufacturing systems. Use of systems modeling software. Overview of ergo-nomics and facilities design. 3 lectures, 1 laboratory. Prerequisite: MATH 241 and IME 223 or consent of instructor. Recommended: STAT 321.

IME 351 Advanced Material Removal Process Design (4)

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. 2 lectures, 2 laboratories. Prerequisite: IME 241, MATE 210 and MATE 215, and CE 204.

IME 352 Manufacturing Process Design II (4)

Advanced engineering analysis of material shaping processes, surface processing and assembly operations with emphasis on optimizing process parameters, equipment, and operational sequence. Process design projects. 2 lectures, 2 laboratories. Prerequisite: IME 141, IME 142, IME 241, MATE 210/215, CE 204.

IME 356 Manufacturing Automation (4)

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. Prerequisite: EE 321.

IME 400 Special Problems for Advanced Undergraduates (1–4)

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

IME 401 Sales Engineering (2)

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. Prerequisite: Senior standing in engineering, or consent of instructor.

IME 404 Engineering Economic Decision Management (3)

Quantitative approaches to engineering and management problems. Time value concepts, breakeven and replacement analysis, optimization techniques for scheduling. Project cost estimation, resource management and risk analysis. Use of computer software packages. For non-majors only. 3 lectures. Prerequisite: Junior standing.

IME 405 Operations Research II (4)

Stochastic decision analysis. Queuing models, inventory models and analysis. Markov processes. Computer aided modeling and case studies. 3 lectures, 1 activity. Prerequisite: IME 301, ~~IME 326~~ STAT 321 or consent of instructor. *Change effective Spring 2012.*

IME 407 Operations Research III (4)

Systems modeling and solution of large scale problems using advanced operations research methods. Integer and goal programming. Application of nonlinear, quadratic, dynamic programming concepts. Case studies of systems modeling including software aided analysis. 3 lectures, 1 activity. Prerequisite: IME 301 or consent of instructor.

IME 408 Systems Engineering (3)

Systems, subsystems, static, dynamic, closed and open systems. Systems design requirements. Performance measures. Process control modeling and analysis, transform methods, linear systems analysis, digital, adaptive and steady state optimal control. Optimal search strategies. Manufacturing, maintenance, replacement and engineering applications. 3 lectures. Prerequisite: IME 326, IME 405, CSC 232.

IME 409 Economic Decision Systems (3)

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. Prerequisite: IME 239, IME 314, and IME 405, or consent of instructor.

IME 410 Production Planning and Control Systems (4)

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. 3 lectures, 1 laboratory. Prerequisite: IME 405 or IME 342.

IME 411 Production Systems Analysis (3)

Systems analysis for production control. Design of computer integrated planning and control systems for scheduling manufacturing orders, monitoring operating costs and control system performance evaluation. Development of computer-aided decision making framework. Interactive decision making using simulation modeling. 2 lectures, 1 laboratory. Prerequisite: IME 410, or equivalent.

IME 413 Flexible Manufacturing Systems (3)

Structure of flexible manufacturing systems. Planning and control for FMS. Tool management and operations control. Application of techniques related to production scheduling decisions. Cellular manufacturing and production flow analysis. Case studies of flexible manufacturing systems. Computer applications. 3 lectures. Prerequisite: IME 301. Recommended: STAT 321.

IME 416 Automation of Industrial Systems (3)

Automation in manufacturing and warehousing. Economic selection of automation systems. Projects in automation. 2 lectures, 1 laboratory. Prerequisite: IME 356 or equivalent.

IME 417 Supply Chain and Logistics Management (4)

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. Prerequisite: IME 342, or IME 410 or consent of instructor.

IME 418 Product-Process Design (4)

Innovation for product development, engineering management of new product development and manufacturing competitiveness. Concurrent engineering. Study of manufacturability constraints in terms of prototyping, designing, testing, pre-production support, processing, quality, delivery, and customer satisfaction. Industrial design projects. Examination of relevant environmental and ethical problems. 3 lectures, 1 laboratory. Prerequisite: Senior standing in engineering or graduate standing or consent of instructor. Recommended: IME 341.

IME 420 Simulation (4)

Design and analysis of manufacturing and service systems by simulation. System modeling. Random number and function generators, programming, and characteristics of simulation languages. Design projects using real world problems. Introduction to rule-based expert systems. 3 lectures, 1 laboratory. Prerequisite: IME 326, IME 405, or consent of instructor.

IME 421 Manufacturing Organizations (3)

Theory and principles for manufacturing organizations. Competitive advantage. Strategic planning and operations management for organizations and teams in a rapidly changing environment. Engineering management concepts and practices. Team-based projects and cases. 3 seminars. Prerequisite Junior standing; PSY 201, PSY 202, or KINE 250 or consent of instructor. Recommended: IME 314.

IME 422 Manufacturability Engineering (4)

Manufacturability constraints in terms of issues related to prototyping, designing, testing, preproduction support, processing, quality, delivery, and customer satisfaction. Hands-on projects to discuss the experimental results in dealing with the process of casting, machining, plastic modeling, and electronic board manufacturing. 3 lectures, 1 laboratory. Prerequisite: IME 341, IME 326. Recommended: IME 342.

IME 427 Process Optimization through Designed Experiments (4)

Experiments for optimization of industrial processes: process variables, response, measurements, analysis and interpretations. Statistical principles in design. Design approaches: conventional methods, response surface methodology, and Taguchi methods. Type of experiments: factorial, fractional factorial, mixture, and orthogonal arrays. Design projects using real world problems. 3 lectures, 1 laboratory. Prerequisite: IME 326 or consent of instructor.

IME 428 Engineering Metrology (4)

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. Prerequisite: IME 335 or consent of instructor.

IME 429 Ergonomics Laboratory (1)

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. Prerequisite: IME 319, IME 326.

IME 430 Quality Engineering (4)

Quality control, reliability, maintainability, and integrated logistic support. Statistical theory of process control and sampling inspection. Risks associated with decisions based on operating characteristics of control charts and sampling plans. Reliability and life testing methods. Economics of statistical QC. Specifications and standards. 4 lectures. Prerequisite: IME 326 or STAT 302.

IME 431 Supplier Quality Engineering (4)

Customer-supplier partnership. Functions of Supplier Quality Engineering. Supplier selection, development, process qualification, concurrent engineering, value engineering. Process characterization, repeatability, consistency, process control. Quality system standards. Supplier survey, audit, rating, measurement of quality, delivery performance and certification. Customer service, corrective action approaches. 3 lectures, 1 laboratory. Prerequisite: IME 430.

IME 433 Advanced Work Measurement (3)

Predetermined time systems. Time formulas. Standard data systems. Use of statistical methods. Standard data systems applied to clerical, manufacturing, and micro assembly. Developing and maintaining computerized systems. Course will be administered with project orientation. 2 lectures, 1 laboratory. Prerequisite: IME 223, IME 326 or equivalent.

IME 435 Reliability Engineering I (3)

Reliability concepts and mathematical models, mechanical device reliability, electrical device reliability, systems reliability and maintainability, reliability data, assurance program elements. 3 lectures. Prerequisite: IME 326.

IME 437 Advanced Human Factors Engineering (3)

Team-based approach to human factors assessment of consumer and industrial products, systems, and information technology. Team building principles and techniques in human factors analysis. Usability analysis and ergonomics auditing through experimental methods. 2 lectures, 1 laboratory. Prerequisite: IME 319 and either IME 326 or IME 503.

IME 440 Quality Process Management (4)

Quantitative approaches to engineering and management of quality. Statistical process control, quality assurance concepts. Variability loss and off-line QC. Tolerance design and experimental design. Human factors and managerial dimensions influencing quality. For non-majors only. 4 lectures. Prerequisite: Junior standing or consent of instructor.

IME 441, 442 Engineering Supervision I, II (1,1)

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

IME 443 Facilities Planning and Design (4)

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. Prerequisite: IME 144, IME 223, IME 405 or IME 342, IME 314, or equivalent. Recommended: IME 319, IME 420.

IME 455 Manufacturing Design and Implementation I (3)

A mix of industry and in-house structured group projects. Projects progress through a complete cycle from design through implementation. Application

of project management methods. Examination of relevant economical and safety issues. 3 laboratories. Prerequisite: IME 418.

IME 457 Advanced Electronic Manufacturing (4)

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. Prerequisite: IME 156 or IME 157.

IME 458 Microelectronics and Electronics Packaging (4)

Materials, processes, and reliability of microelectronics and electronics packaging, surface mount assembly and printed circuit board fabrication. Overview of semiconductor manufacturing and optoelectronics packaging. 3 lectures, 1 laboratory. Prerequisite: MATE 210 and PHYS 133 or consent of instructor. *Crosslisted as CPE 488/IME 458/MATE 458.*

IME 470 Selected Advanced Topics (1–4)

Directed group 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 lectures. Prerequisite: Consent of instructor.

IME 471 Selected Advanced Laboratory (1–4)

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 to 4 laboratories. Prerequisite: Consent of instructor.

IME 481 Senior Project Design Laboratory I (2)

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. 2 laboratories. Prerequisite: Senior standing in major and consent of instructor.

IME 482 Senior Project Design Laboratory II (3)

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. 3 laboratories. Prerequisite: IME 481.

IME 493 Cooperative Education Experience (2) (CR/NC)

Part-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. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units. Prerequisite: Sophomore standing and consent of instructor.

IME 494 Cooperative Education Experience (6) (CR/NC)

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. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units. Prerequisite: Sophomore standing and consent of instructor.

IME 495 Cooperative Education Experience (12) (CR/NC)

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 more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units. Prerequisite: Sophomore standing and consent of instructor.

IME 500 Individual Study (1–4)

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. Total credit limited to 4 units. Prerequisite: Consent of department chair and supervising faculty member.

IME 501 Graduate Survey I (4)

Survey of traditional industrial engineering applications in industrial systems, work methods, measurements and analysis. Facilities design, automation and logistics of industrial operations. Human factors and cost estimation of industrial applications. 3 seminars, 1 activity. Prerequisite: Graduate standing.

IME 502 Graduate Survey II (4)

Survey of current issues in data analysis and mathematical modeling of industrial systems, Queuing theory, Markov Chains quality control and supply chain issues. 4 lectures. Prerequisite: Graduate standing and consent of instructor.

IME 503 Applied Statistical Methods in Engineering (4)

Application of hypothesis testing, regression models, and ANOVA models to forecasting, process optimization, cost estimation, work measurement, inventory control, scheduling, and ergonomics. Probability distributions of process outputs in industries and service systems such as Normal, exponential, Uniform, Hypergeometric, Binomial, and Poisson. Applications in queuing, reliability, Markov chains. Expectations of random variables. Measures of central tendency and variation. Population and a random sample. Central limit theorem and its application in simulation of processes. 3 lectures, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

IME 507 Graduate Seminar (2)

Selected topics of interest to industrial engineering, integrated technology management, and engineering management graduate students. The Schedule of Classes will list topic selected. Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 seminar, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

IME 510 Systems Engineering I (4)

Project management. Scheduling and budgeting. Queuing theory. Process control and life-cycle cost analysis. Contracts and negotiation. 4 lectures. Prerequisite: Graduate standing or consent of instructor. *Crosslisted as AERO/IME 510.*

IME 511 Systems Engineering II (4)

Risk management. Design strategies to meet system/mission requirements. Design for supportability, manufacturability, reliability, etc. Quality function development and quality control concepts. 4 lectures. Prerequisite: AERO 510 or IME 510, graduate standing or consent of instructor. *Crosslisted as AERO/IME 511.*

IME 516 Mechatronics Systems Analysis (4)

Overview of smart products and intelligent manufacturing systems. Tools and technologies utilized in the design, manufacturing, and operations of such products and systems. Artificial Intelligence Technologies and Fuzzy Logic. Design of smart products and intelligent systems. Case studies. Team projects and formal presentations. 3 seminars, 1 laboratory. Prerequisite: IME 416 or ME 405 or equivalent.

IME 520 Advanced Information Systems for Operations (4)

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. Prerequisite: IME 410 or consent of instructor.

IME 526 Advanced Topics in Manufacturing System Design (4)

Modeling and analysis of manufacturing systems. Advanced topics in manufacturing system design to support development of complex systems: Virtual Reality, discrete event simulation, system architectures, systems integration, scheduling and control of manufacturing systems. Total credit limited to 12 units. 3 seminars, 1 laboratory. Prerequisite: IME 410 or equivalent.

IME 541 Advanced Operations Research (4)

Operations Research approach to model building. Linear programming and sensitivity analysis. Network flow models. Integer programming, large scale linear programming. Goal programming and multi-attribute decision making. Dynamic programming. Nonlinear programming and search

methods. Applications in model building and computer solutions in planning, resource allocation, scheduling, and other industrial and service operations. 3 lectures, 1 laboratory. Prerequisite: Graduate standing and consent of instructor.

IME 542 Reliability Engineering II (4)

Reliability engineering terminology and definitions. Reliability mathematics; probability plotting; load-strength interference and safety margin. Failure distributions and failure rate models. Weibull analysis; bath tub curve; reliability of parts. Reliability of systems; redundancy; reliability allocation. Maintain-ability and availability. Failure modes and effects analysis. Fault tree analysis. Failure data analysis; reliability testing; reliability growth testing. Electronic system, mechanical and software reliability. Safety and human reliability; reliability management. 3 lectures, 1 laboratory. Prerequisite: IME 503.

IME 543 Advanced Human Factors (4)

Theory and application of man-machine relations and system design. Concepts of mathematical models, human information input channels, decision making based on capability of human operator. 3 seminars, 1 laboratory. Prerequisite: IME 319 or equivalent, IME 326 or equivalent and graduate standing.

IME 544 Advanced Topics in Engineering Economy (4)

Review of interest calculations and comparison of economic alternatives. Replacement analysis. Capital planning and budgeting. Mathematical programming and capital budgeting. Utility theory. Decision making under risk and uncertainty. Application of simulation in risk modeling. Benefit-cost analysis. Multi-attribute decision making. Analytic hierarchy process. 3 lectures, 1 activity. Prerequisite: Undergraduate course in engineering economy.

IME 545 Advanced Topics in Simulation (4)

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. Prerequisite: IME 420 and graduate standing.

IME 548 Engineering Decision Making (4)

Principles, concepts, models, and case studies of decision making, both quantitative and nonquantitative. Emphasizes commonly used techniques when quantitative models do not exist, do not cover all key factors, or when sufficient data are not available. 3 lectures, 1 laboratory. Prerequisite: IME 301, IME 314, STAT 321 or equivalent and graduate standing.

IME 555 Computer-Integrated Manufacturing (4)

CIM and concurrent engineering concepts. Systems analysis methodologies and functional specifications. Technological and managerial strategies for system integration. Analysis of contemporary CIM frameworks. Information networks and protocols for integrated manufacturing systems. Implementation strategies for CIM and concurrent engineering. 3 seminars, 1 laboratory. Prerequisite: IME 335, IME 411 or equivalent, graduate standing.

IME 556 Technological Project Management (4)

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. Prerequisite: Graduate standing or consent of instructor.

IME 557 Technological Assessment and Planning (4)

Assessing likely future technological environments, speed of change in competitive environments, relationship to business, strategic, and technology plans of firms. Past, present and technological evolution and operational changes. Technological and competitive impact assessment and business/ technology strategy development. Use of case studies and company experiences. 4 seminars. Prerequisite: IME 503 or equivalent, and graduate standing.

IME 558 Executive Seminars (4)

Culminating overview of major issues facing organizations as they meet the challenge to sustain a competitive advantage in a business environment characterized by rapid and pervasive change. Topics include project management, virtual organizations, the service sector, manufacturing futures, and information technology. 2 seminars, 2 supervision. Prerequisite: Advanced graduate program status or consent of instructor.

IME 559 Engineering Research and Development (4)

Principles, approaches and practices for effective engineering innovation, design, research and development (R&D) in business and industry. Relationship of R&D with corporate strategy and technology base. R&D objectives through implementation. Integration of creativity, evaluation, design, and ongoing operations. Case studies. 4 seminars. Prerequisite: IME 314 or equivalent and graduate standing.

IME 560 Quality Engineering II (4)

Integrated total quality system engineering for manufacturing and service firms. Classical and modern quality philosophies and quality assurance and improvement methods. Statistical methods. Designing for quality, continuous quality improvement, and total quality system integration. Case studies. 4 seminars. Prerequisite: IME 421, IME 430, or equivalent.

IME 570 Selected Advanced Topics (1–4)

Directed group study of selected topics for advanced students. Open to graduate students and selected seniors. The Schedule of Classes will list title selected. 1–4 seminars. Prerequisite: Graduate standing and/or consent of instructor.

IME 571 Selected Advanced Laboratory (1–4)

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. Prerequisite: Graduate standing or consent of instructor.

IME 575 Critical Technologies (4)

Scientific, engineering and strategic overview of numerous critical emerging technologies. Topics include: technologies critical for different engineering disciplines, critical to numerous industries, and/or critical to the national interest. Focus on each technology to include: understanding key scientific fundamentals, evaluating commercialization potential to industry, and identifying conditions and outlook for future technological breakthroughs. 3 seminars, 1 laboratory. Prerequisite: Engineering graduate student and consent of instructor.

IME 577 Engineering Entrepreneurship (4)

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. Prerequisite: Graduate standing or consent of instructor.

IME 580 Manufacturing Systems (4)

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. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

IME 591, 592 Integrated Product Development I, II (4) (4)

Team taught course addressing: product opportunity identification, customer needs analysis, concept definition, requirements definition, product-process analysis, product specification, design/process description, prototyping, project management, packaging, product promotion/introduction, and manufacturing ramp-up. Team projects in partnership with industry sponsors, field-trips and formal presentations. 3 seminars, 1 laboratory for each. Prerequisite: Graduate standing.

IME 593 Cooperative Education Experience (2) (CR/NC)

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career

field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

IME 594 Cooperative Education Experience (6) (CR/NC)

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

IME 595 Cooperative Education Experience (12) (CR/NC)

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

IME 596 Team Project/Internship (1-10)

Integrative learning experience through internship and team project with industrial organization. Requires advanced study and focuses on industrial unstructured problem or opportunity requiring integration across disciplines. Team project involves student, faculty, and sponsoring firm representative(s) in a collaborative learning environment, and culminates in comprehensive written report. Total credit limited to 10 units, normally taken over 2 quarters. Prereq-uisite: Advanced graduate standing, completion of, or concurrent enrollment in, engineering courses in specialization, and consent of participating faculty.

IME 599 Design Project (Thesis) (1-9)

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis. Prerequisite: Graduate standing and consent of instructor.

COLUMBIA UNIVERSITY

IN THE CITY OF NEW YORK

DEPARTMENT OF INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

BS IN INDUSTRIAL ENGINEERING PROGRAM PLAN

NAME:

UNI: **PID:** **CELL PHONE:**

ADVISOR: **MINOR:**

FIRST & SECOND YEAR REQUIREMENTS

TERM	COURSE NUMBER	PTS	COMPLETED
	ECON F1105	4.0	☐
	IEOR E2261	3.0	☐
	Pre-professional	3.0	☐
			☐

TERM	COURSE NUMBER	PTS	COMPLETED
	COMS W1004 Or COMS W1007	3.0	☐
	COMS W3134 Or COMS W3137	3.0	☐
	MATH V2010 Or APMA 3101	3.0	☐
	SIEO W3600 Or SIEO W4150	4.0	☐

THIRD YEAR REQUIREMENTS

FALL			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E3106 Or IEOR E4106	3.0	☐
	IEOR E3608 Or IEOR E4004	4.0	☐
	MATH E1210 Or MATH V3027	3.0	☐
	COMS W4111	3.0	☐
			☐
			☐

SPRING			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E3402	4.0	☐
	IEOR E4404	4.0	☐
			☐
			☐
			☐
			☐

FOURTH YEAR REQUIREMENTS

FALL			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E4003 Or IEOR E4403	3.0	☐
	IEOR E4207	3.0	☐
	IEOR E4705	3.0	☐
			☐
			☐
			☐

SPRING			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E4405	3.0	☐
	IEOR E4412	3.0	☐
	IEOR E4510	3.0	☐
			☐
			☐
			☐

ELECTIVE REQUIREMENTS

INDUSTRIAL ENGINEERING ELECTIVES (SELECT 2: IEOR E4210, E4418 or IEME E4310)			
TERM	COURSE NUMBER	PTS	COMPLETED
			☐

TECHNICAL ELECTIVE (3 PTS)			
TERM	COURSE NUMBER	PTS	COMPLETED
			☐

S.W. Mudd Building, Room 313 advising@ieor.columbia.edu

COLUMBIA UNIVERSITY

IN THE CITY OF NEW YORK

DEPARTMENT OF INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

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DEPARTMENTAL ADVISOR

DATE

S.W. Mudd Building, Room 313 advising@ieor.columbia.edu

INDUSTRIAL ENGINEERING PROGRAM: FIRST AND SECOND YEARS

	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV
MATHEMATICS	MATH V1101 (3) →	MATH V1102 (3) →	MATH V1201 (3) →	Linear algebra (3)[1]
PHYSICS (three tracks, choose one)	C1401 (3) → C1601 (3.5) → C2801 (4.5) →	C1402 (3) C1602 (3.5) C2802 (4.5)	→ Chemistry or physics lab: PHYS C1493 (3) **or** PHYS W3081 (2) **or** CHEM C1500 (3) **or** CHEM C2507 (3) **or** CHEM C3085 (4) **or**	
CHEMISTRY (choose one course)	C1403 (3) **or** C1404 (3) **or** C1604 (3.5) **or** C3045 (3.5)			
ENGLISH COMPOSITION (three tracks, choose one)	C1010 (3) Z1003 (0) → Z0006 (0) →	→ C1010 (3) Z1003 (0) →	→ C1010 (3)	
REQUIRED NONTECHNICAL ELECTIVES	ECON W1105 (4) **and** W1155 recitation (0) either semester		HUMA C1001, COCI C1101, **or** Global core (3–4)	HUMA C1002, COCI C1102, **or** Global core (3–4)
			HUMA W1121 **or** W1123 (3) either semester	
FIRST- AND SECOND-YEAR DEPT. REQUIREMENTS	Professional-level course (3) (see pages 12–13)		IEOR E2261 (3)	SIEO W3600 (4)[2]
COMPUTER SCIENCE			COMS W1004 (3) **and** COMS W3134 (3) **or** ENGI E1006 (3) **and** COMS W3136 (3)[3] **or** COMS W1007 (3) **and** COMS W3137 (4)	
PHYSICAL EDUCATION	C1001 (1)	C1002 (1)		
THE ART OF ENGINEERING	ENGI E1102 (4) either semester			

[1] The linear algebra requirement may be filled by either MATH V2010 or APMA E3101.

[2] If taking IEOR E3658, students must take IEOR E4307 to complete the SIEO W3600 requirement.

[3] COMS W3136 will be offered beginning in Spring 2013.

INDUSTRIAL ENGINEERING: THIRD AND FOURTH YEARS

	SEMESTER V	SEMESTER VI	SEMESTER VII	SEMESTER VIII
REQUIRED COURSES[1]	MATH E1210 (3) Ordinary diff. equations IEOR E3106 (3) Stochastic models IEOR E3608 (4) Mathematical prog. COMS W4111 (3) Database systems	IEOR E3402 (4) Production planning IEOR E4404 (4) Simulation	IEOR E4003 (3) Industrial econ. IEOR E4207 (3) Human factors IEOR E4705 (3) Studies in operations research	IEOR E4405 (3) Prod. scheduling IEOR E4412 (3) Quality control and management IEOR E4510 (3) Project management
TECHNICAL ELECTIVES	Choose one (3 pts.): Please consult the list on the departmental website: www.ieor.columbia.edu			
NONTECH ELECTIVES	Complete 27-point requirement. See page 10 or www.engineering.columbia.edu for details.			
INDUSTRIAL ENGINEERING ELECTIVES	Choose two (6 pts.): Please consult the list on the departmental website: www.ieor.columbia.edu			

[1] Taking required courses later than the prescribed semester is not permitted.

COLUMBIA UNIVERSITY

IN THE CITY OF NEW YORK

DEPARTMENT OF INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

BS IN OPERATIONS RESEARCH PROGRAM PLAN

NAME:

UNI: **PID:** **CELL PHONE:**

ADVISOR: **MINOR:**

FIRST & SECOND YEAR REQUIREMENTS

TERM	COURSE NUMBER	PTS	COMPLETED
	ECON F1105	4.0	☐
	IEOR E2261	3.0	☐
	Pre-professional	3.0	☐
			☐

TERM	COURSE NUMBER	PTS	COMPLETED
	COMS W1004 Or COMS W1007	3.0	☐
	COMS W3134 Or COMS W3137	3.0	☐
	MATH V2010 Or APMA 3101	3.0	☐
	SIEO W3600 Or SIEO W4150	4.0	☐

THIRD YEAR REQUIREMENTS

FALL			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E3106 Or IEOR E4106	3.0	☐
	IEOR E3608 Or IEOR E4004	4.0	☐
	MATH E1210 Or MATH V3027	3.0	☐
	COMS W4111	3.0	☐
			☐
			☐

SPRING			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E3402	4.0	☐
	IEOR E4404	4.0	☐
	IEOR E4600	3.0	☐
			☐
			☐
			☐

FOURTH YEAR REQUIREMENTS

FALL			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E4003 Or IEOR E4403	3.0	☐
	IEOR E4407	3.0	☐
			☐
			☐
			☐
			☐

SPRING			
TERM	COURSE NUMBER	PTS	COMPLETED
	IEOR E4405	3.0	☐
	IEOR E4505, E4507 E4615 Or E4700	3.0	☐
			☐
			☐
			☐
			☐

ELECTIVE REQUIREMENTS

TECHNICAL (12 PTS, AT LEAST 2 FROM IEOR)			
TERM	COURSE NUMBER	PTS	COMPLETED
			☐

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COLUMBIA UNIVERSITY

IN THE CITY OF NEW YORK

DEPARTMENT OF INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

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DEPARTMENTAL ADVISOR _____ DATE _____

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OPERATIONS RESEARCH PROGRAM: FIRST AND SECOND YEARS

	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV
MATHEMATICS	MATH V1101 (3) →	MATH V1102 (3) →	MATH V1201 (3) →	Linear algebra (3)[1]
PHYSICS (three tracks, choose one)	C1401 (3) → C1402 (3) C1601 (3.5) → C1602 (3.5) C2801 (4.5) → C2802 (4.5)		Chemistry or physics lab: PHYS C1493 (3) **or** PHYS W3081 (2) **or** CHEM C1500 (3) **or** CHEM C2507 (3) **or** CHEM C3085 (4) **or**	
CHEMISTRY (choose one course)	C1403 (3) **or** C1404 (3) **or** C1604 (3.5) **or** C3045 (3.5)			
ENGLISH COMPOSITION (three tracks, choose one)	C1010 (3) Z1003 (0) →	C1010 (3) Z0006 (0) → Z1003 (0) →	C1010 (3)	
REQUIRED NONTECHNICAL ELECTIVES	ECON W1105 (4) **and** W1155 recitation (0) either semester		HUMA C1001, COCI C1101, **or** Global Core (3–4)	HUMA C1002, COCI C1102, **or** Global Core (3–4)
			HUMA W1121 **or** W1123 (3) either semester	
FIRST- AND SECOND-YEAR DEPT. REQUIREMENTS	Professional-level course (3) (see pages 12–13)		IEOR E2261 (3)	SIEO W3600 (4)[2]
COMPUTER SCIENCE			COMS W1004 (3) **and** COMS W3134 (3) **or** ENGI E1006 (3) **and** COMS W3136 (3)[3] **or** COMS W1007 (3) **and** COMS W3137 (4)	
PHYSICAL EDUCATION	C1001 (1)	C1002 (1)		
THE ART OF ENGINEERING	ENGI E1102 (4) either semester			

[1] The linear algebra requirement may be filled by either MATH V2010 or APMA E3101.

[2] If taking IEOR E3658, students must take IEOR E4307 to complete the SIEO W3600 requirement.

[3] COMS W3136 will be offered beginning in Spring 2013.

OPERATIONS RESEARCH: THIRD AND FOURTH YEARS

	SEMESTER V	SEMESTER VI	SEMESTER VII	SEMESTER VIII
REQUIRED COURSES[1]	MATH E1210 (3) Ordinary diff. equations IEOR E3106 (3) Stochastic models IEOR E3608 (4) Mathematical prog. COMS W4111 (3) Database systems	IEOR E3402 (4) Production planning IEOR E4404 (4) Simulation IEOR E4600 (3) Applied integer prog.	IEOR E4003 (3) Industrial econ. IEOR E4407 (3) Game theoretic models of operations	IEOR E4405 (3) Prod. scheduling
			Choose one: IEOR E4505 Operations research for public policy IEOR E4507 Healthcare operations management IEOR E4615 Service engineering IEOR E4700 Introduction to FE	
OPERATIONS RESEARCH ELECTIVES	Choose four OR electives (12 pts. total): Please consult the list on the departmental website: www.ieor.columbia.edu			
NONTECH ELECTIVES	Complete 27-point requirement. See page 10 or www.engineering.columbia.edu for details.			

[1] Taking required courses later than the prescribed semester is not permitted.

ORE CHECKLIST

Name: CORNELL Advisor:
Email: Cornell ID:
Expected Degree Date:

Updated:
Overall GPA:
Major GPA:

Term	GPA	Term	GPA	Term	GPA

Engineering Core Courses

Course	Cr	Sem	Gr	Advising Notes
MATH 1910	4			**Math Requirement**: Either Math 2930, 3040 or CS 2800 can be used to satisfy the fourth math requirement. Students NOT taking Math 293 may not enroll in PHYS 2214. Math grades must be at least C- **The following courses may be substituted for **Phys 2214**: Chem 2080, Math 3110, Math 3360, Math 2930 (if not used to meet the math. req.), Math 3040 (if not used to meet the math req.) or CS 2800 (if not used to meet the math req.)
MATH 1920	4			
MATH 2930*	4			
MATH 2940	4			
CS 111X	4			
PHYS 1112	4			
PHYS 2213	4			
PHYS 2214**	4			
CHEM 2090	4			

Engr. Distribution Courses (must achieve a C- or above in ENGRD courses to receive cr.)

Course	Cr	Sem	Gr	Advising Notes
ENGRD 2700	3			Required Distribution course
ENGRD 2110	3			Recommended Distrbution course.
ENGRI	3			Intro. to Engineering

Freshman Writing Seminars

Course	Cr	Sem	Gr	Advising Notes
FWS 1	3			
FWS 2	3			

Liberal Studies Courses

Course	Cr	Sem	Gr	Advising Notes
Liberal Studies 1				At least 6 courses, 18 cred. min. taken from at least 3 of the following 6 groups: CA, HA, LA, KCM, SBA, Foreign Languages. 2 courses must be 2000 level or above.
Liberal Studies 2				
Liberal Studies 3				
Liberal Studies 4				
Liberal Studies 5				
Liberal Studies 6				

Physical Education

Course	Cr	Sem	Gr	Advising Notes
PE 1	1			Must pass a swim test to fulfill requirement.
PE 2	1			

Additional Elective Courses - Do Not Count Toward Major

Course	Cr	Sem	Gr	Advising Notes

This document is intended to be a worksheet for students & advisors. It is not a transcript and is subject to change.

ORIE Required Major Courses (must achieve a C- or above to receive credit)

Course	Cr	Sem	Gr	Advising Notes
ORIE 3120	4			Industrial Data and Systems Analysis
ORIE 3150	4			Financial and Managerial Accounting
ORIE 3300	4			Optimization I
ORIE 3310	4			Optimization II
ORIE 3500	4			Engineering Probability & Statistics II
ORIE 3510	4			Introductory Engr. Stochastic Processes
ORIE 4580	4			Simulation Modeling and Analysis
Organizational Behavior	3			Behavioral Science course (from approved list)

ORIE Electives

Course	Cr	Sem	Gr	Advising Notes
ORIE				At least 9 credits of ORIE courses not listed as a required major course. ORIE 4152, 9000, 9100, 9101& 9110 do not fulfill this requirement
ORIE				
ORIE				

Major Approved Electives

Course	Cr	Sem	Gr	Advising Notes
Elective-Category A				At least 9 cr. of technical courses numbered 2000 or above from the approved list. At least 6 cr. must be from Category A (Engineering, Science, & Math). 3 cr. may be from Category B (Engr. Design, Finance, Economic Analysis). At least one course must be from outside of ORIE
Elective-Category A				
Elective-Category B				

Advisor Approved Electives

Course	Cr	Sem	Gr	Advising Notes
Elective				At least 6 credits. Any course agreed upon by student & advisor relevant to the student's educational objectives.
Elective				

Technical Writing Requirement: ____ Check when requirement is fulfilled.

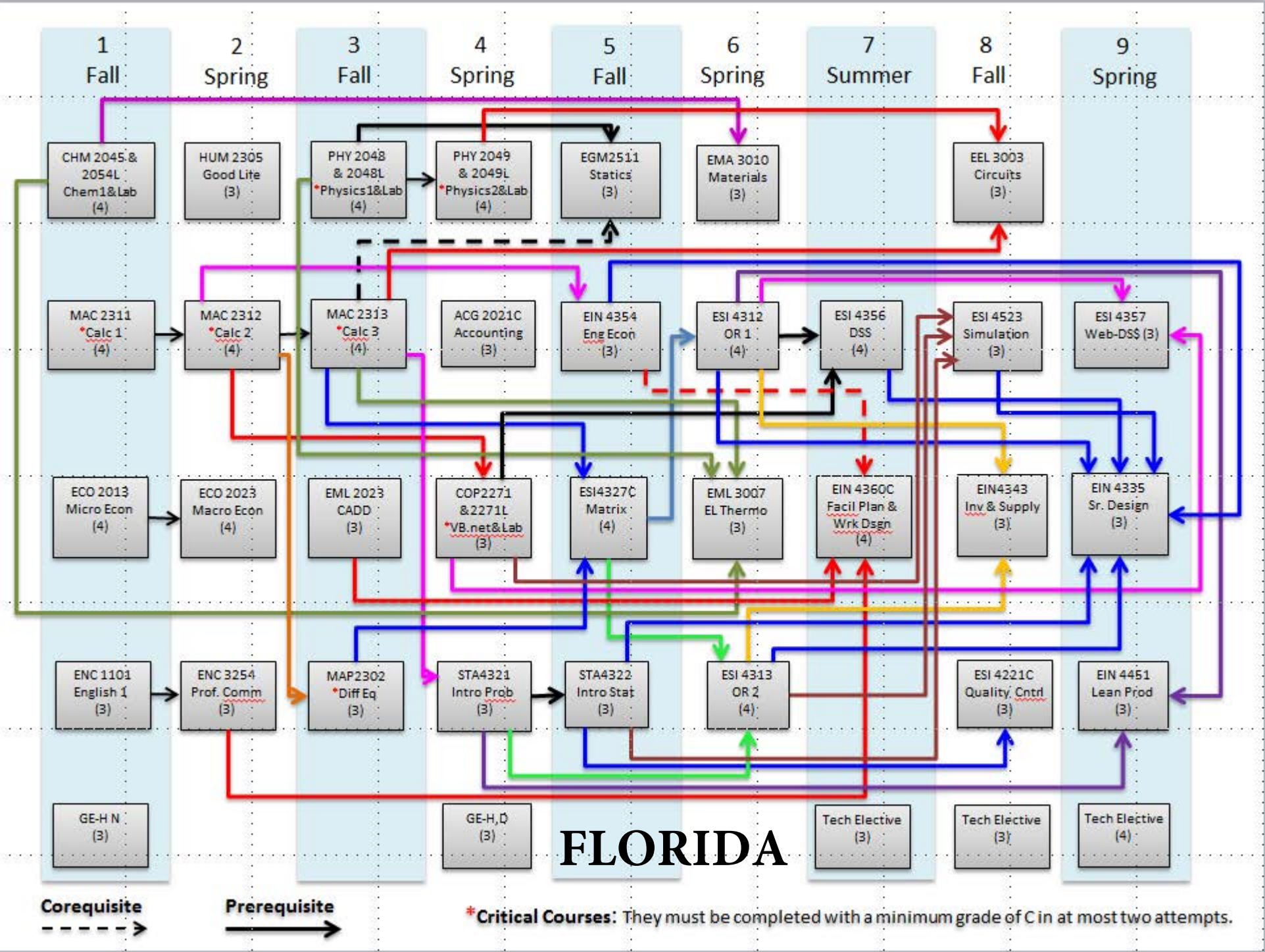
125 minimum required credits.

ORE Honors Program - 9 cr (Optional)

Course	Cr	Sem	Gr	Advising Notes
ORIE 5XXX				9 credits beyond the minimum with at least 4 hours from category (1): (1) advanced courses in ORIE at 5000 level or above; (2) Significant research project - ORIE 4999; (3) Significant teaching experience - ORIE 4990.
ORIE				
ORIE				
ORIE 4999				
ORIE 4990				

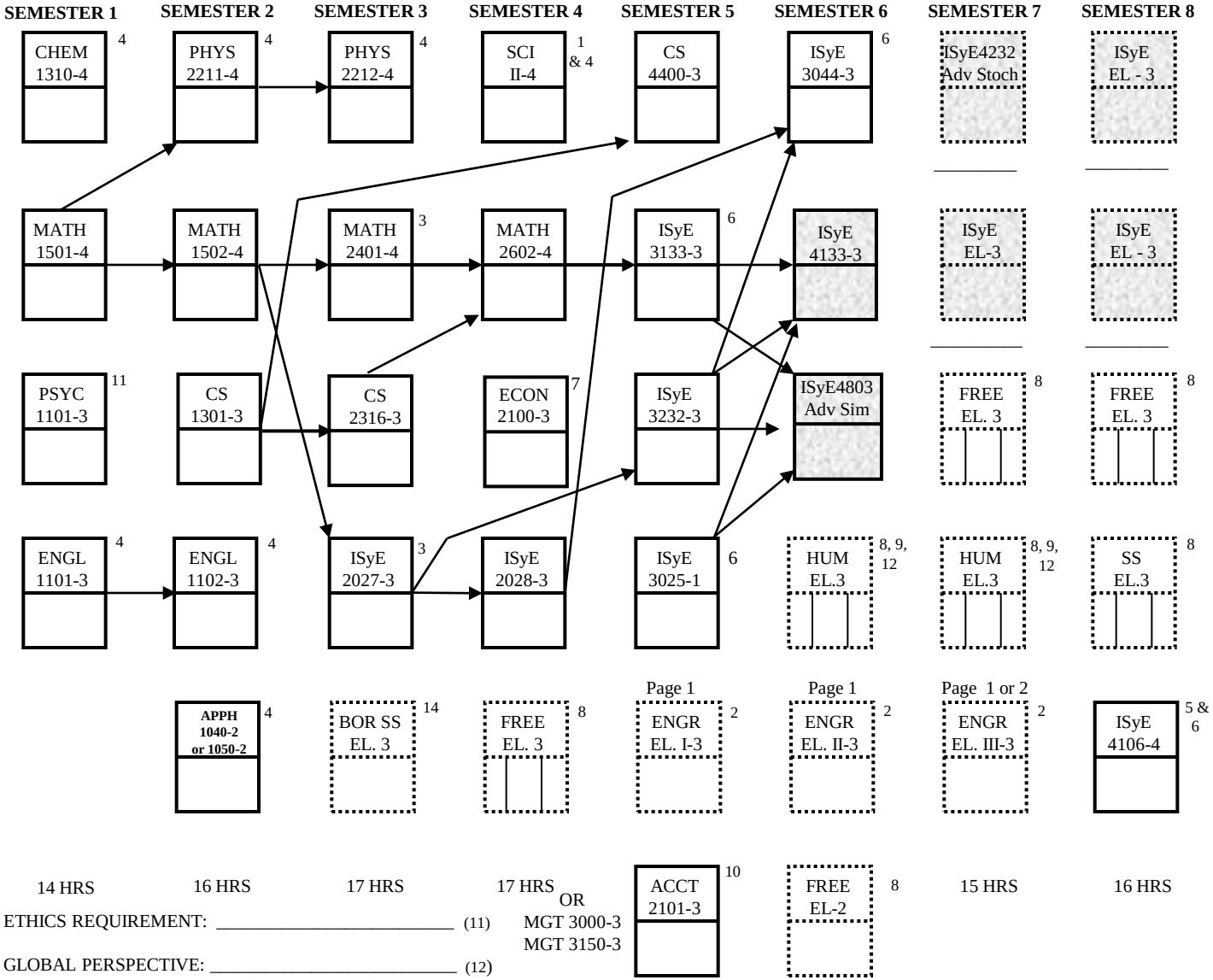
This certifies, to the best of my knowledge, that this checklist is correct.
If this proves not to be true, I understand my graduation may be delayed.

Student Signature _____
Degree requirements met: _____ OR&E approval: _____


1 Fall
2 Spring
3 Fall
4 Spring
5 Fall
6 Spring
7 Summer
8 Fall
9 Spring
CHM 2045 & 2054L Chem1&Lab (4)
HUM 2305 Good Lite (3)
PHY 2048 & 2048L *Physics1&Lab (4)
PHY 2049 & 2049L *Physics2&Lab (4)
EGM2511 Statics (3)
EMA 3010 Materials (3)
EEL 3003 Circuits (3)
MAC 2311 *Calc 1 (4)
MAC 2312 *Calc 2 (4)
MAC 2313 *Calc 3 (4)
ACG 2021C Accounting (3)
EIN 4354 Eng Econ (3)
ESI 4312 OR 1 (4)
ESI 4356 DSS (4)
ESI 4523 Simulation (3)
ESI 4357 Web-DS$ (3)
ECO 2013 Micro Econ (4)
ECO 2023 Macro Econ (4)
EML 2023 CADD (3)
COP2271 &2271L *VB.net&Lab (3)
ESI4327C Matrix (4)
EML 3007 EL Thermo (3)
EIN 4360C Facil Plan & Wrk Dsgn (4)
EIN4343 Inv & Supply (3)
EIN 4335 Sr. Design (3)
ENC 1101 English 1 (3)
ENC 3254 Prof. Comm (3)
MAP2302 *Diff Eq (3)
STA4321 Intro Prob (3)
STA4322 Intro Stat (3)
ESI 4313 OR 2 (4)
ESI 4221C Quality Cntrl (3)
EIN 4451 Lean Prod (3)
GE-H N (3)
GE-H,D (3)
Tech Elective (3)
Tech Elective (3)
Tech Elective (4)
FLORIDA
Corequisite
Prerequisite
*Critical Courses: They must be completed with a minimum grade of C in at most two attempts.

OPERATIONS RESEARCH CONCENTRATION

BSIE PROGRAM for the 2014-2015 Year



ETHICS REQUIREMENT: _____ (11)

GLOBAL PERSPECTIVE: _____ (12)

ENVIRONMENT EL._____ (13)

BOR SOCIAL SCIENCE EL. _____(14)

ACADEMIC ADVISOR_____

TOTAL ISYE CREDIT HOURS: 128

GEORGIA

(1) Science Electives: BIOL 1510, EAS 1600 or 1601 or 2600. Only one EAS allowed. Advisor approval required to take BIOL 1520.

(2) 9 hours Engineering Electives (Non-ISYE) are required from approved list: http://www.isye.gatech.edu/academics/undergraduate/courses/. At least 2 courses from page 1.

(3) MATH 2401 is Co-requisite or Pre-requisite for ISYE 2027.

(4) APPH, English, Lab Sciences and Physics must be taken prior to your Junior year.

(5) You must be within 2 semesters of graduation to register for Senior Design. (Summers Excluded) and complete 4 of 6 Concentration courses before Senior Design.

(6) All ISYE required courses must be completed prior to Senior Design. (see other side for required courses)

(7) (ECON 2100 or 2101), or (2105 or 2106) (Credit cannot be allowed for both ECON 2100 and 2101, and if you take 2100 or 2101 you will NOT receive credit for either 2105 or 2106)

(8) Only 9 hours allowed Pass/Fail within Social Sciences, Humanities and Free Electives. No other courses allowed Pass/Fail. *http://www.catalog.gatech.edu/genregulations/passfail.php

(9) 6 hours Humanities electives required: http://www.catalog.gatech.edu/students/ugrad/core/corec.php

(10) Engineering & Management Minors must take MGT 3150 or MGT 4015. Credit not given For ACCT 2101 and MGT 3000. Do not take ACCT 2101 if you are in this Minor.

(11) See here for Ethics Requirement: http://www.catalog.gatech.edu/students/ugrad/core/ethics.php

(12) See here for Global Perspective requirement: http://www.catalog.gatech.edu/students/ugrad/core/gp.php

(13) See here for Environmental Elective: http://www.isye.gatech.edu/academics/undergraduate/courses

(14) Board of Regents Requirement: Choose one: HIST 2111, HIST 2112, POL 1101, INTA 1200 or PUBP 3000. Credit is not given for both POL 1101 & INTA 1200. Must be taken letter grade.

Updated Jan 2014

Concentration Name	Concentration DEPTH classes	Concentration BREADTH classes
(A) Supply Chain Engineering	A1. 3103 Logistics A2. 3104 Manufacturing A3. One of: a. 4111 Adv Logistics* b. 4803 Adv Manufacturing*	Three courses take from the [DEPTH] of at least two concentrations (B), (C), and (D)
(B) Quality and Statistics	B1. 3039 Quality Control B2. 4031 Regression & Forecasting B3. One of: a. CS 4641 Machine Learning b. Math 4262	Three courses take from the [DEPTH] of at least two concentrations (A), (C), and (D)
(C) Economic and Financial Systems	C1. 4301 Supply Chain Economics C2. 4311 Capital Investment Analysis C3. One of: a. Econ 3150 Econ & Fin Mod b. Mgt 3078 Fin & Investments c. Econ 4340 Industrial Organization d. Econ 4350 Intl Econ	Three courses take from the [DEPTH] of at least two concentrations (A), (B), and (D)
(D) Operations Research	D1. 4133 Adv Optimization* D2. 4803 Adv Simulation** D3. 4232 Adv Stochastics*	Three courses take from the [DEPTH] of at least two concentrations (A), (B), and (C)
(E) General ISyE	One of: a. 4111 Adv Logistics* b. 4803 Adv Manuf/ Adv Simul.* c. 4311 Capital Investment Analysis* d. 4133 Adv Optimization* e. 4232 Adv Stochastics*	E1. 3103 Logistics E2. 3104 Manufacturing E3. 3039 Quality Control E4. 4031 Reg & Forecast* E5. 4301 Supply Chain Economics

ISyE Required Courses
(all concentrations)
ISyE 2027 Probability
ISyE 2028 Statistics
ISyE 3025 Eng Economy
ISyE 3044 Simulation
ISyE 3133 Eng Optimization
ISyE 3232 Stoch Mfg & Svc Sys
ISyE 4106 Senior Design

GEORGIA

*** Graduate Course Option: Please see: http://www.catalog.gatech.edu/students/ugrad/degrees/gradcourse.php**
Undergraduate students taking graduate-level courses and NOT applying course(s) toward Masters must have a cumulative GPA of 3.0. Allowable substitutions are: ISyE 6203 for Advanced Logistics, ISyE 6201 or ISyE 6202 for Advanced Manufacturing, ISyE 6669 for Advanced Optimization, ISyE 6644 for Advanced Simulation, ISyE 6650 for Advanced Stochastics, ISyE 6225 for Advanced EDA, and ISyE 6414 for Regression and Forecasting. Math 3012 Applied Combinatorics as the third OR Concentration depth class. The Associate Chair for Undergraduate Programs may allow additional substitutions as appropriate.

ISyE 4009 Human-Integrated system may be used as an Breadth Elective in any concentration. We do not offer the course but students can take the course elsewhere to transfer back.

GEORGIA

Semester	Sample Course Sequence	Hours	Total
1st Year Fall	MATH 1501 (Calculus I)	4	
	ENGL 1101 (English Composition I)	3	
	PSYC 1101 (General Pyschology)	3	
	LAB SCIENCE (Biology, Chemistry, Earth and Environmental Science	4	**14**
1st Year Spring	MATH 1502 (Calculus II)	4	
	ENGL 1102 (English Composition II)	3	
	PHYS 2211 INTRODUCTORY PHYSICS I	4	
	CS 1301 INTRO TO COMPUTING	3	
	HPS 1040 WELLNESS	2	**16**
2nd Year Fall	MATH 2401 (Calculus III)	4	
	PHYS 2212 INTRODUCTORY PHYSICS II	4	
	CS 2316 DATA INPUT/MANIPULATION	3	
	ISYE 2027 PROBABILITY WITH APPLICATIONS	3	
	HIST 2111 or 2112 or POL 1101 or PUBP 3000 or INTA 1200	3	**17**
2nd Year Spring	MATH 2602 LINEAR & DISCREE MATHEMATICS	4	
	ECON 2100 ECONOMIC ANALYSIS & POLICY	3	
	FREE ELECTIVE	3	
	ISYE 2028 BASIC STATISTICAL METHODS	3	
	LAB SCIENCE (Biology, Chemistry, Earth and Environmental Science	4	**17**
3rd Year Fall	CS 4400 INTRO TO DATABASE SYSTEMS	3	
	ISYE 3025 ESSENTIALS OF ENGINEERING ECONOMY	1	
	ISYE 3133 ENGINEERING OPTIMIZATION	3	
	ENGINEERING ELECTIVE	3	
	ISYE 3232 STOCHASTIC MFG & SERVICE SYSTEMS	3	
	ACCT 2101 or MGT 3000 or MGT 3150	3	**16**
3rd Year Spring	ISYE 3044 SIMULATION ANALYSIS & DESIGN	3	
	2 TRACK COURSES	6	
	HUMANITIES ELECTIVE	3	
	FREE ELECTIVE	2	
	ENGINEERING ELECTIVE	3	**17**
4th Year Fall	2 TRACK COURSES	6	
	ENGINEERING ELECTIVE	3	
	HUMANITIES ELECTIVE	3	
	FREE ELECTIVE	3	**15**
4th Year Spring	ISYE 4106 SENIOR DESIGN	4	
	2 TRACK COURSES	6	
	SOCIAL SCIENCE ELECTIVE	3	
	FREE ELECTIVE	3	**16**
	TOTAL PROGRAM HOURS		**128**

Purdue University
School of Industrial Engineering
Undergraduate Plan of Study

How to use the sample plans of study

Different types of classes are organized by shape. Please refer to the legend for more details.

Classes that have a shaded background are classes with a significant amount of prerequisites. They need to be taken in succession with one another and therefore these classes have the least amount of flexibility in terms of moving them around to different semesters. These classes should be carefully considered when planning your course of study (especially MA 261).

Technical electives (TE, IE TE) and general education electives (GE) have the most amount of flexibility. They can be taken at any time as long as you meet the course prerequisites.

A course relationship diagram at the last page graphically shows the prerequisites and co-requisites for the engineering courses. They do not include FYE courses such as ENGR131, ENGR132, MA166, PHYS172, CHM115, and CS159.

The plans assume that you enroll in the engineering program without receiving any AP, CLEP, IB or any other prior college credits. Also it assumes you do not take summer school or any other classes outside of Purdue that you may be able to receive credits for. If you receive additional college credits either at the beginning or during your studies, you may be able to gain some flexibility in planning your classes. For more information on receiving college credits, please talk to your advisor and/or the Purdue admissions website.

A list of technical electives as well as general education electives are available at the IE website

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Purdue University
315 N. Grant Street, West Lafayette, IN, 47907-2023
Phone: +1 (765) 494-5400
Fax: +1 (765) 494-6802

PURDUE ENGINEERING

Purdue University
School of Industrial Engineering
Undergraduate Plan of Study

4 Year (8 semesters) Plan of Study

Semester 8 (15 hrs)	IE431	IE TE	IE TE	TE	GE	
Semester 7 (15 hrs)	IE474	IE486	TE	TE	GE	
Semester 6 (15 hrs)	IE336	IE386	IE383	ME200	GE	
Semester 5 (18 hrs)	IE332	MA266	IE335	ECE201	IE370	GE
Semester 4 (15 hrs)	IE330	MA265	PHYS241	NUCL273	GE	
Semester 3 (16 hrs)	IE230	MA261	IE343	ME270	GE	IE200
Semester 2 (16 hrs)	MA166	PHYS172	CS159	ENGR132	COM114	
Semester 1 (14 hrs)	MA165	CHM115	ENGL106	ENGR131		

First Year Engineering

Legend

- Core engineering classes
- Least flexible classes
- General Education Electives
- Technical Electives

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PURDUE ENGINEERING

Purdue University
School of Industrial Engineering
Undergraduate Plan of Study

3.5 Year (7 semesters) Plan of Study*

Semester 7 (18 hrs)	IE431	IE474	IE TE	IE TE	GE	GE
Semester 6 (18 hrs)	IE336	IE383	IE486	ME200	GE	GE
Semester 5 (18 hrs)	IE332	IE386	IE335	ECE201	IE370	TE
Semester 4 (18 hrs)	IE330	MA265	PHYS241	NUCL273	MA266	TE
Semester 3 (16 hrs)	IE230	MA261	IE343	ME270	IE200	TE
Semester 2 (19 hrs)	MA166	PHYS172	CS159	ENGR132	GE	COM114
Semester 1 (17 hrs)	MA165	CHM115	ENGL106	ENGR131	GE	

First Year Engineering

*To make this plan more feasible, it is recommended that the student comes in with several college level credits (AP, IB, CLEP etc) or take classes over the summer

Legend

- Core engineering classes
- Least flexible classes
- General Education Electives
- Technical Electives

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PURDUE ENGINEERING

Purdue University
School of Industrial Engineering
Undergraduate Plan of Study

4.5 Year (9 semesters) Plan of Study

Semester 9 (12 hrs)	IE431	IE TE	TE	TE	
Semester 8 (12 hrs)	IE486	IE TE	TE	GE	
Semester 7 (12 hrs)	IE474	ME200	IE386	GE	
Semester 6 (15 hrs)	IE336	IE383	IE343	ECE201	GE
Semester 5 (15 hrs)	IE332	MA266	IE335	IE370	GE
Semester 4 (15 hrs)	IE330	MA265	PHYS241	NUCL273	GE
Semester 3 (13 hrs)	IE230	MA261	IE200	ME270	GE
Semester 2 (16 hrs)	MA166	PHYS172	CS159	ENGR132	COM114
Semester 1 (14 hrs)	MA165	CHM115	ENGL106	ENGR131	

First Year Engineering

Legend

- Core engineering classes
- Least flexible classes
- General Education Electives
- Technical Electives

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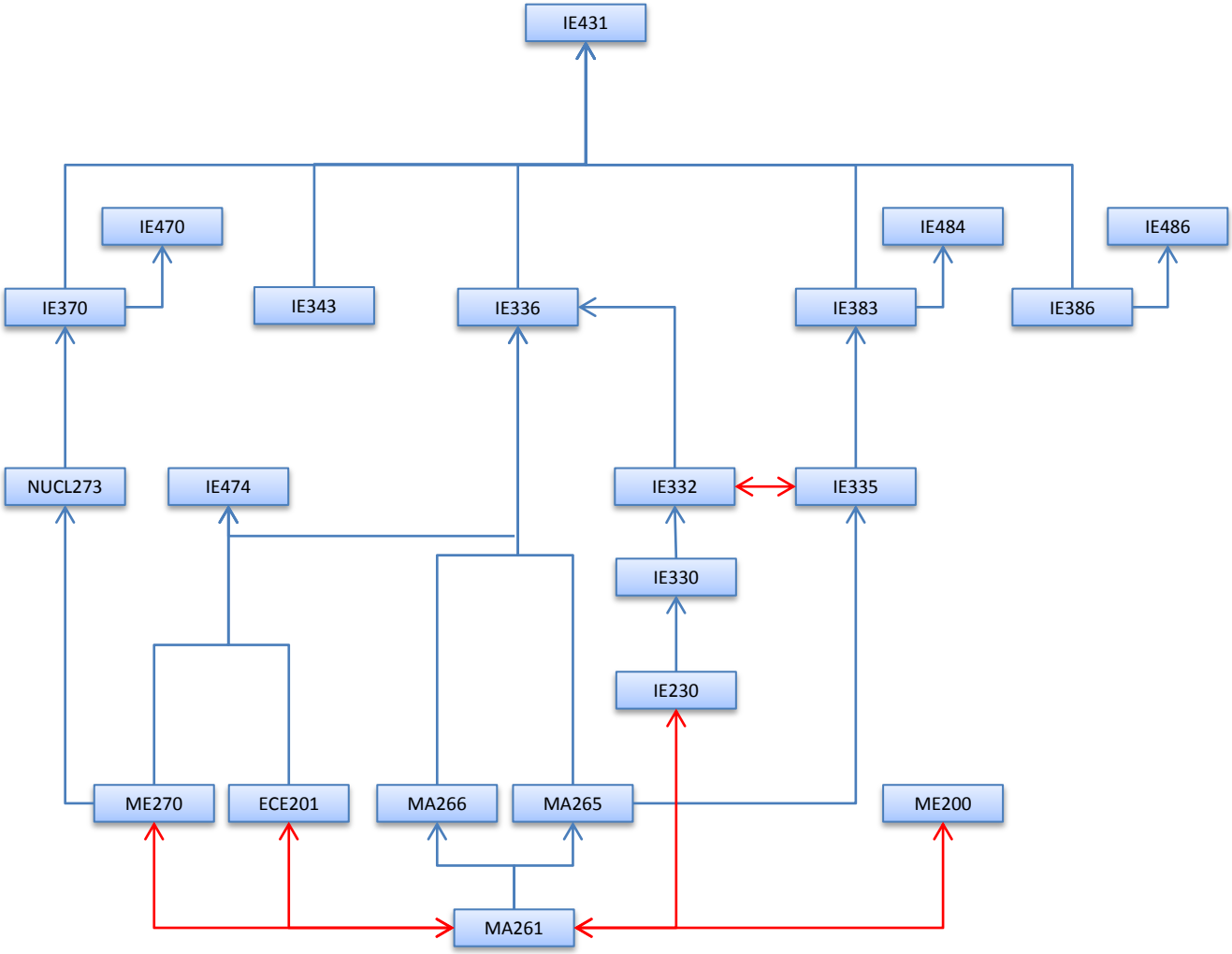
PURDUE ENGINEERING

Purdue University
School of Industrial Engineering
Undergraduate Plan of Study

Engineering Course Relationship Diagram



Notes

- This relationship diagram assumes you have finished the FYE program. The following classes are not shown: ENGR131, ENGR132, MA166, PHYS 172, CHM 115, CS159
- To satisfy the IE technical electives requirement, you must either
  1. Take IE 470 or IE 484, and one IE course at 500-level
  2. Take IE 470 and IE 484.
- Red lines refer to co-requisites

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PURDUE ENGINEERING

MANAGEMENT SCIENCE AND ENGINEERING
STANFORD

The Department of Management Science and Engineering is concerned with how best to organize resources – people, money, and materials – in our information-intensive, technology-based economy. The degree programs in MS&E prepare students to solve practical problems based on fundamental engineering principles. The department has strong research and teaching programs in decision and risk analysis, economics, engineering management, entrepreneurship, finance, information, operations research, organizations, production and manufacturing, strategy, systems analysis, and technology policy.

The undergraduate curriculum in Management Science and Engineering provides students training in the fundamentals of engineering systems analysis to prepare them to plan, design, and implement complex economic and technological management systems where a scientific or engineering background is necessary or desirable. Graduates will be prepared for work in a variety of career paths, including facilities and process management, investment banking, management consulting, or graduate study in industrial engineering, operations research, economics, public policy, medicine, law, or business.

OBJECTIVES AND OUTCOMES FOR MANAGEMENT SCIENCE & ENGINEERING

Objectives:

Principles and Skills: Provide our students with a basic understanding of management science and engineering principles, including analytical problem solving and communication skills.

Preparation for Practice: Prepare our students for practice in a field that sees rapid changes in tools, problems, and opportunities.

Preparation for Continued Growth: Prepare our students for graduate study and self development over an entire career, and

Preparation for Service: Develop in our students the awareness, background, and skills necessary to become responsible citizens, employees, and leaders

Outcomes:

An ability to apply knowledge of math, science, and engineering;
An ability to design and conduct experiments;
An ability to design a system or components to meet desired needs;
An ability to identify, formulate, and solve engineering problems;
An ability to use techniques, skills, and modern engineering tools necessary for engineering practice;
An ability to function on multidisciplinary teams;
An ability to communicate effectively;
A recognition of the need for and an ability to engage in life-long learning;
Background necessary for admission to top professional graduate engineering or business programs;
An understanding of professional and ethical responsibility;
The broad education necessary to understand the impact of engineering solutions in a global and societal context; and
A knowledge of contemporary issues pertinent to the field of management science and engineering.

For information about an MS&E minor, see the "Minors and Honors" section in this Handbook.
In addition to the B.S. degree, the MS&E Department offers Master of Science and Doctor of Philosophy degrees in Management Science and Engineering.
If you would like more information about our degree programs, please visit Lori Cottle, the MS&E Student Services Manager, in Terman Engineering Center Room 306. Students are encouraged to plan their academic programs as early as possible, ideally in the freshman or sophomore year. Please do not wait until you are declaring a major to consult with us. This is particularly important if you would like to study overseas or pursue another major or minor.

RESEARCH EXPERIENCE FOR UNDERGRADUATES

Our Research Experience for Undergraduates (REU) program offers students the opportunity to work closely with a faculty member during the summer quarter, and get paid to do so full-time. We give priority to our declared majors for REU positions. Information is emailed to all declared majors when applications become available during the winter quarter.

REQUIREMENTS: BACHELOR OF SCIENCE DEGREE IN MS&E

MATH AND SCIENCE (45 UNITS MINIMUM)

COURSE	TITLE	UNITS	QTR.
MATH (all listed courses; 32 units minimum)			
MATH 41	Single Variable Calculus (AP/IB credit may be used)	5	A
MATH 42	Single Variable Calculus (AP/IB credit may be used)	5	A,W
MATH 51	Linear Algebra and Diff. Calculus of Several Vars.	5	A,W,S
MATH 53	Ordinary Differential Equations with Linear Algebra	5	A,W,S
STATS 110	Statistical Methods in Engineering and the Physical Sciences	4-5	A
or STATS 200	Introduction to Statistical Inference	3	W
MS&E 120	Probabilistic Analysis	5	A
MS&E 121	Introduction to Stochastic Modeling	4	W

Science (11 units minimum)			
One of the following three eight-unit sequences:			
CHEM 31B/X	Chemical Principles (AP/IB credit may be used)	4	A,W
and CHEM 33	Structure and Reactivity	4	W,S
PHYS 21&22	Mechanics and Heat & Lab (AP/IB credit may be used)	4	A
and PHYS 23&24	Electricity and Optics & Lab (AP/IB credit may be used)	4	W
PHYS 41	Mechanics (AP Physics C /IB credit may be used)	4	W
and PHYS 43	Electricity and Magnetism (AP Physics C/IB credit may be used)	4	S
And also Science Elective from SoE approved list (Fig. 3-2), or PSYCH 55, or PSYCH 70		3	A,W,S

Additional Math or Science elective, if needed to reach 45 total units, from the SoE approved lists, or PSYCH 55 or 70.

At least four of the following nine courses, including at least one course in policy and at least one course in strategy:			
Policy:			
MS&E 193	Technology and National Security	3	A
MS&E 197	Ethics and Public Policy	5	W
MS&E 243	Energy and Environmental Policy Analysis	3	S
MS&E 248	Economics of Natural Resources	3-4	A
MS&E 292	Health Policy Modeling	3	W
Strategy:			
ENGR 145	Technology Entrepreneurship	4	A,W
MS&E 175	Innovation, Creativity, and Change (not given 2010-2011)	3-4	
MS&E 266	Management of New Product Development	3-4	W

PRODUCTION AND OPERATIONS MANAGEMENT (7 COURSES; 26-30 UNITS)

COURSE	TITLE	UNITS	QTR.
Students must choose MS&E 160 in Engineering Depth – Core (above)			
ECON 50	Economic Analysis I	5	A, S
ECON 51	Economic Analysis II	5	A,W
MS&E 140	Accounting for Managers and Entrepreneurs	3-4	A,S
MS&E 152	Introduction to Decision Analysis	4	S
Three of the following nine courses:			
MS&E 142	Investment Science	3	A
or MS&E 245G	Finance I	4	W
MS&E 262	Supply Chain Management	3	S
MS&E 264	Sustainable Product Development and Manufacturing	3	A
MS&E 265	Supply Chain Logistics	4	S
MS&E 266	Management of New Product Development	3-4	W
MS&E 268	Operations Strategy	3	S

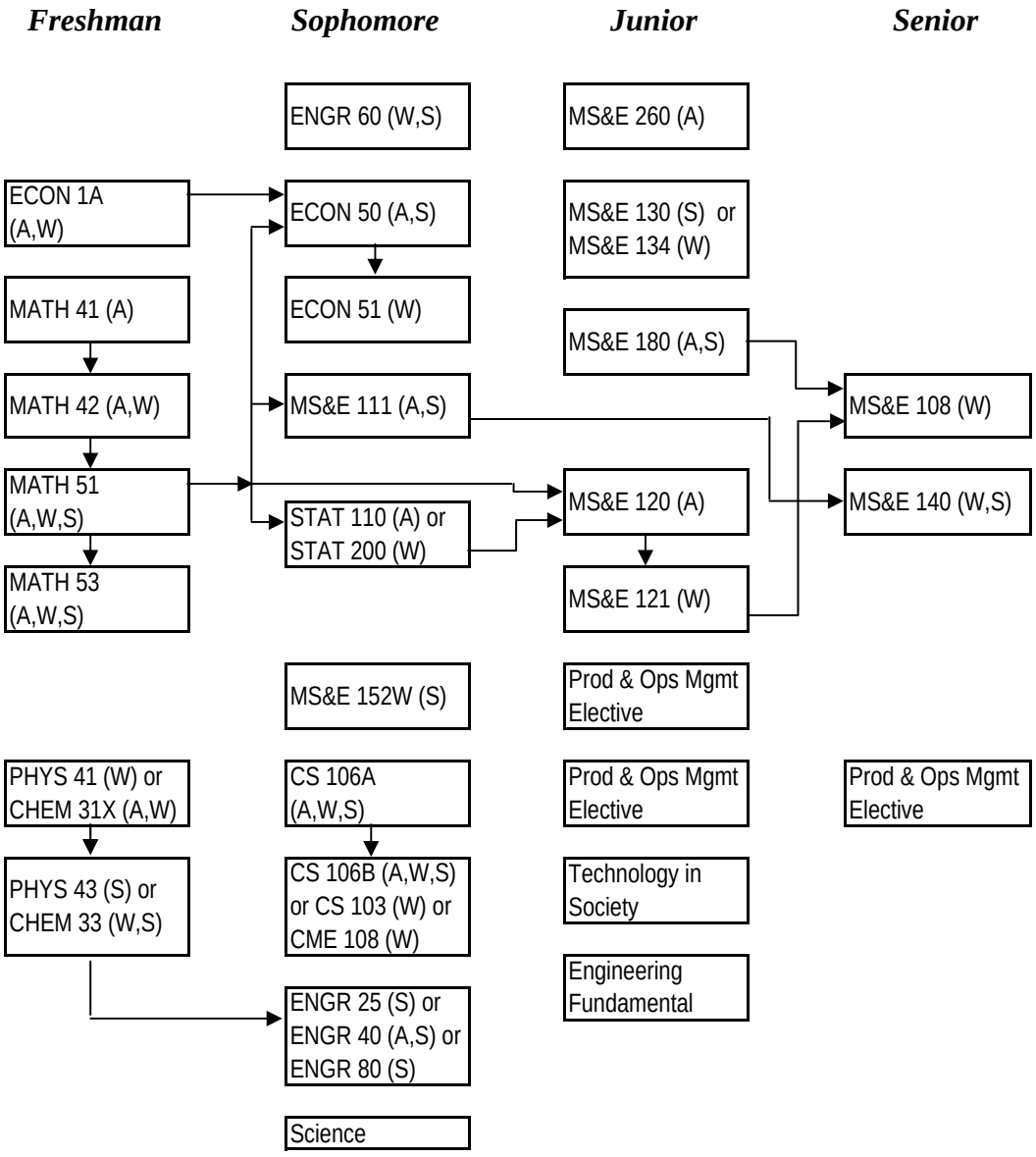
Engineering fundamentals, engineering depth (core), and engineering depth (concentration) must total a minimum of 60 units.

Courses used to satisfy the math, science, technology in society, or engineering fundamental requirements may not also be used to satisfy an engineering depth requirement.

STANFORD

MS&E: Production and Operations Management

Typical Sequence of Courses



* Arrows represent direct prerequisites

IOE Undergraduate Program MICHIGAN

[For students entering the COE as freshmen or transfer students in or after Fall 2004]

Sample Schedule

The following schedule is an example that will lead to graduation in eight terms

Subjects required by all programs (55 hrs.)		**Hrs**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mathematics 115, 116, 215, 214		16	4	4	4	4				
Engineering 100, 101		8	4	4						
Chemistry 130 with Lab 125/126		5	5							
Physics 140 with Lab 141; 240 with Lab 241		10		5	5					
Humanities/Social Science or Intellectual Breadth courses		16	4	4	4			4		
	Total	**55**								
Related Engineering Subjects (11-12 hrs.)										
Non – IOE Engineering Courses *		**12**				4	4			4
Required Program Subjects (34 hrs.)										
IOE 201 – Economic Decision Making		2			2					
IOE 202 – Operations Modeling		2			2					
IOE 265 – Probability and Statistics for Engineers		4				4				
IOE 310 – Intro to Optimization Methods		4					4			
IOE 316 – Intro to Markov Processes		2					2			
IOE 333 – Ergonomics		3				3				
IOE 334 – Ergonomics Lab		1				1				
IOE 366 – Linear Statistical Models		2					2			
IOE 373 – Data Processing		4						4		
IOE 474 – Simulation		4							4	
IOE 424 or 481 – Senior Design Course		4								4
Technical Communication 380		2						2		
	Total	**34**								
Technical Electives (18 hrs.) **		**18**					3	6	6	3
Unrestricted Electives (9 hrs.)		**9**							6	3
TOTAL		**128**	**17**	**17**	**17**	**16**	**15**	**16**	**16**	**14**

Notes

* Non-IOE Engineering courses: Select one course from three different groups (11-12 credits):

A – ME 211, CEE 211, ME 240
B – ChemE 230, ME 235
C – MSE 220, ME 382
D – EECS 270, EECS 314, BiomedE 458
E – NERS 211, CEE 260, CEE 265
F – EECS 280

** Technical Electives: Select at least 12 hours from IOE; at least one course from three different groups:

A – IOE 413, 419, 440, 441, 447, 449
B – IOE 416, 460, 461, 466
C – IOE 430, 432, 434, 436, 437, 438, 463
D – IOE 421, 422, 425, 430, 452, 453

The remaining 6 hours may be selected from any IOE technical elective or from an approved list of non-IOE courses found on the IOE undergraduate home page: http://ioe.engin.umich.edu/degrees/ugrad/index.php.

IOE Technical Electives

MICHIGAN

Select at least 12 hours from IOE; at least one course from three different groups:

IOE 413 Optimization Modeling in Health Care IOE 419 Service Operations Management IOE 440 Operations Analysis and Management IOE 441 Production and Inventory Control IOE 447 Facility Planning IOE 449 Material Handling Systems	IOE 430 Global Cultural Systems Engineering IOE 432 Industrial Engineering Instrumentation Methods IOE 434 Human Error & System Failure IOE 436 Human Factors in Computer Systems IOE 437 Automotive Human Factors IOE 438 Occupational Safety Management IOE 463 Work Measurement and Prediction
IOE 416 Queueing Systems IOE 460 Decision Analysis IOE 461 Quality Engineering Principles and Analysis IOE 465 (no longer offered) IOE 466 Statistical Quality Control	IOE 421 Work Organizations IOE 422 Entrepreneurship IOE 425 Lean Manufacturing and Services IOE 430 Global Cultural Systems Engineering IOE 452 Corporate Finance IOE 453 Derivative Instruments

The remaining 6 hours may be selected from any IOE technical elective or from an approved list of non-IOE courses found on the IOE undergraduate home page: http://ioe.engin.umich.edu/degrees/ugrad/index.php.

Additional Academic Information

Humanities and Social Sciences or Intellectual Breadth Requirements

Students entering the College of Engineering prior to Fall 2011 must complete 16 credits of Humanities and Social Sciences: *http://adue.engin.umich.edu/hussreqs*.
Students entering the College of Engineering beginning Fall 2011 and after must complete 16 credits of Intellectual Breadth Requirements: *http://www.engin.umich.edu/college/academics/bulletin/ug-ed/reqs#intellectualbreadth*.

Pass / Fail

The pass / fail option may be elected for HU/SS, Intellectual Breadth or General Elective credits only. No more than two courses per term (one in spring or summer) may be elected pass/fail. Up to four courses in total (max 14 credits) may be elected pass/fail.

Minimum Grade Requirements

Undergraduate students must maintain an overall 2.00 GPA in IOE to graduate. No lower than a C- is acceptable in the following courses (Note: a grade of C or better in Math, Physics, Chemistry and Engineering courses is required for declaration) :

- Math 115, 116, 215, 214
- Physics 140, 141, 240, 241
- Chemistry 125/126, 130 or 210, 211
- Engineering 101, 100
- IOE 201, 202, 265, 310, 316, 333, 334, 366, 373, 474, 424, 481, TC380

Senior Design Requirement

Each student must elect one of the following design courses during their senior year:

- IOE 424 Practicum in Production and Service Systems
- IOE 481 Practicum in Hospital Systems
- IOE 499 Senior Design Projects *(by special arrangement only)*

In rare occasions different courses can satisfy the design requirement, but the course must be approved by the undergraduate program advisor and elected with the consent of the course instructor. Internships and co-op assignments cannot count toward this requirement.

ISyE Required Curriculum (Fall 2008 and beyond)

WISCONSIN

			Credits
Mathematics			
Math 221 (or 217 or 275)	Calculus and Analytic Geometry		5
Math 222 (or 276)	Calculus and Analytic Geometry		5
Math 234	Calculus – Functions of Several Variables		3
Stat 311	Introduction to Mathematical Statistics I		4
Stat 312	Introduction to Mathematical Statistics II		4
Math Elective	See next page for options		3
Math/Stat Elective	See next page for options		3
		Total	**27 credits**
Science			
Physics 201 (or EMA 201[1])	General Physics		3-5
Physics 202[1]	General Physics		5
Chem 109 (or 103 & 104)	General Chemistry		5-9
Computer Science Elective	See next page for options		3
		Total	**18-21 credits**
Engineering Science Electives	See next page for explanation	**Total**	**6 credits**
Biology Elective	See next page for option	**Total**	**3 credits**
Required ISyE Courses			
Acct IS 300 (or 100)	Accounting Principles		3
ISyE 313	Engineering Economic Analysis		3
ISyE 315	Production Planning & Control		3
ISyE 320	Simulation and Probabilistic Modeling		3
ISyE 321	Simulation Modeling Laboratory		1
ISyE 323	Operations Research – Deterministic Modeling		3
ISyE 349	Introduction to Human Factors		3
ISyE 415	Manufacturing Systems		3
ISyE 417	Health Systems Engineering		3
		Total	**25 credits**
Technical Electives			
Inter-Engr 160	Introduction to Engineering (freshmen only)		3
	*Students not taking Inter-Engr 160 are required to take a different 3 cr. ISyE Technical Elective.		
Electives	See page 11 for options		12
Junior Design Elective	ISyE 350 Junior Design Lab		3
Senior Design Elective	See page 12 for options		3
		Total	**21 credits**
Communication Skills			
Elective	According to CoE regulations		2-3
EPD 397	Technical Communication		3
		Total	**5-6 credits**
Liberal Studies			
Electives	See next page for a detailed explanation.		11
Econ 101 (or 111)	Principles of Micro Economics (Econ-Accelerated)		4
		Total	**15 credits**

Required Total **120 credits**

[1] EMA 201 alone does NOT meet the pre-req for Physics 202. If you take EMA 201 you must take either EMA 202 or ME 240 also to meet the Physics 202 pre-requisites. EMA 202 and ME 240 will fulfill Engr Sci cr requirements.

[2] If you take EMA 201 and Chem 109 in addition to Physics 202 and 3 cr of CS, you will be 2 cr short of the min number of Science cr required (18). You would need to take at least 2 additional cr of math or science from the College of Letters and Science.

Elective Options

Math **Min 3 credits**

Math 320	Linear Mathematics	3 cr.
Math 340	Elementary Matrix & Linear Algebra	3 cr.

NOTE: Students cannot get degree credit for Math 320 and Math 340.

Math/Statistics **Min 3 credits**

Math 319	Techniques in Ordinary Differential Equations	3 cr.
Stat 333	Applied Regression Analysis	3 cr.
Stat/ME 424	Statistical Experimental Design for Engineers	3 cr.
***PLEASE NOTE:	**Students cannot get degree credit for Stat/ME 424 and ISyE 575.**	

Science **Min 18 credits**

PLEASE NOTE: If you take EMA 201 and Chem 109 in addition to Physics 202 and 3 cr of CS, you will be 2 cr short of the min number of Science cr required. Since you need to take at least 2 additional cr of math or science from L & S to meet this min cr requirement, you could take an introductory course in botany, biology, or zoology or an additional course in CS, Physics or Chem without adding too many credits to your total. This additional science could be a distinct benefit to the development of your ISyE focus area.

Computer Science **Min 3 credits**

Comp Sci 302	Algebraic Language Programming	3 cr.
Comp Sci 310	Problem Solving Using Computers	3 cr.

Engineering Science Elective **Min 6 credits**

EMA 202 or ME 240	to meet pre-req for Physics 202 if you took EMA 201	3 cr.

Any engineering science class at the 200 level and above that is not listed as or cross-listed with ISyE, EPD, Inter -Egr or Pro Or is acceptable for Engineering Science credits **with the exception of** classes that teach principles other than engineering science principles, like business or leadership. While business and leadership courses can be excellent and beneficial to your future, they are not approved as Engineering Science electives.

Examples are:

- ECE 601, Topic: Business for Engineers - as of Spring 2003
- Inter-Engr 400, Dean's Leadership class

Biology Elective **Min 3 credits**

Zoology 101	Animal Biology	3 cr.
Zoology 220	Biology and Society	3 cr.
Zoology 260	Introductory Ecology	3 cr.
Biology 153	Introductory Biology	3 cr.

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ISyE Design Requirements

Engineering Design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, and construction, testing, and evaluation.

Freshman Design Requirement – Inter Egr 160 **3 credits**

Intro to Engineering Design

This course provides the incoming freshman with an overview of engineering based on a 'hands-on' experience with a client-centered engineering design project, which includes: 1) a team-based design project, 2) a survey of engineering disciplines, and 3) an introduction to computer tools and lab techniques.

Sophomore Design Requirement –- ISyE 315 **3 credits**

Production Planning & Control

Techniques and applications of control concepts in the design of inventory, production, quality, and project-planning systems; use of the computer as a component in such systems.

Junior Design Lab – ISyE 350 **3 credits**

Junior level lab will include **open-ended problem solving** projects or major homework assignments that:

- Develop the student's creativity and problem solving skills
- Require the formulation of design problem statements, and defined objectives and criteria for system synthesis, analysis, and evaluation
- Develop and use the student's concept of modern design theory and methodology
- Require the consideration and feasibility of alternative solutions
- Address realistic factors related to economics, safety, aesthetics, ethics, and societal impact
- Integrate and build upon basic sciences and knowledge presented in preceding classes
- Develop teamwork and communication skills
- Focus on designing "processes" to promote the understanding, acceptance, and testing of the solution.

Senior Design Elective Courses **3 credits**

Senior level design elective courses involve an **open-ended problem solving project with outside organizations** that includes all the requirements listed above for Junior level design courses plus a significant student presentation of their project activities and results. Furthermore, the course section sizes will be limited to allow for good interactions between the instructor and the students.

ISyE 476	Industrial Engineering Design	3 cr.
ISyE 515	Engineering Management	3 cr.
ISyE 552	Human Factors Engineering Design and Evaluation	3 cr.
ISyE 565	Ergonomics in Service	3 cr.
ISyE/ME 641	Design and Analysis of Manufacturing Systems	3 cr.
ISyE/Psych 653	Organization & Job Design	3 cr.
ISyE/OTM 671	E-Business: Technologies, Strategies and Applications	3 cr.
ISyE/OTM 672	E-Business Transformation: Design, Analysis and Justification	3 cr.

Example: ISyE Curriculum 2012
With Physics 201

Total Credits to Graduate: 120-122

Freshman Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
Math 221 (or 217 or 275)	5	Math 222 (or 276)	5
Chem 109	5	Phys 201	5
InterEngr 160 *	3	Econ 111 (or 101)	3-4
Gen Ed Comm. Elective	2-3	Liberal Studies Elective	3
Total	**15-16**	**Total**	**16-17**
*** Students not taking InterEngr 160 are required to take and additional ISyE Technical Elective**			
Sophomore Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
Math 234	3	Stat 312	4
Phys 202	5	ISyE 313	3
Stat 311	4	ISyE 315	3
Comp Sci Elective	3	***Biology Elective***	***3***
		Math Elective	3
Total	**15**	**Total**	**16**
Junior Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
ISyE 323	3	ISyE 320	3
ISyE 349	3	ISyE 321	1
Acct IS 100/300	3	ISyE 350 Jr Design Lab	3
Math/Stat Elective	3	EPD 397	3
Liberal Studies Elective	3	Engineering Science Elective	3
		ISyE Tech Elect (QE)	***3***
Total	**15**	**Total**	**16**
Senior Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
ISyE 415	3	Senior Design Elective	3
ISyE Technical Elective (HF)	3	ISyE Technical Elective (Quan)	3
ISyE 417	***3***	ISyE Technical Elective (Open)	3
Liberal Studies Elective	3	Liberal Studies Elective	3
Engineering Science Elective	3		
Total	**15**	**Total**	**12**

WISCONSIN

Example: ISyE Curriculum 2012
With EMA 201

Total Credits to Graduate: 122-124

Freshman Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
Math 221 (or 217 or 275)	5	Math 222 (or 276)	5
Chem 109	5	EMA 201	3
InterEngr 160 *	3	Econ 111 (or 101)	3-4
Gen Ed Comm. Elective	2-3	Liberal Studies Elective	3
Total	**15-16**	**Total**	**15-16**
*** Students not taking InterEngr 160 are required to take and additional ISyE Technical Elective**			
Sophomore Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
Math 234	3	Stat 312	4
EMA 202 or ME 240	3	ISyE 313	3
Stat 311	4	ISyE 315	3
Comp Sci Elective	3	Physics 202	5
Liberal Studies Elective	3		
Total	**16**	**Total**	**15**
Junior Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
ISyE 323	3	ISyE 320	3
ISyE 349	3	ISyE 321	1
Acct IS 100/300	3	ISyE 350 Jr Design Lab	3
Math/Stat Elective	3	EPD 397	3
Biology Elective	***3***	Math Elective	3
		ISyE Tech Elect (QE)	***3***
Total	**15**	**Total**	**16**
Senior Year			
First Semester		**Second Semester**	
Course	**Credits**	**Course**	**Credits**
ISyE 415	3	Senior Design Elective	3
ISyE Technical Elective (HF)	3	ISyE Technical Elective (Quan)	3
ISyE 417	**3**	ISyE Technical Elective (Open)	3
Liberal Studies Elective	3	Liberal Studies Elective	3
Engineering Science Elective	3	Engineering Science Elective	3
Total	**15**	**Total**	**15**

WISCONSIN

Major: Industrial Engineering (Undergrad)

TEXAS

Bachelor of Science

Freshman | Sophomore | Junior | Senior

First Semester Courses

Course Name	Credits
ENGL 104 - Composition and Rhetoric	3 hrs
ENGR 111 - Foundations in Engineering I	2 hrs
MATH 151 - Engineering Math I[1]	4 hrs
PHYS 218 - Mechanics	4 hrs
University Core Curriculum elective[2]	3 hrs
KINE 198	1 hr
Total Credit Hours	**17 hrs**

Second Semester Courses

Course Name	Credits
CHEM107/117 - General Chemistry for Engineering Students[3]	4 hrs
ENGR 112 - Foundations in Engineering II	2 hr
MATH 152 - Engineering Math II	4 hrs
PHYS 208 - Electricity and Optics	4 hrs
University Core Curriculum elective[2]	3 hrs
KINE 199	1 hr
Total Credit Hours	**18 hrs**

Notes:

1. Entering students will be given a placement test in mathematics. Test results will be used in selecting the appropriate starting course which may be at a higher or lower level
2. To be selected from the University Core Curriculum. Of the 18 hours shown as University Core Curriculum electives, 3 must be from visual and performing arts, 3 from social and behavioral sciences, 6 from U.S. history, and 6 from POLS 206 and POLS 207. The required 6 hours from international and cultural diversity may be met by courses satisfying the visual and performing arts, social and behavioral sciences, and the political science and history requirements if they are also on the approved list of international and cultural diversity courses.
3. BMEN, CHEN and RHEN require 8 hours of freshman chemistry, which may be satisfied by CHEM 101/CHEM 111 or CHEM 107/CHEM 117 and CHEM 102/CHEM 112; Credit by Examination (CBE) for CHEM 101/CHEM 111 or CHEM 107/CHEM 117 plus CHEM 102/CHEM 112; or 8 hours of CBE for CHEM 101/CHEM 111 or CHEM 107/CHEM 117 and CHEM 102/CHEM 112.

Note: KINE refers to kinesiology = fitness and health class.
http://catalog.tamu.edu/06-07_ug_catalog/course_descriptions/kine.htm

Bachelor of Science TEXAS

Freshman | **Sophomore** | Junior | Senior

First Semester Courses

Course Name	Credits
CSCE 206 - Structured Programming in C	4 hrs
MATH 251 - Engineering MATH III	3 hrs
MEEN 221 - Statics and Particle Dynamics	3 hrs
MEEN 222 - Materials Science	3 hrs
University Core Curriculum electives[1]	3 hr
Total Credit Hours	**16 hrs**

Second Semester Courses

Course Name	Credits
ECEN 215 - Prin of Elec Engineering	3 hrs
ENTC 181 - Manuf. and Assem Proc I	3 hrs
ISEN 220 - Intro to Production Systems	3 hrs
MATH 308 - Differential Equations	3 hrs
MEEN 315 - Principles of Thermodynamics	3 hrs
STAT 211 - Principles of Statistics I	3 hrs
Total Credit Hours	**18 hrs**

Notes:

1. Required by Texas A&M – To be selected from the University Core Curriculum. Of the 18 hours shown as University Core Curriculum electives, 3 must be from visual and performing arts, 3 from social and behavioral sciences, 6 from U.S. history, 6 from POLS 206 and POLS 207, and 6 from international and cultural diversity. The required 6 hours from international and cultural diversity may be met by courses satisfying the visual and performing arts, social and behavioral sciences, and the history requirements if they are also on the approved list of international and cultural diversity courses.

Bachelor of Science TEXAS

Freshman | Sophomore | **Junior** | Senior

First Semester Courses

Course Name	Credits
ENGL 210 - Science ad Technical Writing or ENGL 301- Technical Writing	3 hrs
ISEN 303 - ENGR Economic Analysis	3 hrs
MATH 304 - Linear Algebra	3 hr
POLS 207 - State and Local Government	3 hrs
STAT 212 - Principles of Statistics II	3 hrs
University Core Curriculum[1]	3 hrs
Total Credit Hours	**18 hrs**

Second Semester Courses

Course Name	Credits
ISEN 314 - Statistical Control of Quality	3 hrs
ISEN 315 - Production Systems Planning	3 hrs
ISEN 420 - Operations Research I	3 hrs
ISEN 424 - Systems Simulation	3 hrs
University Core Curriculum[1]	3 hrs
Total Credit Hours	**15 hrs**

Notes:

1. Required by Texas A&M – To be selected from the University Core Curriculum. Of the 18 hours shown as University Core Curriculum electives, 3 must be from visual and performing arts, 3 from social and behavioral sciences, 6 from U.S. history, and 6 from POLS 206 and POLS 207. The required 6 hours from international and cultural diversity may be met by courses satisfying the visual and performing arts, social and behavioral sciences, and/or U.S. history requirements if they are also on the approved list of international and cultural diversity courses. In addition, ENGR 482/PHIL 482 must be taken.

Bachelor of Science

TEXAS

Freshman	Sophomore	Junior	Senior

First Semester Courses

Course Name	Credits
ISEN 316 - Production Systems Operations	3 hrs
ISEN 416 - Facilities, Location, Layout and Material Handling	4 hrs
Technical electives[2]	6 hrs
Total Credit Hours	**13 hrs**

Second Semester Courses

Course Name	Credits
ENGR 482 - Ethics and Engineering	3 hrs
ISEN 459 - Industrial Engineering Systems Design	3 hrs
Technical electives[2]	6 hrs
Total Credit Hours	**12 hrs**

Notes:

1. Required by Texas A&M – To be selected from the University Core Curriculum. Of the 18 hours shown as University Core Curriculum electives, 3 must be from visual and performing arts, 3 from social and behavioral sciences, 6 from U.S. history, and 6 from POLS 206 and POLS 207. The required 6 hours from international and cultural diversity may be met by courses satisfying the visual and performing arts, social and behavioral sciences, and/or U.S. history requirements if they are also on the approved list of international and cultural diversity courses. In addition, ENGR 482/PHIL 482 must be taken.
2. A total of 12 hours of technical electives is required, of which 6 hours must be industrial engineering courses. The choice of courses to be taken must be made in consultation with the student's advisor and/or the Industrial Engineering Advising Office

THE GRADO DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING – UNDERGRADUATE CURRICULUM FLOWCHART

Updated: Spring 2012