UNDERGRADUATE HANDBOOK
INDUSTRIAL ENGINEERING PROGRAM
Department of Mechanical and Industrial Engineering
THE UNIVERSITY OF IOWA

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This handbook describes features of the undergraduate program in Industrial Engineering offered by The University of Iowa. For those who are already accepted in our I.E. program of studies, this booklet serves as a reference to procedures, policies, and regulations and an introduction to the faculty. This handbook, however, is by no means an authoritative interpretation of College of Engineering policies. For those students interested in I.E., this handbook will serve as a sampler of the I.E. program. Copies of this handbook are available to all students in the Industrial Engineering Department office in the Seamans Center. It is also available on the web at www.mie.engineering.uiowa.edu/.

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THE INDUSTRIAL ENGINEERING CURRICULUM

Course No	Course Title	Sess.	SH	Σ SH	Pre- and /Co-Requisites
1st Year	**Semester 1 (FALL)**				
22M:031	Engineering Mathematics I Single Variable Calculus	All	4		P: H.S. Alg. & Trig.
059:005	Engineering Problem Solving I	F	3		
004:011	Principles of Chemistry I	All	4		
010:003	Accelerated Rhetoric (or 10:001 & 10:002)	All	4		
056:010	IE Freshman/First Year Seminar	F, S	0		Fresh and Trans students only
	Total		**15**	**15**	
	Semester 2 (SPRING)				
22M:032	Engineering Mathematics II- Multivariable Calculus	All	4		P: 22M:031
059:006	Engineering Problem Solving II	S	3		C:22M:031
029:081	Introductory Physics I	F, S	4		C: 22M:031
22M:033	Engineering Mathematics III- Matrix Algebra	All	2		P: 22M:032
*	General Education Component #1	All	3		
56:010	IE Freshman Seminar	F, S	0		Fresh and Trans students only
	Total		**16**	**31**	
2nd Year	**Semester 3 (FALL)**				
22M:034	Engineering Mathematics IV- Differential Equations	All	3		P: 22M:033 and 22M:032
029:082	Introductory Physics II	F, S	3		P: 029:081; C:22M:032
059:007	Fund. of Engineering I: Statics	All	2		P:22M:031; C:029:081
059:008	Fund. of Engineering II: Electrical Circuits	All	3		C: 22M:034
059:009	Fund. of Engineering III: Thermodynamics	All	3		P:22M:031; 004:011; 029:081
031:001*	Elementary Psychology (GEC II)	F, S	3		
056:020	IE Sophomore Seminar	F, S	0		Sophomore status
	Total		**17**	**48**	
	Semester 4 (SPRING)				
056:054	Engineering Economy	S	3		C:22S:039
22S:039	Probability & Statistics for Engineers	F, S	3		P:22M:032
057:015	Materials Science	All	3		P:004:011; C:22M:031
056:150	Information Systems Design	All	3		P: 059:006
**	EFA I	All	3		
056:020	IE Sophomore Seminar	F, S	0		Soph. & Trans. Students Only
	Total		**15**	**63**	
3rd Year	**Semester 5 (FALL)**				
056:166	Stochastic Modeling	All	3		P:22S:039, C: 056:171
056:032	Design for Manufacturing	F	3		P:057:015
056:144	Human Factors	F	3		P:031:001
056:171	Operations Research	F	4		C: 22S:039, P: 22M:033
*	GEC III	All	3		
056:091	Professional Seminar	F,S	0		Junior Status
	Total		**16**	**79**	

Course No	Course Title	Sess.	SH	Σ SH	Pre- /Co-Requisites
	Semester 6 (SPRING)				
056:131	Manufacturing Systems	S	3		P: 056:032, 056:171
056:147	Ergonomics	S	3		
**	EFA II	S	3		
22S:030	Statistical Methods and Computing	S	3		
056:178	Digital Systems Simulation	S	3		P: 056:171
*	GEC IV	All	3		
056:091	Professional Seminar: IE	F, S	0		Junior status
	Total		**18**	**97**	
4th Year	**Semester 7 (FALL)**				
056:134	Process Engineering	F	3		P: 56:171
**	EFA III	All	3		
056:162	Quality Control	F	3		P: 22S:039, 22S:030
**	Math/Science Elective EFA IV	F	3		
*	General Education Component V	All	3		
056:091	Professional Seminar: IE	F, S	0		Senior status
	Total		**15**	**112**	
	Semester 8 (SPRING)				
56:160	Operational Systems Design	S	4		P: 56:134, 56:054, Senior status
***	Systems Elective (EFA IV)	All	3		
	EFA V	All	3		
	EFA VI	All	3		
	EFA VII	All	3		
	Total		**16**	**128**	

* GEC – General Education Component (15 SH total). Social Science and Humanities courses selected in Plan of Study to satisfy College of Engineering requirements. See guide from Student Development Center for a list of acceptable courses. Among the GEC courses, at least 3 SH must be Social Science courses and another 3 SH must be Humanities courses. At least 6 SH must be intermediate (100) level courses, at least one of which is a 100 level course in the same department as the lower level course completed by the student.

** EFA – Elective Focus Area (21 SH total). Courses selected in Plan of Study to satisfy departmental requirements. At least 3 SH of EFA courses must be a mathematics/science elective. See EFA guide from MIE Department Office.

*** The systems elective is a 100-level, Industrial Engineering course designated to count as a systems elective course. At least one will be offered each year, with the goal of one each semester.

128 SH of specific coursework are required for graduation. Students may take additional coursework that will not be applicable toward degree requirements.

FOREIGN LANGUAGE REQUIREMENT: Satisfactory completion of 2 years of one high school foreign language or 1 year of one college-level foreign language is required for first year students graduating from high school in 1990 and after; transfer students, 1991 and after.

INTRODUCTION

Industrial Engineering started early in the twentieth century with the application of the scientific method in factories. Because of its initial factory orientation, this engineering discipline became known as industrial, production, or management engineering. Industrial Engineering is frequently defined as: "the integration of machines, people, materials, money, and methods." While these key components still play an extremely important role in I.E., the applications of I.E. tools and techniques have expanded beyond factories to hospitals and other health-care operations, transportation organizations, media operations, service companies, such as banking and utilities and divisions of local, regional, and national governments. With this expansion also came specialization within the discipline and a generation of engineers with narrower scope but greater depth in particular skills and application areas. The Department of Mechanical and Industrial Engineering (MIE) allows students to balance the development of both general and specialized skills through Elective Focus Areas (EFAs).

ELECTIVE FOCUS AREAS

The EFA is a set of 21 semester hours (sh) of elective courses taken during the sophomore to senior years that provide undergraduate students in the MIE department with a unique opportunity to acquire advanced education in an area of their choice. EFAs are not only intended to spark the interest of students in a specialty, but they can also make a student more attractive to future employers.

An EFA must be rigorous, well focused, in-depth, and consistent with a student's career plan. A collection of lower level courses in a number of disparate areas will not satisfy this EFA requirement. Consequently, approval of a student's EFA by the department is generally required. A Plan of Study form, described in greater detail below, facilitates the process of choosing and obtaining approval for the EFA courses.

In order to maintain some technical rigor and depth, EFAs must contain at least 9 sh of 100-level College of Engineering courses. However, this requirement may be waived if the EFA consists of an in-depth program in mathematics, computer science, the physical and natural sciences, or business.

Due to program accreditation issues, at least 3 sh of courses must be mathematics or basic sciences courses (as defined by ABET) in a different area or at a more advanced level than those required in the regular curriculum.

An EFA does not need to consist entirely of technical courses. For example, part or all of the UI Technological Entrepreneurship Certificate program can be completed as an EFA. If the majority of EFA courses is from outside of the College of Engineering, an official UI Minor or UI Certificate program should generally be completed.

Students are urged to integrate their EFA with internships or cooperative education experiences they may be taking as part of their undergraduate studies. Furthermore, an EFA may be complemented by courses taken as part of the General Education Component (GEC) requirement. If a focus in the humanities or social sciences is desired in an EFA, up to 12 sh of GEC courses should be used. The remaining balance of EFA courses may be used as technical electives or toward a second focus area, consistent with the above EFA requirements.

There are two types of EFAs:

- **Standard EFAs (S-EFA**) are programs that are designed and pre-approved by the department. Currently offered S-EFAs in MIE are listed below; they are periodically reviewed by the department. Each S-EFA has a faculty member as a coordinator who can advise a student in more detail.

- **Tailored EFAs (T-EFA)** are individualized and career specific programs designed by the student and approved by the department.

The Plan of Study facilitates the process of choosing and obtaining approval for the courses for the EFA. During the first academic year on campus, all undergraduate students consult with their advisor and begin to develop a tentative Plan of Study. The Plan of Study is finalized and submitted to the department during the third semester. The Sophomore Seminar (third semester) is used to explain EFA choices. The Plan of Study:

- identifies the career goal;
- identifies the courses to be taken as the 21 sh of EFA electives;
- presents the rationale for how the electives support the career goal; the student should provide any necessary supporting material;
- is signed by the student and the advisor; if a student is pursuing a T-EFA or deviating from the approved courses for an S-EFA, the Plan of Study must also be approved by the department chair;
- must be completed in advance of taking any EFA courses;
- is placed in the student's official file;
- may be altered at any time during the undergraduate program; any changes must be approved by completing a new Plan of Study.

There are five standard elective focus areas in the industrial engineering program:

- Computers & Information Systems
- Human Factors
- Management
- Medical Systems
- Product Design & Manufacturing

Each area and its EFA are described below in detail.

THE COMPUTER AND INFORMATION SYSTEM ELECTIVE FOCUS AREA

The demand for Computer and Information System Analysts is projected to grow as computer technology continues to revolutionize our society. Employment in this area is expected to increase by 35% or more during the period from 2001 and 2010. Industrial Engineers have a natural role to play in this field by using quantitative system analysis, manufacturing system knowledge and human factors skills to help to design and refine computer systems that are becoming ever more complex. The field offers substantial opportunities for technical skill development, travel, and interaction with a diverse range of professionals.

This Focus Area completes all the requirements for a minor in computer science.

Semester	Course	**Session**	**SH**	**Pre-/Co-Requisites**
4 (Spring)	22M:072 Elementary Numerical Analysis	F,S	3	22M:032 or 22M:026 or 22M:036
5 (Fall)	55:033 Introduction to Software Design	F,S	3	57:017
7 (Fall)	22C:034 Discrete Structures	All	3	22M:031, /22C:020
8 (Spring)	22C:030 Computer Science II	All	3	55:033, /22C:034
8 (Spring)	Any 100-level Engineering Course		3-4	
8 (Spring)	Technical Elective (choose from Table below)		3	
8 (Spring)	Technical Elective (choose from Table below)		3-4	

Technical Electives	**SH**	**Pre-/Co-Requisites**
22C:034 Discrete Structures	3	22M:021 or 22M:025 or 22M:031 , /22C:020
22C:040 Computer Organization and Hardware	4	22C:020 22C:034
22C:044 Algorithms	3	22C:030 22C:034
22C:050 Introduction to Software Systems	3	22C:030 22C:034 22C:040
22C:054 Programming Language Concept	3	22C:030 22C:034 22C:040*

** The following courses will not be applied towards your degree: 22C:001, 22C:002, 22C:005, 22C:104 22C:106

For further information, please contact: Professor Geb Thomas, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA 52242, Tel. (319) 335-5936, e-mail: Geb-Thomas@uiowa.edu

THE HUMAN FACTORS AND ERGONOMICS ELECTIVE FOCUS AREA

Human Factors and Ergonomics (HFE) represent increasingly important engineering specialties. The dramatic increase in computer technology makes system performance increasingly dependent on the match between system characteristics and human capabilities. Opportunities to apply HFE are very broad and graduates with this focus area find employment in diverse industries that include vehicle systems (e.g., GM, Ford, Delphi, Visteon, DaimlerChrysler, Caterpillar), healthcare (e.g., GE, Medtronics, Guidant), computer systems (e.g., Microsoft, Intel, IBM), and consulting (e.g., Accenture, Battelle). Human Factors considers cognitive characteristics and ergonomics considers physical characteristics.

The HFE EFA builds on the required coursework for undergraduate students in Industrial Engineering and provides advanced education in psychology, systems, statistics, and biomechanics. The EFA consists of 21 semester hours (SH) as listed below. Students who take 15 semester hours from the department of psychology (031:XX) receive a minor in psychology. This requirement can be met with the three required courses (31:001, 31:016, 31:120) and two electives from the table below. The first four courses in the table provide a general background and the three elective courses allow for an emphasis in human factors (HF) or ergonomics (E).

Semester	Course	Session	SH	Pre-/Co-Requisites
4 (Spring)	31:016 Introduction to Cognitive Psychology	All	3	31:001
5 (Fall)	31:120 Experimental Psychology I	All	3	31:016
7 (Fall)	22S:152 Applied Linear Regression	Fall	3	22S:030
8 (Spring)	055:040 Linear Systems II or 55:180 Fund. of Software Eng	Fall/ Spring	3	22C:022 or 55:033 or 59:008
8 (Spring)	Elective			Elective
8 (Spring)	Elective			
8 (Spring)	Elective			

Electives*	SH	Pre-/Co-Requisites	Emphasis
56:148 Human-Centered Design	3	56:147	HF
56: 240 Human Perf in Engineering Systems	3	56:147	HF
56:242 Human-Computer Interaction	3	56:147	HF
56:098 Individual Investigations: IE	1-3	Varies	General
55:060 Control Systems	3	59:012	General
22S:158 Experimental Design and Analysis	3	22S:152	General
31:012 Introduction to Brain and Behavior	3	31:001	HF
31:019 Psychology in Business and Industry	3	31:001	HF
31:043 Evaluating Psychological Research	4	31:001, 22S:030	HF
31:122 Experimental Psychology II	4	31:120	HF
31:131 Cognitive Science	3	31:016	HF
31:133 Sensation and Perception	3	31:016	HF
31:134 Cognition and the Brain	3	31:016	HF
31:154 Psychology of Decision Making	3	31:016	HF
72:154 Biomedical Engineering Physiology*	4		E
51:050 Biomechanics*	3		E
51:152 Ergonomics of Occupational Injuries	3	51:050	E
175:190 Occupational Ergonomics	3	56:147	E
175:192 Occupational Safety	3	56:147	E

**One of these courses is required OR the student must take two upper level psychology courses (31:1XX).

*Pre-requisites may require enrollment in additional courses

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THE MANAGEMENT ELECTIVE FOCUS AREA

Industrial Engineers are often tasked with managerial tasks, project management, and financial assessments as they relate to project budgets, cost calculations, and optimization criteria. The Management EFA prepares students for a career in business management. Students following the Management EFA are required to complete all requirements for the Minor in Business Administration. Information on the Business Administration Minor can be found at http://www.biz.uiowa.edu/upo/programs/minor.html. The following table explains the requirements for a Business Minor, and how they can be satisfied by undergraduate students in the Industrial Engineering (IE) program. It can be seen that four courses for the Business Minor can be satisfied by courses already required in the IE curriculum. Another one, 6E:001 or 6E:002, which can be taken as part of the General Education Component (GEC), and five courses should be taken as part of the 21 semester hours of classes reserved for the EFA. This leaves one course, 6E:001 or 6E:002, which cannot be completed within the GEC requirement, as it is currently stated.

Required Courses for Business Minor	SH	Equivalent Courses for IE Majors	SH
22M:017 Calculus & Matrix Algebra for Business	4	22M:031 Engineering Mathematics I	4
22S:008 Statistics for Business	3-4	22S:039 Probab. & Statistics for Engrs.	3
6E:001 Principles of Microeconomics	4	Take as *part* of GEC	4
6E:002 Principles of Macroeconomics	4	Additional Course	4
6A:001 Introduction to Financial Accounting	3	*Take as part of EFA*	3
6A:002 Managerial Accounting	3	*Take as part of EFA*	3
6J:047 Introduction to Law	3	*Take as part of EFA*	3
6J:048 Introduction to Management	3	*Take as part of EFA*	3
6K:070 Computer Analysis	3	59:006 Engineering Problem Solving II	3
6M:100 Introduction to Marketing	3	*Take as part of EFA*	3
6F:100 Introductory Financial Management	3	56:054 Engineering Economy	3
Total hours required:	**36-7**		**36**

An EFA schedule accommodating the Business Minor could thus be designed as shown in the following table. **This schedule assumes that 6E:001 and 6E:002 are taken as part of the GEC.** The Math/Science Elective is required for any EFA and suitable courses are listed in the last table. The 100-level course in Semester 8 allows students to gain advanced knowledge in an engineering topic of their choice.

Semester	Course	Session	SH	Pre-/Co-Requisites
4 (Spring)	6A:001 Introduction to Financial Accounting	All	3	Sophomore standing
5 (Fall)	6A:002 Managerial Accounting	All	3	6A:001, 6E:001, 22M:031
7 (Fall)	6J:047 Introduction to Law	All	3	Sophomore standing
7 (Fall)	6J:048 Introduction to Management	All	3	Sophomore standing
8(Spring)	6M:100 Introduction to Marketing	All	3	6E:001, Junior standing
8(Spring)	Math/Science Elective		3	
8(Spring)	100-level Engineering course		3	

Math and Science Elective Courses	SH	Pre-/Co-Requisites
29:030 Physics IV	3	22M:026, 032 or 036 or 22M:046 and 29:029
4:012 Principles of Chemistry II	4	4:011
22S:150 Regression, Time Series, & Forecasting	3	22S:120 or 22S:131 or 22S:154
22S:152 Applied Linear Regression	3	22S:030 or 22S:039 or 22S:120 or equiv.
22M:072 Elementary Numerical Analysis	3	22M:026 or 22M:036
22M:037 Engineering Mathematics V	3	
2:010 Principles of Biology I	4	4:011

ENTREPRENEURSHIP EFA

Today, UI engineering students are exploring venture capital, marketability of products, and technology transfer … preparing to launch tomorrow's successful businesses – while earning their engineering degrees. Students taking the Entrepreneurship EFA will obtain a Certificate in the Technological Entrepreneurship Program. Students completing the program will gain exposure to understanding sound business thinking, acquire team-building skills in both small and large companies, understand the entrepreneurial approach to acquiring and managing resources, learn how to create a business plan, and obtain valuable contacts and network opportunities with successful businesses and industries. More detailed information and the course listing for the Technological Entrepreneurship Certificate (TEC) can be found at: http://www.engineering.uiowa.edu/about/tech-certificate.html.

Students will prepare a plan of study, choosing among the courses listed for the program, and meet with the College's TEC representative. Approvals to be admitted to the program are obtained by the TEC representative, faculty advisor, and MIE Department Chair. Two IE Program courses are included in the plan of study: 56:054, Engineering Economy, which satisfies the 6A:020, Accounting for Nonbusiness Students, and a Department Entrepreneurial Course. Students can choose from several management oriented elective courses, including 56:153, Engineering Administration-I and Internet Systems Design. The following table provides a guide for scheduling the TEC EFA courses.

The following courses are required:

Semester	Course	Session	SH	Pre-/Co-Requisites
4 (Spring)	6T:120 Entrepreneurship & New Business Formation	All	3	C:6A:001 or 6A:020 or 6T:113
5 (Fall)	56:153 Engineering Administration-I	F	3	56:054
7 (Fall)	6T:133 Capital Acquisitn & Cash Flow Mgmt	F/S	3	6T:120
8 (Spring)	TEC Elective-2	All	3	
8 (Spring)	Math/Science Elective		3	
8 (Spring)	TEC Elective-3	All	3	
8 (Spring)	Open Elective (100-level engineering course)	All	3	

Math and Science Elective Courses:

Math and Science Elective Courses	SH	Pre-/Co-Requisites
Physics IV	3	22M:026, 032 or 036 or 22M:046 and 29:029
Principles of Chemistry II	4	4:011
Regression, Time Series, & Forecasting	3	22S:120 or 22S:131 or 22S:154
Applied Linear Regression	3	22S:030 or 22S:039 or 22S:120 or equiv.
Elementary Numerical Analysis	3	22M:026, 22M:036
Engineering Mathematics V	3	22M:034
Principles of Biology I	4	4:011

THE MEDICAL SYSTEMS ELECTIVE FOCUS AREA

Healthcare makes up some 20% of the US economy and is expanding. The need for increased productivity and quality in healthcare is apparent especially as the society is aging. Most processes in healthcare are data and information driven, e.g., patient diagnosis, treatment selection, and administrative processes, yet the healthcare system has not seen the benefits of the information "revolution". Many predict that medical technology will be the largest and most vibrant area of the economy in this century. A large number of new jobs will be created in medically related areas. The latest genetic discoveries have begun fueling this growth. Numerous graduates from the Industrial Engineering Program at the University of Iowa have already joined the healthcare market, by taking key technical and managerial positions in clinical departments of the largest hospitals, insurance companies, biotechnology companies, high technology medical equipment manufacturers, pharmaceutical corporations, medical software industry, and government agencies. The growing healthcare sector fueled by the developments in biotechnology, genomics, proteomics, and computer technology will create new job opportunities for engineers trained in medical systems. The EFA in medical systems builds on the regular courses required for a B.S. degree in Industrial Engineering and provides students with advanced education in models, tools, and methods for the growing healthcare market.

Semester	Course	Session	SH	Pre-/Co-Requisites
4 (Spring)	2:010 Principles of Biology I	All	4	4:013
5 (Fall)	2:011 Principles of Biology II	All	4	2:010
7 (Fall)	4:012 Principles of Chemistry I	All	4	4:011
7 (Fall)	Elective			
7 (Fall)	Elective			
8 (Spring)	Elective			

Electives	SH	Pre-/Co-Requisites
56:138 Knowledge Discovery and Management	3	22S:030 and 59:006
58:181 Internet Systems Design	3	59:006
56:186 Health Informatics II	3	59:006
56:287 Health Informatics I	3	59:006
22C:036 Elementary Numerical Analysis	3	22M:026, 22M:036
55:033 Introduction to Software Design	3	057:017
22C:034 Discrete Structures	3	22C:020
22C:030 Computer Science III	3	22C:016 and 22C:020
2: 128 Fundamental Genetics^	4	002:010, 002:011, and 004:012/4:121
4: 021 Basic Measurements	3	004:012 or 004:016 or 004:020
51:040 Biological Systems Analysis I	3	22M:042 or 27:130
51:070 Biomaterials I	3	004:012, 27:130, and 51:130
51:080 Data Acquisition Design Laboratory	3	
51:140 Biomedical Systems Analysis II	3	Co-r. 72:154
55:148 Digital Image Processing	3	51:040 or 55:040 and 51:060 or 55:043
4:121 Principles of Organic Chemistry I^	3	004:012 or 004:014 or 004:019
4: 122 Organic Chemistry II^	3	004:121
072:154 Biomedical Engineering Physiology	4	Instructor consent

^ This course satisfies the Pre-Med requirement
-The sessions listed are typical but are not guaranteed to be taught

For further information, please contact Professor Andrew Kusiak, Andrew-Kusiak@uiowa.edu, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA 52242, Tel. (319) 335-5939.

COURSE DESCRIPTIONS

Program courses are shown on the following pages in moderate detail for your information. There are modifications made each semester so some differences are to be expected. Undergraduates need special permission to take 200-level courses.

SPECIAL TOPICS

056:000 Cooperative Education Training Assignment: Industrial Engineering 0 s.h.

Industrial engineering students participating in the Cooperative Education Program register in this course during work assignment periods; registration provides a record of participation in the program on the student's permanent record. Prerequisites: admission to Cooperative Education Program and consent of faculty advisor.

056:010 INDUSTRIAL ENGINEERING FRESHMAN SEMINAR 0 S.H.

Introduction to curriculum and profession; ethics and professionalism in classroom and workplace. Prerequisite: first-year or transfer standing in engineering.

056:020 Industrial Engineering Sophomore Seminar 0 s.h.

Curriculum and profession; ethics and professionalism in classroom and workplace. Prerequisite: sophomore or transfer standing in engineering.

056:091 Professional Seminar: Industrial Engineering 0 s.h.

Professional aspects of industrial engineering presented through lectures and discussions by guest speakers, field trips, films, panel discussions. Repeatable. Prerequisite: junior standing.

056:098 Individual Investigations: Industrial Engineering arr.

Independent projects in industrial engineering for undergraduate students, including laboratory study, an engineering design project, analysis and simulation of an engineering system, computer software development, CAD/CAM applications, or research. Prerequisite: consent of course advisor. Manufacturing

MANUFACTURING

056:032 Design for Manufacturing 3 s.h.

Fundamentals of design, engineering graphics, and manufacturing processing; computer graphics using Pro/ENGINEER for CAD and CAM; typical industrial processes, including fundamentals of casting, welding, machining, forming; computer numerical control (CNC) machining; laboratory exercises and projects. Corequisite: 057:015. Same as 058:032.

056:131 Manufacturing Systems 3 s.h.

Manufacturing as systems consisting of computer and microprocessor-based control systems; manufacturing and logistics systems; supply chain management; quality function deployment; MRP/ERP systems; lean manufacturing; concurrent engineering; value stream mapping and six sigma. Offered spring semesters. Prerequisites: 056:032 and 056:171, or consent of instructor. Same as 058:131.

056:134 Process Engineering 3 s.h.

Methodologies, algorithms, and tools for processing modeling, analysis, and reengineering; modeling issues in product and component design, product and process modularity, quality, reliability, agility. Prerequisite: 056:171.

056:235 Computational Intelligence 3 s.h.

Concepts, models, algorithms, and tools for development of intelligent systems; data mining, expert systems, neural networks for engineering, medical and systems applications. Prerequisite: 056:171. Same as 096:313.

056:236 Decision Making in Supply Chain Management Engineering 3 s.h.

Control Theory and Kalman Filter approaches; supply chains and behavioral supply chains; organizational approaches; network approaches.

056:237 Operational Issues in Supply Chain Management Engineering 3 s.h.

Probabilitic approaches; supply chain disruption analysis; human decision making in supply chains; auctions and electronic commerce in supply chains..

056:238 Evolutionary Computation 3 s.h.

Evolutionary computation, genetic programming, development of evolutionary systems for applications in industry, medicine, and nonstructured environments; case studies. Prerequisite: 056:171. Human Factors and Ergonomics

HUMAN FACTORS/ERGONOMICS

056:144 Human Factors 3 s.h.

Design of human-machine systems; development of optimum work environments by applying principles of behavioral science and basic knowledge of human capacities and limits. Prerequisite: 031:001.

056:147 Ergonomics 3 s.h.

Ergonomic design of jobs and products in an industrial and consumer market setting; principles of good design, examples of poor design; consequences of poor job and product design; principles of work sampling, usability studies, performance rating, sizing and planning of workstations, hand tool design, ergonomic design in transportation; related group project.

056:148 Human-Centered System Design 3 s.h.

Design strategies for creating customer-centered systems; interview and observation techniques for gathering customer requirements and creating work models; tools for restructuring work and prototype development. Prerequisite: 056:144.

056:240 Human Performance in Engineering Systems 3 s.h.

Human performance limits and capabilities relevant to design of engineering systems; focus on cognitive limits associated with information processing. Prerequisites: 056:144 and 056:147.

056:241 Research Methods in Human Factors Engineering 3 s.h.

Logic and methods for research and for analysis and evaluation of complex human-machine systems; advanced techniques for enhancement of human interaction with advanced information technology; emphasis on cognitive task analysis techniques for innovative design, understanding of how technology affects safety, performance, user acceptance. Prerequisite: 056:240 or intermediate statistics course or consent of instructor.

056:242 Human/Computer Interaction 3 s.h.

Development of projects using human factors principles in the design of computer interfaces.

056:243 Modeling Operator Performance 3 s.h.

Modeling techniques that support design and analysis of the human role in complex systems; process and concepts associated with model development and application. Corequisite: 056:240 or consent of instructor.

056:244 Airborne Design of Experiments 3 s.h.

This course will provide students will a basic understanding of the systematic approach used in human factors flight testing, development of test points (test cards), development of the test apparatus, flight envelope, proper briefing techniques, mission execution, and after action review as well as data securing, synchronizing, and analysis. The majority of the course will be taught at the OPL Operator Performance Laboratory flight operations facility at the Iowa City municipal airport. Access will be given to flight simulators, flight test aircraft, and associated testing equipment.

056:245 Human Factors in Aviation 3 s.h.

Measuring, modeling, and optimizing human visual performance; display design for optimal legibility, research in visibility, legibility, conspicuity, and camouflage; visibility model development. Corequisite: 056:240 or 056:241 or consent of instructor. Mechanical and Industrial Engineering 713

056:246 The Design of Virtual Environments 3 s.h.

Development of techniques for designing and creating three-dimensional representations of information for simulation, scientific visualization, and engineering; emphasis on human factors issues, software. Corequisite: 056:240 or consent of instructor.

056:248 Analytical Methods in Human Factors Engineering 3 s.h.

How analytical techniques can be used to analyze human factors data, how techniques complement each other; techniques used across disciplines (e.g., behavioral science, civil and industrial engineering, economics, epidemiology, marketing); case studies; experience designing a survey and using statistical analysis software to analyze survey data. Prerequisites: 22S:039 and 056:144.

ENGINEERING MANAGEMENT

056:054 Engineering Economy 3 s.h.

Basic concepts of engineering economy: time value of money, cash flow equivalence, depreciation, tax considerations, continuous cash flows, cost accounting overview; main analysis techniques—present worth, uniform annual cost, rate of return, benefit/cost ratio, replacement and break-even analysis. Corequisite: 22S:039.

056:056 Leadership in Engineering 1 s.h.

How to balance aspects of college life, explore a personal mission, and set priorities. Prerequisite: consent of instructor.

056:150 Information Systems Design 3 s.h.

Structure and design of computer-based information systems; concepts of information systems, decision making; computer hardware, software, data structures; methods for determining system requirements; designing, implementing, evaluating, managing information systems; applied projects. Prerequisites: 057:017 and 059:006.

056:153 Engineering Administration I 3 s.h.

Current readings, cases in engineering management; methods for organizing, planning, funding, controlling engineering efforts; nature of the engineering and management function. Offered fall semesters. Prerequisite: 056:054.

QUALITY CONTROL AND CONTROL

056:160 Operational Systems Design 4 s.h.

Projects involving the design of products and related operational systems in an industrial or service organization, including associated entrepreneurial or intrapreneurial planning. Offered spring semesters. Prerequisites: 056:054, 056:134, and senior standing.

056:161 Enhanced Design Experience 3 s.h.

Real-world, in-depth design experience in student teams, working with engineers at major companies in the region; application of industrial engineering knowledge and skills to design products and related operational systems. Prerequisite: senior standing.

056:162 Quality Control 3 s.h.

Basic techniques of statistical quality control; application of control charts for process control variables; design of inspection plans and industrial experimentation; modern management aspects of quality assurance systems. Offered fall semesters. Prerequisite: 22S:030 and 22S:039. Same as 22S:133.

056:166 Stochastic Modeling 3 s.h.

The course covers fundamental probabilistic models and applications of industrial engineering. Course topics: overview of probability and distributions, stochastic processes and Markov chains, queuing theory, inventory theory, decision theory under uncertainty, elements of risk management. Prerequisite: 056:032 and Corequisite: 056:171.

OPERATIONS RESEARCH AND APPLIED STATISTICS

056:171 Operations Research 3 s.h.

Operations research models and applications emphasizing both deterministic and probabilistic models: linear programming, duality, parametric analysis, dynamic programming, Markov chains, queueing theory. Offered fall semesters. Prerequisite: 22M:033 and Corequisite: 22S:039.

056:176 Applied Linear Regression 3 s.h.

Regression analysis with focus on applications; model formulation, checking, selection; interpretation and presentation of analysis results; simple and multiple linear regression; ANOVA; hands-on data analysis with SAS software. Prerequisite: 22S:030 or 22S:039 or 22S:120 or equivalent. Same as 22S:152.

056:178 Digital Systems Simulation 3 s.h.

Simulation modeling and analysis; emphasis on construction of models, interpretation of modeling results; input and output analysis; modeling discrete, continuous and hybrid systems; construction of model-related databases—hands-on usage of ARENA simulation software, manufacturing, health care, and service applications. Offered spring semesters. Prerequisite: 056:171.

056:186 Health Informatics I 3 s.h.

Technological tools that support health care administration, management, and decision making. Graduate standing or consent of instructor required. Same as 021:275, 050:283, 051:187, 074:191, 096:283, 174:226.

056:270 Linear Programming 3 s.h.

Formulation and solution of linear optimization problems; duality, sensitivity analysis, decomposition methods; simplex and interior algorithms; extensions to semidefinite and second-order cone optimization. Prerequisite: 056:171 or equivalent. Same as 06K:286.

056:271 Nonlinear Optimization 3 s.h.

Mathematical models, theory, algorithms for constrained and unconstrained optimization; nonlinear, geometric, quadratic, dynamic programming; optimality conditions; aspects of duality theory. Prerequisite: 056:171 or equivalent.

056:272 Integer Programming and Network Flows 3 s.h.

Theory, applications, algorithms for combinatorial optimization problems, including integer and mixed-integer mathematical programming problems as well as problems formulated in a network or graph setting, including routing of vehicles, location of facilities in networks and scheduling. Offered fall semesters. Prerequisite: 056:171 or equivalent.

056:274 Stochastic Optimization 3 s.h.

General tools and approaches used in decision making under uncertainties; modeling of uncertainties and risk, changes that uncertainties bring to the decision process, difficulties of incorporating uncertainties into optimization models, common techniques for solving stochastic problems.

056:275 Statistical Pattern Recognition 3 s.h..

Fundamental mathematical tools for multivariate statistical analysis and decision-making processes in pattern recognition. Prerequisites: graduate standing or consent of instructor.

056:276 Game Theory 3 s.h.

Problems, challenges, solution strategies, and other elements that arise among decisions makers who have aligned or opposing objectives; changes that collaboration and competition bring to decision making and problem solving; how ideas and concepts of game theory can be used to

understand economic, industrial, social, and biological phenomena. Prerequisites: basic linear programming and probability.

056:287 Health Informatics II 3 s.h.

Journal articles on health informatics topics reviewed in seminar format with several faculty members; student group projects. Prerequisite: 056:186. Same as 021:280, 051:189, 074:192, 096:289.

B.S./M.S. JOINT DEGREE PROGRAM

A special combined Bachelor of Science/Master of Science degree program for qualified Industrial Engineering undergraduate students is available to enable a student to complete a Master of Science degree in two or three semesters after completion of the Bachelor of Science degree. Students in the joint degree program are allowed to take up to 12 sh of 100- or 200-level graduate courses and attend one of the department's graduate seminars in place of the undergraduate seminar before the conferral of the Bachelor of Science degree. Of these courses, 6 sh may be counted towards both the B.S. and M.S. degrees.

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ADMISSION

The requirements for admission to the program are (a) completion of at least 80 semester hours of credits, (b) a cumulative grade point average (GPA) of 3.25 or higher, and (c) a letter of application submitted to the Department of Mechanical and Industrial Engineering Chairperson. The letter of application should state the intended completion date for BS studies, the intended area of specialization for graduate studies and the name of the MS thesis adviser. A student enters the combined program after the junior year and receives a Bachelor of Science degree when all requirements for that degree have been completed, and then becomes a regular Master of Science level graduate student in the Department of Mechanical and Industrial Engineering. Students applying to a joint BS/MS degree program will follow the usual application procedure to the Graduate College. However, the letter of application to the BS/MS joint degree program will substitute for the Statement of Purpose and reference letters are not required. Eventual admission to the MS program is subject to satisfaction of the minimum Graduate College GPA, submission of GRE test scores and, where applicable, submission of test scores for the Test of English as a Second Language (TOEFL) exam. Each student will be required to select a faculty adviser for MS studies upon admission to a joint degree program. The adviser may be changed at the request of the student or the adviser.

CURRICULUM

The courses counting towards the MS must be 100- or 200-level Industrial Engineering elective courses. The courses that count towards both the B.S and M.S. must be taken as part of an Elective Focus Area (EFA) in an area related to the graduate degree objective. For example, a student completing 128 sh for their BS degree requirement could count 6 sh of these towards both the BS and MS degree requirements. As another example, a student with AP credit or through overloading might accumulate 134 sh as an undergraduate. In this case, 6 sh could be counted toward both the BS and MS requirements and the 6 sh beyond the BS requirement of 128 sh could be counted towards the MS, for a total of 12 sh counting towards the MS. All courses counted toward the MS program must be relevant to the MS thesis objective, as determined by the MS thesis committee. Graduate research credits cannot be taken by undergraduate students;

however, students in the program may work on a Master of Science thesis research project with a faculty member starting as early as the summer of the junior year of undergraduate studies.

FINANCIAL SUPPORT

Admission to a joint degree program does not guarantee financial support. However, it is anticipated that many students in these programs will be offered appointments as part-time research or teaching assistants while they are undergraduates and as regular half-time Graduate Research or Teaching Assistants after they are formally admitted to the MS degree program. The BS/MS combined degree student will be assessed undergraduate tuition and fees during the first semester of the senior year, and assessed graduate tuition and fees during the second semester of the senior year. The student will be assessed graduate tuition and fees thereafter. If the student receives at least 1/4-time support from the Department or an advisor during any semester after the first, then the student will be assessed in-state tuition for that semester.

Students in the joint degree program are expected to continue the high degree of academic performance that was evident when they were admitted into the program. A minimum cumulative GPA of 3.25 is required for continuation in the joint degree program. Undergraduate students whose cumulative GPA at any time falls below this minimum for more than one semester will be removed from the joint degree program. Once students in the joint degree program receive the BS and are admitted to the regular MS degree program, academic probation matters will be dealt with in the same manner as for other MS students.

ACADEMIC POLICY

All academic policies of the I.E. program parallel those policies established for the College of Engineering. Information on policy can be found by referring to the University of Iowa General Catalog College of Engineering reprint, available in the Student Development Center located on the 3rd floor of the Seamans Center or by consulting the College of Engineering Web Page.

ADVISING

All new students (freshman and transfer) are advised by the Academic Counselor in the Office of Student Development Center during orientation and the early registration process. New students who have declared Industrial Engineering as their major at the time of admission will be assigned a faculty adviser in the Department of Industrial Engineering during their first semester in the College (about mid-semester time, prior to early registration for the next session.) Students who change their major to Industrial Engineering are assigned a faculty advisor at the time of the change. The assignments are made on the basis of the student's identification number but the advisee may also request a particular faculty member as an adviser.

Normally, students participate in the pre-registration process that is scheduled around mid-term in the fall and spring semesters. The sign-up sheets for appointments with faculty advisers for early registration advising are posted on the adviser's office door. A current copy of the student's grade report, degree evaluation (DELI) and curriculum sheet are maintained in the department office. A current copy of the DELI is mailed to the student prior to the advising session for each registration period.

In order to facilitate the student-adviser consultation, the student should bring their copy of the DELI to the advising appointment along with a tentative schedule plan. Examination of the DELI is a good way to verify progress toward the Bachelor of Science degree. The student must consult his or her adviser to be advised. The advisor will either provide the student with a registration number or authorize the student for registration on ISIS, either of which allow the student to complete the registration process. Students can then register through the Iowa Student

Information Services (ISIS). Changes in registration can be done through ISIS prior to the first day of classes for the semester. After that time changes are handled by using an drop/add form that requires signatures of the adviser, course instructor and if required, the dean.

FACULTY OF INDUSTRIAL ENGINEERING

Name	Rank	Office	Phone Number	Email (@uiowa.edu)
Dr. Linda Boyle	Associate Prof.	2440 SC	354-0554	Linda-Boyle
Dr. Pavlo Krokhmal	Assistant Prof.	2403 SC	335-5680	Pavlo-Krokhmal
Dr. Andrew Kusiak	Professor	2139 SC	335-5934	Andrew-Kusiak
Dr. John Lee	Professor.	2130 SC	354-0810	John-D-Lee
Dr. Peter O'Grady	Professor	2132 SC	355-5938	Peter-OGrady
Dr. Thomas Schnell	Associate Prof.	2135 SC	354-0811	Thomas-Schnell
Dr. Geb Thomas	Associate Prof.	2404 SC	335-5936	Geb-Thomas
Dr. Yong Chen	Assistant Prof.	2138 SC	335-6106	Yong-Chen

STUDENT ORGANIZATIONS

ALPHA PI MU

Alpha Pi Mu is the national industrial engineering honor society founded in 1949 at the Georgia Institute of Technology. Membership is based upon academic excellence as well as demonstrated leadership, sociability, and ethically skills. Juniors in the upper one-fifth and seniors in the upper one-third of their classes are eligible for membership.

HFES

The Human Factors and Ergonomics Society is comprised of over 5000 members worldwide. The society strives to further the knowledge about the assignment of appropriate functions for humans and machines, whether people serve as operators, maintainers, or users in the system. It aims to achieve compatibility in the design of interactive systems of people, machines, and environments to ensure their effectiveness, safety, and ease of performance.

Student Chapter activities include guest speakers from industry and academia, informal student research discussions, and the exchange of information that aids students in attaining a career in Human Factors/Ergonomics. In 2000 and 2002, the Student Chapter at Iowa won the "Most Outstanding Student Chapter Award" from the national HFES organization.

IIE

The Institute of Industrial Engineers is a professional engineering society of industrial engineers consisting of over 50,000 members Worldwide. The purpose of IIE is to promote the profession of industrial engineering in research, study, and discussion. The Iowa IIE Student Chapter's activities include: plant trips, technical paper presentations, and various social events.

UNIVERSITY OF IOWA NONDISCRIMINATION STATEMENT

The University of Iowa prohibits discrimination in employment, educational programs, and activities on the basis of race, national origin, color, creed, religion, sex, age, disability, veteran status, sexual orientation, gender identity, or associational preference. The University also affirms its commitment to providing equal opportunities and equal access to University facilities. For additional information contact the Office of Equal Opportunity and Diversity, (319) 335-0705.

APPENDIX 1: INDIVIDUAL INVESTIGATION PROPOSAL

Project Title: _____

Student Name: _____

Project Faculty Advisor: _____

Educational Objectives of the Investigation:

Investigation Method:

Investigation timeline:

Method by which success or failure will be evaluated:

Will this investigation satisfy a technical elective requirement? _____

Signed:

_____ _____

Student Date

_____ _____

Project Faculty Advisor Date

_____ _____

Department Undergraduate Coordinator Date

(or Department Executive Officer, if faculty advisor is also coordinator)

APPENDIX II: INDIVIDUAL INVESTIGATION FINAL REPORT

Project Title: _____

Student Name: _____

Project Faculty Advisor: _____

Educational Objectives of the Investigation:

Investigation Method (attach a report, if necessary):

Method by which success or failure was evaluated:

Assigned Grade: _____

Does this investigation satisfy a technical elective requirement? _____

Signed:

_____ _____

Student Date

_____ _____

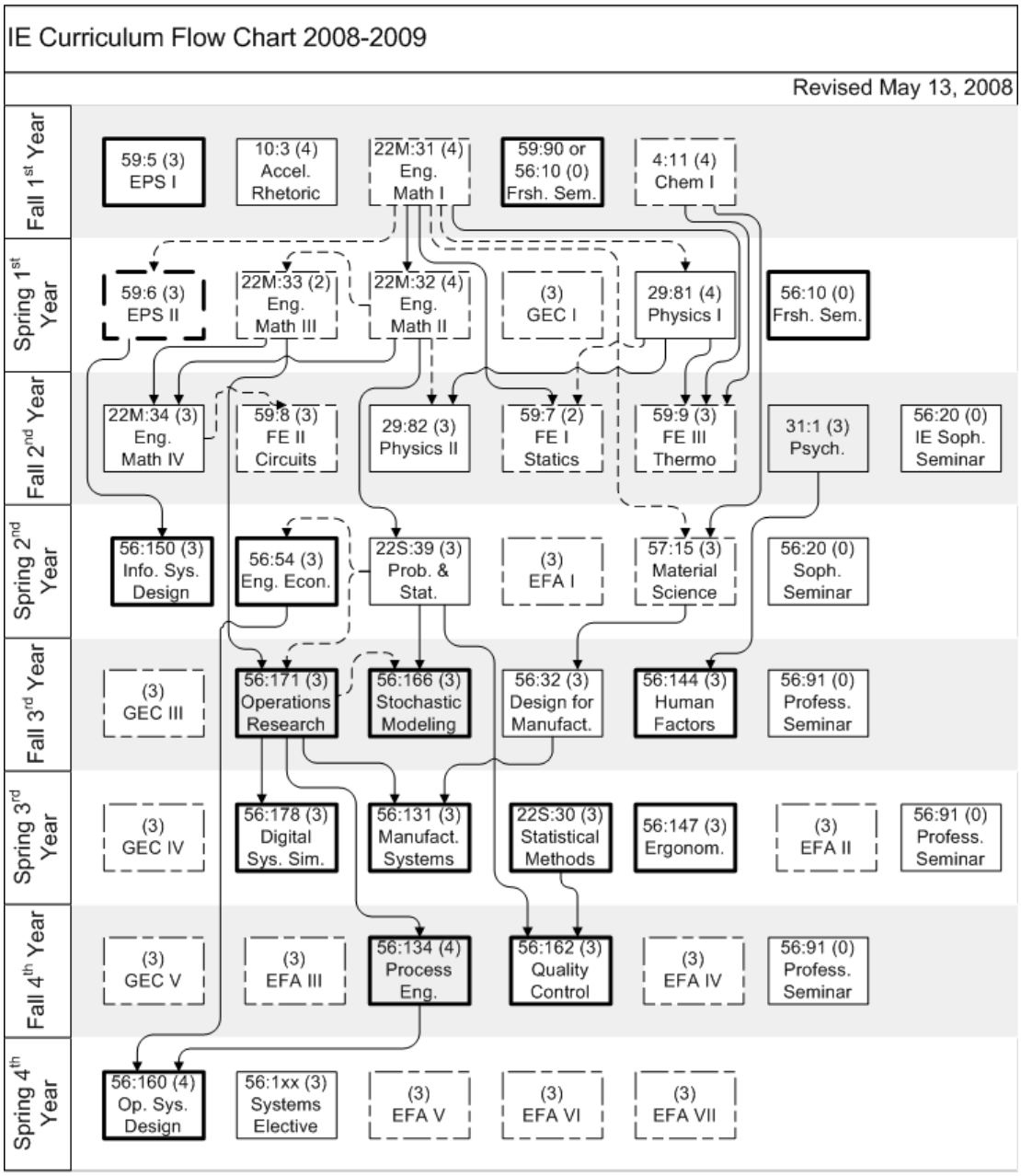
Project Faculty Advisor Date

_____ _____

Department Undergraduate Coordinator Date

(or Department Executive Officer, if faculty advisor is also coordinator)

APPENDIX III: 4-YEAR CURRICULUM FLOW CHARTS



Notes:
Number in parentheses after the course number indicates the number of credits.
Heavy outline indicates that course is offered only once per year in the indicated semester.
Dashed outline indicates that the course is offered during the summer.