

# industrial & systems engineering

WAYNE STATE UNIVERSITY COLLEGE OF ENGINEERING

## Bachelor of Science in Industrial Engineering Student Handbook

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<http://engineering.wayne.edu/ise/>

# Welcome

## ***From the Undergraduate Program Chair***

On behalf of the Undergraduate Program Committee and the entire ISE faculty, I would like to welcome you to our program. I am dedicated to ensuring that you receive a high-quality, rewarding education in Industrial Engineering.



## Important Contact Information

Department Chair	Undergraduate Program Chair	Academic Advisor
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Industrial & Systems Engineering Department  
Wayne State University  
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The purpose of this handbook is to provide industrial engineering students at Wayne State University a quick and complete source of information and guidelines to curriculum requirements and academic policies. The most up-to-date version of this document will be placed on the department web site at <http://engineering.wayne.edu/ise/>.

This Handbook is intended to be comprehensive and up-to-date, but is subject to change without notice. Since the University Bulletin is published infrequently, this document supersedes the University Bulletin with regard to IE requirements and policies.

Consult the Academic Advisor or the Undergraduate Program Chair to determine your official status and current requirements.

# About the Profession & Program

## Industrial Engineering...

...is concerned with the design, improvement and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results to be obtained from such systems.

*- Institute of Industrial & Systems Engineers.*

The industrial engineer is a broadly-trained integration engineer, concerned with enabling complex systems to function effectively. Managing the inventory of a production facility, for example, involves issues of production and stocking policy, manufacturing equipment, human resources, customer demand, and supplier relationships. The industrial engineer must understand the interaction of the components of a system, and coordinate the flow of materials and information to effectively manage the operation. The industrial engineer plays an important role in defining information needs and developing strategies for decision making based on incomplete knowledge. However, the skills of the industrial engineer have much greater application than to traditional production environments. In a growing service sector of the economy including health care delivery, public safety, air transportation, and banking, for example, issues of resource management, scheduling, quality of service, and systems design are important.

Traditionally, the manufacturing engineer was responsible for developing the process capability to realize the output of design engineering. Today, however, the boundary between design and manufacturing engineering is becoming blurred. Both groups work together in teams to assure the soundness of design and manufacturability of product. The manufacturing engineer must have an understanding of the design process, but the special expertise which is brought by the manufacturing engineer is the knowledge and understanding of the production process.

Today's production is computer-based and provides flexibility through computer control. The manufacturing engineer is responsible for designing and implementing the cells and production lines which become the basic units of manufacture. Increasingly, such production units are becoming parts of an integrated factory system, and are not simply islands of automation. The manufacturing engineer must understand the multi-layered control architecture of the integrated factory, and the computer-based technologies which enable it.

The Department maintains laboratories in systems simulation, computer-aided manufacturing, human systems, and concurrent engineering design.

## **Program Professional Objective** *(Last Revised Fall 2012)*

Building on skills developed in the academic program, and extended by experience and personal self-improvement, the graduates of our program have the ability to:

1. Apply the tools and techniques of industrial engineering to make decisions which add value to their organization,
2. Identify opportunities and formulate solutions which integrate technological and human systems,
3. Provide leadership as a member of high-performance teams.

## **Program Outcomes (Enabling Objectives)**

Upon completion of the Industrial Engineering Program, our graduates will exhibit skills necessary of all engineering professionals, including an ability to:

### ***IE Program Student Learning Outcomes 2018 to 2024***

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## **Consistency of Program Objectives with University Mission Statement**

The [Wayne State University mission statement](#) recognizes a dual character of the university and its programs. It is "a national research university... committed to high standards in research and scholarship". At the same time, the university describes itself as "*an urban teaching university*"... whose "*graduates typically remain to live and work in the area throughout their lives.*" The Industrial Engineering Program defined by the objectives stated above, aims to prepare graduates for careers applying skills and knowledge to benefit the manufacturing and service industries in southeast Michigan.

## **Accreditation**

The IE Program at Wayne State University is accredited by the Engineering Accreditation Commission of ABET Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone: (410) 347-7700, <http://www.abet.org>. Wayne State University is accredited by the North Central Association Commission on Accreditation and School Improvement (NCA CASI).

# Faculty

Name	Room No	Phone No (313)	E-mail	Research Interests
Leslie Monplaisir, Department Chair	2143.1	577-1645	<a href="mailto:leslie.monplaisir@wayne.edu">leslie.monplaisir@wayne.edu</a>	Group Decision Support Systems, Integrated Product Development & Computer-Integrated Manufacturing.
Celestine Aguwa	2071	577-4007	<a href="mailto:bd4891@wayne.edu">bd4891@wayne.edu</a>	Healthcare Systems Engineering, Voice of the Customer (VOC) Analysis, Product Design and Development
Kenneth Chelst	2069	577-3857	<a href="mailto:kchelst@wayne.edu">kchelst@wayne.edu</a>	Decision and Risk Analysis, Engineering Management, Urban Services, Operations Research
Ratna Babu Chinnam	2161	577-4846	<a href="mailto:r_chinnam@wayne.edu">r_chinnam@wayne.edu</a>	Intelligent Engineering Systems, Supply Chain Management, and Production and Operations Management.
Evrin Dalkiran	2043	577-5372	<a href="mailto:ey5796@wayne.edu">ey5796@wayne.edu</a>	Decision Analysis and Risk Management in Healthcare, (Nonlinear, Polynomial, Semidefinite) Programming, Optimization
Darin Ellis	2145	577-3296	<a href="mailto:rdellis@wayne.edu">rdellis@wayne.edu</a>	Human Factors Engineering, Human Computer Interaction
Yanchao Liu	2169	577-3301	<a href="mailto:yanchaoliu@wayne.edu">yanchaoliu@wayne.edu</a>	Data Science and Analytics, Applied Engineering Statistics, Operations Research
Kyoung-Yun Kim	2067	577-4396	<a href="mailto:kykim@wayne.edu">kykim@wayne.edu</a>	Globalization of business and industry
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Alper Murat	2051	577-3872	<a href="mailto:alper@eng.wayne.edu">alper@eng.wayne.edu</a>	Supply Chain Management, Logistics and Distribution Planning, Supplier Selection and Contracting, Applied Operations Research
Dean Pichette	2073	577-3821	<a href="mailto:dpichette@wayne.edu">dpichette@wayne.edu</a>	Project Management, Systems Engineering
Jeremy Rickli	2173	577-1752	<a href="mailto:jrickli@wayne.edu">jrickli@wayne.edu</a>	Sustainable Manufacturing, Remanufacturing Systems, Fault Detection and Diagnosis in Manufacturing Environments
Jayant Trewin	2063	577-5675	<a href="mailto:aa6316@wayne.edu">aa6316@wayne.edu</a>	Six Sigma, Lean Engineering, Reliability Engineering
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Kai Yang	2151	577-3858	<a href="mailto:kyang@wayne.edu">kyang@wayne.edu</a>	Robust Engineering, Quality Engineering Operations Research
Qingyu Yang	2167	577-9665	<a href="mailto:qyang@wayne.edu">qyang@wayne.edu</a>	Systems Informatics, Complex System Modeling and Analysis
Murat Yildirim	2049	577-3858	<a href="mailto:murat@wayne.edu">murat@wayne.edu</a>	Operations Research, Data Analytics, Energy and Mobility

# Admission Requirements

All students eligible for admission to the University are also eligible for admission to the College of Engineering. As a result of Wayne State University's urban mission, one of the governing principles of the university's admissions process is to be a "university of opportunity" to students from the southeastern Michigan region. Therefore, the university has a rolling admissions policy so that qualified students may be admitted through the beginning of the semester in which they wish to enroll. In addition, minimum admission standards have been set by the university at a level to provide students with the best opportunity to pursue a university-level education.

In order to provide appropriate academic advising, it has been determined by the faculty and administration of the College of Engineering that students interested in engineering should be admitted directly to the College. Courses within the pre-engineering program include courses taught in the College of Engineering as well as other preparatory courses taught outside the college. While recognizing the importance of working within the admissions framework established by the university, the Engineering faculty have also noted that many students who are both eligible for admission and interested in engineering may not be prepared to begin the engineering pre-professional program. As a result, a multi-tiered admissions structure has been established for the College.

## *Pre-Professional Admission*

In order to be admitted to the pre-professional engineering program, students must meet one of the following criteria:

- Freshmen:
  - 3.0 minimum cumulative high school GPA in science and math courses.
  - Minimum Math ACT score of 21 (SAT Math score of 530)
  - Placement into MAT 1800 (pre-calculus), CHM 1225 (general chemistry), and ENG 1020 (basic composition)<sup>1</sup> or above
- Transfer students:
  - 3.0 minimum cumulative college GPA
  - Placement into MAT 1800 (pre-calculus), CHM 1225 (general chemistry), and ENG 1020 (basic composition) or above based on transfer credit or placement examinations
  - Completion of at least 12 credits at the college-level

Pre-professional students must complete the following sequence of courses, either at Wayne State or through accepted transfer credit, with a minimum grade point average of 2.5 with no grade lower than a C- in order to advance to the professional program of their choice:

- Math: MAT 2010, 2020, 2030 (calculus 1 through 3)

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<sup>1</sup> Students who meet all other requirements for admission to the pre-professional program but who have placed into no more than one lower level course in English (ENG 1010) or chemistry (CHM 1040) will be provided with a waiver to start in the pre-professional program.

- Chemistry: CHM 1225/1230 (general chemistry with lab)
- Physics: PHY 2175, 2185 (general physics);
- English: ENG 1020 (basic composition)
- Basic Engineering: BE 1200 (Introduction to Design), 1300/1310 (Materials Science with lab)

**EOS Program:** Students who are admissible to the University but who do not meet the minimum standards for the Engineering pre-professional program are admitted to the EOS Program. These students must complete a one-year program of math (algebra and pre-calculus), science (chemistry and physics), English, and pre-engineering courses with a minimum grade point average of 3.0 in order to progress into the pre-professional program of their choice. Students who do not meet these requirements after the completion of the one-year program are counseled to select a program other than engineering in order to meet their professional goals.

### *Professional Program Admission:*

Professional Engineering Program: A small number of freshmen and a significant number of transfer students are admitted directly to the professional engineering program of their choice. Requirements for direct admission include:

- Freshmen:
  - 3.5 minimum cumulative high school GPA, overall and in science and math courses
  - Minimum Math ACT score of 26 (SAT Math of 650)
  - Placement into MAT 2010 (calculus 1), CHM 1225 (general chemistry), and ENG 1020 (basic composition) or above
- Transfer students:
  - 3.0 cumulative college GPA, overall and in science and math courses
  - Completion of equivalent of MAT 2010, 2020, 2030 (calculus 1 to 3); CHM 1225/1230 (general chemistry with lab); PHY 2175, 2185 (general physics); and ENG 1020 (basic composition) with no grade lower than a C

Students who progress through the pre-professional program (see below) must earn a minimum of a 2.5 cumulative grade point average in the pre-professional courses with no grade lower than a C- in order to advance to the professional program of their choice. Students directly admitted to the professional program must maintain their grade point average above the 2.5 level or they will be moved back down to the pre-professional program and will be required to meet the general requirements for advancement to professional status.



# Degree Requirements

Candidates for the Bachelor of Science degree must complete a minimum of 120 credits in course work, including satisfaction of the University General Education Requirements (see General Education Requirements, <http://bulletins.wayne.edu/undergraduate/general-information/general-education/>, online), as outlined in the following curriculum. All course work must be completed in accordance with the academic procedures of the University and the College governing undergraduate scholarship and degrees; see the following sections in the Undergraduate Bulletin: Degree Requirements, Baccalaureate, Academic Regulations, University, Division of Engineering: B. S. Program.

The Bachelor of Science in Industrial Engineering degree program is built on a strong core of Industrial Engineering courses. A number of IE Technical Electives allow the student to gain depth in an area of concentration such as production management or quality engineering. In addition to the Technical Electives, the student must complete a Directed Elective to support their plan of work. The directed elective must be approved by the IE undergraduate adviser. A list of courses appropriate for the directed elective is available from the IE adviser. Students are strongly encouraged to meet with the IE undergraduate adviser to complete a plan of work for their professional program, including both IE core requirements, Technical Electives and Directed Electives.

The Engineering Design Project course sequence (IE 4800 and 4880) is a capstone endeavor and is intended to build on and integrate the knowledge that the student has accumulated throughout the undergraduate program, and is intended to be taken in the student's last academic year, that is, within 40 credits of graduating. This course sequence is a year-long undertaking. Students enroll for IE 4800 (2 cr.) in their last Fall semester, and spend the term building their teamwork skills and selecting and planning their project. Practical, professionally relevant projects are usually selected in concert with the Department's industrial partners. In the Winter term students enroll in IE 4880 (2 cr.), and engage in an intensive effort to bring their IE skills and knowledge to bear on the problem. Students who intend to take the capstone sequence should consult their academic advisor.

To enroll in IE 4800 student must have taken and passed IE 3120, IE 4250, IE 4850, and should have taken and passed or be taking at least two of the IE 4420, IE 4330, IE 4560 in the same semester of IE 4800. Under special cases and under instructor(s)'s discretion, students are allowed to register for IE 4800 provided that they have completed at least 6 of the eight IE core courses and are on track to complete all 8 IE core courses together with the IE 4880 in the following semester.

Completing the Industrial Engineering degree program is demanding. Students taking a full load (16 credits) should plan to spend in excess of 40 hours per week on their academic work. With careful planning and consistent academic progress, it is reasonable to expect to complete all degree requirements within 4 academic years. For transfer students and students with a non-traditional path, plan a minimum of 2 years for the IE professional program (2.5 years if starting IE classes in Winter term).

The table below provides a summary of the curriculum requirements. Non-engineering courses, cited below by subject rather than by individual course numbers, indicate courses to be selected in fulfillment of University General Education Requirements. The degree requirements shown in the curriculum below are in effect as of the publication date of this handbook. However, students should consult an academic advisor for verification of current requirements.

<b>Description</b>	<b>Credits</b>
Cultural Inquiry-CI (PHIL 1120)	3
Social Inquiry-SI (ECON 2010 or 2020)	4
Any Diversity, Equity, & Inclusion (DEI)	3
Any Global Learning (GL)	3
Any Civic Literacy (CL)	3
ENG 1020 Introductory College Writing (BC)	3
ENG 3050 Technical Communication I: Report Writing (IC)	3
ENG 3060 Technical Communication II: Writing & Speaking (OC)	3
CHM 1225 Chemical Structure, Bonding and Reactivity (NSI)	3
CHM 1230 Chemical Principles in Laboratory (NSI)	1
MAT 2010 Calculus I	4
MAT 2020 Calculus II	4
MAT 2030 Calculus III	4
MAT 2150 Differential Equations and Matrix Algebra	4
PHY 2175 General Physics (NSI)	4
PHY 2185 General Physics	4
BE 1200 Basic Engineering I - Design in Engineering (CL)	3
BE 1300 Basic Engineering II - Material Science for Engineering Applications	3
BE 1310 Basic Engineering II – Material Science for Engineering Applications Lab	1
BE 2100 Basic Engineering III - Probability and Statistics in Engineering	3
BE 1500 Basic Engineering IV – Intro to Programming Computation for Engineers	3
Engineering Breadth #1 (See Advisor for current list of acceptable courses)	4
Engineering Breadth #2 (See Advisor for current list of acceptable courses)	4
IE 3120 Work Design	3
IE 4250 Engineering Data Analysis	3
IE 4420 System Simulation	3
IE 4850 Engineering Economy	3
IE 4560 Operations Research	3
IE 4260 Principles of Quality Control	3
IE 4310 Production Control (WI)	3
IE 4330 Facilities Design	3
IE 4800 Engineering Design Project I	2
IE 4880 Engineering Design Project II	2
IE Technical Electives (See Advisor for current list of acceptable courses)	16
Directed Elective (See Advisor for current list of acceptable courses)	3
<b>TOTAL MINIMUM CREDITS REQUIRED</b>	<b>121</b>

# Curriculum

## Semester by Semester

### Freshman Year

#### First Semester

BE 1200 -- Basic Engg. I: Design in Engineering: Cr. 3  
CHM 1225 -- (NSI) General Chemistry I: Cr. 3  
CHM 1230 -- (NSI) General Chemistry I Laboratory: Cr. 1  
ENG 1020 -- (BC) Introductory College Writing: Cr. 3  
MAT 2010 -- (QE) Calculus I: Cr. 4  
Total Credits: 14

#### Second Semester

BE 1300 -- Basic Engg. II: Materials Science for Engineering Applications: Cr. 3  
BE 1310 -- Materials Science for Engineering Lab: Cr. 1  
MAT 2020 -- Calculus II: Cr. 4  
PHY 2175 -- (NSI) University Physics for Engineers I: Cr. 4  
(CI) PHI 1120 Professional Ethics: Cr.3  
Total Credits: 15

### Sophomore Year

#### First Semester

BE 2100 -- Basic Engg. III: Probability and Statistics in Engineering: Cr. 3  
MAT 2030 -- Calculus III: Cr. 4  
PHY 2185 -- University Physics for Engineers II: Cr. 4  
Engineering Breadth Option: Cr. 4 (Note 1)  
Total Credits: 15

#### Second Semester

BE 1500 -- Introduction to Programming & Computation for Engineers: Cr. 3  
MAT 2150 -- Differential Equations and Matrix Algebra: Cr. 4  
(SI) ECO 2010/2020 Principles of Microeconomics /Macroeconomics: Cr. 4  
(DEI) Diversity, Equity and Inclusion: Cr. 3  
IE Technical Elective: Cr. 3  
Total Credits: 17

### Junior Year

#### First Semester

ENG 3050 -- (IC) Technical Communication I: Reports: Cr. 3  
IE 3120 -- Work Design: Cr. 3  
ENG 3050 Technical Comm. Report Writing: Cr. 3  
IE Technical Elective: Cr. 3  
(GL) Global Learning: Cr. 3  
Total Credits: 15

#### Second Semester

IE 4250 -- Engineering Data Analysis: Cr. 3  
IE4420 -- System Simulation: Cr. 3  
ENG 3060 Technical Comm. Writing & Speaking: Cr. 3  
Engineering Breadth Elective: Cr. 4 (Note 1)  
(CIV) Civic Literacy: Cr. 3  
Total Credits: 16

### Senior Year

#### First Semester

IE4260 -- Principles Quality Control: Cr. 3  
IE4560 -- Operations Research: Cr. 3  
IE4800 -- Engineering Design I: Project Management: Cr. 2  
IE Technical Elective: Cr. 3  
Directed Elective: Cr. 3 (Note 2)  
Total Credits: 14

#### Second Semester

IE4330 -- Facilities Design: Cr. 3  
IE4310 -- Production Control (WI): Cr. 3  
IE4880 -- Engineering Design II: Cr. 2  
IE Technical Elective: Cr. 4  
IE Technical Elective: Cr. 3  
Total Credits: 15

TOTAL PROGRAM CREDITS: 121

**Note 1:** See Academic Advisor for current list of Engineering Breadth options.

**Note 2:** See Academic Advisor for the acceptability of directed elective courses. The directed elective must be approved by the program director or undergraduate advisor. A list of courses appropriate for the directed elective is available from the Department.

**General Note:** This information is provided to give students guidance for general planning purposes. Course schedules and degree requirements are subject to change, therefore students are STRONGLY encouraged to develop a plan and regularly consult with the program's Academic Advisor or the UG Program Chair.

## IE Course Descriptions

The Bachelor of Science programs offered by the College of Engineering are built upon a strong core of common courses generally completed in the Freshman and Sophomore years under the *Pre-Professional Engineering* status. They satisfy the University General Education Requirements, and provide the foundation for more targeted study at the department level. These courses and other University obligations can be found on the *Degree Requirements* section.

In the Junior year, you'll transfer to the *Professional Industrial Engineering* program and focus on courses that support their major. Professors in the Department of Industrial and Manufacturing Engineering have developed classes and sequences that provide in-depth understanding of the principles of industrial engineering. Listed below are brief descriptions of courses offered for students declaring a major in Industrial Engineering. In addition to these undergraduate courses, students are allowed to select IE technical electives from the 6000-level courses listed in the Graduate Bulletin (note: all prereqs apply).

### **IE 3120 – Work Design** Cr. 3

Prereq: BE 2100. Role of the human as an element of the work environment. Traditional issues of work standards, productivity analysis, and occupational safety are introduced. Examination of functional and organizational role of the worker; impact of emerging computer-based technologies on work design and implementation strategies are discussed.

### **IE 3450 – Manufacturing Processes I** Cr. 3

Prereq: . A study of the field of manufacturing processes from a mechanical engineering design standpoint. Topics include: processing of metals, polymers, and ceramics, and computer-aided manufacturing.

### **IE 4250 – Engineering Data Analysis** Cr. 3

Prereq: BE 2100. Advanced concepts for the analysis of variability in engineering problems, multivariate distributions, hypothesis testing, non-parametric statistics, point and interval estimation, fitting straight lines, goodness of fit tests, contingency tables, and an introduction to the analysis of variance.

### **IE 4260 – Principles of Quality Control** Cr. 3

Prereq: BE 2100. Statistical quality control including process capability, control charts, and acceptance sampling procedures. Procedures for measurement of dimensional tolerance are introduced. Computer-based data collection and analysis.

### **IE 4310 – Production Control (W)** Cr. 3

Prereq: ENG 3050, Enrolled in professional engineering program. The design of production planning and control systems. Materials management, forecasting, planning, scheduling of production systems, the planning and scheduling for large scale projects and introduction to the design of computerized materials management systems. Applications of operations research models to production control problems.

**IE 4330 – Facilities Design Cr. 3**

Prereq; Enrolled in professional engineering program. Design of manufacturing, warehouse, and material handling facilities. Use of analytic and computer-aided methods in the facilities design process.

**IE 4355 Product Engineering Cr. 3**

Prereq BE 2100; Enrolled in professional engineering program. Current principles and processes of product engineering. Use of integrated product engineering processes and methods.

**IE 4420 – Systems Simulation Cr. 3**

Prereq: BE 1200, BE 1500, BE2100. Enrolled in professional engineering program. Systems modeling and discrete event simulation. Methodology applied to analysis and design of a broad range of systems including both production and service systems. Computer assignments and a term project are required.

**IE 4560 – Operations Research Cr. 3**

Prereq: BE 2100 and MAT 2150; Enrolled in professional engineering program. An introduction to the philosophy of operations research. Formulation of linear programming models and their solutions. Duality and sensitivity analysis. The transportation model. Introduction to probabilistic modeling and application of queuing models.

**IE 4700 Leadership in Manufacturing Cr. 3**

Leadership of individuals and teams in a unionized manufacturing environment. Technical elective for Operations Management Leadership Program (OMPL) students.

**IE 4710 Labor Relations in Manufacturing Cr. 3**

Knowledge and skills in administering labor agreements. Technical elective for Operations Management Leadership Program (OMPL) students.

**IE 4800 - Engineering Design Project I Cr. 2**

Prereq: IE 3120, IE 4250, IE 4850, and should have taken and passed or be taking at least two of the IE 4420, IE 4330, IE 4560 in the same semester of IE 4800.; Enrolled in professional engineering program. Preparation for capstone course – Covers project selection, team building and methodological preparation required for Engineering Design Project II.

**IE 4850 – Engineering Economy Cr. 3**

Prereq: BE 2100; Enrolled in professional engineering program. Economic analysis of engineering projects. Selection of appropriate interest rates and methods of analysis, depreciation, tax considerations and use of accounting data in the comparison of investment alternatives.

**IE 4880 - Engineering Design Project II Cr. 2**

Prereq: Prerequisites 4800 and pre- or co-requires IE 4260, 4310, 4330, 4420, and 4560; Enrolled in professional engineering program. An intensive design experience defined and executed by the student; Requires synthesis and application of skills and knowledge gained in the program.

**IE 4990 – Directed Study Cr. 1-6**

Prereq: senior standing; consent of chairperson; outline of proposed study approved by instructor and chairperson prior to election of course. Supervised study and instruction in a field selected by the student.

AGRADE students can take the following courses in lieu of IE 4250 and IE 4560.

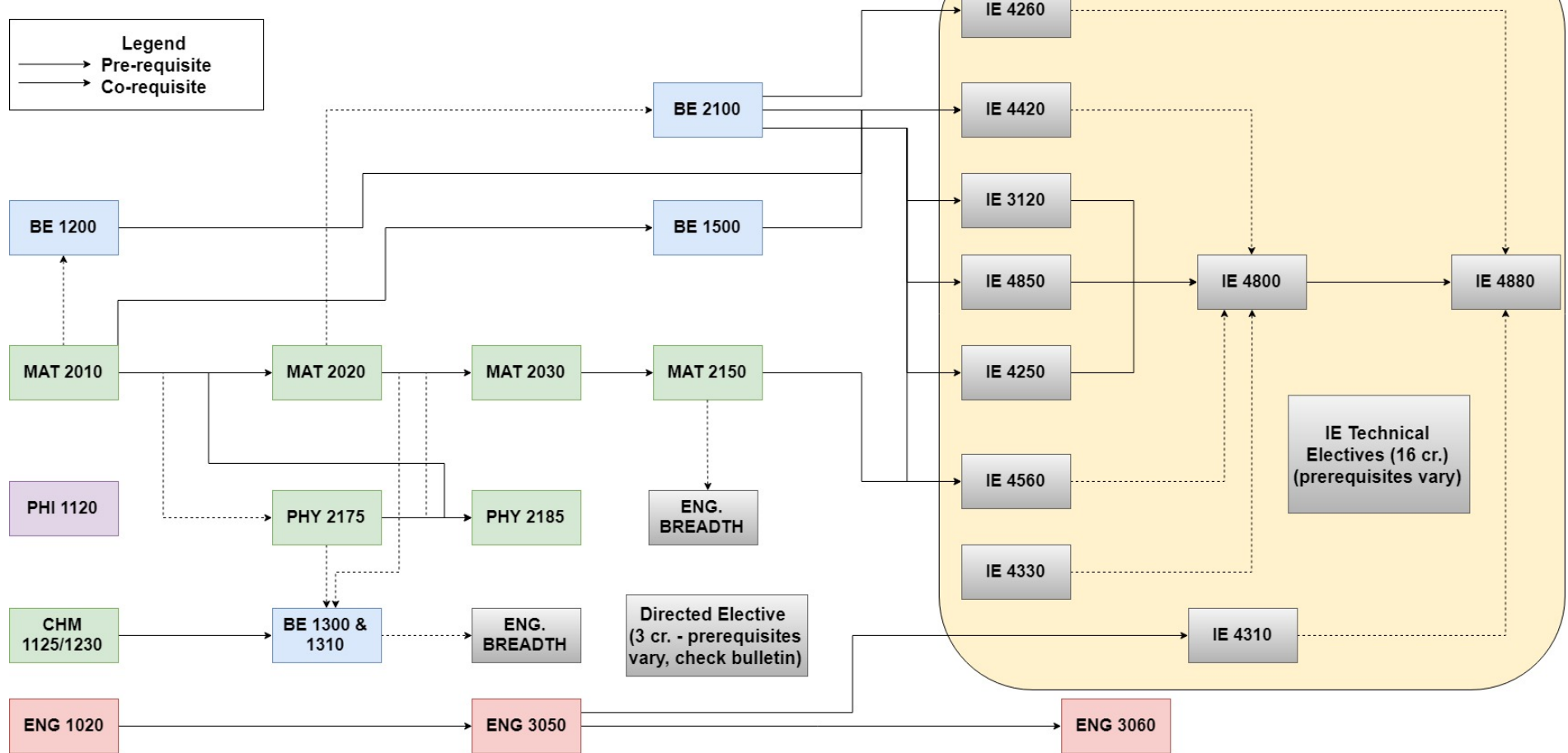
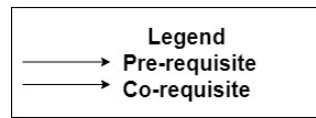
**IE 6210 Applied Engineering Statistics** Cr. 4

Prerequisite: BE 2100. Analysis of variability in engineering decision making; data analysis, probabilistic models, hypothesis testing, regression and analysis of variance. No credit after IE 4250.

**IE 6560 Deterministic Optimization** Cr. 4

Prerequisite: Graduate Standing. Introduction to philosophy of operations research. Formulation of linear program models and their solutions. Duality and sensitivity analysis. The transportation models. Introduction to probabilistic modeling and applications of queuing models. Network models decision theory.

# Model Flow Chart for BSIE Required Courses



**General Education Requirements (16 cr.)**  
 Cultural Inquiry-CI (PHIL 1120)  
 Social Inquiry-SI (ECON 2010 or 2020)  
 Any Diversity, Equity, & Inclusion (DEI)  
 Any Global Learning (GL)  
 Any Civic Literacy (CL)  
 (GenEd requirements subject to change – check bulletin & consult advisor)  
 \* Students who wish to pursue the IE Business Minor should take ECON 2010

**Pre-Professional Requirements**  
 Complete all required courses in math, science, basic engineering (besides BE 1500). Also complete ENG 1020.

**Industrial Engineering Requirements**  
 There are 10 core courses (28 cr.) plus 16 credits of IE technical electives required. All IE courses require students to be registered in the IE Professional Program (i.e. all Preprofessional requirements must be met.) Exceptions to this requirement may be granted with a petition to the UG program coordinator.  
 The course sequence is for illustrative purposes only depicting a typical path through the program. Check the Undergraduate Bulletin for current prerequisites.  
 To enroll in IE 4800 student must have taken and passed IE 3120, IE 4250, IE 4850, and should have taken and passed or be taking at least two of the IE 4420, IE 4330, IE 4560 in the same semester of IE 4800. Under special cases, students are allowed to register for IE 4800 provided that they have completed at least 6 of the eight IE core courses and are on track to complete all 8 IE core courses together with the IE 4880 in the following semester.  
 See the advisor for a plan of work that will best suit your needs.



## Technical Electives

Any course in with the IE designation from the 0000-6999, that is not otherwise required (see exceptions below) is a candidate for IE technical elective credit. Some courses at the master's level, including IE 6210, IE 6260, IE 6442 and IE 6560 may not be taken for undergraduate credit because their content overlaps with undergraduate required courses. Additionally, some 6000-level courses require graduate standing and are thus not eligible for undergraduate technical elective credit.

The following is a partial list of technical electives. In addition to these courses, other courses in the college of engineering may be eligible for IE technical elective credit if their content is highly relevant to IE research and practice.

**IE 3450 – Manufacturing Processes I** Cr. 3

Prereq: A study of the field of manufacturing processes from a mechanical engineering design standpoint. Topics include: processing of metals, polymers, and ceramics, and computer-aided manufacturing.

**IE 4990 – Directed Study** Cr. 1-6

Prereq: senior standing; consent of chairperson; outline of proposed study approved by instructor and chairperson prior to election of course. Supervised study and instruction in a field selected by the student.

**IE 5100 (BME 5010) – Quantitative Physiology.** (CHE 5100) (ECE 5100) (M E 5100) Cr. 4

Prereq: The basic principles of human physiology presented from the engineering viewpoint. Bodily functions, their regulation and control discussed in quantitative terms and illustrated by simple mathematical models when feasible. (F)

**IE 5780 Products Liability Introduction for Engineers** (ME 5780) Cr. 1

Prereq: graduate standing in engineering or consent of instructor; Application of engineering practice to minimize products liability exposure. Stages of a products liability lawsuit; how engineers may be involved at different stages of the process.

**IE 5995 – Special Topics in Industrial Engineering** Cr. 1-4

Prereq: Consent of instructor. Covers current topics in industrial engineering research and practice.

**IE 6000 – Digital Automation.** Cr. 4

Prereq: graduate standing in engineering or consent of instructor. Fundamentals of digital control and logic; integration and automation solution technologies (barcode systems, vision systems, etc.); data acquisition. (W)

**IE 6180 Biomedical Instrumentation (BME 6480) (ECE 6180) (ME 6180) Cr. 4**

Prereq: BME 5020, ECE 3300 or BMW 5010 or BMS 6550. Engineering principles of physiological measurements, signal conditioning equipment, amplifiers, recorders and transducers. Recent advances in instrumentation.

**IE 6220 Value Engineering Cr. 4**

Prereq: graduate standing or instructors approval. Resource management; systematic approach to solving problems and making decisions; forcing latent capabilities to be applied to challenging assumptions; application of unbiased logic techniques to produce superior results.

**IE 6240 – Quality Management Systems. Cr. 4**

Prereq: BE 2100. Design of quality management systems. Topics include: QFD, quality planning, business operating systems, TQM, standards, and auditing. Quality management tools such as PDCA and root case analysis. (W)

**IE 6270 – Engineering Experimental Design. Cr. 4**

Prereq: IE 6210. The design of engineering experiments for manufacturing process analysis, human factors experimentation, societal systems analysis and life testing; basic experimental design models, blocking, factorial experiments, nested designs, covariance analysis, response surface analysis, estimation of effects. (F)

**IE 6310 – Lean Operations and Manufacturing. Cr. 2**

Fundamental theories and concepts in lean manufacturing, six-sigma, mistake proofing, problem solving, process management. Students develop competency in identifying causes and sources of waste in manufacturing, industrial, and business operations. (F)

**IE 6405 – Integrated Product Development. (AET 5600) (EVE 5600) Cr. 2**

Prereq: graduate standing or approval from the instructor. Product development process: product architectures, concurrent engineering. Integration of marketing, design, and manufacturing functions for product development. How such processes are designed to account for various manufacturing and other business constraints to ensure that customer needs are met.

**IE 6420 Computer Aided Manufacturing and Lab Cr. 4**

CAM and process planning. Principles of manufacturing planning and control. Design and integration of ASRS, AGVS, robotic systems in manufacturing.

**IE 6425 Product Lifecycle Management and Sustainable Design Cr. 4**

Introduction to modern principles, practices, and applications of PLM and sustainable design.

**IE 6435 Fundamentals of Sustainable Manufacturing Cr. 3**

Prereq: IE 3120 and IE 4850; Sustainable manufacturing, as defined by the U.S.A. Department of Commerce, is “the creation of manufactured products that use processes that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers and are economically sound.” This course is designed to introduce the fundamental concepts of sustainable manufacturing. While the focus will be on sustainable manufacturing, topics will also include connections of sustainable design, environmental sciences, and the social sciences with sustainable manufacturing.

**IE 6442 Facilities Design and Materials Flow Cr. 2**

Plant location theory, analysis of models of plant location. Models for determining plant size and time phasing. Design of manufacturing warehouse and material handling facilities. Use of analytical and computer-aided methods in the facilities design process.

**IE 6470 – Stochastic System Modeling: Queuing and Simulation.** Cr. 2

Description of queuing systems; analytical solutions; discrete events systems; modeling framework and object models; terminating and non-terminating systems; statistical analysis; case studies. (Y)

**IE 6510 – Information Systems for the Manufacturing Enterprise.** Cr. 2

Methods for information flow modeling. Information needs of global manufacturer: design, testing, manufacture, and delivery. Partnership relation to suppliers via information. (W)

**IE 6610 Introduction to Six Sigma** Cr. 4

For the working engineer who requires exposure to basic concepts of 6-Sigma and its work applications.

**IE 6840 (MGT 6840) – Project Management.** Cr. 4

Principles of successful project management including: time and cost management, risk analysis, human resource management. Consideration of both operational and conceptual issues. Introduction to project management tools. (W)

**IE 6850 – Manufacturing Strategies.** Cr. 2

Prereq: graduate standing in engineering. Strategic approach to the management of manufacturing including: relationship to corporate strategy, operationalizing manufacturing concepts, impact of new technology and manufacturing concepts, impact of new technology and manufacturing as a competitive resource; case-studies approach. (Y)

## Non-IE Engineering Electives (Engineering Science Breadth)

IE students are required to take 8 credits and can elect from the following list of courses.

- ECE 3300 / ECE 3310 – Circuits + Lab (4 cr.)
- ECE 2620 – Introduction to Microcomputers (4 cr.)
- ME 2210 – Thermodynamics + Lab (3 cr.)
- ME 3300 – Fluid Mechanics (4 cr.)
- ME 3400 – Dynamics (3 cr.)
- BME 5010 – Engineering Physiology (4 cr.)
- CE 3250 – Applied Fluid Mechanics (4 cr.)
- CE 4600 – Transportation Engineering (4 cr.)
- ME/CE 2410 – Statics (3 cr.)

In addition to these courses, other courses which are focused on engineering fundamentals, such as might be present on the FE or EIT licensing exams, may be accepted. See your Academic Advisor for details.

## Directed Electives

The following is a list of currently approved courses for Directed Elective credit. This list is not comprehensive. If you want to take a course for Directed Elective credit that is not on this list, please submit an Academic Petition form with the course and your rationale for its inclusion in your plan of work. Courses may not count for both Non-IE Engineering Breadth elective and Directed Elective credit.

- ACC 3010 Elementary Financial Accounting Theory
- ANT 3150 Anthropology of Business (IF FC covered by another course - can't double count as general education and directed elective)
- BME 5010 Engineering Physiology (ME 5100)
- BME 5570 Design of Human Rehabilitation Systems (ME 5170, ECE 5170)
- CE 4600 Transportation Engineering
- CE 5810 Legal Aspects of Engineering Problems
- CE 6010 Construction organization and management
- CE 6050 Construction estimating
- CHE 2800 Material and Energy Balances
- CHE 3300 Thermodynamics
- CSC 1100 Problem Solving and Programming
- ECE 2620 Introduction to Microcomputers
- ECE 3330 Electrical Circuits II
- ISM 4630 Business Information Systems
- ISM 5820 Systems Analysis and Design
- ISM 5860 Data Communications and Networks
- LBS 4500 Applied Labor Studies
- ME 2200 Thermodynamics
- ME 3400 Dynamics
- ME 5440 Industrial Noise Control
- MGT 4520 Managing Organizational Behavior
- MGT 2530 Management of Organizational Behavior
- PSY 3500 Psychology and the Workplace
- PSY 5540 Motivation in the World of Work
- ECO 5100 Introductory Statistics & Econometrics

Note: Many of these courses have program restrictions or complicated prerequisites. Being on this list does not imply that any given student will be able to take any course listed. It will be the student's responsibility to determine the applicability of this list to their circumstances.

## Academic Policies

BSIE students complete their degrees in accordance with all applicable University and College academic regulations and policies. The following items are important areas where the IME department places additional policies/regulations in place, over and above the applicable University and College policies/regulations. The following was current at the time of the last handbook update – see the College of Engineering Associate Dean for Academic Affairs for confirmation on these policies.

### Transfer credits accepted

Per University policy, a maximum of 64 credits will be accepted from a 2-year institution (i.e. community college). For students transferring from a Bachelor Degree granting institution, the College requires 34 credits to be completed at WSU. Further, the IME Department requires that IE 4800/4880 Engineering Design be taken at WSU – under no circumstances will transfer credit be accepted for our capstone course. In addition, at least 4 of the remaining 8 IE core courses must be taken at WSU. A minimum of 20 IE-designated credits earned at WSU will be required (including core and technical electives) to fulfill BSIE program requirements.

### Withdrawals and Repeating Courses.

The University has implemented a new grading system, effective Fall 2006. More information will be provided from the Registrar's Office on the policy changes and processes. Approvals for withdrawals do not require the approval of the Associate Dean for Academic Affairs. However, after the end of the 4th week of the semester, instructor approval is required. This will be requested through the University withdrawal system on Pipeline.

**For the purpose of determining the allowed number of repeats for a student, ANY** grade of WP, WF, or WN that appears on your transcript will count as an 'attempt' (refer to the *Pre-Professional Handbook* for the specific policies on allowed number of repeats). Due to the fact that Withdrawals will count as an attempt, students should consider carefully whether or not they will withdraw from the course after the fourth week.

Students who feel that extenuating circumstances (e.g. extended illness, family emergency, out-of-town work responsibilities) justify the withdrawal should submit a petition *in writing* to the Associate Dean for Academic Affairs before the end of the semester. Supporting documentation should be included with the petition. These petitions will only be considered if submitted before the end of the semester in which the course is taken. If the petition is approved, a notation will be made in your advising record not to count the course among the allowed repeats. If you have any questions about this policy, please contact your advisor.

## **Academic Progress**

BSIE students are expected to make academic progress in accordance with the policies of the College of Engineering. Consult the Associate Dean for Academic Affairs for a complete description of policies regarding progress, calculation of College gpa, probation, and exclusion.

## **The Institute of Industrial and Systems Engineers (IISE)**

### ***Professional Involvement***

BSIE students are strongly encouraged to become involved in professional societies while a student. Participation in professional societies gives our students an edge in everything from professional networking to maintaining current technical skills. BSIE students who join the Institute of Industrial and Systems Engineers (IISE) as a student member may be entitled to a 100% dues rebate from the Department -- see Gail Evans for details.

### ***IISE Student Chapter***

Wayne State's BSIE program is home to a vibrant, active student chapter of the Institute of Industrial and Systems Engineers. Chapter operations are housed in Room 2042 of the Manufacturing Engineering building. The chapter office houses 2 PCs with access to the internet through WSU's network. Annual activities include the following: social gatherings, volunteering/attending local IISE workshops and symposia, public service (e.g. volunteering for Gleaner's Food bank). See the WSU IISE bulletin board (outside the chapter office) for a list of upcoming events.

Other benefits of membership include access to the IISE's online resource library, the IISE Online Career Center, IISE fellowships, and discounted conference registration fees.

### ***Detroit Professional Chapter***

Students are also encouraged to participate with your local IISE student chapter in Detroit IISE Senior Chapter events and activities. The Detroit Chapter of IISE has monthly meetings, a website, and newsletter. Aside from learning current applications of IE techniques in industry, you also get to meet individuals that have been in the field 5, 10, 15 + years. You'll make connections and contacts - but more importantly you learn first hand what it means to be a practicing IE. The Detroit Chapter makes every effort to support IE students. A scholarship is available to students - all you have to do is apply to your Faculty Advisor. Also, a Technical Paper contest is sponsored by the Detroit chapter - which puts you in line for Regional, National, and International awards. And the Detroit Chapter funds (in part) trips to Regional and National IE conferences.

Find out more on the web at <http://www.iisedetroit.org/>