INDUSTRIAL ENGINEERING, B.S. (BEHREND)

Begin Campus: Any Penn State Campus
End Campus: Erie

Program Description
The undergraduate program in industrial engineering, being the first established in the world, has a long tradition of providing a strong, technical, hands-on education in design, control, and operation of manufacturing processes and systems. The curriculum provides a broad-based education in manufacturing, operations research and ergonomics through a base of mathematics, physical and engineering sciences, and laboratory and industrial experiences. It builds a strong foundation for the development of a professionally competent and versatile industrial engineer, able to function in a traditional manufacturing environment as well as in a much broader economy, including careers in financial services, communication, information technology, transportation, health care, consulting, or academia.

After completing courses required for the core and fundamental competencies in the major, students can choose two technical elective courses from the department list, out of which must be an IE course. In addition, the students must also complete the 3-credit capstone design course.

What is Industrial Engineering?
Industrial Engineering is rooted in the sciences of engineering, the study of systems, and the management of people. Industrial engineers are big-picture problem solvers who optimize complex engineering systems and processes. They bring together people, machinery, materials, information, energy, and financial resources to improve efficiency, performance, quality, and safety while reducing cost and waste. According to the Institute of Industrial & Systems Engineers, Industrial Engineers "work to eliminate waste of time, money, materials, energy, and other commodities." Because it is a broad and versatile discipline, study of industrial engineering prepares you for careers in every sector of the economy.

You Might Like This Major If...
• You frequently wonder, How could this [fill in the blank] be improved?
• You like to organize things and to manage groups of people to make them work better together.
• You are curious about how complex engineering systems and processes work.
• You're interested in not only engineering, but also business and human psychology and behavior.
• You communicate well and would enjoy working in a client-facing environment.

Entrance to Major
In addition to the minimum grade point average (GPA) requirements described in the University Policies, all College of Engineering entrance to major course requirements must also be completed with a minimum grade of C: CHEM 110, MATH 140, MATH 141, and PHYS 211. All of these courses must be completed by the end of the semester during which the admission to major process is carried out.

1 In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed and students must be enrolled in the College of Engineering or Division of Undergraduate Studies at the time of confirming their major choice.

Degree Requirements
For the Bachelor of Science degree in Industrial Engineering, a minimum of 129 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>111</td>
</tr>
</tbody>
</table>

General Education
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)
• Quantification (GQ): 6 credits
• Writing and Speaking (GWS): 9 credits

Knowledge Domains
• Arts (GA): 6 credits
• Health and Wellness (GHW): 3 credits
• Humanities (GH): 6 credits
• Social and Behavioral Sciences (GS): 6 credits
• Natural Sciences (GN): 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)
• Inter-Domain or Approved Linked Courses: 6 credits

27 of these 45 credits are included in the Requirements for the Major.

University Degree Requirements
First Year Engagement
All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.
First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

**Cultures Requirement**

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

**Writing Across the Curriculum**

3 credits required from the college of graduation and likely prescribed as part of major requirements.

**Total Minimum Credits**

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

**Quality of Work**

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

**Limitations on Source and Time for Credit Acquisition**

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.

**Requirements for the Major**

This includes 27 credits of General Education courses: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

**Prescribed Courses: Require a grade of C or better**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>EMCH 210</td>
<td>Statics and Strength of Materials</td>
<td>5</td>
</tr>
<tr>
<td>IE 302</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>IE 305</td>
<td>Product Design, Specification and Measurement</td>
<td>3</td>
</tr>
<tr>
<td>IE 322</td>
<td>Probabilistic Models in Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>IE 323</td>
<td>Statistical Methods in Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>IE 327</td>
<td>Introduction to Work Design</td>
<td>3</td>
</tr>
<tr>
<td>IE 330</td>
<td>Engineering Analytics</td>
<td>3</td>
</tr>
<tr>
<td>IE 405</td>
<td>Deterministic Models in Operations Research</td>
<td>3</td>
</tr>
</tbody>
</table>

**Additional Courses**

Select 1 credit of First-Year Seminar

- ENGL 15  | Rhetoric and Composition                         | 3       |
- ENGL 30  | Honors Freshman Composition                      | 3       |
- CAS 100A | Effective Speech                                  | 3       |
- CAS 100B | Effective Speech                                  | 3       |
- CMPSC 201 | Programming for Engineers with C++              | 3       |
- or CMPSC 202 |                                               |         |
- ECON 102 | Introductory Microeconomic Analysis and Policy    | 3       |
- or ECON 104 |                                               |         |
- Select one of the following: ![](http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

**Supporting Courses and Related Areas**

Select 3 credits as a science selection from department list

Select 6 credits as non-major electives from department list

Select 3 credits in manufacturing processes from department list

Select 6 credits of technical electives from the department list, out of which at least 3 credits must be IE credits

1 The course not taken to satisfy this requirement can be taken as a track elective. Please see the list in (iv) of section C.

2 The courses not taken to satisfy this requirement can be taken as a technical elective. Please see the department list.

**Program Educational Objectives**

We expect our graduates to:

1. Participate in and lead cross-functional teams, designing, implementing and improving processes and systems in the manufacturing, service, or government sectors;
2. Work effectively in managerial and leadership positions;
3. Work and communicate effectively with internal and external team members in the global environment; and
4. Engage in continuous learning through varied work assignments, graduate school, professional training programs, and independent study.
Program Outcomes

The following outcomes are included in the courses taught in the program:

1. **Management and Information Systems for Industrial Engineering:** apply time value of money to make financial decisions and understand cost-accounting principles; understand probability concepts applicable to solve engineering problems; including reliability issues; conduct tests of hypotheses, create regression models and understand and apply statistical quality control methods such as process capability and control charts; formulate, solve and analyze real problems using Markov chains, network models, dynamic programming, queuing theory and inventory models; create simulation models of manufacturing and service systems and analyze simulation output; and gain an in-depth knowledge of implementation-related issues and theoretical aspects of database and Web-based operations related to industrial engineering.

2. **Manufacturing Engineering:** understand information contained in typical specifications and methods of product verification and conformance to specifications; and program flexible manufacturing equipment and system controllers; design logical manufacturing layouts and implement contemporary systems issues.

3. **Human Factors:** analyze and design both the job and the work site in a cost-effective manner, as well as measure the resulting output; understand and apply cognitive systems engineering: identify visual, auditory, cognitive, perceptual and environmental aspects of human performance, perform task analysis and evaluate human-computer interfaces; and perform work measurement, develop an MTM analysis and carry out a work sampling study.

4. **General:** present engineering study results in technical reports and in oral presentations, demonstrate life-long learning by synthesizing information from several sources, work effectively in groups on case studies and projects, demonstrate knowledge of contemporary issues, understand professional and ethical responsibility and the impact of engineering decisions in a global and societal context; and design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

Academic Advising

The objectives of the university’s academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee’s unit of enrollment will provide each advisee with a primary academic adviser, the information need to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)

**Erie**

Dipo Onipede
Associate Professor of Mechanical Engineering

Suggested Academic Plan

**Industrial Engineering at Erie Campus**

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Spring</th>
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</tr>
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<tbody>
<tr>
<td>CHEM 110**#†</td>
<td>3</td>
<td>CMPSC 200†</td>
<td>3</td>
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<tr>
<td>CHEM 111†</td>
<td>1</td>
<td>ECON 102 or 104†</td>
<td>3</td>
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<tr>
<td>EDSGN 100S†</td>
<td>3</td>
<td>MATH 141*#†</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 15 or 30†</td>
<td>3</td>
<td>PHYS 211*#†</td>
<td>4</td>
</tr>
<tr>
<td>MATH 140*#†</td>
<td>4</td>
<td>General Education Course</td>
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<table>
<thead>
<tr>
<th>Second Year</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CAS 100†</td>
<td>3</td>
<td>EMCH 213*</td>
<td>3</td>
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<td>EMCH 211*</td>
<td>3</td>
<td>MATH 250</td>
<td>3</td>
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<tr>
<td>MATH 220†</td>
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<td>Course from Approved List‡</td>
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<tr>
<td>MATH 231</td>
<td>2</td>
<td>Course from Approved List‡</td>
<td>3</td>
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<tr>
<td>PHYS 212†</td>
<td>4</td>
<td>Science Elective†</td>
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<td>17</td>
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<table>
<thead>
<tr>
<th>Third Year</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>IE 302†</td>
<td>3</td>
<td>ENGL 202C†</td>
<td>3</td>
</tr>
<tr>
<td>IE 305†</td>
<td>3</td>
<td>IE 306 or 311†</td>
<td>3</td>
</tr>
<tr>
<td>IE 322†</td>
<td>3</td>
<td>IE 323†</td>
<td>3</td>
</tr>
<tr>
<td>IE 327†</td>
<td>3</td>
<td>IE 330†</td>
<td>3</td>
</tr>
<tr>
<td>MATSE 259</td>
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<td>IE 405†</td>
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<td>General Education Course (GHW)</td>
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<thead>
<tr>
<th>Fourth Year</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>IE 418†</td>
<td>3</td>
<td>IE 453†</td>
<td>3</td>
</tr>
<tr>
<td>IE 425†</td>
<td>3</td>
<td>IE 460†</td>
<td>3</td>
</tr>
<tr>
<td>IE 470†</td>
<td>3</td>
<td>IE 480†</td>
<td>3</td>
</tr>
<tr>
<td>Specialization Course*1A</td>
<td>3</td>
<td>Specialization Course*2B</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>General Education Course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Total Credits 129

* Course requires a grade of C or better for the major
‡ Course requires a grade of C or better for General Education

# Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

1 This course is only offered in the FALL SEMESTER
2 This course is only offered in the SPRING SEMESTER
3 Select from BIOL 141, CHEM 112, MATH 311W, or PHYS 214 (will require 1 additional credit),
4 • 3 credits from the following: CMPEN 271, EE 211, or EE 212
• 3 credits from the following: ME 300, EMCH 212, 3 credits from a minor upon completion of the minor as approved by the IE department, or 3 credits from any combination of co-op or internship. For those who complete the ROTC program, 3 ROTC credits may be used to substitute for this requirement and 3 ROTC credits may be used to substitute for the GHW requirement.

A Students should take IE 497 (FALL SEMESTER ONLY)
B Students should take IE 402 or IE 454 (both are SPRING SEMESTER ONLY)

Program Note:
• Students starting at a location other than Penn State Behrend must take EDSGN 100S plus a seminar course.
• Only students who have gone through the entrance to major (ETM) process and have been accepted into this major may register for junior and senior-level IE courses.

Career Paths
After study of industrial engineering, you might design, develop and improve systems and processes for manufacturing, inventory control, quality control, facilities planning, or logistics. Or maybe you’ll make your career in the health care, retail, utility, transportation, information systems, consumer goods, or financial industries. You are limited only by your interests and goals. Penn State Behrend has a comprehensive support system to help you identify and achieve your goals for college and beyond. Meet with your academic adviser often and take advantage of the services offered by the Academic and Career Planning Center beginning in your first semester.

Careers
Employers of recent Behrend B.S. in Industrial Engineering graduates include Boeing Commercial Aircraft, IBM, Lockheed Martin, and SpaceX.

MORE INFORMATION (http://behrend.psu.edu/school-of-engineering/academic-programs/industrial-engineering)

Opportunities for Graduate Studies
Graduate programs in industrial engineering delve more deeply into areas of specialization such as manufacturing systems integration, data science, automotive engineering, textile engineering, production engineering, integrated design, or polymer engineering. Or, you can use a master’s degree to learn management skills; Penn State Behrend offers a Master of Manufacturing Management (M.M.M) degree program for aspiring organizational leaders.

MORE INFORMATION (http://behrend.psu.edu/school-of-engineering/academic-programs/master-of-manufacturing-management)

Professional Resources
• ABET (http://www.abet.org)
• Institute of Industrial and Systems Engineers (http://www.iise.org/Home)
• Society of Women Engineers (http://societyofwomenengineers.swe.org)
• National Society of Black Engineers (http://www.nsbe.org/home.aspx)

Accreditation
The B.S. in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET, abet.org. ABET is a nonprofit, non-governmental accrediting agency for programs in applied and natural science, computing, engineering and engineering technology and recognized as an accreditor by the Council for Higher Education Accreditation. ABET accreditation is voluntary and provides assurance that a college or university program meets the quality standards of the profession for which that program prepares graduates. The School of Engineering at Penn State Behrend consistently places in the Top 50 in U.S. News & World Report’s rankings of the nation’s undergraduate engineering programs.

MORE INFORMATION (http://www.abet.org)

Contact
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engineering@psu.edu
http://behrend.psu.edu/school-of-engineering