General Engineering

The General Engineering program offers both a B.A. with a major in general engineering and a number of non-departmental courses.

Bachelor of Arts in General Engineering

The Bachelor of Arts in General Engineering is a liberal arts degree that is designed to provide students with both a concentration in some area of humanities or social sciences and the fundamental engineering principles needed to understand the basics of modern technology, innovations, and engineering practices. It is intended for undergraduate students who desire a background in engineering and technology yet have neither the desire nor the intention to become professional engineers. These students may, for example, plan to pursue graduate or professional study in architecture, business, law (e.g., intellectual property, patent law), or medicine. They may wish to work in areas which relate to engineering and technology or to thrive in the global industrial economy. The Bachelor of Arts in General Engineering is a true liberal arts degree with a concentration in engineering.

This degree is not an engineering degree, and is not suitable for employment as a professional engineer. This program is not accredited by the Accreditation Board for Engineering and Technology. Students desiring careers as professional engineers should complete a B.S. degree in one of the engineering disciplines offered by the Whiting School.

The distinctive features of the Bachelor of Arts in General Engineering include:

- **Breadth.** Course requirements for the Bachelor of Arts in General Engineering encourage breadth, including mathematics, natural sciences, humanities and/or social sciences, international studies (language or other courses and experience in a foreign country), and in engineering. The curriculum also allows for many free electives.

- **Flexibility.** This program is designed to allow students, in consultation with their advisor, the flexibility to choose a program of study that matches their interests. The engineering concentration and the humanities and social science requirements may be departmentally based or may follow a theme designed by the student and his/her advisor. Students are encouraged to minor in any area of their choosing.

- **Interdisciplinary Study.** The distribution requirements are ideal for students who seek to understand areas at the inter-face between technical fields (such as robotics, nanotechnology, and biomaterials) or the connections between a technical area and a discipline in the humanities or social sciences (for example environment issues and international trade or ethics and biotechnology).

- **International Dimensions of Engineering.** Students are required to develop knowledge of the international dimensions of engineering. They may do this by studying abroad or by taking a combination of language and other classes that develop an understanding of the culture, technology, or society in a foreign country.

Requirements for the B.A. Degree

All undergraduate students majoring in the Bachelor of Arts in General Engineering must follow a program approved by their advisor. Candidates must fulfill the overall requirements for the B.A. degree as described in this catalog (see page 50). These include the university writing requirement, distribution requirement and 120 credit minimum. Sample curricula and details on concentrations can be found in the Advising Manual for general engineering (www.engineering.jhu.edu/academics).

### Mathematics (20 credits)

Mathematics is at the core of modern science and technology and a solid foundation is required to understand how contemporary engineering problems are solved. Students are required to take five courses including:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AS.110.108</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>AS.110.109</td>
<td>Calculus II (For Physical Sciences and Engineering)</td>
<td>4</td>
</tr>
<tr>
<td>One course in statistics</td>
<td>4</td>
<td></td>
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<tr>
<td>One course at the 200-level or above in either statistics or mathematics</td>
<td>4</td>
<td></td>
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<tr>
<td>One mathematics or statistics elective</td>
<td>4</td>
<td></td>
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<tr>
<td><strong>Total Credits</strong></td>
<td><strong>20</strong></td>
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### Natural Sciences (15 credits)

Students are required to take four courses and two laboratory courses including:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AS.171.101</td>
<td>General Physics:Physical Science Major I</td>
<td>4</td>
</tr>
<tr>
<td>or AS.171.107</td>
<td>General Physics for Physical Sciences Majors (AL)</td>
<td>4</td>
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<tr>
<td>At least one course chosen from the following:</td>
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<td>3</td>
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<tr>
<td>AS.030.101</td>
<td>Introductory Chemistry I</td>
<td></td>
</tr>
<tr>
<td>EN.510.101</td>
<td>Introduction to Materials Chemistry</td>
<td></td>
</tr>
<tr>
<td>AS.020.151</td>
<td>General Biology I</td>
<td></td>
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<tr>
<td>Two terms of laboratory course</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Two elective courses (area code N)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>15</strong></td>
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### Humanities and Social Sciences (24 credits)

*Writing Requirement.* Students must complete at least four (minimum of 12 credits) writing intensive courses (catalog code W) and one of these courses must specifically develop writing skills, such as Technical Communication or Basic Expository Writing.

*Humanities or Social Science Concentration.* A minimum of four courses (12 credits) must be taken as a coherent group in either the humanities or social sciences, of which two are at the advanced (300+) level.

*Humanities or Social Science Elective.* Three additional courses (9 credits) in either the humanities or social sciences. These electives are typically used to take courses in economics and the history of
science and technology, depending on the courses chosen to fulfill the concentration requirements detailed above.

**International Dimensions of Engineering**

Because of the importance of the globalization of technology, all students completing the B.A. in general engineering are required to demonstrate competence in being able to address technical issues within the context of another society. This can be done in one of three different ways.

First, students are encouraged to study abroad for a minimum of one fall or one spring semester in any foreign country (except Canada). In that country, they must take the equivalent of a minimum of 12 credits which are transferred to their Hopkins transcript. In this case, these credits can satisfy any degree requirements (Humanities or Social Sciences, Engineering Concentration, Mathematics, Free Electives, etc.).

Second, students may complete the equivalent of two semesters of the same foreign language (students may not use language courses in their native language to satisfy this requirement) and one additional course which relates to the culture, economy, social structure, or politics of a country to which uses this foreign language (9 credits).

Third, students may demonstrate proficiency in a foreign language by taking an intermediate course in a foreign language (this can include their native tongue) and two additional courses which relate to the culture, economy, social structure, or politics of a country which uses this foreign language (9 credits).

**Engineering Core (15 credits)**

One course (3 credits) that is an introduction to an engineering discipline. Examples include:

- EN.500.101 What Is Engineering? 3
- EN.520.137 Introduction to Electrical & Computer Engineering 3
- EN.530.101 Freshman Experiences in Mechanical Engineering 2
- EN.560.141 Perspectives on the Evolution of Structures 3
- EN.570.108 Introduction Environmental Engineering 3

One course (3 credits) in a computer language. Examples include:

- EN.500.200 Computing for Engineers and Scientists 3
- EN.600.107 Introductory Programming in Java 3

Three courses in the fundamentals of engineering science (at least one course from three of the following four areas).

- EN.520.213 Circuits 4
- EN.530.201 Statics and Mechanics of Materials 4
- EN.510.201 Introductory Materials Science for Engineers 3
- EN.510.311 Structure of Materials 3
- EN.530.231 Mechanical Engineering Thermodynamics 3
- EN.540.203 Engr Thermodynamics 3

**Engineering Focus Area (20 credits)**

The concentration in engineering must consist of at least six courses (minimum of 20 credits) that are related thematically or departmentally; at least three (3) of which must be at the advanced level (300 or above). While examples of concentrations are provided in the Advising Manual, students are encouraged to develop their own concentrations in consultation with their faculty advisor.

**Free Electives**

Between five and nine full courses (at least 3 credits each) to ensure a minimum of 120 credits in total. The number of courses required will depend on how the International Dimensions requirement is satisfied and on the courses chosen in other areas. Students must select these courses in consultation with their advisor. These free electives are designed to allow students to develop a curriculum of study uniquely suited to their interests.

Students are required to have a minimum cumulative GPA of 2.0 to graduate. Further, a maximum of 12 “D” credits may be counted toward degree requirements. There is a maximum limit of six “D” credits in any combination of courses used to satisfy the Humanities or Social Sciences concentration, the Engineering Core and the Engineering Concentration (47 total credits). No more than 12 credits completed prior to matriculation or in summer sessions at other accredited colleges or universities may be accepted.

Transfer students are not subject to the 12-credit limit on transfer credit. They must obtain credit for courses they wish to transfer during their first year at Hopkins. University regulations require a minimum of four consecutive full-time semesters and 60 credits earned at JHU for a Hopkins degree.

For current faculty and contact information go to http://engineering.jhu.edu/academics/general-engineering/people/

**Faculty**

**Chair**

Edward Scheinerman
Professor (Applied Mathematics and Statistics) and Vice Dean for Education. Primary Advisor to the General Engineering Program and Chair of the General Engineering Faculty Oversight Committee.

**Professors**

Marc Donohue
Professor (Chemical and Biomolecular Engineering).

Andrew Douglas*
Professor (Mechanical Engineering) and Interim Dean Whiting School of Engineering.

Kalina Hristova*
Professor (Materials Science and Engineering).

Daniel Naiman*
Professor (Applied Mathematics and Statistics).

Ben Schafer*
Professor (Civil Engineering).

Erica Schoenberger*
Professor (Geography and Environmental Engineering).

Scott Smith
Professor (Computer Science)

Howard Weinert
Professor (Electrical and Computer Engineering).
Courses

EN.500.100. Archimedes’ Lever: How Engineers Move the World. 1 Credit.
S/U Grading Only. Freshmen only. This course is an introduction to the world of engineering as a creative endeavor that reshapes the world. This course will give students multiple perspectives on engineering, including historical, ethical, societal, commercial, legal, environmental, and interpersonal. The soul of engineering is invention and students will enjoy opportunities to express their creativity. Weekly meetings will feature presentations and hands-on activities led by the Dean and Vice Deans of engineering as well as other faculty from our campus.
Instructor(s): M. Karweit
Area: Engineering.

EN.500.101. What Is Engineering?. 3 Credits.
This is a course of lectures, laboratories, and special projects. Its objective is to introduce students not only to different fields of engineering but also to the analytic tools and techniques that the profession uses. Assignments include hands-on and virtual experiments, oral presentations of product design, and design/construction/testing of structures. Freshmen only or Permission Required.
Instructor(s): M. Karweit
Area: Engineering.

EN.500.103. Hopkins Engineering Sampler Seminar. 1 Credit.
This course provides students with an overview of the undergraduate programs in the Whiting School of Engineering. Faculty from various departments will introduce students to their discipline including aspects of their personal research. Freshmen only.
Instructor(s): E. Scheinerman
Area: Engineering.

EN.500.110. What is Engineering?-Summer. 3 Credits.
To introduce engineering ideas, thoughts, and problem-solving to potential engineering students. The course is intended to establish the framework within which engineers typically operate.
Registration Requirement: Algebra II with Trig. Open only to high school students admitted to the Engineering Innovation Summer Program. Undergraduates should refer to EN.500.101.
Instructor(s): K. Borgsmiller; M. Karweit.

EN.500.125. Spatial Reasoning and Visualization for Engineers. 1 Credit.
This course will enhance students ability to imagine and mentally manipulate objects in three-dimensional space—a talent that is important in engineering. Through guided practice and fun hands-on activities, students will hone their spatial skills. This course is only for engineering freshmen. Registration is by invitation only, based on the results of the summer spatial reasoning diagnostic assessment. S/U only.
Instructor(s): K. Ferrara
Area: Engineering.

EN.500.200. Computing for Engineers and Scientists. 3 Credits.
This course introduces a variety of techniques for solving problems in engineering and science on a computer using MATLAB. Topics include structure and operation of a computer, the programming language MATLAB, computational mathematics, and elementary numerical analysis. Co-listed with EN.550.200.
Prerequisites: Prereqs: AS.110.107 OR AS.110.109
Instructor(s): K. Hedrick
Area: Engineering, Quantitative and Mathematical Sciences.

EN.500.401. Research Laboratory Safety. 1 Credit.
An introduction to laboratory safety including chemical, biological, radiation, and physical hazards. Includes information on hazard assessment techniques, laboratory emergencies, and general lab standards for Whiting School of Engineering. The class will feature hands-on exercises with real-life experiments. Intended for students who have not yet begun working in a research laboratory.
Instructor(s): D. Kuespert.

EN.500.403. Introduction to Research Laboratory Safety.
This course covers laboratory hazards including chemical, biological, radiation (non-ionizing and ionizing), and physical hazards, as well as JHU-specific procedures. This course is intended for undergraduates beginning work in a research laboratory for the first time, as well as other students with no laboratory safety background. Credit may be received for only one of these courses, EN.500.703 Research Lab Safety Review, and EN.540.490 Chemical and Laboratory Safety. Co-listed with EN.500.703, AS.360.403, and AS.360.703. ***NOTE: Most coursework is on Blackboard and must be completed before the live class meeting. A brief introduction to safety in Johns Hopkins University experimental research laboratories.
Instructor(s): D. Kuespert.

EN.500.405. Energy Engineering: Fundamentals and Future. 3 Credits.
Area: Engineering, Natural Sciences.

EN.500.410. Surgery For Engineers. 3 Credits.
Perm Req’d. Students must apply for this course - contact Cynthia Ramey at cramey@jhu.edu
Instructor(s): M. Marohn; R. Kumar
Area: Engineering, Natural Sciences.

Instructor(s): J. Selinski.

Instructor(s): Staff.

EN.500.603. Academic Ethics.
Instructor(s): C. Smith; Staff.

EN.500.703. Research Laboratory Safety Review.
This course briefly reviews hazards in the laboratory and provides information regarding JHU-specific procedures such as chemical and biological waste handling. This course is intended for incoming postdoctoral fellows with some experience in laboratory safety; those with no background should take EN.500.403 instead. Credit may be received for only one of these courses, EN.500.403 Intro to Research Lab Safety, and EN.540.490 Chemical and Laboratory Safety. Co-listed with EN.500.403, EN.360.403, and EN.360.703. ***NOTE: Most coursework is on Blackboard and must be completed before the live class meeting. A review of hazards and safety procedures specific to Johns Hopkins University laboratories.
Instructor(s): D. Kuespert.
EN.500.745. Seminar in Computational Sensing and Robotics.
Seminar series in robotics. Topics include: Medical robotics, including computer-integrated surgical systems and image-guided intervention. Sensor based robotics, including computer vision and biomedical image analysis. Algorithmic robotics, robot control and machine learning. Autonomous robotics for monitoring, exploration and manipulation with applications in home, environmental (land, sea, space), and defense areas. Biorobotics and neuromechanics, including devices, algorithms and approaches to robotics inspired by principles in biomechanics and neuroscience. Human-machine systems, including haptic and visual feedback, human perception, cognition and decision making, and human-machine collaborative systems. Cross-listed Mechanical Engineering, Computer Science, Electrical and Computer Engineering, and Biomedical Engineering.
Instructor(s): Staff.

EN.500.781. Preparation for University Teaching.
This course will prepare graduate students to teach at the university level. Topics covered include large and small class teaching, characteristics of student learning, syllabus construction, grading students, and developing a teaching portfolio. Full-time EN Graduate Students only. Co-listed as EN.360.781.
Instructor(s): R. Shingles.

Cross-listed with Mechanical Engineering.
Instructor(s): J. Guest.

Instructor(s): Staff.

Cross Listed Courses

Civil Engineering
EN.560.141. Perspectives on the Evolution of Structures. 3 Credits.
Why do buildings and bridges look the way they do today? Students will be provided the tools to answer this question for themselves through a study of the history of the design of buildings and bridges throughout the world from both engineering and architectural/aesthetic perspectives. Only simple mathematics is required (no calculus). Students will participate in individual and group critique of structures from engineering, architectural, and social points of view.
Instructor(s): B. Schafer
Area: Engineering, Quantitative and Mathematical Sciences
Writing Intensive.

Institute for NanoBio Technology
EN.670.495. Animation in Nanotechnology & Medicine. 3 Credits.
Instructor(s): P. Searson
Area: Engineering, Natural Sciences.

EN.670.616. Introduction to NanoBio Tutorials II.
Ph.D. students and postdoctoral fellows in the HHMI/IGERT/PSOC/CCNE/CNTC training programs study and present topics in nanotechnology for biology and medicine.
Instructor(s): D. Wirtz.

EN.670.620. Fundamental Laboratory Principles of Nanobiotechnology.
This laboratory course introduces students to fundamental concepts of materials science and cell engineering required for research in biological nanoscience. Topics covered include cell culture, quantitative light microscopy, and synthesis of nanoparticles. This laboratory course is a prerequisite for EN.500.621.

EN.670.629. Cancer Nanotechnology Training Center (CNTC) Tutorial.
This course is to allow CNTC fellows the opportunity each week to review and present on cancer research topics. The papers and discussions covered will be on areas of human cancers and nanotechnology and include the latest developments from studies of model organisms.
Instructor(s): D. Wirtz.

EN.670.695. Animation in Nanotechnology & Medicine.
Instructor(s): P. Searson
Area: Engineering, Natural Sciences.