General Engineering

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

The Faculty

Sanjay R. Arwade, Assistant Professor (Civil Engineering)
Marc Donohue, Professor (Chemical and Biomolecular Engineering) and Associate Dean for Research
Andrew Douglas, Professor (Mechanical Engineering) and Associate Dean for Academic Affairs. Primary Adviser to the General Engineering Program and Chair of the General Engineering Faculty Oversight Committee
Kalina Hristova*, Assistant Professor (Materials Science and Engineering)
Mike Karweit, Research Professor (Chemical and Biomolecular Engineering)
Joseph L. Katz, Professor (Chemical and Biomolecular Engineering)
Erica Schoenberger*, Professor (Geography and Environmental Engineering)
Ben Schafer*, Assistant Professor (Civil Engineering)
David Yarowsky*, Professor (Computer Science)

* members of the Faculty Oversight Committee for General Engineering.

Bachelor of Arts in General Engineering

The bachelor of arts in general engineering is a liberal arts degree which 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 a number of free electives.
- *Flexibility.* This program is designed to allow students, in consultation with their adviser, the flexibility to choose a program of study which 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 adviser. 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 interface 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 some knowledge of the international dimensions of engineering. They can do this by studying abroad or by taking a combination of language and other classes which 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 adviser. Candidates must fulfill the overall requirements for the B.A. degree as described in the University Catalog (see page 46 of the 2005-2007 Johns Hopkins Undergraduate and Graduate Programs Catalog). These include the University writing requirement, distribution requirement and 120 credit minimum. Details of these requirements are also provided in the Student Handbook. Sample curricula and details on concentrations can be found in the Advising Manual for general engineering (**http://engineering.jhu.edu/academics/**).

Mathematics (20 credits)
Mathematics is at the very 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:

110.108 Calculus I

110.109 Calculus II

110.202 Calculus III or 110.211 Honors Multivariable Calculus and Linear Algebra

Two mathematics or statistics electives (these may be at any level). Students are strongly advised to take a calculus-based statistics course.

Natural Sciences (15 credits)
Students are required to take four courses and two laboratory courses including:

171.101 General Physics I and at least one course chosen from

030.101 Introductory Chemistry,

510.101 Introduction to Materials Chemistry,

or

020.151 General Biology,

two terms of laboratory course; and

two elective courses (area code N).

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 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 can 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 can 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) which is an introduction to an engineering discipline such as: What is Engineering?; Energy and the Environment; Perspectives on the Evolution of Structures; From the Stone Age to the Age of Silicon: Materials and Their Influence on Technology; Introduction to Electrical and Computer Engineering; Introduction to Environmental Engineering; and Freshman Experiences in Mechanical Engineering

One course (3 credits) in a computer language. Examples include Introduction to Programming in Java; Introduction to Programming in C/C++; Computing for Engineers and Scientists; and Computing in Mechanical Engineering.

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

1. Circuits,
2. Statics and Mechanics of Materials,
3. either Introduction to Engineering Materials or Structure of Materials, and
4. either Mechanical Engineering Thermodynamics or Engineering Thermodynamics.

Engineering Concentration (20 credits)
The concentration in engineering must consist of at least six courses (minimum of 20 credits) which 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 adviser.

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 adviser. 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 towards degree requirements. There is a maximum limit of 6 "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.

Undergraduate Courses

General Engineering Courses

500.101 (E) What is Engineering?
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. Open to freshmen only.
Karweit 3 credits

500.111 (E,N) Energy and the Environment
Energy generation, transmission, and use are presented, with particular emphasis on the environmental consequences. Topics include the nature of energy, the types of energy sources (e.g., electricity, hydrogen), the greenhouse effect, conversation, and projected needs, both in the U.S. and worldwide.
Katz 3 credits

500/560.141 (N,Q,E,W) Perspectives on the Evolution of Structures
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 the 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.
Arwade, Schafer 3 credits

500.150 (H,E) Ethical and Societal Issues in Engineering
Engineers face a variety of dilemmas related to their responsibilities to society, their profession, and the environment. This course examines these responsibilities and how to deal with these dilemmas.
Donohue 3 credits

500.200 (E,Q) Computing for Engineers and Scientists
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. Prerequisite: 110.109.
Karweit 3 credits

500.301 (E,Q) Computational Techniques in Engineering and Science
Beginning with a review of structured programming languages (C, FORTRAN), this course develops the numerical tools needed to solve basic engineering and science problems. Topics include numerical solutions of equations, interpolation, approximation, numerical differentiation and integration, root finding, and solutions to linear systems. Accuracy and stability are emphasized throughout. Engineering problems requiring the use of algorithms from Press, et al., Numerical Recipes are assigned weekly. Prerequisites: 110.202, 550.291, and a cursory knowledge of C or FORTRAN, or instructor's permission.
Karweit 4 credits

500.303 (E,Q) Applied Mathematics I
Course topics include ordinary differential equations, complex variables, Fourier transforms (discrete and continuous), Laplace transforms, "elements" of partial differential equations, and numerical methods. Prerequisite: 550.291 or equivalent.
Staff 4 credits

500.304 (E,Q) Applied Mathematics II
Partial differential equations, special functions, calculus of variations, eigenfunction expansions, integral equations, asymptotic expansions, and complex analysis with numerical methods treated throughout the course. Prerequisite: 500.303 or equivalent.
Staff 3 credits

500.410 (E,N) Surgery for Engineers
Surgery for Engineers is a laboratory experience that teaches the fundamental skills and operative procedures for general surgery. This hands-on course is designed for engineers tasked with development of computer-integrated surgical systems and associated technologies. Students are exposed to both traditional and innovative operating room (OR) environments and are taught basic techniques used during surgery. Limit: 12.
Brown 3 credits

Graduate Course

500.851 Engineering Research Practicum
This course is for Whiting School graduate students who spend a semester or summer working off-campus conducting scientific research at a sponsoring corporation. The research conducted for the practicum must help fulfill a degree requirement in some way (e.g., serves as a course applied to the degree, satisfies a computer proficiency requirement, contributes to the master's essay or doctoral thesis). Before the practicum is begun, the sponsoring faculty member and the student's faculty adviser (this may be the same person) must sign a form which states the number of credits to be received by the student, verifies the nature of the work to be performed by the student, and explains how the practicum helps to fulfill a degree requirement. Once the practicum is completed, the sponsoring faculty member submits a grade (P/F) for the student. This course may be used for Curricular Practical Training (CPT) purposes.