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engineering101

2018-2019 program planning guide for first-year engineering students
in the Whiting School of Engineering at Johns Hopkins University



Welcome to the Whiting School of Engineering at Johns Hopkins University!

We look forward to meeting you when you arrive on campus for orientation. In the meantime, we have prepared the [First-Year Academic Guide](#) and [Engineering 101](#) to get you started. The [Academic Guide](#) includes information for all first-year students at Hopkins, while [Engineering 101](#) is directed specifically to engineering students. [Engineering 101](#) contains information about all of the majors in the School of Engineering, including recommended first semester class schedules. You'll also find out about some opportunities to join student groups. We hope that these materials help you learn about the Hopkins community and the options available to you. Again, welcome to Hopkins and we'll see you in August!

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Table of Contents

Introduction	4	Getting Involved in Student Groups	36-53
Academic Advising	4	American Academy of Environmental Engineers and Scientists (AAEES)	37
Planning Your First Semester Courses	4	American Institute of Chemical Engineers/ Society for Biological Engineering (AIChE/SBE)	37
Registering for Classes	5	American Society of Civil Engineers (ASCE).....	38
Things to Consider.....	6	American Society of Mechanical Engineers (ASME).....	39
Engineering Programs and Course Schedule	7-33	Association for Computing Machinery (ACM)	40
Applied Mathematics and Statistics.....	7	Biomedical Engineering Society (BMES).....	41
Biomedical Engineering.....	9	Design, Build, Fly.....	41
Chemical & Biomolecular Engineering.....	12	Earthquake Engineering Research Institute (EERI).....	41
Civil Engineering.....	14	Engineers Without Borders (EWB).....	42
Computer Science.....	16	Engineering World Health (EWH).....	43
Electrical and Computer Engineering.....	18	Hopkins Aerospace Design Club, "Hopkinauts".....	44
Environmental Engineering and Geography.....	20	Hopkins Baja, "Blue Jays Racing".....	44
Materials Science and Engineering.....	22	HopHacks.....	44
Mechanical Engineering and Engineering Mechanics.....	24	Hopkins Rocketry, "Astrojays".....	45
General Engineering.....	26	Hopkins Undergraduate Society for Applied Mathematics (HUSAM).....	45
Undecided Engineering.....	27	Institute of Electrical and Electronic Engineers (IEEE).....	46
Computer Integrated Surgery Minor.....	28	Materials Research Society (MRS).....	46
Computational Medicine Minor.....	29	MedHacks.....	46
Robotics Minor.....	29	National Society of Black Engineers (NSBE).....	47
Engineering for Sustainable Development Minor.....	30	Optical Society of America (OSA Student Chapter).....	48
Center for Leadership Education.....	31	oSTEM.....	48
Accounting and Financial Management Minor.....	31	Pi Tau Sigma.....	49
Business Minor.....	31	Robotics Club.....	49
Entrepreneurship and Management Minor	32	Society for Biomaterials (SFB).....	49
Marketing and Communications Minor.....	32	Society of Hispanic Professional Engineers (SHPE).....	50
Space Science and Engineering Minor.....	33	Society of Women Engineers (SWE).....	51
Pre-Professional Advising for Engineers	34	Tau Beta Pi (Engineering Honor Society).....	51
Study Abroad Opportunities for Engineers	35	Theta Tau (Professional Engineering Fraternity).....	52
		Women in Computer Science (ACM-W).....	52
		Center for Leadership Education (CLE) Student Organizations	53
		Course Listings	55-67
		Krieger School of Arts & Sciences Courses (AS).....	56
		Whiting School of Engineering Courses (EN).....	61

Introduction

Academic Advising

Engineering students have two advisors – a faculty/departmental advisor in your major department and an academic advisor in the Office of Engineering Advising – so there’s always someone to help you out when you need it!

Office of Engineering Advising

103 Shaffer Hall

During the summer, academic advisors in the Office of Engineering Advising will assist you with course selection and answer questions related to your studies at JHU. Our office provides general academic support to all undergraduate engineering students. We have general information about the various engineering majors at Hopkins and we’re always happy to answer questions, provide resources, and support students in any way we can.

You may want to stop by our office if you:

- have basic questions about your academic program
- want to change or declare your major
- are interested in studying abroad
- are having some trouble in a class
- have to miss classes due to an illness or family emergency
- just want to talk to an advisor

Feel free to contact us at 410-516-7395 or wseadvising@jhu.edu. You can also visit our website at <http://engineering.jhu.edu/academics/wse-academic-advising/>

Faculty/Departmental Advisors

You will be assigned a faculty/departmental advisor in your department who will:

- approve all course selections and schedule changes
- provide information on academic programs available to you
- help you learn about other opportunities at Hopkins, such as research

Your faculty/departmental advisor will be assigned to you late in the summer, and you will first meet with him or her during orientation to discuss your

course selections. This meeting time will be scheduled by your department. You are encouraged to meet with your advisor as needed throughout the year to discuss your progress. Advisors generally post office hours when they expect to be available; other times can be arranged by appointment. Mandatory advising meetings will take place in November in order to choose classes for the spring, and again in April to choose classes for first semester sophomore year.

If you are undecided about a major, you will be assigned to a faculty advisor who will help you choose an engineering program. Once you select a major, you will be reassigned a faculty advisor in that department.

Some tips regarding faculty/departmental advisors:

- Except during orientation (when you have a set meeting time), getting in touch with your advisor is your responsibility. Learn your advisor’s email address, phone number, and office hours – and make use of them!
- Never wait until the last day of a deadline to try to contact your advisor.
- Try to have a list of specific questions when you meet with your advisor.
- Expect your advisor to give you guidance, but don’t expect him or her to plan your schedule for you!

Planning Your First Semester Courses

You will be choosing your first semester courses based on the information in this book and the [First-Year Academic Guide](#).

- If you have already chosen your major, you should follow the appropriate departmental program, as described in the next section.
- If you are not yet sure about your major, you can either choose to follow the departmental program that seems most interesting to you, or you can follow the program for Undecided

Engineering students. A student who follows this program may transfer into any engineering department (except BME) at the end of the first year and complete the requirements in time to graduate within the normal four year period.

- You should review the information about placement tests in the First-Year Academic Guide.
- All engineering students take classes in the School of Arts and Sciences (calculus, chemistry, physics) as well as in the School of Engineering (introductory engineering courses, computer programming, discrete math).

Not sure about your major?

When you complete your on-line Advising Profile, you can either confirm the choice of major you selected when you applied to Hopkins, or you can make a new choice (except BME). Whatever major you indicate on the Profile is what we will consider you when assigning faculty/departmental advisors. (It is, of course, possible to change your mind later!)

Some additional information to help you plan:

1. Read pages 55 and 59-60 of the First-Year Academic Guide for some registration basics.
2. Most engineering freshmen will be taking calculus, physics, a freshman engineering course and often chemistry. This is a normal load. Don't panic!
3. Hopkins courses follow a Monday/Wednesday/Friday or Tuesday/Thursday schedule. Usually the MWF classes are one hour and the TuTh classes are 1 1/2 hours. You can schedule classes back-to-back since instructors dismiss class in time for you to get to the next class.
4. For most engineering degrees there is no foreign language requirement, but you may take a language as one of your humanities courses. Review the placement test information on pages 67-69 of the First-Year Academic Guide. In addition to the usual language choices, check out the courses offered through the Center for Language Education such as Chinese, Hindi, and Arabic.

5. Physics is calculus-based. If you didn't take calculus in high school, please contact the Office of Engineering Advising before registering for Physics I.
6. Review the AP/IB/GCE credit tables on pages 46-49 of the First-Year Academic Guide. Although you may not have received your score report before registering, you should have a good idea of your test results. Go with your best guess. You can make registration changes online after you receive your scores, if necessary.
7. Enroll in an introductory engineering course in the first semester. This course will give you additional information about the major you have chosen. If you are an undecided engineer, enroll in the "Hopkins Engineering Sampler Seminar" or "What is Engineering?" or the introductory engineering class that best fits your interests.
8. Detailed descriptions about the courses engineering freshmen commonly take can be found in the last section of Engineering 101. A comprehensive list of Fall 2018 courses can be found online at <https://studentaffairs.jhu.edu/registrar/students/course-schedule/>.
9. First-semester engineering students are allowed to register for a maximum of 18.5 credits. **Credit overloads will not be permitted.**

Registering for classes

You will be registering using the Hopkins online registration system SIS, which you can access through the portal (<https://my.jh.edu>). Registration dates are July 3 through July 20.

You can make changes to your schedule during the Schedule Adjustment period which begins July 21 and ends August 29, and also during the Add/Drop period from August 30 to September 14. There are no charges for changes made during Schedule Adjustment or Add/Drop.

Things to Consider

MATH

- At JHU, there are two sequences of Calculus students can take: Calculus I and II for Biological and Social Sciences Majors (110.106 and 110.107), and Calculus I and II for Physical Science and Engineering Majors (110.108 and 110.109). Engineering majors need to follow the 108 AND 109 sequence.
- Linear Algebra (110.201), Calculus III (110.202), and Differential Equations (110.302) may be taken in any order after completing Calculus II (110.109).
- It is very common that most incoming first year students have taken many advanced-level or honors courses while in high school; however, that does not happen as frequently at the collegiate level. At JHU, there are very few “honors” courses. In fact, the only ones that you may encounter are within the Math Department. The Department of Mathematics offers the following courses: Honors One Variable Calculus (110.113), Honors Multivariable Calculus (110.211) and Honors Linear Algebra (110.212). These courses are much more theoretically based and do not delve as in depth on the application side of the material that most engineering disciplines need. Typically, these courses are strongly recommended for students who wish to pursue a mathematics major and/or minor. It is preferred for most engineering students to take the traditional versions of math courses, which should prove to be sufficiently challenging.
 - Students who earned credits for 110.108 & 110.109 AND take 110.113 will forfeit 4 credits for 110.109.

PHYSICS

- At JHU, there are two sequences of General Physics students can take: General Physics I and II for Biological Science Majors (171.103/104), and General Physics: Physical Science Majors I and II (171.101/102 OR 171.107/108).

Engineering majors need to take 101/107 for Physics I AND 102/108 for Physics II.

- 171.107/108 are the exact same material as 171.101/102, but are taught in small group problem-solving format and are termed “Active Learning” or AL.
- All general physics sequences utilize the same laboratory courses: 173.111 for General Physics I and 173.112 for General Physics II.
- For students with a strong physics background, the Department of Physics & Astronomy also offers a Classical Physics sequence: 171.105/106. These courses are intended for students who plan to take more than one year of physics, perhaps as an additional major or minor. The courses are less comprehensive than 171.101/107 & 171.102/108, but they cover the material in greater depth. Students should be aware that the 171.105/106 sequence alone is not adequate preparation for the physics portion of the MCAT exam. Students who have earned AP Physics Mech and E&M credits will not forfeit their AP credits if they decide to take the Classical Physics sequence.

CHEMISTRY

The Department of Chemistry offers the following courses that are relevant to engineering students: Introduction to Chemistry I and Lab, 030.101 & 030.105 (offered in fall and summer), Introduction to Chemistry II and Lab, 030.102 & 030.106 (offered in spring and summer), Applied Chemical Equilibrium & Reactivity with Lab, 030.103 (offered in fall and spring), Chemical Structure & Bonding with Lab, 030.204 (offered in spring), and Organic Chemistry I, 030.205 (offered in fall and summer). Below are suggestions of which classes to take depending on students' preparation, including those who have taken AP, IB, or GCE level exams:

AP score of 3 or below, IB score of 5 or below, or no previous chemistry: No chemistry credits are awarded. If your major

requires a year of general chemistry, you must take 030.101 & 030.105 in the fall AND 030.102 & 030.106 in the spring.

AP score of 4: You will receive 4 credits for 030.101 & 030.105. You have 2 options:

(1) Accept your AP credits and take 030.103 in the fall or spring.

(2) Forfeit your AP credits and start with 030.101 & 030.105 in the fall and continue the sequence with 030.102 & 030.106 in the spring.

NOTE: Students who receive a score of 4 and who accept their AP credits CANNOT start with 030.102 & 030.106 in the spring. NO EXCEPTIONS. Only students who complete 030.101 & 030.105 at JHU in the fall will be permitted to register for 030.102 & 030.106 in the spring.

AP score of 5, IB score of 6/7, or GCE grade of A or B: You will receive 8 credits for 030.101 & 030.105 AND 030.102 & 030.106. You have 4 options:

(1) Accept all of your AP credits and take one of the following and not lose any AP credits:

030.205 in the fall OR 030.204 in the spring

(2) Accept all of your AP credits and take no chemistry in your freshman year and start with Organic Chemistry in sophomore fall semester (if your major requires it)

(3) Accept 4 of your AP credits (lose 4 credits for 030.102 & 030.106) and take 030.103 in the fall or spring (NOTE: Students cannot start with 030.102 & 030.106 in the spring if they did not take 030.101 & 030.105 at JHU, NO EXCEPTIONS)

(4) Forfeit all 8 AP credits and start with 030.101 & 030.105 in the fall AND continue the sequence with 030.102 & 030.106 in the spring.

Applied Mathematics and Statistics

The Department of Applied Mathematics and Statistics is devoted to the study and development of mathematical disciplines especially oriented to the complex problems of modern society. A broad undergraduate and graduate curriculum emphasizes several branches of applied mathematics: probability, the mathematical representation and modeling of uncertainty; statistics, the analysis and interpretation of data; operations research, the design, analysis, and improvement of operations and processes; optimization, the determination of best or optimal decisions; discrete mathematics, the study of finite structures, arrangements, and relations; scientific computation, which includes all aspects of numerical computing in support of the sciences; and financial mathematics, deriving, analyzing, and extending mathematical models of financial markets.

Getting started

We want our students to learn how to recognize a proof and do them on their own. This skill is emphasized in the Discrete Mathematics course (553.171), which can be used to meet the requirement of at least one course in discrete mathematics. The course has only high school mathematics as a prerequisite.

Most courses that can be used to satisfy the requirements for the departmental major have Calculus I and II as prerequisites, and at least Calculus III as a co-requisite. Students should plan on completing the calculus sequence and taking a course in linear algebra (Linear Algebra I 10.201, or Honors Linear Algebra I 10.212).

Activities

The department encourages teams of interested undergraduate students to compete in the COMAP (Consortium for Mathematics and its Applications) International Mathematical Contest in Modeling. The teams tackle a given problem (for example, determining the optimal deployment of tollbooths for the New Jersey Turnpike), formulate an approach, and write a detailed report over the course of a weekend; the reports are examined and ranked by a panel of judges.

The department also has an active club called HUSAM—Hopkins Undergraduate Society for Applied Mathematics—which has many opportunities for student participation, involvement, and leadership. The club sponsors and organizes events that help undergraduate students to network, learn about professional and research opportunities, and discover the many different disciplines where applied mathematics plays a key role. Recent events include a discussion panel composed of Johns Hopkins alumni actuaries, a presentation by a vice president of a major financial institution, an exploration of opportunities in the mathematics group at a national defense agency, and a look inside a major operations research consulting firm.

Looking ahead to senior year...Capstone Experience

You may elect to complete a capstone experience. This consists of taking Modeling & Consulting (553.400) in the fall of your senior year followed by a senior thesis (553.501) during the spring. An oral presentation based on the thesis is required.

Bachelor's/Master's Program

Highly motivated and exceptionally well-qualified undergraduates may apply for admission to the combined bachelor's/master's program in applied mathematics and statistics.

Interested students should apply no later than September of their senior year. Additional information is available online at: <http://engineering.jhu.edu/ams/bachelors-masters-program/>.

What do our graduates go on to do?

- Actuarial profession
- Analyst for a financial institution
- Operations research and consulting
- Biostatistician working with a pharmaceutical company
- Information Security
- Applied mathematician in industry
- Applied mathematician in a policy/regulatory agency
- Communication network analyst
- Graduate school
- Law school
- Medical School

Recommended schedule

Fall Semester	Course #	Credit
Intro to Applied Mathematics & Statistics*	553.100	1
Calculus II or III	110.109 or 110.202	4
Discrete Mathematics	553.171	4
Humanities/Soc Science Elective		3
Gateway Computing*	500.112	3
Optional HEART course	500.111	1
Total Credits		15-16

Spring Semester	Course #	Credit
Calculus III	110.202	4
Linear Algebra or Differential Equations or	110.201 or 110.212 or 110.302	4
Humanities/Soc Science elective		3
Other elective		3
Total Credits		14

* Courses are highly recommended but not required for AMS degree.

Biomedical Engineering

The past thirty years have witnessed the maturing of biomedical engineering as an independent engineering discipline. While the traditional engineering disciplines, such as electrical engineering and materials engineering are grounded in mathematics, physics and/or chemistry, biomedical engineering adds fundamental biology to its list of basic science roots. The task faced by biomedical engineering faculty for the past quarter-century has been to integrate the emerging life science principles of modern biology with the other basic sciences into a coherent framework for solving fundamental and applied problems in biology and medicine. Because the job of integrating the physical sciences into traditional engineering disciplines had already been accomplished, it became the task of the biomedical engineering community to integrate biology into the traditional engineering fields.

The curriculum provides a foundation in broadly defined core areas in biomedical engineering while allowing each student to gain an in-depth understanding in one of five focus areas. There are several unique qualities associated with our curriculum:

- The biomedical engineering curriculum begins with the core course "Biomedical Engineering Modeling and Design." This required course

introduces students to an orderly method for analyzing and modeling biological problems, and students meet with their faculty advisors to discuss modeling assignments.

- By organizing the students' choices of advanced engineering courses around biomedical engineering focus areas rather than traditional engineering disciplines, we can ensure both the depth of engineering education and the relevance to biological and medical problem solving.
- Because curriculum development and maintenance for each focus area is the responsibility of faculty members with research interests appropriate to the area, all faculty members are active participants in shaping the undergraduate curriculum.
- The department has developed a hands-on sequence of courses called Design Teams that exposes students to "real-world" biomedical engineering from day one. Design teams consist of students at all levels—from freshmen to seniors, and masters students—working in teams solving problems involving biomedical engineering design. The end goal is the creation of a prototype product, system or process that meets a previously unmet biomedical need.

Core Knowledge and Curriculum

BME faculty have identified many areas of knowledge that must be part of the education of graduates of our program:

- Molecular and cellular biology
- Engineering analysis of systems level biology and physiology
- Creating, analyzing and simulating a linear or non-linear system model from knowledge of the real biological system
- Analysis of systems described by linear and non-linear ordinary differential equations
- Analysis of biological control systems
- Fundamental thermodynamic principles in biology.

Students master this body of core knowledge by completing a set of biomedical engineering courses, collectively referred to as the “BME core curriculum.” You will begin taking core curriculum courses in the fall of your freshman year.

Getting started...

BME Modeling and Design

All engineers, if they are to be successful, must learn to analyze and design complicated systems. These skills are particularly challenging in biomedical engineering because most biological systems were not designed; they evolved. Freshmen biomedical engineers at Johns Hopkins are introduced to these skills and challenges by participating in BME Modeling and Design (580.111). This course (1) introduces students to an orderly method for analyzing and modeling biological systems and (2) introduces engineering principles to solve design problems that are biological, physiological, and/or medical in nature. Freshmen will use the informational content being taught in calculus, physics and chemistry and apply this knowledge to the solution of problems encountered in biomedical engineering.

Looking ahead...to Junior Year

Building on the foundation of the core curriculum, you are required to take a cohesive sequence of advanced engineering courses that are related to one of five biomedical engineering focus areas. Your choice of focus area is made before the start of the junior year and is based on your experience with the biomedical engineering core and your answers to these questions:

- Do you want to understand at a fundamental level how biological systems work?

Focus Area: Biological systems engineering

- Do you want to build devices that facilitate research or clinical medicine?

Focus Area: Sensors, micro/nano systems, and instrumentation

- Do you want to create replacement cells, tissues and organs?

Focus area: Cell and tissue engineering and biomaterials

- Do you want to use mathematical theory or computers to solve very complex biological and medical questions?

Focus area: Computational bioengineering

- Do you want to develop new imaging technology to reveal how biological systems work and to diagnose disease?

Focus Area: Imaging

Some of your courses will be biomedical engineering courses; some courses will be required from other departments. Along the way you are encouraged to seek out research and design experiences that complement your engineering interests and pursue extracurricular activities that will round out your undergraduate experience.

Recommended schedule for a student beginning with Calculus I

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus I	110.108	4
Physics I	171.101/107	4
Physics I lab	173.111	1
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
BME Modeling and Design	580.111	2
Gateway Computing or Humanities/Social Science Elective		3
Total Credits		18

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Physics II	171.102/108	4
Physics II lab	173.111	1
Intro Chemistry II	030.102	3
Chemistry Lab II	030.106	1
Gateway Computing or Humanities/Social Science Elective		3
Career Exploration in BME		0
Total Credits		16

*Select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 46-49 in the First Year Academic Guide) and JHU math placement exam results. Course choices include: Calculus II or III; Linear Algebra; or Differential Equations. Please note that it is highly recommended to have both Linear Algebra and Differential Equations completed by the beginning of the sophomore spring semester.

If there is room in your schedule, consider adding a 1-credit HEART course (EN.500.111) to your fall courseload. For details, see www.engineering.jhu.edu/HEART.

Recommended schedule for a student beginning with Calculus II or III

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Math Course*		4
Physics I	171.101/107	4
Physics I lab	173.111	1
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
BME Modeling and Design	580.111	2
Gateway Computing or Humanities/Social Science Elective		3
Total Credits		18

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Linear Algebra or Differential Equations	110.201	4
Physics II	171.102/108	4
Physics II lab	173.112	1
Intro Chemistry II	030.102	3
Chemistry Lab II	030.106	1
Gateway Computing or Humanities/Social Science Elective		3
Career Exploration in BME		0
Total Credits		16



Chemical & Biomolecular Engineering

Chemical and Biomolecular Engineering (ChemBE) is dedicated to the design and exploitation of chemical, biological and physical processes, and to the study of phenomena for chemical and biological applications. As a result of the scope and breadth of this rigorous undergraduate program, our students commonly secure employment in the following industries:

- Chemical and pharmaceutical production
- Biomedicine
- Biotechnology
- Energy
- Material design
- Food industry

Research in ChemBE yields new products that include:

- Novel polymers and materials
- Biopharmaceuticals
- Drugs and vaccines
- Drug delivery devices
- Semiconductors
- Biofuels
- Gene therapy products
- Cells and tissues

Nanodevices, Food, Coatings, and Health Care Products

The demands on the modern engineer are high, and graduates must possess a wide range of skills in order to be competitive in a global market. The ChemBE program successfully satisfies these demands. Students take advanced courses in chemistry, physics, mathematics, and biology. Additionally, students are trained in transport, kinetics, separations, and thermodynamics, which are essential to solving real-world engineering problems. Students also hone their professional and communication skills through report writing, oral presentations, and teamwork, in courses involving experimental project, process design and product design.

Depending on their interests and future career goals, students can choose electives from exciting areas including green engineering, nanotechnology, and bioengineering. These courses, along with undergraduate research opportunities offered by our faculty, are designed to prepare graduates for careers in the chemical industry, biotechnology, pharmaceuticals or microelectronics. The curriculum

also offers an outstanding foundation for advanced graduate studies in chemical and biomolecular engineering, biomedical engineering, materials engineering, or for medical, law, or business school.

TRACKS: Students also have the opportunity to develop more in-depth specialty in one or two areas within chemical and biomolecular engineering. The ChemBE tracks are interfaces and nanotechnology (IN) and molecular and cellular bioengineering (MCB):

Interfaces and Nanotechnology (IN) Track

Interesting and new physics exist at nanometer length scales, as the surface area of an object begins to approach and exceed its volume. In this track, students are trained in the fundamental sciences used to solve problems in nanotechnology and interfacial science. Courses include Materials and Surface Characterization and other electives such as Colloids and Nanoparticles, Supramolecular Materials and Nanomedicine and Micro/Nanotechnology: the Science and Engineering of Small Structures.

Molecular and Cellular Bioengineering (MCB) Track

Fields in biotechnology and biomedicine often involve processes at biological, cellular and molecular levels. Common areas utilizing skills in the MCB track include the genetic manipulation of cells for protein and vaccine production and the study and treatment of diseases such as arteriosclerosis and cancer. Courses in this track include lectures and laboratory courses in biochemistry and cell biology, cellular and molecular biotechnology, bioengineering in regenerative medicine, and computational protein structure prediction. In addition, students will take a biomolecular engineering laboratory to learn the hands-on skills required for future careers in biological systems at the molecular and cellular level.

Your First Year in ChemBE

The first two years of the curriculum are dedicated to sciences and mathematics. To get started in the program, during your first semester, you'll take Chemical Engineering Today (540.101), a course which introduces the different career opportunities available to graduates from the department. This course covers real world problems in molecular biotechnology, electronics, law, medicine, biopharmaceuticals, energy, and the environment. A variety of companies and institutions are profiled weekly. You will learn how chemical and biomolecular engineering concepts impact the world and how engineers in industry, academics, medicine, and the not-for-profit sector can make a real contribution.

You have the option to take the first fundamental course in chemical and biomolecular engineering during your second semester, Introduction to Chemical and Biological Process Analysis (540.202). This course will also be available during the first semester of your sophomore year.

Your Last Year in ChemBE

Of particular interest are three senior-level courses entitled "Projects in ChemBE Unit Operations with Experiments," "Chemical and Biomolecular Product Design," and "Chemical and Biomolecular Process Design" that are designed to develop project management and professional skills in chemical engineering. In the first of these courses, you will work in small teams and learn how to operate different types of process equipment, use your knowledge of engineering to assess their operation, and write a report on your findings. In the second course, you will design a chemical plant, and in the third course, you will create a chemical or a biochemical product, design the process, and produce a detailed forecast of the profit that you expect from the successful marketing and sales process. Some students will have the option to develop a prototype. Students find these courses to be both fun and challenging, as well as an image of real-world problems.

Recommended schedule for a student beginning with Calculus I

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus I	110.108	4
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
Physics I	171.101/107	4
Physics I Lab	173.111	1
Chem Eng Today	540.101	1
Humanities/Soc Science Elective		3
<i>Optional HEART course</i>	<i>500.111</i>	<i>1</i>
Total Credits		17-18

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Intro Chemistry II	030.102	3
Chemistry Lab II	030.106	1
Physics II	171.102/108	4
Humanities/Soc Science Elective		3
Total Credits		15

Recommended schedule for a student beginning with Calculus II or III

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
or Calculus III	110.202	
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
Physics I	171.101/107	4
Physics I Lab	173.111	1
Chem Eng Today	540.101	1
Humanities/Soc Sci Elective		3
<i>Optional HEART course</i>	<i>500.111</i>	<i>1</i>
Total Credits		17-18

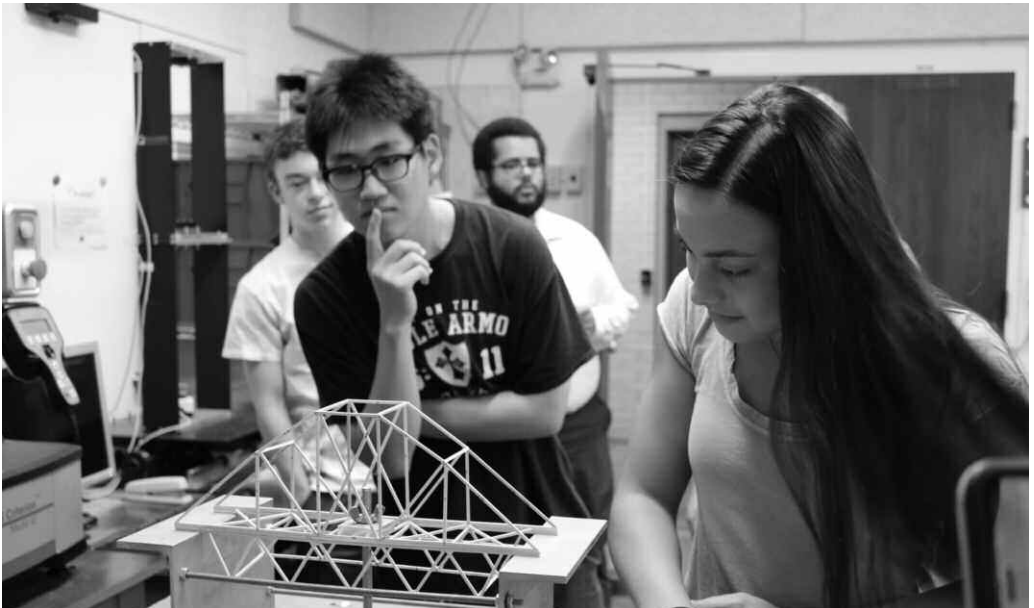
<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Intro to Chem & Bio Process Analysis	540.202	4
Intro Chemistry II	030.102	3
Chemistry Lab II	030.106	1
Physics II	171.102/108	4
Humanities/Soc Sci Elective		3
Total Credits		15

Civil Engineering

The backbone of our modern society is the built environment that we all rely on. The house you live in, the road you drive on, the building you work in, the pipes that bring water to your home and work or take waste away – all of these needs are met through engineered solutions that civil engineers provide. The foundation of all of today’s modern engineering knowledge began with the first engineering field: civil engineering. Today, civil engineering remains dynamic and vital to the nation’s well being. Civil engineers help find solutions to the many challenges posed by our housing and work place needs, transportation demands and a myriad of other infrastructure issues. Moreover, the size of the nation’s infrastructure (its buildings, highways, ports and airports, bridges, rails) is not only growing, but many of these facilities have reached the end of their design life and must be replaced or renovated.

Designing new structures (and retrofitting the old) to withstand natural disasters, such as hurricanes and earthquakes, and also building them to be sustainable and “green” for reduced environmental impact and lower energy usage, are critical to the future. Further, integrating new technologies (new materials, new sensors, new design philosophies and methods etc.) into civil engineering design is an ever present challenge. Finally, continual refinement of our design methodologies will reduce the costs associated with uncertainty in applied loadings, material properties, and the intended use of the structure.

Johns Hopkins University has graduated civil engineers through an accredited civil engineering program since 1934. We have strengths in probabilistic methods for design and analysis for application to the randomness in many building materials, the uncertainties in



the design process, and in the environmental loading on structures. We are developing new techniques for building with thin-walled structures and how to design in a way that incorporates the knowledge of material properties their response to repeated cycling of the structure. We are modeling large-scale civil engineering systems related to energy, transportation, and public health, whose optimized performance is critical to the health, safety, and welfare of the public. We are concerned with the soil that must support buildings and how it responds to loading. We are also concerned about civil engineering at the nation's coastlines and nearshore areas, as the population there continues to grow, while the sea level rises.

Looking ahead to senior year...

The culmination of the undergraduate civil engineering experience at Hopkins is the year long senior design project. Students, under the guidance of a practicing engineer, take a civil engineering design project through all stages of development, from project conception, to budgeting, to final design. Recent projects include bridge and building design projects and building rehabilitation/restoration projects, including one involving Frank Lloyd Wright's Fallingwater.

We have designed our undergraduate program so that our graduates are prepared for advanced study in engineering or other fields and are prepared for successful engineering practice. We have a long tradition of placing our graduates in the most prestigious engineering firms and in the top master's and Ph.D. programs in the country, including our own.

Currently the department offers Bachelor of Science in Civil Engineering, a Master of Science in Civil Engineering, and a Ph.D. in Civil Engineering. Students also have an opportunity to pursue a five year combined bachelor's /master's degree program in civil engineering.

Recommended schedule

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Math course*		4
Freshman Experiences in Civil Engineering	560.101	1
Intro Chemistry I	030.101	3
Intro Chemistry Laboratory I	030.105	1
Humanities, Social Science, or Writing Intensive course (060.113, 660.105, or 661.110)		3
General Physics I	171.101/107	4
General Physics Lab I	173.111	1
Total Credits		17

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Math course*		4
Humanities, Social Science, or Professional Writing and Communication (661.110)		3
Perspectives on the Evolution of Structures	560.141	3
General Physics II	171.102/108	4
General Physics Lab II	173.112	1
Total Credits		15

*MATH COURSE SELECTION

Freshmen should take a math course each semester, choosing among the required courses shown below according to their level of preparation.

<i>Course Name</i>	<i>Course #</i>	<i>Credits</i>
Calculus I	110.108	4
Calculus II	110.109	4
Calculus III	110.202	4
Linear Algebra & Differential Equations	553.291	4

NOTE: If a student earns AP credit for Physics I, he or she MUST still take either General Physics Lab I (173.111) or another 1 credit laboratory course.

Computer Science

Computer science is the study of models of computation, their physical realizations, and the application of these models to an incredibly diverse and continually evolving set of applications. As such, students who major in computer science have a wide range of directions in which to apply their degree. Whether your dream job is to develop the latest applications for Google, Apple, or Microsoft, create the greatest computer game ever, construct a truly secure electronic voting system, invent robots for medical or environmental applications, build a universal language translator, or run your own e-business (to name a few), a computer science degree at JHU can get you started.

PROGRAMS

We offer both a Bachelor of Science (BS) degree and a Bachelor of Arts (BA) degree.

This gives computer science students the options of pursuing a strongly technical program (BS), or crafting a more traditional liberal arts program (BA). Both degrees start with a balanced foundation in computer science, so that majors don't have to decide whether to pursue a BS or a BA until mid-way through their undergraduate studies. The first two years of study focus on core courses within the major: programming in Java, C, and C++, data structures and algorithms, computer system fundamentals, automata and computation theory. This core gives students a strong understanding of how computers work and how we can use them to manipulate data. To complement these required courses, students take distributional courses in math, science, humanities and social science, and may also start exploring the field of CS through courses such as databases, user interfaces and mobile applications, parallel programming, or video game design.

In their junior and senior years CS students have great flexibility in choosing their upper level CS, and other distributional courses. In addition to core courses in software engineering, algorithms, and networks, students may choose from courses in artificial intelligence, sensor-based robotics, distributed systems, operating systems, cryptography and security, computer integrated surgery, natural language processing, machine learning, computational genomics, computer graphics and more. A key feature of our major is the tremendous amount of teamwork and collaboration that takes place in the upper level courses. Many of them provide students with opportunities to develop significant term projects in small groups, sometimes with an external client, and other times of the students' own design.

FOCUS AREAS

As students progress through the program, many discover a special interest and want to concentrate their studies in that area. To facilitate this, we have developed several tracks within the major consisting of relevant CS and distributional courses: natural language processing, software engineering, information security, video game design, and robotics. Additional focus areas include data-intensive computing, computing fundamentals, systems & networking, computational biology, and business computing. Together these 10 areas represent faculty research strengths and typical career directions, offering specialization options for undergraduate exploration within the department. Regardless of whether you pursue a particular focus or not, our bachelor programs provide excellent preparation for research within the department, summer internships, and post-graduation industry employment or graduate work.

COMMUNITY

Students majoring in computer science form a strong community and support system. This is facilitated through course team projects, as well as our own undergraduate computer labs. Students have 24/7 access to these labs, as well as to our compute servers either directly on the lab machines or remotely from their own laptops. The collaboration lab in particular provides a common gathering place to work on projects, get advice and homework help, and generally socialize with others in the department.

The department is also home to four student groups: ACM, ACM-W, UPE and HopHacks. ACM is our chapter of the Association for Computing Machinery, which you can read about later in this booklet. ACM-W is the affiliated Women in CS group which meets informally every week for "coding circles," as well as sponsoring a mentorship program and other events throughout the year. UPE stands for Upsilon Pi Epsilon which is the computer science honor society. Students in this group typically help with open house events and hold tutoring sessions HopHacks is the student organizing team for our 36-hour hackathon held on campus every semester.

PROGRAM COMBINATIONS

Because of our flexible program requirements, students frequently combine studies in CS with minors, other majors, and sometimes even masters programs in CS or related areas. Some of the most popular minors among CS majors are Entrepreneurship & Management, Robotics, Computational Medicine, Computer Integrated Surgery, and Math (traditional or applied). We also offer a minor in computer science for those pursuing other majors. Double majors may combine studies in CS with almost any other major offered in Engineering or Arts & Sciences.

Due to the close relationship between computer science and many other fields, it may be difficult to choose the right course of study. Students who are interested in the intersection of computer science and electrical engineering are encouraged to pursue a Bachelor of Science in Computer Engineering (CE), which is jointly sponsored by the computer science and electrical and computer engineering departments. CE majors take core courses from both departments, and may choose advisors and upper level courses from either department.

Do you want to build the next generation of computer hardware or design smart surgical tools? If so, think about majoring in electrical engineering or computer engineering. Both of these programs combine a rigorous education in engineering and the sciences with research experience that lets you put your knowledge to work in the world of high-tech engineering and in advanced studies. You can find more information about these programs elsewhere in this booklet.

At the graduate level, students may pursue a combined bachelor's/master's program, which allows undergraduates to begin a masters degree before completing their undergraduate courses. Because it is not necessary for both the bachelor's and master's degrees to be in the same field, some students use the combined program as an opportunity to combine their bachelor in CS with a specialized masters program in information security, robotics, or engineering management, or a more traditional graduate field such as applied math or computer engineering.

On the next page you will find our recommended courses for the first year of study as a computer science major. More details on all our programs are readily available on our department website: <http://cs.jhu.edu>.

Recommended schedule for a student without AP Computer Science

Fall Semester	Course #	Credit
Calculus I*	110.108	4
Discrete Math	553.171	4
Gateway Computing	500.112	3
Optional HEART course	500.111	1
Writing Course**		3
Total Credits		14

Spring Semester	Course #	Credit
Calculus II*	110.109	4
Intermediate Programming	601.220	4
M&Ms	601.105	1
Free Elective		3
H/S elective		3
Total Credits		15

Recommended schedule for a student with AP Computer Science

Fall Semester	Course #	Credit
Calculus I*	110.108	4
Discrete Math	553.171	4
Intermediate Programming	601.220.03	4
Optional HEART course	500.111	1
Writing Course**		3
Total Credits		15-16

Spring Semester	Course #	Credit
Calculus II*	110.109	4
Data Structures	601.226	4
M&Ms	601.105	1
Free Elective		3
H/S Elective		3
Total Credits		15

*Select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 46-49 in the First Year Academic Guide) and JHU math placement exam results. Course choices include Calculus I, II, III, or Linear Algebra.

**Select a writing course from the following choices: 060.113, 220.105, 661.110.

Electrical and Computer Engineering

Electrical engineering is concerned with a wide variety of topics in electronics, integrated circuits, signals, systems, and communications; in photonics and optoelectronics; in medical imaging; and in computer hardware.

Computer engineering is concerned with the design and application of analog and digital devices and systems, including computer systems. In the computer engineering program, you can select advanced courses with orientations towards microsystems, computer-integrated surgery, software, or robotics and sensors.

Design a program that fits your interests

The department centers its teaching and research in three major areas: communications and signal processing, photonics and optoelectronics, and computer engineering systems. Working closely with your advisor, you can put together an electrical engineering or computer engineering program that lets you focus on the areas of the

field where your interest lies. Students who are interested in the intersection of electrical engineering and computer science are encouraged to pursue a Bachelor of Science in Computer Engineering (CE), which is jointly sponsored by the electrical/computer engineering and computer science departments. CE majors take core courses from both departments, and may choose advisors and upper level courses from either department.

Research is an essential tool

Hands-on research is one of the best tools for learning. Right from the beginning, you'll work with your instructors in their area of research as well as on projects of your own. Some of the areas that faculty are currently researching include parallel signal processing, VLSI analog architectures for machine vision, nonlinear systems, photonics, optical communications, semiconductor devices, biomorphic systems for robotics and sensory information processing, medical imaging, and much more.

You're only as good as your tools

The department maintains extensive facilities for teaching and research in Barton Hall and Hackerman Hall. The two main teaching labs (ECE lab and MicroSystems Design lab) make extensive use of state-of-the-art design environments such as CADENCE, Xilinx Tools, TI DSP systems, VHDL, and Verilog. In addition, the department also includes the computational sensory-motor microsystem lab, the control systems design lab, the parallel computing and imaging lab, the photonics and optoelectronics lab, the semiconductor microstructures lab, and the sensory communication and microsystems lab.

Current and recent noteworthy accomplishments

- ECE researchers have developed smart optical tools that will help revolutionize microsurgeries.
- Algorithms for speech processing that were pioneered by ECE researchers can be found in most speech recognition applications worldwide.
- ECE researchers are developing a dynamic electronic surface to allow blind or visually impaired people to "feel" mathematical graphs, diagrams and other visuals now displayed on computer screens.
- ECE researchers have received national attention for developing biologically inspired smart vision sensors and motor control chips. These chips are being used to develop humanoid robots, smart toys, robot-assisted surgery and prosthesis for amputees and for patients with spinal injuries.
- Teams of students have developed an intelligent ground vehicle using custom designed software and hardware, to participate in the annual Intelligent Ground Vehicle competition.
- ECE researchers have developed a satellite based, high-power fiber-optic laser system to monitor air pollution and atmospheric changes associated with global warming and ozone depletion.

What you'll study

The freshman program is almost the same for Computer Engineering and Electrical Engineering. During your sophomore year, you'll begin to prepare for upper-level courses by completing specific pre-requisite courses. Depending on the major and area of emphasis you decide to pursue, you'll have the chance to choose from a wide range of courses including:

- Mastering Electronics
- Signals and Systems
- Electromagnetics
- Intro to VLSI
- Control Systems
- Optical and Electronic Properties of Materials
- Photonics
- FiberOptics
- Optoelectronic Devices
- Image Processing and Analysis
- Speech and Audio Processing
- Computer Architecture
- Medical Imaging Systems
- Information Theory and Coding
- Microwaves and High Speed Circuits
- CAD of Digital VLSI Systems
- Semiconductor Devices
- Telecommunications

You'll also take courses in the social sciences and humanities. These classes sharpen your thinking and improve writing and communication skills.

Learning in the real world

Join many of your fellow Hopkins students who take part in an internship at some point in their college career. Recent internships include:

- Medtronic
- IT intern, Eli Lilly and Company
- Programmer, IBM
- Northrup Grumman
- Columbia Telecom
- Ernst & Young
- NASA
- Java developer, onepage.com
- Decision Systems, Inc.
- Researcher, University of California, Super Nike Computer Center
- Intel
- National Semiconductor
- AMD
- Applied Physics Laboratory

Where do you go from here?

Hopkins graduates take their degrees lots of different places:

- Graduate and professional schools
- Communications & telecommunications firms
- Business
- Government and corporate labs
- Research and teaching
- Industrial labs

Recommended schedule for Electrical Engineering

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Physics I	171.101/107	4
Physics Lab I	173.111	1
Intro to ECE & Seminar	520.137	3
Gateway Computing	500.112	3
Total Credits		15

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Linear Algebra	110.201	4
Physics II	171.102/108	4
Physics Lab II	173.112	1
Digital Sys. Fundamentals	520.142	3
Comp. Modeling/ECE	520.123	3
Total Credits		15

Recommended schedule for Computer Engineering

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Physics I	171.101/107	4
Physics Lab I	173.111	1
Intro to ECE & Seminar	520.137	3
Gateway Computing	500.112	3
Total Credits		15

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Physics II	171.102/108	4
Physics Lab II	173.112	1
Digital Sys. Fundamentals	520.142	3
Comp. Modeling/ECE	520.123	3
Intermediate Programming	601.220	3
Total Credits		14

**You should select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 46-49, in the [First-Year Academic Guide](#)) and JHU math placement exam results. Course choices include Calculus I, II, or III; Linear Algebra; or Differential Equations.*

Environmental Engineering and Geography

Housed in the Department of Environmental Health and Engineering, the environmental engineering involves the application of physical, chemical, biological, and social sciences to protect human health, enhance the quality of human life, and protect ecosystems. Environmental engineers plan, design, and operate technological systems to prevent, control, or remediate pollution. They evaluate and design public policy and conduct research to understand and solve environmental problems. Our degree program is flexible enough to accommodate students with a variety of interests in Environmental Engineering.

Our program provides ideal preparation for future employment in business or industry or for subsequent training at the graduate level, either in Environmental Engineering or in a field such as environmental law, public health, or medicine. Graduates in this field work in private consulting firms, industrial firms, governmental agencies, nongovernmental agencies (NGOs), international agencies, research laboratories, and universities.

The Department of Environmental Health and Engineering (EHE) offers:

- an undergraduate Bachelor of Science (B.S.) degree in Environmental Engineering
- four focus areas within the environmental engineering major:
 - Environmental Management and Economics
 - Environmental Engineering Science
 - Environmental Transport
 - Environmental Health Engineering
- An undergraduate Bachelor of Arts (B.A.) degree in Geography
- two focus areas within the Geography major:
 - Human Geography
 - Physical Geography
- three minors:
 - a minor in environmental engineering (designed to allow other engineering students to pursue an interest in environmental engineering and to incorporate aspects of this field into careers in their own discipline)
 - a minor in environmental sciences (designed to encourage and facilitate studies in environmental science by students completing degrees in natural sciences e.g. chemistry, biology, physics.)
 - a minor in engineering for sustainable development (designed to expose students to some of the key issues related to development, methods of information-gathering in diverse and difficult settings, and working effectively with non-engineers on complex problems)
- a five-year concurrent (B.S./M.S. or B.S./M.S.E.) program.

The department offers electives in such areas as ecology, hydrology, water and wastewater treatment processes, environmental systems analysis, and environmental policy studies.

EHE has undergraduate exchange programs available with the University of Utrecht, which is the Netherlands' lead environmental sustainability university, and Comillas Pontifical University in Madrid, which is the top private university in the energy systems area. Courses are available in English. If you are interested in learning more about the exchange programs, you should contact the EHE department.

Recommended schedule for Environmental Engineering

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus I, II, or III	110.108, 109 or 202	4
Intro Chemistry I	030.101	3
Intro Chem Lab I	030.105	1
Intro to Environ. Eng.	570.108	3
Humanities/Soc Sci Elective		3
<i>Optional HEART course</i>	<i>500.111</i>	<i>1</i>
Total Credits		14-15

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II, III or other math	110.109, 202	4
Intro Chemistry II	030.102	3
Intro Chem Lab II	030.106	1
Physics I	171.101	4
Physics I Lab	173.111	1
Gateway Computing	500.112	3
Total Credits		16

Recommended schedule for Geography

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Math course*		4
Intro Chemistry I	030.101	3/4
or Physics I	or 171.101/107	
Chemistry Lab I	030.105	1
or Physics I Lab	or 173.111	
Humanities/Soc Sci Elective		3
Other Elective		3
<i>Optional HEART course</i>	<i>500.111</i>	<i>1</i>
Total Credits		14-16

*You should select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 46-49 in the First-Year Academic Guide) and JHU math placement exam results. Course choices include Calculus I, II, or III; Linear Algebra; or Differential Equations.

Materials Science and Engineering

Materials are essential to the implementation of any engineered technology, from the smallest integrated circuit to the strongest artificial muscles to the longest bridge. In almost every technology, the performance, reliability, or cost is determined by the materials used. As a result, the drive to develop new materials and processes (or to improve existing ones) makes materials science and engineering one of the most important and dynamic engineering disciplines. Because the field encompasses so many different areas, it is often categorized according to types of materials (metals, ceramics, polymers, semiconductors) or to their applications (biomaterials, electronic materials, magnetic materials, or structural materials).

The central theme of materials science and engineering is that the relationships among the structure, properties, processing, and performance of materials are crucial to their function in engineering structures. Materials scientists seek to understand these fundamental relationships, and use this understanding to develop new ways for making materials or to synthesize new materials. Materials engineers design or select materials for particular applications and develop improved processing techniques. Since materials scientists and engineers must understand the properties of materials as well as their applications, the field is inherently interdisciplinary, drawing on aspects of almost every other engineering discipline as well as physics, chemistry, and biology.

Three B.S. degree tracks are offered by the Department of Materials Science and Engineering.

(1) Standard Materials Track. The materials track is intended for those students with general materials science and engineering interests. It permits the student to tailor the degree program by allowing a broad range of choices for upper level science and engineering electives.

(2) Biomaterials Concentration. The biomaterials track is intended for those students with a focused interest in biomaterials.

(3) Nanotechnology Concentration. The nanotechnology track is intended for those students with a focused interest in nanotechnology.

Description of the Biomaterials Concentration

Biomaterials is an exciting and rapidly developing field at the interface of materials science, engineering, biology, chemistry and medicine. It is an interdisciplinary field that requires thorough understanding of materials properties and interactions of materials with the biological environment. Our unique biomaterials program is designed to provide a broad educational basis with emphasis on principles and applications of biomaterials. It is designed to provide a firm grounding in the physics, chemistry, and biology of materials, as well as breadth in general engineering, mathematics, humanities and social science. Our curriculum covers a variety of topics including biomimetic materials and natural materials, host responses to biomaterials and biocompatibility, as well as applications of biomaterials, particularly to tissue engineering, regenerative medicine, drug delivery, medical devices and implants. Students enrolled in this track will take a series of lecture courses and a laboratory course, as well as conduct a senior design project focusing on design, synthesis,

processing, characterization, and applications of biomaterials. The goal of the biomaterials track in the Department of Materials Science and Engineering is to train students in the basic principles of materials science and engineering as they apply to the development of novel biomaterials that benefit human health. Students under this track will receive among the best educations for successful careers in biomaterials engineering or biomedically-related fields.

Description of the Nanotechnology Concentration

Nanotechnology advances the utilization of materials and devices with extremely small dimensions. Nanotechnology is a visionary field, as micro- and nano-structured devices impact all fields of engineering, from microelectronics (smaller, faster computer chips) to mechanical engineering (micromotors and actuators) to civil engineering (“smart”, self-healing nanocomposite materials for buildings and bridges) to biomedical engineering (drug delivery, biosensors and tissue engineering). Materials science is central to nanotechnology because the properties of materials can change dramatically when things are made extremely small. A wide (and sometimes unexpected!) variety of phenomena associated with nanostructured materials allow us to envision radically new devices and applications that can only be made with nanostructured materials.

Under the nanotechnology track, the Department of Materials Science and Engineering offers a curriculum designed to train students in the fundamental interdisciplinary principles of materials science including physics and chemistry, and also expose students to cutting edge nanomaterials research, both through elective classes and in research laboratories. Students in the nanotechnology track will be well-prepared for successful careers in materials science and engineering across a wide range of disciplines.

Recommended schedule

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus I	110.108	4
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
Physics I	171.101/107	4
Physics Lab I	173.111	1
Foundation of MSE	510.106	3
<i>Optional HEART course</i>	<i>500.111</i>	<i>1</i>
Total Credits		16-17

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Intro Chemistry II	030.102	3
Chemistry lab II	030.106	1
Physics II	171.102/108	4
Physics Lab II	173.112	1
Gateway Computing	500.112	3
Total Credits		16

You should select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 46-49 in the First-Year Academic Guide) and JHU math placement exam results.

Students who earned a score of 5 on AP Chemistry may elect to receive credits for Introductory Chemistry I (030.101), Introductory Chemistry Laboratory I (030.105), Introductory Chemistry II (030.102) and Introductory Chemistry Laboratory II (030.106). Students may enroll in Introductory Organic Chemistry I (030.205) in the fall semester.

Students who earned a score of 4 on AP Chemistry may enroll in Applied Chemical Equilibrium and Reactivity with Lab (030.103) in fall semester to fulfill the MSE requirement for chemistry. An elective can be selected in the spring semester.

Mechanical Engineering and Engineering Mechanics

THE MECHANICAL ENGINEERING (ME)

MAJOR emphasizes mechanical and thermal systems analysis and design. Students develop a wide range of fundamental skills required of the mechanical engineering professional and choose upper-level technical electives for further in-depth study. We offer formal tracks in Aerospace Engineering and Biomechanics, allow students to pursue special interests in engineering, physics, biology, mathematics, management, and humanities. Students interact with a multidisciplinary faculty both in the classroom and in research laboratories. Double-majors and a 5-year concurrent bachelor's/master's degree are also available.

The modern engineer must be well versed in communication and teamwork skills. These are developed in a number of courses that involve laboratory exercises, report writing, and oral presentations. In addition to the two-semester capstone senior design course, the students' development in solving design problems is cultivated and encouraged through design electives and special design projects assigned in many of the courses.

TRACKS: Students are encouraged to develop depth in one or two areas within mechanical engineering. Your faculty advisor can help you choose courses that form tracks in areas such as mechanics and design, thermo-fluids and thermo-fluid systems, robotics, aerospace engineering, and biomechanics. The Aerospace Engineering and Biomechanics tracks have formal course requirements.

The Aerospace Engineering track helps students develop knowledge in areas such as advanced dynamics, flight mechanics, propulsion, aerospace materials and structures, signal processing, control systems, astrophysics and space systems. Students pursuing this track are required to take at least five eligible courses, which count toward the requirements of the Mechanical Engineering and Technical electives in the general ME

program. Another popular track in ME is Biomechanics. The essence of mechanics is the interplay between forces and motion. In biology, mechanics is important at the macroscopic, cellular, and subcellular levels. ME Students pursuing this track are required to take at least four eligible courses, which count toward the requirements of the Mechanical Engineering and Technical electives in the general ME program.

Recommended schedule for Mechanical Engineering

Fall Semester	Course #	Credits
Calculus I	110.108	4
Intro to Chemistry I	030.101	3
MechE Undergraduate Seminar I	530.107	0.5
Intro to MechE Design and CAD	530.111	2
MechE Freshman Lab I	530.115	1
Intro to Mechanics I	530.123	3
HS Elective—Writing	060.100, 060.113, or 220.105	3

Total Credits **16.5**

Spring Semester	Course #	Credits
Calculus II	110.109	4
MechE Undergraduate Seminar II	530.108	0.5
Gateway Computing	500.112	3
MechE Freshman Lab II	530.116	1
Intro to Mechanics II	530.124	2
HS Elective		3
HS Elective		3

Total Credits **16.5**

NOTE: If a student earns AP Physics credits, he or she MUST take the Physics laboratory courses, which include either 530.115/116 Mechanical Engineering Freshman Lab I/II (preferred) or 173.111, Physics Lab I. 173.112 Physics Lab II is also required. This is an exception to University policy as the Mechanical Engineering Department has chosen to require the lab courses.

THE ENGINEERING MECHANICS (EM)

MAJOR is designed to provide students with a highly flexible but rigorous foundation in solid and fluid mechanics. Students choose an area of specialization in preparation for technical careers or graduate and professional school. The major offers numerous technical electives and allows students to pursue special interests in engineering, physics, biology, mathematics, management, and humanities. Double majors and a 5-year concurrent bachelor's/master's degree are also possible. Courses in the basic sciences and mathematics and in other engineering disciplines, including electrical, civil and materials are required. The major offers elective opportunities in diverse areas such as the physical and mathematical sciences, aerospace engineering, biomedical engineering, and environmental engineering. Students interact with a multidisciplinary faculty both in the classroom and in research laboratories.

The modern engineer must be well versed in communication and teamwork skills, which are developed in courses that involve laboratory exercises, report writing, and recording of oral presentations. Development in solving design problems is cultivated through design electives and special design projects assigned in many of the courses, up to and including the capstone senior design course.

TRACKS: Engineering Mechanics is a highly flexible program, ideal for students who want to specialize in any area of mechanics. Students who pursue tracks within this major, in consultation with their EM advisors, choose a set of technical and engineering course electives that best matches the student's interests.

The Aerospace Engineering track helps students develop knowledge in areas such as advanced dynamics, flight mechanics, propulsion, aerospace materials and structures, signal processing, control systems, astrophysics and space systems. Students

pursuing this track are required to take at least five eligible courses, which count toward the requirements of the Engineering Mechanics and Technical electives in the general EM program.

Another popular track in EM is Biomechanics. The essence of mechanics is the interplay between forces and motion. In biology, mechanics is important at the macroscopic, cellular, and subcellular levels. EM Students pursuing this track are required to take at least six eligible courses, which count toward the requirements of the Engineering Mechanics and Technical electives in the general EM program.

Recommended schedule for Engineering Mechanics

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus I	110.108	4
Intro Chemistry I	030.101	3
MechE Undergraduate Seminar I	530.107	0.5
Intro to MechE Design and CAD	530.111	2
MechE Freshman Lab I*	530.115	1
Intro to Mechanics I*	530.123	3
HS Elective-Writing	060.100, 060.113, or 220.105	3
Total Credits		16.5

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Gateway Computing	500.112	3
MechE Undergraduate Seminar II	530.108	0.5
MechE Freshman Lab II*	530.116	1
Intro to Mechanics II	530.124	2
Basic Science Elective		3
HS Elective		3
Total Credits		16.5

* *Alternate introductory course sequence: 500.101, What is Engineering (3) or other acceptable introduction to engineering course, plus 171.101/171.107, Physics I (4) and 173.111, Physics Lab I (1).*

General Engineering

Our time has seen the rapid development of a broad range of technological, scientific, and engineering innovations that shape the way in which contemporary society functions. The pace of these developments will become even faster and more global in this century. The Bachelor of Arts in General Engineering is designed to provide students with the fundamental engineering principles needed to understand the basics of, and to work with, modern technology, innovations and engineering practices.

The B.A. degree with a major in General Engineering is intended for undergraduate students who want to obtain a background in engineering and technology but do not intend to become professional engineers. This degree might be appropriate for you if you plan to pursue graduate or professional study in architecture, business, law (e.g. intellectual property, patent law) or medicine. You may wish to work in areas that relate to engineering and technology such as public policy or business, and prepare yourself to thrive in the global industrial economy.

In this program, you will have a great deal of flexibility in your course selection, within broad guidelines. You will have significant math, science, and engineering requirements, but you will also have the opportunity to include more humanities, social science, and writing courses than a typical engineering program. In your program, you will need to make choices that provide exposure to the international dimensions of engineering (either by study abroad or relevant coursework).

Recommended schedule

Fall Semester	Course #	Credits
Calculus I or II	110.108 or 110.109	4
or other math course	or 110.xxx	
Intro Chemistry I	030.101	3
Chemistry Lab	030.105	1
Intro Engineering course*		1-3
Humanities/Social Science		3
or Elective course		
Optional HEART course	500.111	1
Total Credits		12-15

*Select one Intro Engineering course from the following choices: 500.101, 540.101, 520.137, 570.108

Spring Semester	Course #	Credits
Calculus II or other	110.109 or	4
math course	110.xxx	
General Physics I	171.101	4
General Physics Lab I	173.111	1
Gateway Computing	500.112	3
Humanities/Social Science		3
or Elective course		
Total Credits		15

Undecided Engineering

The following core curriculum has been developed for students who are undecided about a specific major. Completing this program will allow you to transfer into any engineering department (except BME) during or at the end of your first year and complete the requirements in time to graduate within the normal four year period. All engineering students enroll in an introductory engineering course. You may choose to take What Is Engineering? (500.101), a three credit course combining hands-on projects and lectures to introduce engineering as a field of study, a profession, and an academic pursuit. However, you may choose to take an introductory engineering course offered by one of the major departments instead. It is strongly recommended that all undecided engineering students take 500.103, Hopkins Engineering Sampler Seminar, in order to become familiar with the major and minor programs available in the Whiting School of Engineering.

Schedule for a student beginning with Calculus I

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus I	110.108	4
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
What Is Engineering?	500.101	3
or other intro engineering course		
Humanities/Soc Science Elective		3
Hopkins Engineering Sampler Seminar	500.103	1
Optional HEART course	500.111	1
Total Credits		15-16

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
Intro Chemistry II	030.102	3
Chemistry Lab II	030.106	1
Physics I	171.101	4
Physics I Lab	173.111	1
Humanities/Soc Science Elective		3
Total Credits		16

Schedule for a student beginning with Calculus II or III

<i>Fall Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus II	110.109	4
or Calculus III	or 110.202	
General Physics I	171.101/107	4
Physics I Lab	173.111	1
Intro Chemistry I	030.101	3
Chemistry Lab I	030.105	1
What Is Engineering?	500.101	3
or other intro engineering course		
Hopkins Engineering Sampler Seminar	500.103	1
Optional HEART course	500.111	1
Total Credits		17-18

<i>Spring Semester</i>	<i>Course #</i>	<i>Credits</i>
Calculus III	110.202	4
or other math	or 110.xxx	
Physics II	171.102/108	4
Physics II Lab	173.112	1
Intro Chemistry II	030.102	3
Chemistry Lab II	030.106	1
Humanities/Soc Science Elective		3
Total Credits		16

Computer Integrated Surgery Minor

The Laboratory for Computational Sensing and Robotics (LCSR) offers an interdisciplinary minor in computer integrated surgery (CIS). To complete the minor in CIS, you will work with an advisor from the LCSR. The minor is particularly well-suited for students interested in computer integrated surgery issues who are majoring in a variety of disciplines, including biomedical engineering (BME), computer science (CS), computer engineering (CompE), electrical engineering (EE) and mechanical engineering (ME).

To satisfy the requirements for the minor in CIS, you must have a fundamental background in computer programming and computer science. Required fundamental mathematics courses include Calculus I, II and III, and Linear Algebra. Moving beyond the foundation, you'll take at least six courses directly related to concepts relevant to CIS, beginning with Computer Integrated Surgery I. Subsequent choices include courses in imaging, such as Computer Vision, Image Processing and Analysis, and Medical Imaging Systems; and courses in robotics, such as Robotic Sensors and Actuators, Mechatronics, and Introduction to Robotics.

For more information, visit our website at <https://lcsr.jhu.edu/computer-integrated-surgery-minor/>



Computational Medicine Minor

Computational medicine (CM) is an emerging discipline devoted to the development of quantitative approaches for understanding the mechanisms, diagnosis and treatment of human disease through applications of mathematics, engineering and computational science. The core approach of CM is to develop computational models of the molecular biology, physiology and anatomy of disease, and apply these models to improve patient care. CM approaches can provide insight into and across many areas of biology, including genetics, genomics, molecular networks, cellular and tissue physiology, organ systems, and whole body pharmacology.

The CM minor is available to any undergraduate in the Whiting School of Engineering and suitably

prepared students in the Krieger School of Arts and Sciences with sufficient mathematical and programming background. By officially enrolling in the CM minor, each student will be assigned an ICM faculty advisor who is an active tenure-track professor conducting research in the area. Students begin the minor with two core courses (EN.580.431 and either EN.553.450 or EN.580.488), followed by the completion of 12 additional credits of CM elective courses for a total of 18 credits of CM courses. In addition, students enrolled in the minor are required to attend six Distinguished Seminars in Computational Medicine by graduation.

For more information regarding the CM minor, visit <http://icm.jhu.edu/academics/undergraduate-minor/>.

Robotics Minor

The Laboratory for Computational Sensing and Robotics (LCSR) offers a robotics minor that helps undergraduate students at Johns Hopkins University advance their knowledge in robotics. Any student from any department within the university can work toward the minor. To complete the minor in Robotics, you will work with an advisor from LCSR.

Robotics is fundamentally integrative and multidisciplinary. Therefore, any candidate for the robotics minor must cover a set of core skills that cut across these disciplines, as well as obtain advanced supplementary skills. Core skills include:

1. Robot kinematics and dynamics
2. Systems theory, signal processing, control
3. Computation and sensing.



Supplementary advanced skills may be obtained in specialized applications—such as space, medicine, or marine systems—or in one of the three core areas listed above.

For more details, please visit <http://lcsr.jhu.edu/robotics-minor/>

Engineering for Sustainable Development Minor

Engineers will be increasingly called upon to help devise solutions to the tremendous problems of poverty, inequality, and social and environmental dislocation that afflict major parts of the globe in the 21st century. Working as an engineer in this context involves negotiating highly complex social, economic and political realities and dealing with a wide range of institutions and actors, including national and local governments, multilateral lenders such as the World Bank, diverse non-governmental organizations (NGOs) and local communities. It also increasingly involves working in interdisciplinary teams with social scientists, public health and medical workers, humanitarian aid workers, bankers, politicians and the like. “Sustainable” development implies a development path that is socially equitable, culturally sensitive, and environmentally appropriate over a multi-generational time frame.

The minor in engineering for sustainable development exposes students from all engineering disciplines to some of the key issues related to development, methods of information-gathering in diverse and difficult settings, and working effectively with non-engineers on complex problems. We begin with a one-semester core course that surveys the various issues involved, followed by an individually-designed but coherent program organized around a particular theme, disciplinary approach or region of the world.

All courses must be completed with a grade of C- or better to qualify for the minor. At least two semesters of foreign language study are strongly recommended but not required. Students who participate in a Study Abroad program for a semester can, with the minor advisor’s consent, use this experience to count in place of one of the required courses.

Structure and Content of the Minor

Students pursuing the minor are required to take seven courses. The core course is 570.110, Introduction to Engineering for Sustainable Development. Six additional courses will be selected in a program devised in consultation with the minor advisor.

Of the six additional courses:

- Three must be grouped around a specific theme, region or within a specific discipline. Themes might include, for example, public health, environment, or economic development. Regions include Africa, Latin America or Asia. Disciplinary concentrations might be in anthropology, economics, geography, history, political science, public health or sociology.

- Two of the courses must be at the 300-level or above.

- One of the courses must cover methods for gathering and evaluating information in a development context. Examples include:

070.319 The Logic of Anthropological Inquiry

070.219 Anthropology and Public Action

070.347 Discourse Analysis: Stories and their Structures

280.345 Biostatistics in Public Health

280.350 Introduction to Epidemiology

230.202 Research Methods for the Social Sciences

- The value of this program will be enhanced by some form of hands-on experiential project, whether at a field site in a developing country, in support of field-workers in other divisions of the university or in distressed communities in Baltimore. This experience is not required for the minor, but we hope to provide guidance to students interested in pursuing such a project.

The minor is housed in the Department of Environmental Health & Engineering. Contact Professor Erica Schoenberger at ericas@jhu.edu for more information.

Center for Leadership Education

The primary goal of the Center for Leadership Education (CLE) is to provide Hopkins students with the knowledge and skills necessary to become leaders in public and private for-profit and non-profit enterprises. This is accomplished by focusing on business from a multidisciplinary viewpoint and offering students a diversified learning experience that emphasizes the concepts, practices and skills necessary for effective leadership. In addition, the CLE administers a number of minors: Entrepreneurship and Management; Accounting and Financial Management; Marketing and Communications; and Business (many students choose to double or triple minor). Furthermore, the CLE boasts a talented and dedicated faculty with many years of private enterprise experience in their respective fields. These faculty also advise varied experiential learning programs supported by the CLE.

The CLE is focused on meeting student needs, whether a student wants to enter the corporate world; start a new venture; work in consulting or financial services; or go to law, medical or business school. Engineering students often find that a background in business and communications is crucial for professional advancement. Employers are particularly interested in engineering students who have taken a variety of business-related courses and demonstrate the ability to work in multi-disciplinary teams. All undergraduate courses and minors offered by the CLE are open to students in the Kreiger School of Arts and Sciences, the Whiting School of Engineering, and the Peabody Institute.

At the graduate level, the CLE directs the Master of Science in Engineering Management (MSEM) program, which bridges the gap between technology and business by equipping students with the technical expertise and leadership skills they need to advance their career in the fast-paced world of technology. Typically, selected Hopkins undergraduates can complete a concurrent BS and MSEM degree in five years and receive a 50 percent tuition fellowship for their MSEM degree.

In addition to the academics, the CLE offers many experientially based programs to help students gain valuable real-world experience. Student groups and events include Hopkins Student Enterprises, the Marshal Salant Student Investment Team, Oral Presentations Club, the annual JHU Business Plan Competition and business internships for academic credit. For more information about CLE programs, please visit <http://web.jhu.edu/leadership>.

CLE administered minors

The **Accounting and Financial Management minor** offers Hopkins students a focused, quantitative minor that will prepare them more effectively for careers in small companies, major corporations and consultancies, as well as acceptance into graduate programs in accountancy and business.

This minor enables students in all disciplines to complement their major fields of study with the academic training necessary for them to compete within the expanding marketplace. The minor is not only relevant to students who plan to seek employment after graduation, but critical for those who plan to attend graduate programs in accounting and business immediately after completing their undergraduate degrees. Requirements for the minor can be found at <https://engineering.jhu.edu/cle/accounting-financial-management/>.

The CLE also administers the **Business minor**, a joint program offered by The Whiting School of Engineering, the Carey Business School and the Krieger School of Arts and Sciences to Hopkins students. This highly-structured minor offers students a focused, quantitative learning experience that will prepare them for careers in small companies, major corporations and consultancies, as well as acceptance into graduate programs in accountancy and business.

This joint program combines critical analysis and theoretical grounding in a broad set of core and required courses; depth through an elective chosen from a list of courses in specialized topics; and hands-on experience through internships, community-based learning and experiential programs. Requirements for the minor can be found at <https://engineering.jhu.edu/cle/business-minor/>.

The **Entrepreneurship and Management (E&M) minor** provides Johns Hopkins Arts and Sciences, Engineering and Peabody students with the fundamentals of marketing, finance, accounting, management, business law and leadership. Students may also specialize in areas of their choice. The courses are engaging and challenging with a focus on business-related issues with practical applications. Requirements for the minor can be found at https://engineering.jhu.edu/cle/programs-minors/em_minor/.

The **Marketing and Communications (M&C) minor** offers students a broad array of courses designed to equip them to lead in the marketing and communications fields, and complements major courses of study in departments across campus. Students who opt to declare the minor will choose between two tracks: the Marketing Management track and the Integrated Marketing Communications track. Courses are also open to students who choose not to declare the minor.

The Marketing Management track is geared towards students who wish to pursue a career in product or marketing management at a large-scale enterprise. This track emphasizes learning how to manage both the message and the financial impact of marketing campaigns as well as how to manage a product line from development to launch.

The Integrated Marketing Communications track is designed for students who want to be more involved in the creative side of the marketing field, including areas such as advertising, public relations and social media. This track emphasizes

the development of messages, and the production of creative content and deliverables for a variety of different industries.

As a starting point, there are several courses available to freshmen who wish to build a foundation for business and communications. Please see the course listings section in the back of this guide for detailed course descriptions.

660.105 Introduction to Business
660.203 Financial Accounting
660.250 Principles of Marketing
661.110 Professional Writing and Communications
661.250 Oral Presentations

Courses are open to all students regardless of whether they choose to declare a minor or not.

Master of Science in Engineering Management (MSEM)

The MSEM program bridges the gap between technology and business by equipping engineers with the leadership and professional skills to succeed in business and industry. On the technical side, all students complete five advanced engineering and science courses, one of which may be double-counted from among 400 level and above courses taken as an undergrad. On the management side, students participate in a cohort program, taking three management courses together in the first semester: Strategies for Innovation and Growth, Strategies for Accounting and Finance, and Professional Presentations. The following spring, MSEM students take half-semester courses in Principles of Management and Marketing and may choose among a varied slate of electives to fill out their course load. In between semesters, students participate in a three-week course, officially titled The Practice of Consulting and unofficially referred to as the Immersion Experience. This course allows teams of students to immerse themselves in consulting projects, some abroad and some in the U.S. Students often cite the Immersion Experience as the highlight of the MSEM program.

EXPERIENCE ENTREPRENEURSHIP

Hopkins Student Enterprises

Hopkins Student Enterprises (HSE) gives students a chance to propose ideas for campus-based, for-profit businesses and gain experience as managers of those businesses under the guidance and support of the CLE. To learn more, visit: <http://hse.jhu.edu/>.

Business Internships

Gaining valuable work experience during college is critical for success after graduation. The CLE sponsors select students for internships for academic credit each semester. Our faculty internship coordinator works closely with approved students to help them secure internships in fields like communications, finance and marketing. Freshmen who may be interested in this opportunity in the future are encouraged to review our requirements and stop by our office for advice.

Student Organizations

The CLE supports a number of business-focused student associations and professional societies including the Alpha Kappa Psi Business Fraternity, the JHU Chapter of the American Marketing

Association, the Marshal Salant Student Investment Team, a microfinance club, a consulting group for profit and non-profit organizations, and financial literacy and entrepreneurship training programs for Baltimore City youth. For more information about these organizations, please see pages 42-43 and visit the referenced websites found there.

JHU Business Plan Competition

The Johns Hopkins University Business Plan Competition provides an opportunity for students to take a novel idea or innovative technology and develop a business plan based around it. Starting with a concept, students build an understanding of their target market, analyze potential competitors and craft an effective market entry strategy. Students can attend workshops and work with mentors as they develop a viable business plan. Finalists present their ideas to a panel of experts and more than \$80,000 in prizes are awarded in the life sciences, general business, and social enterprise categories. The competition is open to full-time and part-time students, including post-docs from any of the nine academic divisions of the University. To learn more, visit: <http://bpc.jhu.edu>.

Space Science and Engineering Minor

The objective of the minor is to prepare a student for a career in space science and space engineering, either directly as an entering professional in industry, government laboratories, and other organizations, or as a student in a graduate program. The educational goals of the minor are to enable students to:

- Apply an understanding and mastery of the fundamental scientific, engineering, and mathematical principles obtained through the major subject of study to space science and space engineering
- Help to develop an understanding and capacity for interdisciplinary approaches to technical activities
- Improve the ability to work in multidisciplinary teams, which are typical in space and other complex technical activities, through interdisciplinary education and internship(s) or equivalent experience(s).

Students seeking a minor in space science and engineering take five courses: Introduction to Space Science and Technology (AS.171.321), plus four additional courses that are chosen by the student and approved by an advisor. Students are required to submit a proposal and course plan to their advisor early in their program, prior to taking the courses. The minor in space science and engineering also carries an internship (or equivalent experience) requirement.

Detailed information about the minor is available in the handbook for the minor, available at <http://physicsastronomy.jhu.edu/undergraduate/minors/>.

Pre-Professional Advising for Engineers

The Office of Pre-Professional Programs and Advising serves undergraduates, graduate students, and alumni of the Krieger School of Arts & Sciences and the Whiting School of Engineering pursuing professional education in medicine, other health professions, and law. Pre-Professional advisors provide academic advising, professional school application advising, and career counseling. Our goal is to encourage students to pursue a holistic approach to their education, to be reflective about their learning and decision-making, and to demonstrate social responsibility and a commitment to volunteerism in preparation for a career of service.

Pre-Health Students

The Pre-Professional Office encourages all pre-health students to download and read Guide One: Pre-Med and Pre-Health Planning at JHU before classes begin (the guide is available on our website, and is updated annually). Guide One includes an overview of pre-health curricular requirements, advanced placement credit, and more. Guide One can be found here: <http://studentaffairs.jhu.edu/preprofadvising/pre-medhealth/guides/>.

Pre-Health 101

Pre-health freshmen should attend Pre-Health 101, a small group advising meeting that focuses on the qualities and requirements relevant to pre-health students and provides an opportunity for answers to your questions about being pre-health at Johns Hopkins. Attendance at Pre-Health 101 is required prior to scheduling your first individual appointment with a pre-professional advisor. Registration instructions will be available at the beginning of the fall semester.

*Freshmen pre-law students are **not** required to attend a small group advising meeting and can schedule an individual advising appointment at any time.

Pre-Professional Listservs

All incoming students who have indicated a pre-health or pre-law interest in their Advising Profile will be added to our pre-health or pre-law email listserv before fall classes begin. The Pre-Professional Office primarily communicates with pre-professional students via email, so it is important to read all listserv messages to receive information about pre-professional programs, events, internships, volunteer opportunities, etc. If you did not indicate a pre-health or pre-law interest in your advising profile, please visit the Pre-Professional website to register yourself for the appropriate listserv.

Pre-Professional Newsletters

The Pre-Health and Pre-Law Newsletters are the Pre-Professional Office's bi-weekly email publications. Newsletter issues include upcoming events, links to articles of interest, and other important announcements. The Pre-Health Opportunities Newsletter is distributed weekly and highlights internships, employment, and research opportunities, as well as community service experiences of interest to pre-health students. Students subscribed to the pre-health listserv automatically receive both the weekly and bi-weekly newsletters. Students subscribed to the pre-law listserv automatically receive the pre-law newsletter.

The Office of Pre-Professional Programs and Advising is located on the third floor of Garland Hall (Suite 300). Please feel free to contact us at your convenience by calling (410) 516-4140 or writing to preprofessional@jhu.edu.

Study Abroad Opportunities for Engineers

Students at Johns Hopkins have numerous possibilities for studying abroad. Maybe you've always wanted to learn about the German auto industry, study art history in Italy, conduct robotics research in Japan, or work on sustainable development project in Tanzania. The sky really is the limit if you choose to investigate all the opportunities you have for going abroad.

If you are interested in going abroad, you should get started on the planning process early - even as early as your freshman year. Here are some things to start thinking about:

- Do I want to take a language to prepare myself for going abroad?
- Will I want to take my classes abroad in English or in another language?
- When is the best time in my academic career to study abroad (fall or spring of sophomore or junior during the summer)?
- Am I more interested in studying abroad or working abroad?
- What countries would I like to travel to?

For more information on general study abroad opportunities, visit the Study Abroad Office in Levering Hall or visit our website:

<https://studyabroad.jhu.edu/>. The study abroad advisors can help you choose the best program to meet your academic and cultural goals.

In addition to general study abroad opportunities, there are international experiences designed specifically for engineering students:

- Hopkins Engineering Exchange Programs: A number of engineering departments sponsor exchange programs that directly support major and minor requirements at world-renowned universities such as the Danish Technical University (DTU), École Polytechnique Fédérale de Lausanne (EPFL), the National University of Singapore (NUS), and the Technion - Israel Institute of Technology.



Hopkins Engineering Exchanges also offer students the opportunity to earn 3 credits and collaborate on international engineering projects for 8 weeks during the summer. Summer engineering projects are available at DTU, EPFL and NUS, as well as at Shanghai Jiao Tong University and Universidad Carlos III de Madrid. Students may apply to the Vredenburg Travel Fund for assistance in covering the cost of these summer engineering projects. Students who are interested in an exchange program should consult a study abroad advisor.

- Vredenburg Travel Fund: This fund is only open to sophomore and junior engineering majors. It provides an opportunity for students to apply their engineering skills to a research experience, a community service project, or an internship abroad during the summer. Students submit project proposals, and approximately 12-18 students receive the award each year. The fund covers travel and living expenses abroad, and is a great way to get some hands-on experience in the engineering field while experiencing a different culture. The Vredenburg Travel Fund has been called “one of the best opportunities at Hopkins” and has sent over 100 students to places around the world including Chile, Tanzania, Australia, India, China, England, Denmark, and Singapore, just to name a few. For information on this scholarship, email vredenburg@jhu.edu.

Getting Involved in Student Groups

The following student organizations are co-curricular groups committed to enhancing your academic and professional growth. These groups range from student chapters of professional organizations to groups of students who share similar backgrounds or interests. Participating in these groups is a great way to meet new people, learn more about your major, make professional connections and have fun. To contact a student group, visit Hopkins Groups and search the group's name. This will bring you to their page where you can find additional information.

Hopkins Groups at Johns Hopkins University is located at <https://johnshopkins.campuslabs.com/engage/>



American Academy of Environmental Engineers & Scientists (AAEES)

Formed in Spring 2014, the Johns Hopkins University Student Chapter of the American Academy of Environmental Engineers & Scientists (AAEES), is housed within the Department of Geography and Environmental Engineering. Its mission is to support and “benefit environmental engineering and

environmental science undergraduate and/or graduate students and related engineering and scientific disciplines” (www.aaees.org).

Interested?

For more information, please email aaeesjhu@gmail.com.

American Institute of Chemical Engineers / Society for Biological Engineering (AIChE/SBE)

In January 2007, the student chapter of the American Institute of Chemical Engineers (AIChE) changed its name to the American Institute of Chemical Engineers / Society for Biological Engineering (AIChE/SBE) to reflect the organization’s shift in focus to incorporating both biological engineering and chemical engineering affairs. AIChE/SBE is committed to furthering the educational experience of chemical and biomolecular engineering students and all other interested students at Johns Hopkins. The chapter’s mission is to create a network of upstanding undergraduate students dedicated to chemical and biomolecular engineering and the pursuit of knowledge. The chapter serves as a liaison between the student body, the department faculty, and chemical and biological engineering professionals in industry. The main purposes of the chapter are to organize social activities, educational forums, and inspirational talks, and to facilitate social interaction amongst students, professors, and professionals.

Some of our events include...

- Networking Events: AIChE/SBE hosts networking events throughout the semester where we bring in alumni and professionals

working in the chemical and biological engineering professions in industry, consulting, government, etc. to expose undergraduates to professional opportunities available to them and to help them develop important networking skills. Annually occurring events include Alumni, Grad School, Research and Internship Panels. Employers that have visited in the past include DuPont, WR Grace and Deloitte among others that we continue to form partnerships with.

- Fall BBQ: AIChE/SBE hosts one picnic annually where faculty members and students chat along with enjoying grilled food.
- Spring formal: An annual event where students and professors from the Chemical & Biomolecular Engineering Department celebrate the end of the year with food, dance and a traditional senior video honoring the graduating class.

Interested?

View our organization on Hopkins Groups or e-mail aiche.hopkins@gmail.com to request being placed on the mailing list. E-board elections take place every Spring (exception is Fall for freshman class reps) and are open to all ChemBE undergraduates!

American Society of Civil Engineers (ASCE)

Our goal as an organization is to provide a social forum for civil engineering students to network, collaborate on engineering projects, participate in service projects, and otherwise enrich their education with extracurricular, civil engineering-based opportunities.

What we do:

What we do:

- We sponsor field trips to interesting sites in the area. Past trips have included local construction projects such as the Susquehanna River Bridge, Woodrow Wilson Bridge, and our own Gilman Hall.
- We sponsor trips to monthly ASCE Maryland Chapter meetings where students and practicing engineers can network and socialize.
- We sponsor trips to monthly ASCE SEI Maryland Section meetings where students can participate in technical presentations, field trips, and social events.
- We host a BBQ on campus every fall and spring, which brings together students, faculty, and staff from the department.
- We compete against the mechanical engineers in flag football, and hope to add more sports and games in the battle over Latrobe Hall.
- We build a mini-golf hole for the Maryland Section ASCE Annual Indoor Golf Tournament, which is a charity event that raises money for scholarships for the local universities including our own. The “tournament” consists of building and setting up holes in the morning at a hotel and then returning for a fun night of food, mini-golf, and socializing with local practicing engineers as well as other civil engineering students from neighboring universities.
- Our chapter is involved in community service. We currently help test and break bridges in the high school Maryland Wood Bridge Challenge and we regularly participate in President's Day of Service.

Interested?

Email us at asce.jhuchapter@gmail.com. Be sure to show up to the department pizza party for incoming freshmen to meet the officers and learn more about being an active member in our student chapter.



The JHU ASME chapter aims to enhance students' academic and professional aspirations by providing them with opportunities to get involved with research and to find internships. The chapter also organizes social events that allow students to interact and connect with other students, faculty members, alumni, and engineering professionals in the Baltimore area.

What we do:

Lunch with a Professor Series: Through these lunches, the chapter provides students with the opportunity to interact with professors and other faculty members in a casual setting outside of class. These lunches also provide students with an excellent opportunity to get involved with research as these professors are often seeking to hire students as undergraduate research assistants.

Baltimore ASME Trips: The chapter attends trips with the Baltimore ASME chapter to facilities related to mechanical engineering. Recent trips have included Camden Yards and Fort McHenry Tunnel.

Mentorship Program: Through the mentorship program, the chapter pairs new mechanical engineering students with upperclassmen. This program allows for new students to learn about opportunities in the department and to better adjust to life at Hopkins.

Alumni Connections and Jobs Database: A number of alumni members support our efforts and help students build their careers. By connecting students with these alumni and offering students the opportunity to be mentored by a member of our alumni, the chapter hopes to provide students with the ability to find an internship or job that fits their interests and career aspirations.

Interested?

Email us at asme.jhu@gmail.com.



Association for Computing Machinery (ACM)

We are the JHU student chapter of the Association for Computing Machinery, the first international computing organization. On campus, we are a student organization “dedicated to promoting the knowledge and use of computers and information technology through the free exchange of ideas and information.” Really, we just love computers. We break new computers, we fix old computers, and we have a museum of antique computers, which still play a mean game of NetHack. We hold meetings each week, which vary between talks from members of the community and more social events. We have hosted talks by Google and Microsoft, among other exciting companies. When students lead ACM meetings, they teach members about topics ranging from 3D Printing to software libraries such as Glib, to privacy in social media.



Some things we do:

- Housed in Malone Hall, our office has a magnetic card reader so any member can hang out in the lab, get work done, or find other like-minded students.
- Offer a computer cluster to our members for parallel computation, VM hosting, and Minecraft. If you want to work on our systems, let us know and we'll show you around!
- We host a GNU Mailman mailing list server for the JHU community. We take spare computer parts from the hall, apply kilo-ohm resistors to them, and call them our own.
- We also run other network services for the JHU community.
- In addition to our local activities, we host a regional programming contest that attracts bright undergraduates from around the northeastern United States.

Interested?

To become a member of ACM, you must attend three meetings. Membership gives you an account on our servers, an email address, web hosting, and card access to our office for life. For more information, you can find us on Hopkins Groups.

Biomedical Engineering Society (BMES)

Our mission:

“To promote awareness of biomedical engineering knowledge and its utilization”
– *National BMES*

The BMES chapter at Johns Hopkins is a student-run organization dedicated to serving the BME community. In addition to providing academic services, BMES also hosts social events, which serve to foster a sense of camaraderie among students and faculty.

What we do:

- Graduate/Medical School Advising Session: Puzzled by the medical or graduate school admission process? Attend our advising session, and listen to guest speakers from the BME department and medical campus speak on the latest in admission strategy.

- BME Winter Social: A wonderful evening for the entire Hopkins BME community where students, staff, and faculty mingle with each other. Enjoy fully catered hors d'oeuvres, and music by the Hopkins Jazz Band for a relaxing night.
- Student Mentor Program: Each incoming freshman is assigned an upperclassman (selected through an application process) who will provide academic and social guidance.
- Socials: Fall dessert socials, spring picnics, movie nights.

Interested?

All students whose declared major is BME will automatically receive event announcements from BMES. Dedicated students should email jhu.bmes@gmail.com for volunteer opportunities, and there are opportunities in the fall for freshmen to apply to the BMES board. For more information, visit our Hopkins Groups page.

Design, Build, Fly

The Design Build Fly (DBF) team members are united by their keen interest in flight vehicles. Together they learn about the design of micro air vehicles including their structure, aerodynamics and controls. Each year they design one or more platforms and perform test flights. They also participate in a national competition where they showcase their airplane in challenging missions, and compete against other teams from around the country.

Earthquake Engineering Research Institute (EERI)

Earthquake Engineering Research Institute (EERI)
The objective of the Earthquake Engineering Research Institute (EERI) is to reduce earthquake risk by (1) advancing the science and practice of earthquake engineering, (2) improving understanding of the impact of earthquakes on the physical, social, economic, political, and cultural environment, and (3) advocating comprehensive and realistic measures for reducing the harmful effects of earthquakes. The EERI Johns Hopkins Student Chapter contributes to these objectives by holding special seminars and sharing information, news, and recent scientific advances regarding earthquake engineering and seismic risk mitigation with undergraduate and graduate students.

Engineers Without Borders (EWB)

Engineers Without Borders-USA seeks to partner with disadvantaged communities to improve their daily quality of life through the implementation of environmentally and economically sustainable engineering projects while developing internationally responsible engineering students. As undergraduate students at Johns Hopkins University, we share the university's long-standing interests and commitment to public health, human welfare, and environmental responsibility, and we therefore intend to apply our own abilities and time toward the fulfillment of this mission. For more info, visit the national EWB- USA website at www.ewb-usa.org and the Johns Hopkins chapter website at <http://ewb.jhu.edu>.

What we do:

- Developmental projects with partnered communities. These projects are partnerships between students, faculty, professional engineers, and the host community. Students work on the designs of the projects during the semester, and small teams are formed to travel to the communities to implement the projects during breaks.



- In the last year, EWB-JHU worked on two international projects in Guatemala and Sierra Leone. While these specific projects are related to water, energy and the structural needs of the communities, they incorporate the work of many engineering disciplines. EWB-JHU has also been working on two local projects in Baltimore. One with a local middle school and the other on a small green space in south Baltimore.
- In addition to engineering students, students from various majors such as health sciences, anthropology, international relations, writing seminars and economics can contribute to the successful implementation of the projects. In short, any student can participate in EWB!
- Members attend general body meetings, project meetings, guest speaker events, social events, and fundraisers.

Why get involved?

- Learn about different cultures
- Gain important analytical thinking and problem solving skills relevant to a variety of careers
- Have unique engineering experiences with other college students
- Help communities in developing nations
- Build your knowledge and abilities
- Make a difference in the lives of others
- Build something of lasting value
- Give yourself outstanding opportunities for personal growth

Interested?

Email us at ewb.jhu@gmail.com or visit us at www.facebook.com/jhuewbusa/.

Engineering World Health (EWH)

The mission of the JHU Chapter of Engineering World Health is to improve healthcare in developing world countries by designing, building, and repairing medical equipment. To reach this goal, we collaborate with undergraduate students, graduate students, professors, and engineering experts. We seek to apply our knowledge and skills to find creative solutions to real healthcare problems.

What we do:

EWH at JHU is involved in three primary outreaches. Our design teams focus on designing creative, affordable, and long-lasting medical devices to solve health problems in the developing world. In addition to design team, EWH at JHU is involved in building medical devices using biomedical instrumentation kits from the national Engineering World Health organization. We hold Build Days during the school year in which the Hopkins student body

is invited to learn the basics of soldering and circuitry, while aiding our efforts to improve world health. We are able to provide: hands-on training with practical electronics fabrication skills, insight and understanding of important biomedical engineering concepts, and the ability to build devices distributed throughout hospitals in developing countries. Lastly, we also have Speaker Series, in which experts present useful and exciting information to interested students. These presentations can be on a wide array of topics, from how to get a summer internship to how to stop the spread of disease in developing nations.

Interested?

Please contact us at jhuewh@gmail.com to join our mailing list, and visit our page on Hopkins Groups. Be sure to join us at our Fall 2018 meetings!



Hopkins Aerospace Design Club, "Hopkinauts"

The Hopkins Aerospace Design Club, or the "Hopkinauts", aim to offer Space System design opportunities to undergraduates. The chance for students to apply classroom knowledge to real engineering problems presents tremendous learning opportunity.

The Hopkinauts will bring that gap with a long run goal is to design, build and launch a nanosat. The Hopkinauts will enter AIAA/AAS competitions to build experience and hope to win a NASA grant for a Cubesat.

Hopkins Baja, "Blue Jays Racing"

The Johns Hopkins University Baja Team, otherwise known as Blue Jay Racing, is a student-run design/build team in the Department of Mechanical Engineering. Participation as a member of the team is open to all undergraduate students. The program was founded in 2004 and competes annually in three international events organized and executed by the International Society of Automotive Engineers (SAE International). Additionally, Blue Jay Racing has numerous corporate and academic sponsors which support the design/build process.

Student team members take part in designing, building, and racing a single seat off-road vehicle against approximately 200 teams representing university engineering programs from 14 nations. The award-winning program offers young engineers an educational experience that goes beyond what the classroom can offer. In addition to technical knowledge gained during the design/build process, students also learn critical team-building skills which will be extremely important in the development of each individual's ability to become leaders in academia and/or industry.

HopHacks

We are HopHacks, a student-run group which organizes Johns Hopkins University's bi-annual 36-hour general hackathon event of the same name. A hackathon is an event where hundreds of students form groups and work together to bring their software or hardware ideas to life. Hackathons provide nurturing environments with mentorship, food, space, and time for students to work on projects that can turn into startups, or to learn new technologies and skills that prepare them for the real world. We attract sponsor companies such as Facebook, Google, Microsoft, and Bloomberg, who send representatives to our

events to provide mentorship, recruit students, and provide swag. As a group, we organize transportation, food, accommodations, and gather sponsors to come to Homewood to interact with students who represent a wide spectrum of universities on the East Coast (or even the West Coast!), including Johns Hopkins. Our aim as an organization is to promote Computer Science and the spirit of learning and building. With Computer Science currently standing as the second most popular major at Johns Hopkins, we want to give students the opportunity to use our resources and pursue their greatest ideas at one of our events.

Hopkins Rocketry, "AstroJays"

The JHU Rocketry Team (the AstroJays) is an interdisciplinary team of students that designs, builds, and launches high-powered rockets. Our mission is to improve upon an innovative science and engineering community for rocket and space science enthusiasts at JHU. We proudly provide more opportunities in aerospace and related disciplines for students of all majors and skill levels.

The team is split into six subsystems (Avionics, Payload, Propulsion, Recovery, Simulations, and Structure) that work together on projects to bring them to completion.

- Avionics designs and programs the on-board and grounded electronics that control the rocket's functions.
- Payload oversees the implementation of an experimental payload onto the rocket.
- Propulsion researches, develops, and builds rocket engines, including hybrid- and liquid-fuel motors.

- Recovery develops unique and reusable systems to safely bring the rocket back to earth.
- Simulations models flight path and other important data of the rocket from launch to descent.
- Structure builds the body of the rocket and oversees its crucial structural components.

What We Do:

The AstroJays compete annually in the Spaceport America Cup, the world's largest intercollegiate rocketry competition hosted by Virgin Galactic and the Experimental Sounding Rocket Association. Throughout the year, the team works on researching, designing, developing, testing, and implementing new and experimental aerospace solutions.

Interested? Visit us at Hopkins Groups and www.facebook.com/HopkinsRocketry/ to see photos and posts of what we're working on now.

Hopkins Undergraduate Society for Applied Mathematics (HUSAM)

The Hopkins Undergraduate Society for Applied Mathematics (HUSAM) is an active community of applied mathematics and statistics undergraduates whose goal is to advance educational and professional opportunities in the mathematical sciences for Johns Hopkins University undergraduates as well as the broader community. HUSAM brings together the applied mathematics community through campus events which provide career information, academic research, professional networking, general

enrichment, and broad social opportunities. We host experts and alumni from different mathematical sciences professions, popular speakers, corporate recruiters, and we organize social gatherings. Aside from this, HUSAM bridges between students and faculty at Johns Hopkins. Membership is free and open to all, and the members are a dynamic and exciting group of individuals from all walks of life. Please feel free to contact us for more information.

Institute of Electrical and Electronic Engineers (IEEE)

The Johns Hopkins University student chapter of the Institute of Electrical and Electronic Engineers strives to promote the career opportunities available and to raise awareness of new developments in the field among electrical and computer engineering students by fostering interaction among students, faculty, employers and professional engineers.

What we do:

- JHU IEEE hosts a series of speakers from various companies and organizations to discuss their experiences as electrical or computer engineers in industry or academia.

- We also host barbecues in the fall and spring and monthly movie nights in the winter as study breaks for ECE students.

Interested?

JHU IEEE will be at the student activities fair for incoming freshmen and we will be having a social during the first week of school.

For more information, look for us on www.facebook.com/ieee.jhu and on Hopkins Groups.

Materials Research Society (MRS)

The Materials Research Society brings together scientists, engineers and research managers from industry, government, academia and research laboratories to share findings in the research and development of new materials of technological importance.

What we do:

- Field trips to Materials-related companies and agencies, such as National Institute of Standards & Technology (NIST), Army

Research Lab (ARL), and Reactive NanoTechnology (RNT)

- Departmental social events
- Networking and social events with materials science professionals in the DC area
- Attend departmental and interdepartmental seminars and national conference

Interested?

For more information, look for us on Hopkins Groups!

MedHacks

MedHacks is the nation's premier medical Hackathon. Hosted at the Johns Hopkins Hospital every fall, MedHacks brings over 750 participants from all around the world and studying various fields including public health, computer science, and bioengineering together for 76 hours of interdisciplinary

hacking. Projects that come out of MedHacks often go on to join incubators, have IP filed on their inventions, and turn into full-fledged and heavily funded startups. Join MedHacks to be a part of the next wave of innovation in medicine!

National Society of Black Engineers (NSBE)

We are the Johns Hopkins University Chapter of NSBE, the National Society of Black Engineers. We are a student run organization committed to the recruitment, retention, and successful graduation of blacks and other minorities in engineering and other related technical and scientific fields. NSBE also acts as a vehicle to promote unity, emphasize effective leadership, and provide an organizational support network. The mission of this society is to increase the number of culturally responsible black engineers who excel academically, succeed professionally, and positively impact the community. We want to put special emphases on minorities because we want to reach everyone. Anyone can join NSBE.

What we do:

- Attend NSBE's phenomenal conferences, where we get the chance to network with students from around the country, land internships from top companies and institutions, win prizes and scholarships, and much more.
- Host workshops to help students polish their resumes, learn how to effectively manage their money, and tackle other related responsibilities. Most programs are sponsored by companies.

- Sponsor and coordinate programs to help both the members as well as others in the community, including Engineering Day where we invite high school and junior high students to a day full of interesting facts and fun-filled activities that get them interested in engineering and S.I.F.E. (Science is for Everyone) where we help elementary and middle school students with math and science concepts at a local church, and our Pre-College Initiative (PCI) Program at Milford Mill High School.
- Last but not least, we host game nights and social gatherings to offer a diversion or two for your social life!

Interested?

NSBE holds general body meetings where all students are welcome. We hope you will gain meaningful experiences and networks through our NSBE chapter. You can visit our national website at www.nsbe.org and find more information at about our local on Hopkins Groups. You can also email us at nsbe.jhu@gmail.com. We look forward to meeting you soon.



Optical Society of America (OSA Student Chapter)

The Optical Society at Johns Hopkins was founded in 2013 with the goal of promoting awareness about optical sciences and optical engineering. Our primary affiliation is with the department of Electrical and Computer Engineering. We are the hub for anything light related. We actively host events that include

ice-cream socials, career talks, intersession courses and Hopkins wide photonics conference. We also have a directory of all the labs across the university that use light in their research. Contact us and we will be happy to help you get started with your optics career. (<https://engineering.jhu.edu/ece/osa/>)

oSTEM

Who we are:

Out in Science, Technology, Engineering & Mathematics (oSTEM) is a national student society dedicated to increasing the participation of people who identify with lesbian, gay, bisexual, transgender, queer, or ally (LGBTQA) communities in disciplines related to science, technology, engineering, or mathematics (STEM).

Our mission:

- To serve and affirm people who identify as LGBTQA.
- To promote the participation from and development of LGBTQA communities in STEM disciplines.
- To educate and develop students of STEM disciplines, preparing them for graduation.
- To support and contribute to the dynamic network sustained by oSTEM Incorporated.
- To provide education, outreach, and professional resources to students on campus.
- To actively recruit and address the needs of diverse LGBTQA groups within the University community, inclusive of those who are historically underrepresented with regards to gender, gender identity or expression, and ethnic background.

- To actively recruit and address the needs of diverse LGBTQA groups within the University community, inclusive of those who are historically underrepresented with regards to gender, gender identity or expression, and ethnic background.

What we do:

- Host talks by prominent figures of the LGBTQA community.
- Co-sponsor events with other local oSTEM chapters and LGBTQA organizations.
- Attend yearly oSTEM National Conferences for professional development, workshops, networking, etc.
- Professional development workshops for building resumes, cover letters, business cards.
- Panel discussions on topics such as: Being out in the workplace, Academia vs. Industry vs. Government.
- Host social events to connect with the Hopkins LGBTQA community.

Interested?

Attend our bi-weekly general body meetings and other events. Contact ostem.jhu@gmail.com for more information.

Mechanical Engineering and Engineering Mechanics juniors and seniors who demonstrate high academic and service achievement can be inducted into the Tau Alpha Chapter of Pi Tau Sigma, the national honorary mechanical engineering fraternity. Members, who are inducted twice yearly, are invited to participate in service-oriented events that benefit the entire Mechanical Engineering community.

We are a project based club that provides Hopkins students with the resources to build robots. If you have an idea for robotics project, we want to hear about it!

We hold weekly meetings for members to collaborate and form design teams to work on the projects they're interested in. We also hold technical workshops where anyone can start learning how to use the tools that bring designs and ideas into reality.

Some past projects include a musical staircase, outdoor gaming theater, Segway tour guide, guitar playing robot, and hexacopter.

Society for Biomaterials (SFB)

The purpose of this student chapter of the Society for Biomaterials (SFB) at JHU is to encourage the development, dissemination, integration and utilization of knowledge in the field of biologically related materials among students and faculty of the Johns Hopkins University with members of industry, government research facilities, and other academic institutions.

Our activities include:

- Seminars and lectures by experts in the biomaterials field
- Trips to biomaterials conferences
- Field trips to industrial, corporate and government labs
- Advising sessions for underclassmen
- Exploring research and internship opportunities for members

Interested?

Email us at jhu.sfb@gmail.com or visit us at www.jhubiomaterials.com for more information.



Society of Hispanic Professional Engineers (SHPE)

SHPE is a national organization that promotes the development of Hispanics in engineering, science, and other technical professions to achieve educational excellence, economic opportunity, and social equity.

Our chapter's goals are to:

- Increase the number of Latino engineering and science students at JHU.
- Promote the advancement of Latino engineers and scientists in employment and education.
- Develop and participate in programs with industry and the university.
- Provide a forum for the exchange of information pertinent for Latino engineering/science students enrolled in JHU.

- Create a learning environment where Latino engineers/scientists feel comfortable asking for help and where they can receive the proper advice.

What we do:

- Host professional development meetings and guest speakers.
- Attend regional and national conferences, including the National Technical Career Conference, where students participate in workshops that will help them advance as professionals, meet representatives from graduate schools, and have the opportunity to interview with corporations.
- Community outreach programs.
- And of course, social events!

Interested?

Visit our webpage on Hopkins Groups and email us at hopkins.shpe@gmail.com.



Society of Women Engineers (SWE)

The Society of Women Engineers, or SWE, is a national organization committed to supporting women in engineering. At Johns Hopkins University, female engineers are approximately 32% of the population in the Whiting School of Engineering. The JHU Chapter of SWE is dedicated to providing opportunities for this population to socialize and network both within the university and with local professional engineers and engineering firms. We also support opportunities to serve the community, with a focus on encouraging middle and high school girls to pursue careers in engineering, science, and math.sue careers in engineering, science, and math.

What we do:

- Monthly meetings (industry presentations, roundtable discussions with faculty, panels, and more!)
- Outreach programs Introduce a Girl to Engineering Day and Ready, Set, Design!
- Social events (ice cream social)
- Annual networking banquet with students, faculty, and industry representatives

Interested?

- Email us at swe@jhu.edu or visit our website, <http://pages.jh.edu/~swe/>
- Sign up at the Student Activities Fair
- Come to the Ice Cream Social during the first few weeks of school

Tau Beta Pi (Engineering Honor Society)

“Tau Beta Pi is the only engineering society representing the entire engineering profession. It is the nation’s second-oldest society, founded at Lehigh University in 1885 to recognize students of distinguished scholarship and exemplary character.” (National website) For more info visit the national Tau Beta Pi website at www.tbp.org.

What we do:

- Mentoring events — we invite underclassmen to ask current TBP members for advising information concerning classes, majors, and careers.
- Service events — TBP members participate in service events in the school and local community.

- Speaker events — professionals from industry and academia are invited to share their experiences with members and offer advice on future professional endeavors.

Becoming a member:

The top 1/5 of the senior class and the top 1/8 of the junior class are invited to join Tau Beta Pi. However, many of our activities are open to and for the benefit of all students and will be publicized throughout the year. If you would like to learn more, contact us at jhutbp@gmail.com.

Theta Tau (Professional Engineering Fraternity)

Theta Tau is recognized as the nation's oldest and the premiere co-ed professional engineering fraternity. The Theta Delta chapter of Theta Tau was installed in May 2011 at the Johns Hopkins University.

What we do:

The purpose of Theta Tau is to develop and maintain a high standard of professional interest among its members, and to unite them in a strong bond of fraternal fellowship. Some opportunities provided to members are:

- Professional development and networking with speakers from different fields of engineering.
- Opportunity to travel to other chapters around the area, including UPenn, GWU.
- Scholarships through the Theta Tau Education Foundation
- Participate in national engineering projects and competitions

How to join:

Theta Tau carefully follows a program in the selection and development of its members that stresses the importance of high professional ethics and exemplary practices. At the beginning of both the fall and spring semesters, there are open rush events and information sessions. Candidates must submit their resume, be interviewed, go through a six week pledging process and then finally be initiated as a brother into Theta Tau.

Interested?

Email us at jhuthetatau@gmail.com or visit us on our Hopkins Groups page and at www.facebook.com/jhuthetatau.

Women in Computer Science (ACM-W)

Women in Computer Science is a student organization that is an ACM-W chapter. On campus, we promote diversity in computing by hosting events and mentorship opportunities within the department. We have weekly meetings for students to meet one another and everyone is welcome to attend.

If you'd like to learn more about what we do, visit our website at <http://wics.acm.jhu.edu> and our Page on Hopkins Groups.



PROFESSIONAL SOCIETIES/ ASSOCIATIONS

Alpha Kappa Psi (AKPsi) at the Johns Hopkins University is the premier co-ed business fraternity in the world with over 250 chapters in the United States, Europe and Canada. The Rho Psi Chapter at Hopkins focuses its activities on professional development and brotherhood. AKPsi organizes many business-related networking and speaker events during the academic year for Hopkins undergrads. Notable alumni of AKPsi include Sam Walton, Richard Nixon, Ronald Reagan, Mr. J.C. Penney and countless others. To learn more, visit our page on Hopkins Groups.

The JHU undergraduate chapter of the national **American Marketing Association (AMA)** was established in December 2008. AMA student members are connected to a network of 40,000 experienced marketers throughout the U.S., including leading marketing academics, researchers and practitioners from every industry. Our mission is to provide members with valuable opportunities in the marketing field, to network with established businesses and professionals, and to practice marketing skills through volunteer community involvement. To learn more, visit our page on Hopkins Groups.

JHU TAMID is Israel Business Group that is student-run, apolitical, areligious organization that seeks to develop the professional skills of undergraduate students through hands-on interaction with the Israeli and American economies. JHU TAMID provides undergraduate students with an education on the Israeli and American economies. Members will have the unique opportunity to consult for major Israeli tech firms and help run an investment fund that specializes in the Tel Aviv Stock Exchange. Members also have opportunities to work and

intern with leading global companies in the technology, healthcare and finance industries. The nationally renowned Tamid Israel Investment Group, headquartered in Washington D.C., has chapters on 24 campuses nationwide and has an international chapter in Israel. To learn more, visit our page on Hopkins Groups.

OTHER BUSINESS RELATED GROUPS

JHU Undergraduate Consulting Club aims to help the undergraduate student body learn more about consulting as a career track. We host events and provide resources that give students insight into the field of consulting and connect them with recruiters from firms. This will facilitate our members becoming competitive candidates for entry-level and internships positions within consulting firms. To learn more, visit: <https://www.facebook.com/jhubca/>

Marshal L. Salant Student Investment Team provides Hopkins undergraduate students the opportunity to make actual investment decisions while managing a portfolio. By participating in this highly competitive investment program, students will receive a unique business experience that will enhance their career opportunities. A portion of any profits earned by the portfolio will be dedicated to providing scholarship support for undergraduate students in the Schools of Engineering and Arts & Sciences. The Marshal L. Salant Student Investment Program is jointly sponsored by the Whiting School of Engineering, the Zanvyl Krieger School of Arts & Sciences, and the Office of Investment Management. To learn more, visit our page on Hopkins Groups.

Oral Presentation Club aims to provide an encouraging environment for students to develop public speaking abilities, practice giving presentations and improve overall communication skills. All students, regardless of

their background in public speaking, are welcome to join us as we collectively work to further our capabilities in oral communication. For more info visit our page on Hopkins Groups.

Women in Business at Johns Hopkins University was created with the goal of expanding the network of undergraduate women interested business careers. The group provides resources to discover which field is right for each individual and presents women opportunities to pursue their field of interest. Events include student and alumni panels, networking events, career advancement workshops and a mentorship program. For more information, visit our page on Hopkins Groups and contact jhuwib@gmail.com

TCO Labs, Inc. is a 501(c)(3) nonprofit organization with a student group chapter at Johns Hopkins University focused on building a stronger entrepreneurial ecosystem at the JHU Homewood campus and getting students involved in Baltimore's innovation community. TCO runs the student-venture incubator on campus, The Hatchery, which works with 10-12 student team every semester to help them take their ideas to the next level. Additionally, TCO host a variety of events, from workshops to entire conferences focused on entrepreneurship, as well as works with school departments to incorporate entrepreneurship into academic programs. Finally, we connect students to opportunities at startups at Hopkins and in Baltimore for contract work, internships, and full-time positions. We are always looking for motivated students to join one of our eight functional teams: Marketing, Finance, Programming, Technology, Outreach, Incubation (Hatchery), Media/Design, and Blogging. jhu.opclub@gmail.com.

SOCIAL ENTREPRENEURSHIP

Hopkins AND I aims to instruct high school student athletes about the importance of enrolling in college. Through a simple, focused, interactive program curriculum, Hopkins student tutors work directly with high school student athletes to prepare them for college and teach them effective studying habits. Hopkins AND I tutors help student athletes with all subject matters to increase their chances of gaining NCAA eligibility. AND I tutors will implement a combination of homework assistance and SAT/ACT practice and preparation one day a week for the entire school year. With consistent progress reports and weekly practice on basic math, reading and writing skills, AND I tutors will be able to gauge the improvement of each student.

Hopkins Student Enterprises (HSE)

is part corporation, part student group, part classroom and part internship all rolled into one. HSE provides valuable resources to student entrepreneurs on the Hopkins campus. Whether your business idea is completely off-the-wall or a simple improvement to an existing business, HSE has an opportunity for you. By developing your business ideas through HSE, you'll make a lasting impact at Hopkins. After you graduate, your business stays at the university, serving customers and educating student entrepreneurs for years to come. To learn more, visit our page on Hopkins Groups and at <http://hse.jhu.edu>.

Students Consulting for Non-Profit Organizations (SCNO)

is a national organization of undergraduate students committed to developing communities through pro bono consulting engagements with non-profit organizations. The Johns Hopkins Chapter carries out these engagements with a focus on sustainable business. We believe the future health and success of an organization is equally, if not more important, than addressing current issues. For more information, visit our page on Hopkins Groups.

Course Listings



This section describes the courses most commonly taken by engineering freshmen. This is by no means a comprehensive listing of all the courses that are available to you. The full list of Fall 2018 courses can be found online at <https://sis.jhu.edu/classes/>. You should use the information on the website to pick the specific lecture and section times for the courses you plan to take. As you select your courses, keep in mind that first-semester engineering students are allowed to register for a maximum of 18.5 credits. Credit overloads WILL NOT be permitted.

If you are entering the university with Advanced Placement (AP), International Baccalaureate (IB), General Certificate of Examination (GCE), or other foreign examination credit and take an equivalent course at JHU for credit, then the AP/IB/GCE (and/or other foreign exam) credits will be removed. Please see pages 46-49 in the [First-Year Academic Guide](#) for information on examination credit and JHU course equivalencies.

If there is room in your schedule, consider adding a 1-credit HEART course (EN.500.111) to your fall courseload. For details, see www.engineering.jhu.edu/HEART.

Krieger School of Arts & Sciences Courses (AS)

BIOLOGY

FRESHMEN SEMINAR: TUBERCULOSIS (1).....020.106 (N)

Horner • Freshmen only • Limit 12 per section • 2 sections

Mycobacterium tuberculosis is an extremely successful intracellular bacterial pathogen able to manipulate phagocytic cells and its own metabolism to survive within a host. The molecular mechanisms of this survival and resistance to antibiotics will be studied.

PROJECT LAB: PHAGE HUNTING (2).....020.135 (N)

Fisher • Freshmen only • Limit 22

This is an introductory course open to all freshman regardless of intended major. No science background is required. This is the first semester of a year-long research-based project lab course in which students will participate in a nation-wide program in collaboration with undergraduates at other colleges. Students will isolate and characterize novel bacteriophages (viruses that infect bacteria) from the environment using modern molecular biological techniques. The course includes two lab meetings per week. Continues in the spring. Each semester provides 2 credit hours of Natural Sciences (N) distribution credits.

GENERAL BIOLOGY I (5).....020.151 (N)

Pearlman/Roberson/Shingles • Limit 305 per section • 2 sections • Offered Fall only

This course is an introduction to biology from an evolutionary, molecular and cellular perspective. Specific topics and themes include evolutionary theory, the structure and function of biological molecules, mechanisms of harvesting energy, cell division, classical genetics and gene expression. This section will involve in-class problem solving and the use of assigned pre-class videos and questions.

GENERAL BIOLOGY LAB I (1).....020.153 (N)

Pearlman • Coreq: 020.151 • Limit 72 per section • 5 sections • Offered Fall only

This course reinforces the topics covered in AS.020.151. Students participate in a semester-long project, identifying bacteria from Homewood campus soils using molecular biology techniques. Other laboratory exercises cover aspects of evolution, genomics and biochemistry. Cross-listed with Behavioral Biology. Student must have enrolled in AS.020.151 either this term or in past terms. Students who have credit for AP Biology but take General Biology Lab I will lose four credits of AP Biology credit. Cross-listed with Behavioral Biology.

CURRENT EVENTS IN BIOLOGY (1).....020.161 (N)

Pearlman • Limit 19 per section

In this lively and collaborative course, students discuss current events and controversies in biology ranging from bioterrorism to the health of the Chesapeake Bay.

CHEMISTRY

INTRODUCTORY CHEMISTRY I (3).....030.101 (N)

Goldberg/Thyagarajan • Corequisite: 030.105 • Limit 340 per section • 2 sections • Offered Fall & Summer only

Switching sections requires instructor's approval.

An introduction to the fundamental principles of chemistry. The main topics are atomic and molecular structure at the level of electron dot structures and VSEPR geometries, the periodic table, stoichiometry and the balancing of chemical equations, the gas laws, the law of mass action and chemical equilibrium, acids and bases, and elementary chemical thermodynamics.

APPLIED CHEMICAL EQUILIBRIUM AND REACTIVITY W/LAB (4)..... 030.103 (N)

McQueen • Prereq: AP chemistry or similar advanced chemistry experience • Limit varies per section • 10 sections
This course is designed for freshmen who have previously taken AP chemistry or have similar advanced chemistry experience. This course will review an advanced introductory chemistry sequence in a single semester. Chemical equilibrium, reactivity and bonding will be covered. These topics will be explored through the use of laboratory experiments and problem solving, and the use of these principles in current research areas will be discussed.

INTRODUCTORY CHEMISTRY LABORATORY (1).....030.105 (N)

Pasternack/Thyagarajan • Coreq: 030.101 • Limit varies per section • 7 sections • Offered Fall & Summer only
Laboratory in the fundamental methods of chemistry with related calculations. Note: Midterm exams will be held on select Wednesdays at 8am, announced the first day of class. They will not conflict with AS.020.151 (General Biology) exams.

CHEMISTRY WITH PROBLEM SOLVING I (0)..... 030.112

Greco/Hill • Coreq: 030.101 or 030.102 • Limit 24 per section • 2 sections • Section selection should match 030.101 section
This course is for students who have had moderate or limited exposure to the subject. Special emphasis is placed on scientific problem-solving skills. There are two discussion sections per week, including one devoted exclusively to interactive quantitative problem solving. A typical student may have taken a year of descriptive chemistry as a high school sophomore, but has not been exposed to the problem-solving mathematical approach used in university-level science courses.

THE SCIENCE OF COLOR (3).....030.118 (N)

Young • Limit 18 • 2 sections

As we look around us, we are surrounded by colors - from the vivid palette provided by the natural world to the brightly colored clothing we wear. This course is designed to introduce students to the fundamental physical and chemical origins of color and how we perceive them, starting with electromagnetic waves and the electromagnetic spectrum, leading into what light is, the current quantum-mechanical understanding of light, and how it interacts with matter. From there we will progress into the chemistry of color, studying aspects of all three core chemistry fields. For organic chemistry, students will learn the origins and modern development of organic dyes and move onto more advanced topics such as how extended conjugation causes organic compounds to appear colored. The inorganic portion will investigate pigments utilized throughout human history, facilitating discussions on colored metal complexes and electronic transitions. Finally, for the physical chemistry component, the course will draw on the instructor's fields of research (spectroscopy), providing insight into atomic spectra, fluorescence and phosphorescence, and how color and light are studied and used in various physical and analytical techniques to study matter.

ORGANIC CHEMISTRY I (4).....030.205 (N)

Falzone/Greenberg/Tovar/Townsend • Prereq: 030.102 OR 030.103 OR 030.204

Limit varies per section • 3 sections • Section 3 is freshmen only • Offered Fall & Summer only

The fundamental chemistry of the compounds of carbon. Methods of structure determination and synthesis. The mechanisms of typical organic reactions and the relations between physical and chemical properties and structures.

ECONOMICS

ELEMENTS OF MACROECONOMICS (3) 180.101 (S)

Barbera • Limit 18 per section • 24 sections

An introduction to the economic system and economic analysis, with emphasis on total national income and output, employment, the price level and inflation, money, the government budget, the national debt, and interest rates. The role of public policy. Applications of economic analysis to government and personal decisions. Prerequisite: basic facility with graphs and algebra.

ENGLISH

INTRODUCTION TO LITERARY STUDY (3)..... 060.107 (H,W)

Thompson • Limit 20 • Approval Required

This course serves as an introduction to the basic methods of and critical approaches to the study of literature. Some sections may have further individual topic descriptions; please check in SIS when searching for courses. Special Notes: Students must request an approval for this course by adding the course to their enrollment cart and enrolling as you normally would; students will remain in "pending" status until they are approved, typically within 24 hours, if a seat is available. All questions should be directed to Tracy Glink at tglink1@jhu.edu.

EXPOSITORY WRITING (3)..... 060.113 (H,W)

Staff • Limit 15 per section • 23 sections

"Expos" is designed to introduce more confident student writers to the elements of academic argument. Students learn to apply the paradigm of academic argument in academic essays of their own. Classes are capped at 15 students and organized around four major writing assignments. Each course guides students' practice through pre-writing, drafting, and revising, and includes discussions, workshops, and tutorials with the instructor. In addition to its central focus on the elements of academic argument, each "Expos" course teaches students to document sources correctly and provides its own topic or theme to engage students' writing and thinking. Please note: Each course has a different topic. Individual instructors and course titles for AS.060.113 will be posted on June 20th on the EWP web site at: <http://krieger.jhu.edu/ewp/courses/courses-fall.html>. This course is meant to be a small class experience. Enrollment limits will be strictly enforced. "Expos" courses are available to freshmen, sophomores, and juniors, and to seniors by special permission.

MATHEMATICS

Please see page 70 in the First-Year Academic Guide for information about the JHU mathematics placement test.

CALCULUS I (4)..... 110.108 (Q)

Staff • Limit 30 per section • 5 sections • Offered Fall & Summer only

Differential and integral calculus. Includes analytic geometry, functions, limits, integrals and derivatives, polar coordinates, parametric equations, Taylor's theorem and applications, infinite sequences and series. Some applications to the physical sciences and engineering will be discussed, and the courses are designed to meet the needs of students in these disciplines.

CALCULUS II (4)..... 110.109 (Q)

Wang • Prereq: C- or better in 110.108 or credit for Calculus I by AP or other recognized exam • Limit varies per section 10 sections

Differential and integral calculus. Includes analytic geometry, functions, limits, integrals and derivatives, polar coordinates, parametric equations, Taylor's theorem and applications, infinite sequences and series. Some applications to the physical sciences and engineering will be discussed, and the courses are designed to meet the needs of students in these disciplines.

HONORS ONE VARIABLE CALCULUS (4)..... 110.113 (Q)

Staff • Limit 30

This is an honors alternative to the Calculus sequences AS.110.106-AS.110.107 or AS.110.108-AS.110.109 and meets the general requirement for both Calculus I and Calculus II (although the credit hours count for only one course). It is a more theoretical treatment of one variable differential and integral calculus and is based on our modern understanding of the real number system as explained by Cantor, Dedekind, and Weierstrass. Students who want to know the "why's and how's" of Calculus will find this course rewarding. Previous background in Calculus is not assumed. Students will learn differential Calculus (derivatives, differentiation, chain rule, optimization, related rates, etc), the theory of integration, the fundamental theorem(s) of Calculus, applications of integration, and Taylor series. Students should have a strong ability to learn mathematics quickly and on a higher level than that of the regular Calculus sequences.

LINEAR ALGEBRA (4)..... 110.201 (Q)

Tang • Prereq: A 5 on the AP BC exam or C- or better in 110.107, 110.109, or 110.113 • Limit 30 per section • 6 sections
Vector spaces, matrices, and linear transformations. Solutions to systems of linear equations. Eigenvalues, eigenvectors, and diagonalization of matrices. Applications to differential equations.

CALCULUS III (4)..... 110.202 (Q)

Riehl • Prereq: A 5 on the AP BC exam or C- or better in 110.107, 110.109, or 110.113, 110.202, or 110.302
30 per section • 12 sections
Calculus of functions of more than one variable: partial derivatives; multiple integrals, line and surface integrals; Green's theorem, Stokes' Theorem, and Gauss' Divergence Theorem.

HONORS LINEAR ALGEBRA (4)..... 110.212 (Q)

Wilson • Prereq: A 5 on the AP BC exam or B+ or better in 110.107, 110.109, 110.202 or 110.302 • Limit 19
This course includes the material in AS.110.201 with some additional applications and theory. Recommended for mathematically able students majoring in physical science, engineering, or mathematics. AS.110.211-AS.110.212 used to be an integrated yearlong course, but now the two are independent courses and can be taken in either order. This course satisfies a requirement for the math major that the nonhonors version does not.

DIFFERENTIAL EQUATIONS WITH APPLICATIONS (4)..... 110.302 (Q)

Staff • Prereq: A 5 on the AP BC exam or C- or better in 110.107, 110.109, 110.113, 110.201, 110.202, 110.211, or 110.212
Limit 30 per section • 9 sections

This is an applied course in ordinary differential equations, which is primarily for students in the biological, physical and social sciences, and engineering. The purpose of the course is to familiarize the student with the techniques of solving ordinary differential equations. The specific subjects to be covered include first order differential equations, second order linear differential equations, applications to electric circuits, oscillation of solutions, power series solutions, systems of linear differential equations, autonomous systems, Laplace transforms and linear differential equations, mathematical models (e.g., in the sciences or economics).

PHYSICS AND ASTRONOMY

GENERAL PHYSICS FOR PHYSICAL SCIENCE MAJORS I (4)..... 171.101 (E,N)

Swartz • Recommended Coreqs: 110.106, 110.108, or 110.113 AND 173.111 • Limit 24 per section • 7 Sections
Some sections freshmen only • Offered Fall, Spring, & Summer

First semester of two-semester sequence. In this term, the topics covered include the basic principles of classical mechanics and fluids as well as an introduction to wave motion. Midterm exams are given at 8am Fridays, so students must leave their schedules open at this time in order to be able to take these exams.

GENERAL PHYSICS FOR PHYSICAL SCIENCE MAJORS II (4)..... 171.102 (E,N)

Maksimovic • Prereq: C- or better in 171.101, 171.103, 171.105 or 171.107 or 530.123 • Coreq: 110.107 or 110.109 AND 173.112 • Limit 24 per section • 6 sections • Offered Fall, Spring, & Summer

Second semester of two-semester sequence. In this term, the topics covered include wave motion, electricity and magnetism, optics, and modern physics. Midterm exams are given at 8am Thursdays, so students must leave their schedules open at this time in order to be able to take these exams.

CLASSICAL MECHANICS I (4)..... 171.105 (E,N)

Robbins • Recommended Coreqs: 110.108 AND 173.115 • Limits vary per section • 2 sections

An in-depth introduction to classical mechanics intended for physics majors/minors and other students with a strong interest in physics. This course treats fewer topics than 171.101 and 171.103 but with greater mathematical sophistication. It is particularly recommended for students who intend to take 171.201-202 or 171.309-310.

GENERAL PHYSICS FOR PHYSICAL SCIENCES MAJORS I (AL) (4)..... 171.107 (E,N)

Leheny/Wyse • Recommended Cores: 110.106, 110.108, or 110.113 AND 173.111 • Limit 21 per section • 8 sections

This course is the first part of a two-semester sequence in general physics is identical in subject matter to 171.101-102.

The first course covers mechanics, heat and sound, but differs in instructional format. Rather than being presented via lectures and discussion sections, it is instead taught in an "active learning" style with most class time given to small group problem-solving guided by instructors. Midterm exams for every section are given during the 8 AM section time!

Accordingly, students registering for sections at times other than 8 AM must retain availability for 8 AM sections as needed.

SUBATOMIC WORLD (3)..... 171.113 (N)

Blumenfeld • Limit 44

Introduction to concepts of physics of the subatomic world: Symmetries, relativity, quanta, neutrinos, particles, and fields. Emphasis on ideas of modern physics, not on the mathematics. Intended for nonscience majors.

SPECIAL RELATIVITY AND WAVES (4)..... 171.201 (E,N)

Reich • Prereq: 171.106 (preferred) or 171.108 or 171.102 or 171.104 AND 110.107 or 110.109 or 110.113

Coreq: 110.202 or 110.211 • Limit 20 per section • 2 sections

Course continues introductory physics sequence (begins with 171.105-106). Special theory of relativity, mathematics of waves, harmonic oscillation, forced and damped oscillators, electromagnetic waves, diffraction, and interference.

Meets with 171.207.

GENERAL PHYSICS LAB I (1)..... 173.111 (N)

Chien/Mumford • Coreq: 171.101, 171.103, or 171.107 • Limit 24 per section • 23 sections

Offered Fall, Spring & Summer

Experiments performed in the lab provide further illustration of the principles discussed in General Physics. Students are required to take this course concurrently with General Physics unless they already have received credit for the lab. Note: First and second terms must be taken in sequence.

GENERAL PHYSICS LAB II (1)..... 173.112 (N)

Chien/Mumford • Recommended Prereq: 173.111 • Coreq: 171.102, 171.104, or 171.108 • Limit 24 per section

6 sections • Offered Fall, Spring & Summer

Experiments are chosen from both physical and biological sciences and are designed to give students background in experimental techniques as well as to reinforce physical principles.

CLASSICAL MECHANICS LABORATORY (1)..... 173.115 (N)

Chien/Mumford • Coreq: 171.105 • Limit 36 • 1 section

Experiments chosen to complement the lecture course Classical Mechanics I, II, 171.105-106 and introduce students to experimental techniques and statistical analysis.

WRITING SEMINARS

FICTION/POETRY WRITING I (3)..... 220.105 (H,W)

Staff • Limit 15 per section • 21 sections

A course in realist fiction and traditional verse, with readings in Eudora Welty, Vladimir Nabokov, Henry James, Robert Frost, Paul Fussell, John Gardner, Seamus Heane, and Gwendolyn Brooks. This first course for writers is a study of forms of short fiction and metered verse. Students compose short stories and poems; includes practice of critical attention to literary models and workshop of student writing. This course is a prerequisite for most upper level courses. This course is part one of the year-long Introduction to Fiction and Poetry, and must be taken before AS.220.106.

Whiting School of Engineering Courses (EN)

APPLIED MATHEMATICS AND STATISTICS

INTRODUCTION TO APPLIED MATHEMATICS AND STATISTICS (1)..... 553.100 (E,Q)

Bichuch • Limit 45

A seminar-style series of lectures and assignments to acquaint the student with a range of intellectual and professional activities performed by applied mathematicians and statisticians. Problems arising in applied mathematics and statistics are presented by department faculty and outside speakers. Recommended Course Background: one semester of Calculus.

DISCRETE MATHEMATICS (4).....553.171 (Q)

Torcaso • Prereq: Four years of high school mathematics • Limit varies per section • 6 sections

Introduction to the mathematics of finite systems. Logic; Boolean algebra; induction and recursion; sets, functions, relations, equivalence, and partially ordered sets; elementary combinatorics; modular arithmetic and the Euclidean algorithm; group theory; permutations and symmetry groups; graph theory. Selected applications. The concept of a proof and development of the ability to recognize and construct proofs are part of the course.

INTRODUCTION TO MATHEMATICAL PROGRAMMING (4).....553.281 (E,Q)

Lebair • Prereq: AS.110.107 or AS.110.109 or AS.110.113 AND AS.110.201 or AS.110.212 or EN.553.291 • Limit 25

This course introduces a variety of techniques for solving optimization problems in engineering and science on a computer using MATLAB. Topics include the programming language MATLAB, as well as optimization theory, algorithms, and applications. MATLAB optimization tools will also be explored. Algorithms to be covered will include gradient descent, Newton's method, and the simplex method. Applications will include constrained least squares regression, neural networks, and k-means clustering.

LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS (4).....553.291 (E,Q)

Athavale • Prereq: 110.106 or 110.108 AND 110.107 or 110.109 • Limit 25 per section • 2 Sections

An introduction to the basic concepts of linear algebra, matrix theory, and differential equations that are used widely in modern engineering and science. Intended for engineering and science majors whose program does not permit taking both 110.201 and 110.302

BIOMEDICAL ENGINEERING

BME MODELING & DESIGN (2)..... 580.111 (E,N)

Haase/Logsdon/Boyle • B/ME Freshmen only • Limit 5 per section • 28 Sections

Working in teams with upperclassmen this course (1) introduces biomedical engineering freshmen to an orderly method for analyzing and modeling biological systems and (2) introduces engineering principles to solve design problems that are biological, physiological, and/or medical. Freshmen are expected to use the informational content being taught in calculus, physics and chemistry and to apply this knowledge to the solution of practical problems encountered in biomedical engineering.

CHEMICAL & BIOMOLECULAR ENGINEERING

CHEMICAL ENGINEERING TODAY (I)..... 540.101 (E)

Wan • Freshmen only • Limit 135

A series of weekly lectures to introduce students to chemical and biomolecular engineering and its role as a profession in addressing contemporary technological, social, ethical, and economic issues in today's world. The lectures will include examples of how chemical and biomolecular engineers apply the principles of physics and chemistry to develop new products, improve process efficiencies, and alleviate the strain on the ecosystem through the design of novel environmentally conscious processes. In addition, the lectures will highlight exciting new areas now being advanced by chemical and biomolecular engineers, such as biochemical engineering, tissue engineering, nanoparticle fabrication, and processing smart polymers for applications in computer technology and as sensors.

CIVIL ENGINEERING

FRESHMAN EXPERIENCES IN CIVIL ENGINEERING (I)..... 560.101(E)

Sangree • Freshmen Only • Limit 19

An introduction to civil engineering for first-year students. This course welcomes freshmen to the major by exploring civil engineering design and the range of design projects in which professional civil engineers engage. Students will have the opportunity to practice the design process using hands-on team-based projects, with emphasis on creative design, graphical communication, and teamwork.



COMPUTER SCIENCE

INTERMEDIATE PROGRAMMING (4).....601.220 (E)

Staff • Prereq: AP CS, 601.107, 601.111/112 or equiv. • Limit 34 per section • 4 sections

This course teaches intermediate to advanced programming, using C and C++. (Prior knowledge of these languages is not expected.) We will cover low-level programming techniques, as well as object-oriented class design, and the use of class libraries. Specific topics include pointers, dynamic memory allocation, polymorphism, overloading, inheritance, templates, collections, exceptions, and others as time permits. Students are expected to learn syntax and some language specific features independently. Course work involves significant programming projects in both languages.

DATA STRUCTURES (4).....601.226 (E,Q)

Schatz • Recommended Prereqs: AP CS, 601.107, 601.220, or equivalent • Limit 125

This course covers the design and implementation of data structures including arrays, stacks, queues, linked lists, binary trees, heaps, balanced trees (e.g. 2-3 trees, AVL-trees) and graphs. Other topics include sorting, hashing, memory allocation, and garbage collection. Course work involves both written homework and Java programming assignments.

ELECTRICAL & COMPUTER ENGINEERING

INTRODUCTION TO ELECTRICAL AND

COMPUTER ENGINEERING (3).....520.137 (E,Q)

Tran • Freshmen only • Limit 60

An introductory course covering the principles of electrical engineering including sinusoidal wave forms, electrical measurements, digital circuits, and applications of electrical and computer engineering. Laboratory exercises, the use of computers, and a design project are included in the course.

ENTREPRENEURSHIP AND MANAGEMENT

INTRODUCTION TO BUSINESS (4)..... 660.105 (S)

Aronhime • Limit varies per section • 9 sections • Section 9 is for Clark Scholars only

This course is designed as an introduction to the terms, concepts, and values of business and management. The course comprises three broad categories: the economic, financial, and corporate context of business activities; the organization and management of business enterprises; and, the marketing and production of goods and services. Topic specific readings, short case studies and financial exercises all focus on the bases for managerial decisions as well as the long and short-term implications of those decisions in a global environment.

PRINCIPLES OF FINANCE (3)..... 660.200

Sun • Limit 19

This course covers central issues in financial management and corporate finance. Students will learn how financial managers make investment, financing and other decisions and what are the tools they use to reach such decisions. Topics covered include time value of money, risk, valuation, capital structure, capital budgeting, dividend policy and mean-variance portfolio selection. The course provides the analytical tools and the financial theories needed to implement sound financial decisions within a corporation (and outside of a corporation). Ideas are presented in a cohesive way within the framework of the no-arbitrage principle, the fundamental principle shaping all aspects of modern finance. Command of the subject is crucially important for anyone considering a career not only in investment banking, investment management or trading, but also in general management, corporate strategy, management consulting, entrepreneurship, and the non-profit world.

FINANCIAL ACCOUNTING (3).....660.203

Aronhime/Furlong/Leps • Limit varies per section • 5 sections

The course in Financial Accounting is designed for anyone who could be called upon to analyze and/or communicate financial results and/or make effective financial decisions in a for-profit business setting. No prior accounting knowledge or skill is required for successful completion of this course. Because accounting is described as the language of business, this course emphasizes the vocabulary, methods, and processes by which all business transactions are communicated. The accounting cycle, basic business transactions, internal controls, and preparation and understanding of financial statements including balance sheets, statements of income and cash flows are covered.

PRINCIPLES OF MARKETING (3)..... 660.250

Conley/Kendrick • Limit 40 per section • 3 sections

This course explores the role of marketing in society and within the organization. It examines the process of developing, pricing, promoting and distributing products to consumer and business markets and shows how marketing managers use the elements of the marketing mix to gain a competitive advantage. Through interactive, application-oriented exercises, case videotapes, a guest speaker (local marketer), and a group project, students will have ample opportunity to observe key marketing concepts in action. The group project requires each team to research the marketing plan for an existing product of its choice. Teams will analyze what is currently being done by the organization, choose one of the strategic growth alternatives studied, and recommend why this alternative should be adopted. The recommendations will include how the current marketing plan will need to be modified in order to implement this strategy and will be presented to the instructor in written form and presented to the class.

GENERAL ENGINEERING

WHAT IS ENGINEERING? (3)..... 500.101 (E)

Ayhan • Freshmen Only or Permission Required • Limit 35

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.

HOPKINS ENGINEERING SAMPLER SEMINAR (1)..... 500.103 (E)

Falk • Freshmen only • Limit 100

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.

HOPKINS ENGINEERING APPLICATIONS & RESEARCH TUTORIALS (HEART) (1).....500.111 (E)

Staff • Freshmen given priority • Limit 19 per section • 34 sections

The HEART program provides new undergraduate students with a window on cutting-edge engineering research and its applications to society. These small classes are taught by advanced graduate students and postdoctoral fellows. Students will be introduced to cutting-edge engineering research and learn how that research impacts society. These tutorials will be useful to students as they evaluate their potential role in research projects.

GATEWAY COMPUTING (3)..... 500.112 (E,N)

Staff • Freshmen only • Limit 19 per section • 8 sections

This course introduces fundamental programming concepts and techniques, and is intended for all who plan to develop computational artifacts or intelligently deploy computational tools in their studies and careers. Topics covered include the design and implementation of algorithms using variables, control structures, arrays, functions, files, testing, debugging, and structured program design. Elements of object-oriented programming, algorithmic efficiency and data visualization are also introduced. Students deploy programming to develop working solutions that address problems in engineering, science and other areas of contemporary interest that vary from section to section. Course homework involves significant programming. Attendance and participation in class sessions are expected.

ENVIRONMENTAL HEALTH AND ENGINEERING

INTRODUCTION TO ENVIRONMENTAL ENGINEERING (3)..... 570.108 (E)

Alavi • Limit 39

Overview of environmental engineering, including water and air quality, water supply and wastewater treatment, hazardous and solid waste management, pollution prevention, global environmental issues, public health considerations and environmental laws, regulations and ethics. Cross listed with Public Health Studies.

ECOLOGY (3)..... 570.205 (N)

Brush • Limit 45

Introduction to processes governing the organization of individual organisms into populations, communities, and ecosystems. Interactions between individual organisms, groups of organisms, and the environment, including adaptation, natural selection, competition.

ENVIRONMENT & SOCIETY (3)..... 570.222 (H,S)

Schoenberger • Limit 30

Humans make their living in the environment. How we do that changes nature and changes us. This class explores human impacts on the environment, how we have thought about our relationship to nature over the millennia, and contemporary environmental discourses.

MATERIALS SCIENCE AND ENGINEERING

FOUNDATIONS OF MATERIALS SCIENCE & ENGINEERING (3)..... 510.106 (E,N)

Ma • Limit 35

Basic principles of materials science and engineering and how they apply to the behavior of materials in the solid state. The relationship between electronic structure, chemical bonding, and crystal structure is developed. Attention is given to characterization of atomic and molecular arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors and polymers (including proteins). The processing and synthesis of these different categories of materials. Basics about the phase diagrams of alloys and mass transport in phase transformations. Introduction to materials behavior including their mechanical, chemical, electronic, magnetic, optical and biological properties.

MSE DESIGN TEAM I (3)..... 510.135 (E,N)

Wilson • Freshmen only • Limit 10

This course is the first half of a two-semester course sequence for freshmen majoring or double majoring in materials science and engineering (MSE). This course provides a broad exposure to various aspects of planning and conducting independent research in a team setting (3 to 6 students on each team). In this course, MSE freshmen working with a team leader and seniors on the team, apply their general knowledge in MSE to develop the solution to open-ended problems. The team will meet 150 minutes per week at a time to be designated by the instructor.

MECHANICAL ENGINEERING

MECHANICAL ENGINEERING UNDERGRADUATE SEMINAR I (.5)..... 530.107 (E)

Marra • *Mechanical Engineering, Engineering Mechanics, or Undecided Engineering freshmen* • Limit 60

A series of weekly seminars to inform students about careers in mechanical engineering and to discuss technological, social, ethical, legal, and economic issues relevant to the profession. Part I of a year-long sequence.

INTRO TO MECHE DESIGN & CAD (2)..... 530.111 (E)

Marra • *Mechanical Engineering, Engineering Mechanics, or Undecided Engineering Freshmen* • Limit 60

This course introduces students to the basic engineering design process and to fundamental concepts and knowledge used in the design of mechanical devices and systems. Students will explore the range of tools utilized in design practice, beginning with the skills of hand-drawing, exploring ways to articulate visual ideas, and concluding with the standards of presentation and CAD tools typical in professional practice.

MECHANICAL ENGINEERING FRESHMAN LABORATORY I (1)..... 530.115 (E)

Marra • *Mechanical Engineering, Engineering Mechanics, or Undecided Engineering Freshmen*

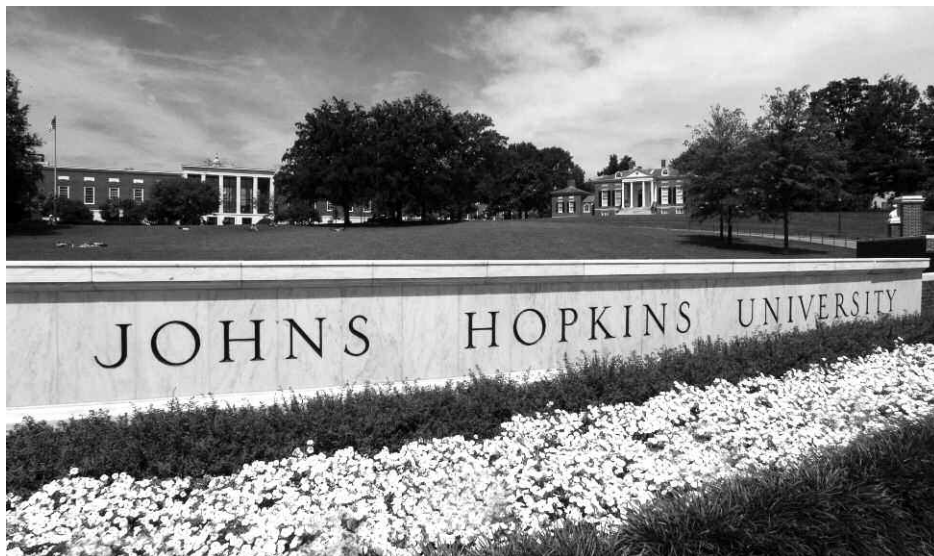
Limit 15 per section • 4 sections

Hands-on laboratory complementing EN.530.111, including experiments, mechanical dissections, sketching and CAD, and a cornerstone design project. Experiments and mechanical dissections connect physical principles to practical engineering applications. Sketching and CAD work build the students' design and communication skills. The design project allows students to synthesize a working system by combining knowledge of mechanics and design with practical engineering skills.

INTRO TO MECHANICS I (3)..... 530.123 (E)

Thomas • *Mechanical Engineering, Engineering Mechanics, or Undecided Engineering Freshmen* • Limit 60

This course offers an in-depth study of the fundamental elements of classical mechanics, including particle and rigid body kinematics and kinetics, and work-energy and momentum principles. Part I of a year-long sequence.



PROFESSIONAL COMMUNICATION PROGRAM

PROFESSIONAL WRITING & COMMUNICATION (3) 661.110 (W)
Staff • 19 per section • 7 sections

This course teaches students to communicate effectively with a wide variety of specialized and non-specialized audiences. Projects include production of resumes, cover letters, proposals, instructions, reports, and other relevant documents. Class emphasizes writing clearly and persuasively, creating appropriate visuals, developing oral presentation skills, working in collaborative groups, giving and receiving feedback, and simulating the real world environment in which most communication occurs.

PROFESSIONAL WRITING & COMMUNICATION FOR INTERNATIONAL STUDENTS (3)..... 661.111 (W)
Etzine • Limit 19

This course teaches ESL students to communicate effectively with a wide variety of specialized and non-specialized audiences and will provide ESL-specific help with grammar, pronunciation, and idiomatic expression in these different contexts. Projects include production of resumes, cover letters, proposals, instructions, reports, and other relevant documents. Class emphasizes writing clearly and persuasively, creating appropriate visuals, developing oral presentation skills, working in collaborative groups, giving and receiving feedback, and simulating the real world environment in which most communication occurs.

IMPROVISATIONAL TECHNIQUES FOR COMMUNICATION (3)..... 661.128
Forsyth/Hartwell • Limit 19 per section • 2 sections

Science and engineering are disciplines which mandate immersive study, attention to detail, and extreme forethought. Is it possible, then, that as students condition themselves to meet these needs, they compromise their ability to navigate impromptu social situations, public speaking events, and the like? Following the lead of innovative communities and businesses, this class turns to improvisation techniques to develop communication skills, encourage creative problem solving, and support teamwork. Through imaginative movement and play, improv encourages students to hone their abilities to initiate, listen, react, and connect. Using the power of "Yes, And...", improv's most famous aphorism, students learn to respond confidently and spontaneously to unforeseen challenges.

ORAL PRESENTATIONS (3)..... 661.250 (W)
Staff • Limit 13 per section • 7 sections

This course is designed to help students push through any anxieties about public speaking by immersing them in a practice-intensive environment. They learn how to speak with confidence in a variety of formats and venues - Including extemporaneous speaking, job interviewing, leading a discussion, presenting a technical speech, and other relevant scenarios. Students learn how to develop effective slides that capture the main point with ease and clarity, hone their message, improve their delivery skills, and write thought-provoking, well-organized speeches that hold an audience's attention.

ORAL PRESENTATIONS FOR INTERNATIONAL STUDENTS (3)..... 661.251 (W)
Davis • Limit 13

This course is designed to help students push through any anxieties about public speaking by immersing them in a practice-intensive environment. They learn how to speak with confidence in a variety of formats and venue— Including extemporaneous speaking, job interviewing, leading a discussion, presenting a technical speech, and other relevant scenarios. Students learn how to develop effective slides that capture the main point with ease and clarity, hone their message, improve their delivery skills, and write thought-provoking, well-organized speeches that hold an audience's attention. Special attention will be placed on diction, pronunciation, tone, pace and emphasis of language. Additional attention also will be given to syntax as well as non-verbal communication patterns. Not open to students that have taken EN.661.151



JOHNS HOPKINS

WHITING SCHOOL
of ENGINEERING