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 Freshman Academic Guide and Engineering 101 to get you started. The Academic Guide includes information for all freshmen 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!

Missy Kirby, Linda Moulton, Denise Shipley, and Janet Weise
Engineering Advising Staff

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**Academic Advising**

Engineering students have two advisors – a faculty 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 Advisors**

You will be assigned an engineering faculty advisor in your major 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 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 advisors:
- Except during orientation (when you have a set meeting time), getting in touch with your faculty 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 faculty 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 Freshman 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 Freshman 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 advisors. (It is, of course, possible to change your mind later!)

**Some additional information to help you plan:**
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 35-37 of the Freshman 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 14-17 of the Freshman 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 2016 courses can be found online at http://web.jhu.edu/registrar/schedule/index.html.
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 ISIS, which you can access through the portal (https://my.jh.edu). Registration dates are July 6 through July 22. The online-system operates between 7 a.m. and 9 p.m. (Eastern Daylight Time).

You can make changes to your schedule during the Schedule Adjustment period which begins July 23 and ends August 31, and also during the Add/Drop period from September 1- September 16. There are no charges for changes made during Schedule Adjustment or Add/Drop.
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 sequencings 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 (offered in fall and spring), 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.
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 (550.171), 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 110.201, or Honors Linear Algebra 110.212).

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.
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 (550.400) in the fall of your senior year followed by a senior thesis (550.501) 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 course schedule
<table>
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<tr>
<th>Fall Semester</th>
<th>Course #</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro to Applied</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mathematics &amp; Statistics 550.100</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Calculus II or III 110.109 or 110.202</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Discrete Mathematics 550.171</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Humanities/Soc Science Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Computing for Engineers &amp; Scientists 500.200</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Optional HEART course 500.111</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>16-17</strong></td>
<td></td>
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<table>
<thead>
<tr>
<th>Spring Semester</th>
<th>Course #</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>Calculus III 110.202</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Linear Algebra 110.201 or 110.212</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>or Differential Equations 110.302</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humanities/Soc Science elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Other elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>14</strong></td>
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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, and students meet with their faculty advisors to discuss modeling assignments. 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.

Schedule for a student beginning with Calculus II or III

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Course #</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Math Course*</td>
<td>171.101/107</td>
<td>4</td>
</tr>
<tr>
<td>Physics I</td>
<td>173.111</td>
<td>1</td>
</tr>
<tr>
<td>Intro Chemistry I</td>
<td>030.101</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry Lab I</td>
<td>030.105</td>
<td>1</td>
</tr>
<tr>
<td>BME Modeling and Design</td>
<td>580.111</td>
<td>2</td>
</tr>
<tr>
<td>Computer Programming or Humanities/Social Science Elective**</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
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</table>

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Course #</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Linear Algebra</td>
<td>110.201</td>
<td>4</td>
</tr>
<tr>
<td>or Differential Equations</td>
<td>110.302</td>
<td></td>
</tr>
<tr>
<td>Physics II</td>
<td>171.102/108</td>
<td>4</td>
</tr>
<tr>
<td>Physics II lab</td>
<td>173.112</td>
<td>1</td>
</tr>
<tr>
<td>Intro Chemistry II</td>
<td>030.102</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry Lab II</td>
<td>030.106</td>
<td>1</td>
</tr>
<tr>
<td>Computer Programming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or Humanities/Social Science Elective**</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BME in the Real World</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td>17</td>
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*Select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 15-17 in the Freshman 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.

**BME students are required to take one 3-credit programming course. There are a variety of programming courses available in the fall and spring semester.
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
- Material design
- Food industry
- Energy

Research in ChemBE yields new products that include:

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

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 and Biomolecular 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 two senior-level courses entitled “Chemical Engineering Laboratory” and “Chemical and Biomolecular Product and 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 one, 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.

Schedule for a student beginning with Calculus II or III

<table>
<thead>
<tr>
<th>Course #</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Calculus II</td>
<td>110.109</td>
</tr>
<tr>
<td>or Calculus III</td>
<td>110.202</td>
</tr>
<tr>
<td>Intro Chemistry I</td>
<td>030.101</td>
</tr>
<tr>
<td>Chemistry Lab I</td>
<td>030.105</td>
</tr>
<tr>
<td>Physics I</td>
<td>171.101/107</td>
</tr>
<tr>
<td>Physics I Lab</td>
<td>173.111</td>
</tr>
<tr>
<td>Chem &amp; Biomol Eng Today</td>
<td>540.101</td>
</tr>
<tr>
<td>Humanities/Soc Sci Elective</td>
<td>3</td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>500.111</td>
</tr>
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<td><strong>Total Credits</strong></td>
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Schedule for a student beginning with Calculus I

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<tbody>
<tr>
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</tr>
<tr>
<td>Intro Chemistry I</td>
<td>030.101</td>
</tr>
<tr>
<td>Chemistry Lab I</td>
<td>030.105</td>
</tr>
<tr>
<td>Physics I</td>
<td>171.101/107</td>
</tr>
<tr>
<td>Physics I Lab</td>
<td>173.111</td>
</tr>
<tr>
<td>Chem &amp; Biomol Eng Today</td>
<td>540.101</td>
</tr>
<tr>
<td>Humanities/Soc Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>500.111</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>17-18</strong></td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus II</td>
<td>110.109</td>
</tr>
<tr>
<td>Intro Chemistry II</td>
<td>030.102</td>
</tr>
<tr>
<td>Chemistry Lab II</td>
<td>030.106</td>
</tr>
<tr>
<td>Physics II</td>
<td>171.102/108</td>
</tr>
<tr>
<td>Humanities/Soc Science Elective</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>
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 incorporating the knowledge of material properties and how they respond 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 course schedule

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math course*</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Freshman Experiences in Civil Engineering</td>
<td>560.101</td>
<td>1</td>
</tr>
<tr>
<td>Intro Chemistry I</td>
<td>030.101</td>
<td>3</td>
</tr>
<tr>
<td>Intro Chemistry Laboratory I</td>
<td>030.105</td>
<td>1</td>
</tr>
<tr>
<td>Humanities, Social Science, or Writing Intensive course</td>
<td>(060.113, 660.105, or 661.110)</td>
<td>3</td>
</tr>
<tr>
<td>General Physics I</td>
<td>171.101/107</td>
<td>4</td>
</tr>
<tr>
<td>General Physics Lab I</td>
<td>173.111</td>
<td>1</td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>500.111</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>17-18</strong></td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math course*</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Writing Intensive course</td>
<td>(060.113, 660.105, or 661.110)</td>
<td>3</td>
</tr>
<tr>
<td>Perspectives on the Evolution of Structures</td>
<td>560.141</td>
<td>3</td>
</tr>
<tr>
<td>General Physics II</td>
<td>171.102/108</td>
<td>4</td>
</tr>
<tr>
<td>General Physics Lab II</td>
<td>173.112</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>15</strong></td>
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</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus I</td>
<td>110.108</td>
<td>4</td>
</tr>
<tr>
<td>Calculus II</td>
<td>110.109</td>
<td>4</td>
</tr>
<tr>
<td>Calculus III or Linear Algebra &amp; Differential Equations</td>
<td>110.202</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>550.291</td>
<td>4</td>
</tr>
</tbody>
</table>

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 computer 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 three student groups: ACM, UPE and WiCS. ACM is our chapter of the Association for Computing Machinery, which you can read about later in this booklet. 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 around exam time. WiCS is our Women in CS group which meets several times a semester for dinners with guest speakers, and also more regularly for informal "coding circles".

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, 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: www.cs.jhu.edu.
## 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.

---

**Option A**  
(with AP Computer Science, choose this one)

**Fall Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>#</th>
<th>Credit</th>
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<tbody>
<tr>
<td>Calculus I</td>
<td>110.108</td>
<td>4</td>
</tr>
<tr>
<td>or Calculus II (if 5 AP)</td>
<td>110.109</td>
<td></td>
</tr>
<tr>
<td>Discrete Math</td>
<td>550.171</td>
<td>4</td>
</tr>
<tr>
<td>Writing: 661.110, 220.105, 060.113</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Intermediate Programming</td>
<td>600.120.02</td>
<td>4</td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>500.111</td>
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</tr>
<tr>
<td><strong>Total Credits</strong></td>
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</table>

**Spring Semester**

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<thead>
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<th>#</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>Calculus II</td>
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<td>4</td>
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<tr>
<td>or other math</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics I</td>
<td>171.101</td>
<td>4</td>
</tr>
<tr>
<td>Physics I Lab</td>
<td>173.111</td>
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</tr>
<tr>
<td>H/S Elective</td>
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<tr>
<td>Data Structures</td>
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<td><strong>Total Credits</strong></td>
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**Option B**  
(without AP Computer Science, choose this one)

**Fall Semester**

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<tbody>
<tr>
<td>Calculus I</td>
<td>110.108</td>
<td>4</td>
</tr>
<tr>
<td>or Calculus II (if 5 AP)</td>
<td>110.109</td>
<td></td>
</tr>
<tr>
<td>Discrete Math</td>
<td>550.171</td>
<td>4</td>
</tr>
<tr>
<td>Writing: 661.110, 220.105, 060.113</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Intro Programming in Java</td>
<td>600.107.03</td>
<td>3</td>
</tr>
<tr>
<td>(if novice programmer, also 600.108)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>500.111</td>
<td>1</td>
</tr>
<tr>
<td>Optional H/S course</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
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**Spring Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>#</th>
<th>Credit</th>
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<tbody>
<tr>
<td>Calculus II</td>
<td>110.109</td>
<td>4</td>
</tr>
<tr>
<td>or other math</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics I</td>
<td>171.101</td>
<td>4</td>
</tr>
<tr>
<td>Physics I Lab</td>
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<tr>
<td>H/S elective</td>
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<tr>
<td>Intermediate Programming</td>
<td>600.120</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>
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:
• Circuits
• Signals and Systems
• Fields, Matter, and Waves
• 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 in lots of different places:
• Graduate and professional schools
• Communications & telecommunications firms
• Business
• Government and corporate labs
• Research and teaching
• Industrial labs

Recommended course schedule

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>Math course*</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Physics I</td>
<td>171.101/107</td>
</tr>
<tr>
<td></td>
<td>Physics Lab I</td>
<td>173.111</td>
</tr>
<tr>
<td></td>
<td>Intro to Elec/Comp Eng</td>
<td>520.137</td>
</tr>
<tr>
<td></td>
<td>Humanities/Soc Sci Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Optional HEART course</td>
<td>500.111</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>15-16</td>
</tr>
<tr>
<td>Spring Semester</td>
<td>Math course*</td>
<td>4</td>
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<tr>
<td></td>
<td>Physics II</td>
<td>171.102/108</td>
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<td></td>
<td>Physics II lab</td>
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<td></td>
<td>Digital Systems Fundamentals</td>
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<tr>
<td></td>
<td>ECE Team Project</td>
<td>520.212</td>
</tr>
<tr>
<td></td>
<td>Humanities/Soc Sci Elective or Intro to Programming in Java (for Comp Eng majors)</td>
<td>600.107</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

*You should select a math course according to your level of preparation (as indicated by AP Calculus or other exam score; see pages 15-17 in the Freshman 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

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 Geography and
Environmental Engineering (DoGEE) 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.

DoGEE 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 DoGEE department.

### Environmental Engineering

**Fall Semester**

<table>
<thead>
<tr>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus I, II, or III</td>
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</tr>
<tr>
<td>110.108, 109 or 202</td>
<td></td>
</tr>
<tr>
<td>Intro Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>030.101</td>
<td></td>
</tr>
<tr>
<td>Intro Chem Lab I</td>
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</tr>
<tr>
<td>030.105</td>
<td></td>
</tr>
<tr>
<td>Intro to Environ. Eng.</td>
<td>3</td>
</tr>
<tr>
<td>570.108</td>
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</tr>
<tr>
<td>Humanities/Soc Sci Elective</td>
<td>3</td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>1</td>
</tr>
<tr>
<td>500.111</td>
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**Total Credits** **14-15**

**Spring Semester**

<table>
<thead>
<tr>
<th>Course #</th>
<th>Credits</th>
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<tbody>
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<td>4</td>
</tr>
<tr>
<td>110.109, 202</td>
<td></td>
</tr>
<tr>
<td>Intro Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>030.102</td>
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</tr>
<tr>
<td>Intro Chem Lab II</td>
<td>1</td>
</tr>
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<td>030.106</td>
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<tr>
<td>Physics I</td>
<td>4</td>
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<td>171.101</td>
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<td>Physics I Lab</td>
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<td>173.111</td>
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<tr>
<td>Intro Computational &amp; Math Modeling</td>
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**Total Credits** **16**

### Geography

For a student beginning with Calculus II or III

**Fall Semester**

<table>
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<tr>
<td>or Calculus III</td>
<td>3/4</td>
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<tr>
<td>110.202</td>
<td></td>
</tr>
<tr>
<td>Intro Chemistry I</td>
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<tr>
<td>030.101</td>
<td></td>
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<tr>
<td>or Physics I</td>
<td>1</td>
</tr>
<tr>
<td>030.105</td>
<td></td>
</tr>
<tr>
<td>or Physics I Lab</td>
<td>3</td>
</tr>
<tr>
<td>171.101/107</td>
<td></td>
</tr>
<tr>
<td>Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>030.105</td>
<td></td>
</tr>
<tr>
<td>or Physics I Lab</td>
<td>3</td>
</tr>
<tr>
<td>173.111</td>
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</tr>
<tr>
<td>Humanities/Soc Sci Elective</td>
<td>3</td>
</tr>
<tr>
<td>Other Elective</td>
<td>3</td>
</tr>
<tr>
<td>Optional HEART course</td>
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</table>

**Total Credits** **14-16**

Schedule for a student beginning with Calculus I

**Fall Semester**

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
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<td>4</td>
</tr>
<tr>
<td>110.108</td>
<td></td>
</tr>
<tr>
<td>Intro Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>030.101</td>
<td></td>
</tr>
<tr>
<td>Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>030.105</td>
<td></td>
</tr>
<tr>
<td>Humanities/Soc Sci Elective</td>
<td>3</td>
</tr>
<tr>
<td>Other Elective</td>
<td>3</td>
</tr>
<tr>
<td>Optional HEART course</td>
<td>1</td>
</tr>
<tr>
<td>500.111</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits** **14-15**
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 course schedule

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall Semester</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculus I</td>
<td>110.108</td>
<td>4</td>
</tr>
<tr>
<td>or Calculus II</td>
<td>110.109</td>
<td></td>
</tr>
<tr>
<td>Intro Chemistry I</td>
<td>030.105</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry Lab I</td>
<td>030.105</td>
<td>1</td>
</tr>
<tr>
<td>Physics I</td>
<td>171.101/107</td>
<td>4</td>
</tr>
<tr>
<td>Physics Lab I</td>
<td>173.111</td>
<td>1</td>
</tr>
<tr>
<td>Foundation of MSE</td>
<td>510.106</td>
<td>3</td>
</tr>
<tr>
<td>Optional HEART course</td>
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<td>1</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>16-17</strong></td>
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<table>
<thead>
<tr>
<th>Semester</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring Semester</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculus II</td>
<td>110.109</td>
<td>4</td>
</tr>
<tr>
<td>or Calculus III</td>
<td>110.202</td>
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</tr>
<tr>
<td>Intro Chemistry II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or elective</td>
<td>030.102</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry lab II</td>
<td>030.106</td>
<td>1</td>
</tr>
<tr>
<td>Physics II</td>
<td>171.102/108</td>
<td>4</td>
</tr>
<tr>
<td>Physics Lab II</td>
<td>173.112</td>
<td>1</td>
</tr>
<tr>
<td>Comp &amp; Prog for</td>
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<td></td>
</tr>
<tr>
<td>Mats Sci &amp; Eng</td>
<td>510.202</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>16</strong></td>
<td></td>
</tr>
</tbody>
</table>

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.
THE MECHANICAL ENGINEERING 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 several concentrations and 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.

For example, 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 in this track can also participate in internships in organizations involved with aerospace engineering.

Opportunities within the university include the Applied Physics Laboratory (Satellites), the Center for Astrophysical Sciences (CAS) and the Space Telescope Science Institute (Hubble Space Telescope). In addition, local companies and institutions, such as Northrop Grumman (which is formally affiliated with the Mechanical Engineering Department as an Industrial Partner), NASA Goddard, Lockheed Martin, Orbital Sciences and other private corporations offer excellent internship opportunities.

Sample Mechanical Engineering Program

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Course #</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus I</td>
<td>110.108</td>
<td>4</td>
</tr>
<tr>
<td>Intro Chemistry I</td>
<td>030.101</td>
<td>3</td>
</tr>
<tr>
<td>Freshman Experiences I</td>
<td>530.101</td>
<td>2</td>
</tr>
<tr>
<td>Intro to Mechanics I</td>
<td>530.103</td>
<td>2</td>
</tr>
<tr>
<td>MechE Freshman Lab I</td>
<td>530.105</td>
<td>1</td>
</tr>
<tr>
<td>Writing:</td>
<td>060.113 or 220.105</td>
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</tr>
<tr>
<td>Optional HEART course</td>
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<td>1</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
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<tr>
<th>Spring Semester</th>
<th>Course #</th>
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<tbody>
<tr>
<td>Calculus II</td>
<td>110.109</td>
<td>4</td>
</tr>
<tr>
<td>Freshman Experiences II</td>
<td>530.102</td>
<td>2</td>
</tr>
<tr>
<td>Intro to Mechanics II</td>
<td>530.104</td>
<td>2</td>
</tr>
<tr>
<td>MechE Freshman Lab II</td>
<td>530.106</td>
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<td>HS Elective</td>
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<td><strong>Total Credits</strong></td>
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NOTE: If a student earns AP Physics credits, he or she MUST take the Physics laboratory courses, which include either 173.111 Physics Lab I or 530.105/106 Mechanical Engineering Freshman Lab I/II. 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 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 (EM) 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.

A 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. At the macroscopic length scale, biomechanics of both soft and hard tissues plays an important role in computer-integrated surgical systems and technologies (e.g., medical robotics). At the cellular level, issues such as cell motility and chemotaxis can be modeled as mechanical phenomena. At the subcellular level, conformational transitions in biological macromolecules can be modeled using molecular dynamics simulation (which is nothing more than computational Newtonian mechanics), statistical mechanics, or using coarse-grained techniques that rely on principles of the mechanics of materials. In addition, much of structural biology can be viewed from the perspective of Kinematics (e.g., finding spatial relationships in data from the Protein Data Bank).

Sample Engineering Mechanics Program

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Course #</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Calculus I</td>
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<td>Intro Chemistry I</td>
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<td>Intro engineering elective*</td>
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<tr>
<td>Writing:</td>
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</tr>
<tr>
<td>Basic science elective</td>
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<td><strong>Total Credits</strong></td>
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<table>
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<th>Course #</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Calculus II</td>
<td>110.109</td>
<td>4</td>
</tr>
<tr>
<td>General Physics I*</td>
<td>171.101</td>
<td>4</td>
</tr>
<tr>
<td>General Physics I Lab*</td>
<td>173.111</td>
<td>1</td>
</tr>
<tr>
<td>Computing elective*</td>
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<td></td>
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<tr>
<td>H/S elective</td>
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<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>15</strong></td>
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*NOTE: To meet the requirements for the introduction to engineering, computing, physics, and physics lab courses, it is recommended that EM students take 530.101/102 Freshman Experiences I/II, 530.103/104 Intro to Mechanics I/II, and 530.105/106 Mech E Freshman Lab I/II.
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).

Sample BA in General Engineering Program

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
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<tr>
<td>Calculus I or II</td>
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</tr>
<tr>
<td>or other math course</td>
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</tr>
<tr>
<td>Intro Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry Lab</td>
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</tr>
<tr>
<td>Intro Engineering course</td>
<td>1-3</td>
</tr>
<tr>
<td>Humanities/Social Science</td>
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<tr>
<td>or Elective course</td>
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<tr>
<td>Optional HEART course</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring Semester</strong></td>
<td></td>
</tr>
<tr>
<td>Calculus II or other</td>
<td>4</td>
</tr>
<tr>
<td>or other math course</td>
<td></td>
</tr>
<tr>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>General Physics Lab I</td>
<td>1</td>
</tr>
<tr>
<td>Computing course</td>
<td>3</td>
</tr>
<tr>
<td>Humanities/Social Science</td>
<td>3</td>
</tr>
<tr>
<td>or Elective course</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td>15</td>
</tr>
</tbody>
</table>
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 II or III**

**Fall Semester**  
Course | # | Credits  
--- | --- | ---  
Calculus II | 110.109 | 4  
or Calculus III | 110.202 | 4  
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

**Spring Semester**  
Course | # | Credits  
--- | --- | ---  
Calculus III | 110.202 | 4  
or other math | 110.xxx | 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  
Humanities/Soc Science Elective | | 3  
**Total Credits** | 16

**Schedule for a student beginning with Calculus I**

**Fall Semester**  
Course | # | Credits  
--- | --- | ---  
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

**Spring Semester**  
Course | # | Credits  
--- | --- | ---  
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
The Department of Computer Science offers an interdisciplinary minor in computer integrated surgery (CIS). To complete the minor in CIS, you will work with an advisor from the Laboratory for Computational Sensing and Robotics/the Engineering Research Center for Computer Integrated Surgical Systems and Technology (LCSR-ERC CISST). 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 EN.550.450), followed by the completion of at least 6 core course totaling at least 18 credits (to include the two, one-semester core courses). In addition, students enrolled in the minor are required to register for the Distinguished Seminars in Computational Medicine (EN.580.737) and attend no less than six seminars.

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

Robotics Minor

The faculty of the Laboratory for Computational Sensing and Robotics (LCSR), in collaboration with the academic departments and centers of the Whiting School of Engineering, offers a robotics minor in order to provide a structure in which undergraduate students at Johns Hopkins University can advance their knowledge in robotics while receiving recognition on their transcript for this pursuit. The minor is not "owned" by any one department, but rather it is managed by the LCSR itself. Any student from any department within the university can work toward the minor.

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.

Please visit http://lcsr.jhu.edu/robotics-minor/ for more details.
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.

• Three 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 Geography and Environmental Engineering. Contact Professor Erica Schoenberger, ericas@jhu.edu.
The primary goal of the Center for Leadership Education (CLE) is to provide Hopkins students with the knowledge and skills to become leaders in public and private for profit and non-profit enterprises. The center supports several academic programs and offers a variety of popular experiential learning programs.

The W. P. Carey Program in Entrepreneurship and Management (E&M) provides Homewood undergraduates 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.

By developing crucial communication skills, the Professional Communication Program (PCP) Students may take courses in professional and technical communication, presentations, research writing, copy writing, journalism, and social media.

All undergraduate courses offered by the CLE are open to students in the Whiting School of Engineering and the Krieger School of Arts and Sciences.

The center also supplies the five “management” courses the design seminar in the Master of Science in Engineering Management (MSEM) graduate program. Typically, selected Hopkins undergraduates can complete a concurrent BS and MSEM degree in five years and receive a 50% tuition fellowship for their MSEM degree.

In addition, the CLE also offers many experientially based programs to help students gain valuable real-world experience. Activities include Hopkins Student Enterprises, the annual JHU Business Plan Competition, the Marshal Salant Student Investment Team, an Oral Presentations Club, business internships for academic credit and business-minded student organizations and professional societies.

For more information about CLE programs, please visit http://web.jhu.edu/Leadership.

The W. P. Carey Program in Entrepreneurship & Management

The E&M program focuses on business from a multidisciplinary viewpoint and offers students a diversified learning experience that emphasizes the concepts, practices, and skills necessary for effective leadership. The program boasts a talented and dedicated faculty with many years of private enterprise experience in their respective fields. Several members of our faculty have been honored as outstanding instructors by the university and by the student body.

Students may pursue the highly popular minor in entrepreneurship and management. The minor has a flexible structure that enables students to get a broad fundamental business education while allowing them to specialize in their own interests. It also serves several different types of students: students working for a small or large corporation; or those starting a new business or social enterprise; students seeking careers in consulting or financial services; and those heading to medical school, an MBA program, law school or other graduate field. Engineering students often find that background in business is crucial for professional advancement. Employers are particularly interested in engineering students who have taken a variety of business courses and worked in multi-disciplinary teams.

Getting started...

There are several courses available to freshmen who wish to pursue the Entrepreneurship and Management minor. They are listed here; 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

Courses are also open to students who choose not to declare the minor.
The Marketing & Communications Program

The Marketing and Communications (M&C) program offers Johns Hopkins Arts & Sciences, Engineering and Peabody 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.

Getting Started…

There are several courses available to freshmen who wish to pursue the Marketing and Communications minor. They are listed here; please see the course listings section in the back of this guide for detailed course descriptions.

660.105 Introduction to Business
660.250 Principles of Marketing
661.110 (W) Professional Writing and Communication

The Professional Communication Program

Courses offered by the Professional Communication Program at Hopkins are designed to help students from all disciplines develop strong written and oral communication skills relevant to their educational and professional goals. Several courses in the Professional Communication Program are ideal for freshmen:

661.110 (W) Professional Writing and Communication
661.250 (W) Oral Presentations

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 those 400 level and above courses taken as an undergrad. On the management side, students participate in a cohort program, taking three full 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 all 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 semester, 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 center. CLE will fund approved businesses and, as the original founders graduate, the businesses remain at Hopkins—serving customers and educating a new group of
Business Internships
Gaining valuable work experience during college is critical for success as graduates compete with their peers for top jobs. 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 marketing, finance, and communications. 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 Marshall Salant Student Investment Team, Alpha Kappa Psi Business Fraternity, the JHU Chapter of the American Marketing Association, a microfinance club, a consulting group for non-profit organizations, and financial literacy and entrepreneurship training programs for Baltimore City youth. For more information about these organizations, please see pages 40 and 41.

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/.

http://web1.johnshopkins.edu/~hse/

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. http://bpc.jhu.edu

http://physicsastronomy.jhu.edu/undergraduate/minors/
If you are pursuing pre-med/health requirements (or even considering it), now is the time to download and read Guide One: Pre-Med and Pre-Health Planning at JHU (this publication is updated annually on or before June 1). Guide One includes an overview of pre-medical requirements, academic planning suggestions, advanced placement credit, covered grades, recommended courses, and more. It is essential that you download Guide One from http://studentaffairs.jhu.edu/preprofadvising/pre-medhealth/guides/.

**The Pre-Prof. Listserv**
During the summer before you arrive on campus, you will automatically be put on a pre-health listserv if you indicated interest in pre-health programs on your Advising Profile. It is important that all pre-med/health students at Hopkins be on the listserv to receive information on programs, events, class meetings, internships, volunteer opportunities, etc.

**Freshmen Group Appointments**
As a freshman interested in the health professions, you should plan to attend a “Freshman Group Appointment” at some point your first year. This is the step you will take prior to scheduling your first individual appointment with an advisor. Information on signing up for a Group Appointment will arrive via the listserv.

**The Pre-Prof. Newsletters**
The Pre-Health e-Newsletter is a bi-weekly publication of the Pre-Professional Office. The issues regularly include upcoming events, featured health professions, myths vs. facts, and announcements. The Pre-Health Opportunities Newsletter is distributed weekly and highlights internships, employment, research opportunities, and community service experiences of interest to pre-health students. Students subscribed to the pre-health listserv automatically receive both newsletters.
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. Dr. Lori Citti and 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 study abroad programs that directly support major and minor requirements. Students who are interested in an exchange program should consult Linda Moulton at lmoulton@jhu.edu in the Engineering Advising Office.

• Vredenburg Scholarship: This scholarship 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 scholarship 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 scholarship 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.

The Whiting School has also created the Johns Hopkins Semesters Abroad in Engineering and Entrepreneurship, fully articulated programs where JHU undergrads can study abroad and receive courses and credits towards their undergraduate engineering majors and Hopkins Degree. There are two options currently: fall semester at the Danish Technical University (DUS) just outside of Copenhagen, and spring semester at the Israel Institute of Technology (Technion) in Haifa, Israel. All required engineering classes will be offered as well as a range of engineering, entrepreneurship, and humanities electives. In addition, the spring semester offers students an internship for seven weeks.
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!
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)

Who we are…
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.

• Fall and Spring Picnics: AIChE/SBE hosts one picnic each semester. Along with enjoying grilled food, faculty members and students chat and participate in the faculty vs. student volleyball game.

• Game Night: An annual event where students and professors from the Chemical & Biomolecular Engineering Department get to know one another through friendly competition in a Texas Hold-Em Tournament.

Interested?
E-mail aiche.hopkins@gmail.com for information about meeting times.
Our mission:
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:
- We participate in student design competitions such as the EERI Undergraduate Seismic Design Competition, AISC Steel Bridge Competition, ASCE Concrete Canoe Competition, and CANstruction.
- We sponsor field trips to interesting sights 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?
Visit our website, www.ce/jhu.eduasce-dev/ or 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.
**Who we are:**
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.
**Who we are:**

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 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 compute cluster to our members for parallel computation, VM hosting, and Minecraft.
- 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.

**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, visit our website at http://acm.jhu.edu.
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. For more info, please consult the <About Us> page located at http://www.jhu.edu/bmes/.

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.
• Industry Tours: Go on a trip to actual BME companies and see what life would be like working in the BME industry.

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. Especially motivated freshmen with strong service records may apply for positions on the executive board in their spring semester.
PROFESSIONAL SOCIETIES/ASSOCIATIONS

Alpha Kappa Psi (AKPsi)
Alpha Kappa Psi (AKPsi) is the premier co-ed business fraternity in the world with more than 250 chapters in the United States, Europe and Canada. The Rho Psi Chapter at JHU focuses its activities on professional development and brotherhood. AKPsi organizes many business-related networking and speaker events during the academic year for Hopkins undergrads, including the annual Elevator Pitch Competition (EPC), where Hopkins undergrads have 90 seconds to present business ideas in front of industry judges. http://web1.johnshopkins.edu/akpsi

American Advertising Federation Johns Hopkins University Chapter
The American Advertising Federation is the nation’s oldest national advertising trade association with 100 blue chip corporate members from the nation’s leading advertisers, advertising agencies, and media companies with a national network of 200 local federations representing 40,000 advertising professionals. AAF is also known for its robust and highly supportive and active college program with more than 200 AAF college chapters and over 6,500 student members. It helps college student’s transition from academia to professional careers through:
- Student advertising competitions
- Career advice and guidance
- Club member discounts to participating retailers and service-providers
- Distinguished award and honor programs
- Industry mentors
- Internship programs
- Leadership
- Merit scholarships
- MOSAIC Center on multiculturalism
- Networking events with top agencies and corporate recruiters

American Marketing Association (AMA)
Johns Hopkins Chapter
The JHU undergraduate chapter of the national American Marketing Association is connected to a network of 40,000 experienced marketers throughout the U.S., including leading marketing academics, researchers and practitioners from every industry. Its 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. http://jhu.edu/ama/

Business in China Association
Business in China Association (BCA) is a student group that existed on campus since 2010, with a mission to bridge the East and the West and to improve broader Hopkins community’s understanding of business in China and business with China.

BCA has a unique standing among Hopkins Groups. BCA is a group different from other networking-oriented group, for it focuses on a specific category of topics and encourages more serious academic discussion on such issues. BCA is a group different from other cultural-oriented group, for it concerns beyond the West’s interest in Chinese culture, but responds to the rising demand in professional and career opportunities in China and industries that relate to China. BCA aims not just to foster the links between students of Chinese backgrounds but is open to all who aspire to know more about the region and the new opportunities incurred.

Finally, BCA is a group different from other symposium-oriented group, for bringing in speakers is just a method to bring forth our mission, bridging the East and the West and BCA set up its events within that specific framework.

Kairos Society
The Kairos Society is an international, student-run, not-for-profit foundation based in the United States. Kairos fosters a culture of innovation-driven entrepreneurship by engaging its diverse fellows with a variety of industry and thought leaders surrounding a wide range of global challenges. JHU Kairos holds meetings to review case studies of the ventures its fellows are pursuing and provide constructive feedback to help the fellows improve
their businesses. JHU Kairos also connects its entrepreneurs with technically skilled students interested in joining ventures, hosts speaker events and skills workshops, and sends fellows to regional and national Kairos functions. For more information about JHU Kairos, please email kairos@jhu.edu.

Golden Key International Honour Society
Golden Key is an international, interdisciplinary honor society which recognizes the top 15% of sophomores, juniors, and seniors from more than 400 colleges and universities around the world, including Hopkins. Golden Key provides students with countless opportunities to receive leadership training and experience. Members have the chance to attend leadership conferences and networking events, and search for exclusive jobs and internships through the Golden Key website. http://jhu.goldenkey.org/.

JHU Undergraduate Consulting Club (JHUCC)
JHUCC aims to help the undergraduates learn more about consulting as a career track. Events and resources are provided to give students insight into the field of consulting, advise them on interview preparation, and connect them with recruiters from highly-regarded consulting firms. This facilitates the students to become competitive candidates for entry level and internships positions within consulting firms.

MARSHAL L. SALANT STUDENT INVESTMENT TEAM
The Marshal L. Salant Student Investment Team provides a select group of Hopkins undergraduates the opportunity to make actual investment decisions while managing a portfolio that totals more than $250,000. By participating in this investment program, students receive a unique business experience that will enhance their career opportunities. A portion of profits earned by the portfolio is dedicated to providing need-based scholarship support for undergraduate students in the Schools of Engineering and Arts & Sciences. http://jhu.edu/salant/

SOCIAL ENTREPRENEURSHIP
Building Bright Ideas (BBI)
A 10-week entrepreneurship course designed for Baltimore City high school students, and taught by Hopkins undergrads. The high school students will learn important business, leadership and management skills that will prepare them for entrepreneurial ventures of their own. For more information or to get involved, contact buildingbrightideas@gmail.com.

Save the Future (STF)
Save the Future leverages the brainpower of business-savvy, socially-minded college undergraduates from Hopkins to teach personal money management skills to Baltimore-area high school students. It is an intensive, twelve week financial literacy course that exposes high school students to a college campus while they take advantage of 15+ hours of classroom instruction. http://www.savethefuture.org

Social Investment Outreach (SIO)
Social Investment Outreach (SIO) is a microfinance club at Hopkins dedicated to helping communities in less developed countries. Its goal is to provide underprivileged individuals with a means of helping themselves escape poverty through microcredit and sustainable community development. Upcoming SIO projects include traveling to Honduras to provide microloans, teach entrepreneurial skills, and fundraising techniques to provide loans to entrepreneurs in other underprivileged areas. To find out more, please email sio@jhu.edu.

Students Consulting for Non-Profit Organizations (SCNO)
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. It believes the future health and success of an organization is equally if not more important than addressing current issues. For more information, please visit: http://web1.johnshopkins.edu/scno.
Who we are:
CISSRS was founded in the March of 1998 in response to a growing need for educational support and student involvement in computer integrated surgery. CISSRS is associated with the NSF Computer-Integrated Surgery, Science, and Technology Engineering Research Center (CISST-ERC) and the Laboratory for Computational Sensing and Robotics (LCSR) on the Homewood Campus. The club's primary activity is organizing the JHU RoboCompetition, which is a robotics competition held annually on campus for high school and middle school students. CISSRS is principally comprised of graduate students and dedicated undergraduate students.

What we do:
- CISSRS annually organizes the JHU RoboCompetition, a single-day robotics competition for high school and middle school students.

What students say about CISSRS:
"The JHU RoboCompetition is a very rewarding experience. The competitors' excitement is infectious and at the end of the day you are left exhausted yet thoroughly convinced your efforts were worthwhile."

Interested?
For more information, email jhu.robo.comp@gmail.com or alison.morrow@jhu.edu.
Who we are:
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 http://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 three international projects in South Africa, Guatemala, and Ecuador. Although these specific projects are related to water and structural needs of the communities, these projects incorporate the work of many engineering disciplines. In addition, students from various majors such as health sciences, anthropology, international relations, 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 engineering skills
- 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/.
Our mission:
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 healthcare problems, and to learn new knowledge and skills to further our mission.

What we do:
EWH at JHU is involved in three primary outreaches. Our primary focus is designing creative, affordable, long-lasting medical devices to solve problems in developing world hospitals. Each year, we enter one design in a national EWH competition. In the fall of 2011 and 2013, we won third place in the design competition for our zinc-ion battery oxygen analyzer, a long-lasting and affordable alternative to traditional oxygen analyzers. This year, we plan to continue testing and refining our oxygen analyzer design and to build a prototype for our newest design, a smart phone based toco transducer and tocodynamometer. In addition to design team, EWH at JHU is involved in building medical devices that come in the form of 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 the 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.

Interested?
Please contact us at jhuewh@gmail.com to join our 2016-2017 mailing list, and visit us at https://johnshopkins.collegiatelink.net/organization/engineeringworldhealth and www.ewh.org. Be sure to join us at our fall 2016 meetings! Location and meeting times will be announced through JHU announcements.
Institute of Electrical and Electronic Engineers (IEEE)

Our mission:
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. For more info, visit the national IEEE website at: http://www.ieee.org or the JHU chapter website at http://ieee.ece.jhu.edu.

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.

Materials Research Society (MRS)

Our mission:
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. Please visit http://www.jhu.edu/~mrs to find more info on the benefits of being a member! (website under revision at this time; available later in summer)

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 conferences

Interested?
Email us at jhumrs2@gmail.com.
**Who we are:**
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, 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 has meetings every other Monday in Mattin 161 from 8PM - 9PM. All students are welcomed. We hope you will gain meaningful experiences and networks through our NSBE chapter. You can visit our national website at www.nsbe.org for information or our Facebook, www.facebook.com/jhunsbe/?fret+ts for current events. You can also email us at nsbe.jhu@gmail.com. We look forward to meeting you soon.
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.

What we do:
• 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.

• 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.
What we’re about:
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.

Some things we do:
• 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.
Who we are:
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?
Email us at hopkins.shpe@gmail.com.
Who we are:
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.

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
Theta Tau (Professional Engineering Fraternity)

Who we are:
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:
- 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 at www.facebook.com/jhuthetatau.

Who we are:
“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!
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 2016 courses, including Freshmen Only Courses, can be found online at http://web.jhu.edu/registrar/schedule/index.html. 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 14-17 in the Freshman 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 course load. For details, see www.engineering.jhu.edu/HEART.
BIOLOGY

FRESHMEN SEMINAR: FROM GENES TO DNA TO BACK (1.5) ........................................020.104 (N)
Moudrianakis • Freshmen only • Limit 18
A course consisting of introductory lectures followed by student presentations in the form of seminars. The issues we usually analyze are: How did we arrive at the concept of the “gene”? What are the early observations that gave substance to this concept? How did we arrive at the “one gene, one enzyme” dogma? What is the chemical nature of the gene? Is DNA enough for regulated gene expression? Is it “all in our genes”? What is genetic plasticity and epigenetics? What about genomics and proteomics? In the course of our analyses we bring together observations, and experimental results and ideas not only from biological sciences (Genetics, Cell and Developmental Biology and Genetics) but also from Physics, Sociology, Politics and Philosophy. We do all this in order to clarify how observations turn to ideas, then dogmas and even biases that distort the true meaning of objective Sciences.

FRESHMEN SEMINAR: TUBERCULOSIS (1) ........................................................................020.106 (N)
Horner • Freshmen only • Limit 12
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.

FRESHMEN SEMINAR: THE ‘NOBELS’ IN MEDICINE AND CHEMISTRY (2) .................020.111 (N)
Brand • Freshmen only • Limit 14
Key events in our understanding of the life sciences will be traced with the aid of Nobel awards.

ENVIRONMENTAL BIOMES: MARYLAND ZOO PENGUIN COAST (1) ....................................020.124 (N)
Spencer/Taylor • Freshmen Only • Limit 12 per section • 2 sections
This one semester introductory class is open to freshmen who successfully completed a high school biology course. No other experience is required. Students will explore concepts and methods required to understand an environmental biome, the sum of organisms that coexist and interact in a given environmental space. The laboratory component will compare environmental samples using ribosomal DNA typing, as well as metagenomic sequence analysis. This year’s research focus will explore biological profiles surrounding penguins at the Maryland Zoo using novel metagenomic DNA sequence data.

PROJECT LAB: PHAGE HUNTING (2) ....................................................................................020.135 (N)
Fisher • Freshmen only • Limit 19
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 and/or counts 2 hours toward the research requirement for the Molecular and Cellular Biology degree. No textbook is required.

GENERAL BIOLOGY I (3) ......................................................................................................020.151 (N)
Pearlm an/Roberson/Shingles • Limit 250 per section • 2 sections
This course is an introduction to biology from a molecular and cellular perspective. Specific topics and themes include the structure and function of biological molecules, cells, how organisms use energy, Mendelian and molecular genetics, and the evolution of organisms and their genomes.
GENERAL BIOLOGY LAB I (1) .................................................................020.153 (N)
Pearlman • Coreq: 020.151 • Limit varies per section • 6 sections • Offered Fall only
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 all eight credits of AP Biology credit. This course reinforces the topics covered in AS.020.151. Laboratory exercises explore subjects ranging from forest ecology to molecular biology to animal behavior. Students participate in a semester-long project, identifying bacteria using DNA sequencing.

CURRENT EVENTS IN BIOLOGY I (1) .......................................................020.161 (N)
Pearlman • Limit 19
Students will discuss current events and controversies in biology ranging from bioterrorism to influenza.
Recommended Course Background: Score of 4 or 5 on AP Biology exam.

CHEMISTRY

INTRODUCTORY CHEMISTRY I (3) .......................................................030.101 (N)
Goldberg/Thyagarajan • Corequisite: 030.105 • Limit 320 per section • 2 sections • Offered Fall & Summer only
Sw itching 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
Section 3 is Freshmen only
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.
Students enrolled in AS.030.103 may not enroll in AS.030.105, AS.030.115, or AS.030.107.

INTRODUCTORY CHEMISTRY LABORATORY (1) ......................................030.105 (N)
Pasternack • Coreq: 030.101 or 510.101 • Limit 100 per section • 6 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.
Students enrolled in AS.030.105 may not enroll in AS.030.115, AS.030.103, or AS.030.107.

CHEMICAL PRINCIPLES W/ LAB: INTERGRATED STUDIO COURSE (4) ..........030.107 (N)
Greco • Limit 32
An introduction to the fundamental principles of chemistry. The main topics to be covered are fundamental chemical reactions, stoichiometry and the balancing of chemical equations, solutions, gas laws, chemical equilibrium, acids and bases, and elementary chemical thermodynamics. Laboratory experiments and laboratory techniques will be incorporated into the course. Course will be run in three 2 hour blocks per week some of which will be used for lab. This course is equivalent to AS.030.101 and AS.030.105. Students enrolled in AS.030.107 may not enroll in AS.030.101, AS.030.105, AS.030.115, or AS.030.103. This course is intended for students with limited high school laboratory experience.

CHEMISTRY WITH PROBLEM SOLVING I (0) ..............................................030.112
Hill • Coreq: 030.101 or 030.102 • Limit 15 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.
FRESHMAN SEMINAR: THE MAKING OF A CHEMIST (3) .........................................................030.114 (N,W)
Staff • Limit 18
Students will be introduced to professional culture and practice in academic and industrial chemical research laboratories. Through reading and analysis of a few series of seminal papers from the 1800’s to the present leading to Nobel Prizes in Chemistry or Physics, students will learn how scientific inquiry and writing has evolved over time. Through discussion and practice, students will learn how to communicate chemistry in social media, scientific publications, scientific talks, and public lectures.

PROJECT-BASED INTRODUCTORY CHEMISTRY LABORATORY(2) ...........................................030.115 (N)
Thyagarajan • Coreq: 030.101 • Limit 40
A two-credit laboratory designed to teach the fundamentals of introductory chemistry with advanced experiments that parallel Introductory Chemistry Lab I (AS.030.105). Each lab session will be preceded by a live lecture to explain the experiment to the students. Students will be expected to complete a special project and participate in a poster session at the end of the semester. This course does not replace AS.030.106. SPECIAL NOTES: To enroll in this course, students need to place AS.030.101 in their enrollment cart above this course. Students enrolled in AS.030.115 may not enroll in AS.030.105, AS.030.103, or AS.030.107. This course is intended for students who have a very strong background in chemistry and a serious interest in it.

ORGANIC CHEMISTRY I (4) ........................................................................................................030.205 (N)
Falzone/Tovar/Townsend • Prereq: 030.102 OR 030.103 OR 030.204 OR 510.101
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
This course introduces the basic tools of macroeconomics and teaches how they are applied to real world economic policy. Throughout the course, the main goals will be to a.) study economics aggregates such as the overall price level, the unemployment rate and the GDP. b.)understand how they relate to each other. Attention will be given to fiscal and monetary policies. We will also analyze the recent financial crisis and its impact on the economic activity.

ENGLISH

INTRODUCTION TO EXPOSITORY WRITING (3) .................................................................060.100 (H,W)
Staff • Limit 10 per section • 7 sections • Freshmen only
Introduction to “Expos” is designed to introduce less experienced writers to the elements of academic argument. Students learn to recognize the paradigm of academic argument as they learn to read and summarize academic essays, and then they apply the paradigm in academic essays of their own. Classes are small, no more than 10 students, and are organized around three 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 “Intro” course teaches students to avoid plagiarism and document sources correctly. “Intro” courses do not specialize in a particular topic or theme.

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.
MATH EMATICS

Please see page 38 in the Freshman 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)
Staff • Prereq: C- or better in 110.108 or credit for Calculus I by AP or other recognized exam • Limit 30 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)
Staff • 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

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 • 30 per section • 11 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 MULTIVARIABLE CALCULUS (4) ..............................................................................110.211 (Q)
Brown • Prereq: A 5 on the BC AP exam or B+ or better in 110.107, 110.109, or 110.113 AND 110.201 or 110.212 • Limit 30
This course includes the material in AS.110.202 with some additional applications and theory. Recommended for mathematically able students majoring in physical science, engineering, or especially mathematics.

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, or 110.113 • Limit 30
This course includes the material in Linear Algebra (201) with some additional applications and theory. Recommended for mathematically able students majoring in physical science, engineering, or mathematics.
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, or 110.113 • 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 • 6 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 530.103 • 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)
Reich • 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)
Lehnen/Wyse • Recommended Coreqs: 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.

THE UNSOLVED MYSTERIES OF THE COSMOS (3) ............................... 171.127
Rahman • Limit 18 per section • 2 sections
While our knowledge of the universe has expanded greatly over the past century, there are some very basic problems that stump astronomers to this very day. In this course, we will explore some of the unsolved mysteries that astronomers are actively working on, including the formation of planets to the composition of the universe. This course will be a freshman seminar directed towards non-physical science majors. The focus will be on qualitative questions and phenomena rather than numerical details. NOTE: This course is meant to be a small class experience. Enrollment limits will be strictly enforced.
SPECIAL RELATIVITY AND WAVES (4) ................................................................. 171.201 (E,N)  
Zakamska • 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)  
Swartz • Coreq: 171.101, 171.103, or 171.107 • Limit 24 per section • 24 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 • 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 • Coreq: 171.105 • Limit varies • 2 sections  
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 • multiple 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) .................. 550.100 (E,Q)  
Staff • 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) .............................................................................. 550.171 (Q)  
Castello • Prereq: Four years of high school mathematics • Limit 35 per section • 4 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.
LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS (4) .................................................. 550.291 (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)
Staff • BME 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 (1) ........................................................................ 540.101 (E)
Dahuron • 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 (1) ................................................. 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

INTRODUCTION TO PROGRAMMING IN JAVA (3) ...................................................... 600.107 (E)
Selinski • Limit varies per section • 3 sections • Section 3 for CS freshmen only
This course introduces fundamental structured and object-oriented programming concepts and techniques, using Java, and is intended for all who plan to use computer programming in their studies and careers. Topics covered include variables, arithmetic operators, control structures, arrays, functions, recursion, dynamic memory allocation, files, class usage and class writing. Program design and testing are also covered, in addition to more advanced object-oriented concepts including inheritance and exceptions as time permits.
INTRO PROGRAMMING LAB (1) ........................................................................................................600.108 (E)
Selinski • Coreq: 600.107 • Satisfactory/Unsatisfactory only • Limit varies per section • 3 sections
This course is intended for novice programmers, and must be taken in conjunction with EN.600.107. The purpose of this course is to give first-time programmers extra hands-on practice with guided supervision. Students will work in pairs each week to develop working programs, with checkpoints for each development phase. Must have familiarity with computers.

INTERMEDIATE PROGRAMMING (4) ................................................................................................600.120 (E)
Staff • Prereq: AP CS, 600.107, 600.111/112 or equiv. • Limit 33 per section • 3 sections • Section 2 CS freshmen only
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) .................................................................................................................600.226 (E,Q)
Staff • Recommended Prereqs: AP CS, 600.107, 600.120, or equivalent • 2 sections • 60 per section
This course covers the design and implementation of data structures including collections, sequences, trees, and graphs. Other topics include sorting, searching, and hashing. 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 • 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

HOPKINS LEADERSHIP CHALLENGE SEMINAR (1) ...............................................................660.100 (S)
Staff • Freshmen only • Limit 19 per section • 3 sections
The Hopkins Leadership Challenge seminar is designed specifically for students enrolled in Hop-in program. The classroom content will include discussions with current university leaders and will serve as an introduction to the history, services and involvement opportunities open to JHU undergraduates. The seminars will include discussion and assignments from The Leadership Challenge by Kouzes and Posner. The experiential component of the course will include programs designed to enhance classroom content and expose students to the on campus and off campus involvement opportunities available.

INTRODUCTION TO BUSINESS (4) ................................................................................................660.105 (S,W)
Aronhime • Limit 19 per section • 8 sections
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.
FINANCIAL ACCOUNTING (3) ..................................................................................................660.203
Staff • Limit varies per section • 4 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
Staff • Limit varies by sections • 6 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)
Larson • 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)
Scheinerman • 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 • 38 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.

COMPUTING FOR ENGINEERS & SCIENTISTS (4) ......................................................500.200 (E,Q)
Lahouel • Pre-Req: Calc 2 • Limit 19
This course introduces a variety of techniques for solving problems in engineering and science on a computer using MATLAB. Topics include structure and operation of a computer, the programming language MATLAB, computational mathematics, and elementary numerical analysis.
GEOGRAPHY & ENVIRONMENTAL ENGINEERING

INTRODUCTION TO ENVIRONMENTAL ENGINEERING (3) ............................................570.108 (E)
Alavi • Limit varies per section • 2 sections
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 40
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 20
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 25
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.

MECHANICAL ENGINEERING

FRESHMAN EXPERIENCES IN MECHANICAL ENGINEERING (2) .........................530.101 (E)
Marra • Mechanical Engineering, Engineering Mechanics, Undecided Engineering Majors, or permission of instructor
Coreq: 530.103 AND 530.105 • Limit 75
An overview of the field of mechanical engineering along with topics that will be useful throughout the mechanical engineering program. This is the first half of a one-year course that includes applications of mechanics, elementary numerical analysis, programming in MatLab, use of computer data acquisition, analysis, design, and visualization; technical drawing, the design process and creativity, report preparation, teamwork, and engineering ethics.

INTRODUCTION TO MECHANICS I (2) .................................................................530.103 (E,N)
Thomas • Mechanical Engineering, Engineering Mechanics, Civil Engineering, Undecided Engineering majors or permission of instructor • Limit 60
This is the first half of a one-year course offering in-depth study of elements of mechanics, including linear statics and dynamics, rotational statics and dynamics, thermodynamics, fluids, continuum mechanics, transport, oscillations, and waves. This is an alternate to 171.101, designed specifically for Mechanical Engineering and Engineering Mechanics students taking 530.101 concurrently.
MECHANICAL ENGINEERING FRESHMAN LABORATORY I (I) ..........................530.105 (E)
Marra • Mechanical Engineering, Engineering Mechanics, Undecided Engineering Majors, or permission of instructor
Coreq: 530.103 AND 530.105 • Limit 18 per section • 5 sections
Hands on laboratory complementing 530.101 and 530.103, including experiments, mechanical dissections, and design experiences distributed throughout the year. Experiments are designed to give students background in experimental techniques as well as to reinforce physical principles. Mechanical dissections connect physical principles to practical engineering applications. Design projects allow students to synthesize working systems by combining mechanics knowledge and practical engineering skills.

PROFESSIONAL COMMUNICATION PROGRAM

PROFESSIONAL COMMUNICATION FOR BUSINESS, ..............................................661.110 (W)
SCIENCE & INDUSTRY (3)
Staff • 19 per section • 9 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 COMMUNICATION FOR INTERNATIONAL STUDENTS (3)........................................................................................................................................661.111 (W)
Staff • 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. Note: not open to students who have taken EN.661.110 as Technical Communication or Professional Communication for Science, Business, and Industry or EN.661.120 Business Communication. Open to Undergrad and Grad Students.

ORAL PRESENTATIONS (3) ........................................................................................................661.250 (W)
Staff • Limit 13 per section • 9 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 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. 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.