This publication is available in alternative media upon request.

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The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Discrimination or harassment against faculty, staff or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901, 814-865-4700/V; 814-863-1150/TTY.

U.Ed. ENG 12-39
COLLEGE OF ENGINEERING

UNDERGRADUATE PROGRAMS

GUIDE

2012-2013

For Students in the Spring 2014 Entrance-to-Major Pool

For additional information about College of Engineering undergraduate curricula and academic advising issues, please contact:

The Engineering Advising Center
College of Engineering
208 Hammond Building
University Park, PA 16802
814-863-1033

or

College of Engineering Department and Program Representatives

This College of Engineering Undergraduate Programs Guide serves as an advising and curriculum reference for undergraduate students admitted to the College of Engineering during the 2012-2013 academic year, prior to admission to any major offered by the College.
### TABLE OF CONTENTS

**PART I: ADVISING AND OTHER ACADEMIC INFORMATION**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advising - Why is it Important to you?</td>
<td>2</td>
</tr>
<tr>
<td>Finding your advisor:</td>
<td></td>
</tr>
<tr>
<td>- At University Park (Pre-major)</td>
<td>3</td>
</tr>
<tr>
<td>- At a Commonwealth Campus</td>
<td>3</td>
</tr>
<tr>
<td>- After Admission to a Major at UP</td>
<td>3</td>
</tr>
<tr>
<td>Academic Assistance – how to find help for academic concerns</td>
<td>4</td>
</tr>
<tr>
<td>eLion</td>
<td>4</td>
</tr>
<tr>
<td>Where to go for help with coursework</td>
<td>4</td>
</tr>
<tr>
<td>Transfer/AP Credits</td>
<td>6</td>
</tr>
<tr>
<td>- Transfer credits</td>
<td></td>
</tr>
<tr>
<td>- Advanced Placement credits</td>
<td>6</td>
</tr>
<tr>
<td>- International Baccalaureate</td>
<td>6</td>
</tr>
<tr>
<td>- GCE Advanced Levels</td>
<td>6</td>
</tr>
<tr>
<td>Additional Advising Information</td>
<td>9</td>
</tr>
<tr>
<td>- Important Academic Procedures</td>
<td></td>
</tr>
<tr>
<td>- Important Academic Information</td>
<td>10</td>
</tr>
<tr>
<td>- Reserve Officer Training Corps Program (ROTC)</td>
<td>10</td>
</tr>
<tr>
<td>- Change of Campus from a Commonwealth Campus to University Park</td>
<td>11</td>
</tr>
<tr>
<td>Entrance to Major (ETM) and Early Entrance to Major</td>
<td>12</td>
</tr>
<tr>
<td>- Basic Entrance-to-Major Requirements for All Majors</td>
<td>12</td>
</tr>
<tr>
<td>- Major Information</td>
<td>13</td>
</tr>
<tr>
<td>- Majors Under Enrollment Control</td>
<td>13</td>
</tr>
<tr>
<td>- Majors Not Under Enrollment Control</td>
<td>13</td>
</tr>
<tr>
<td>- Early Entrance to Major</td>
<td></td>
</tr>
<tr>
<td>- Regular Entrance to Major (ETM)</td>
<td>14</td>
</tr>
<tr>
<td>- Special ENGAE Designation</td>
<td>15</td>
</tr>
<tr>
<td>- Exceptions to the Regular ETM Process</td>
<td>15</td>
</tr>
</tbody>
</table>

**PART II: GENERAL EDUCATION AND GENERAL INFORMATION IN ENGINEERING**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is General Education</td>
<td>16</td>
</tr>
<tr>
<td>Important Nuances</td>
<td>18</td>
</tr>
<tr>
<td>Other Requirements</td>
<td>19</td>
</tr>
<tr>
<td>Computer Science Course Requirement</td>
<td>20</td>
</tr>
<tr>
<td>Harassment Policy</td>
<td>20</td>
</tr>
</tbody>
</table>

**PART III: SPECIAL PROGRAMS**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multicultural Engineering Program</td>
<td>21</td>
</tr>
<tr>
<td>Women in Engineering Program</td>
<td>21</td>
</tr>
<tr>
<td>Engineering Cooperative Education &amp; Professional Internship Program</td>
<td>22</td>
</tr>
<tr>
<td>Study Abroad</td>
<td>23</td>
</tr>
<tr>
<td>Global Internship and Cooperative Education Program</td>
<td>23</td>
</tr>
<tr>
<td>International Engineering Certificate</td>
<td>23</td>
</tr>
<tr>
<td>Concurrent Majors Programs</td>
<td>24</td>
</tr>
</tbody>
</table>

**PART IV: STUDENT ORGANIZATIONS**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Engineering Student Societies and Organizations</td>
<td>25</td>
</tr>
<tr>
<td>Major-related Societies and Organizations</td>
<td>25</td>
</tr>
</tbody>
</table>

**PART V: MINORS**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26</td>
</tr>
</tbody>
</table>

**PART VI: CERTIFICATES**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26</td>
</tr>
</tbody>
</table>
### PART VII: COLLEGE OF ENGINEERING BACCALAUREATE MAJOR ALTERNATIVES

<table>
<thead>
<tr>
<th>B.S. Programs in the College of Earth and Mineral Sciences</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.S. Programs at Penn State Altoona, Altoona, PA</td>
<td>27</td>
</tr>
<tr>
<td>B.S. &amp; Associate Degree Programs at Penn State Behrend College, Erie, PA</td>
<td>27</td>
</tr>
<tr>
<td>B.S. Programs at Penn State Capital College, Harrisburg, PA</td>
<td>27</td>
</tr>
<tr>
<td>Baccalaureate &amp; Associate Degree Programs at The School of Engineering Design, Technology and Professional Programs (SEDTAPP)</td>
<td>28</td>
</tr>
<tr>
<td>Other Programs</td>
<td>28</td>
</tr>
</tbody>
</table>

### PART VIII: COLLEGE OF ENGINEERING MAJORS

| Information About Using the College of Engineering Majors Section | 30 |
| Where to Find Information About College of Engineering Majors  | 30 |
| College of Engineering Web Site                                | 30 |
| Advising                                                      | 30 |
| Major Nights at University Park                                | 30 |
| Spring & Fall Penn State Career Fairs                         | 30 |
| First-Year Seminars                                           | 31 |
| Major-related Student Societies and Organizations              | 31 |
| E-News                                                        | 31 |
| Aerospace Engineering                                         | 32 |
| Architectural Engineering                                     | 34 |
| Bioengineering                                                | 36 |
| Biological Engineering                                        | 38 |
| Chemical Engineering                                          | 39 |
| Civil Engineering                                             | 41 |
| Computer Engineering                                          | 42 |
| Computer Science                                              | 43 |
| Electrical Engineering                                        | 44 |
| Electro-Mechanical Engineering Technology (Offered at Altoona, Berks, New Kensington and York). | 46 |
| Engineering Science                                           | 48 |
| General Engineering (Offered at Abington, Brandywine, DuBois, and Hazleton) | 49 |
| Industrial Engineering                                        | 50 |
| Mechanical Engineering                                        | 51 |
| Nuclear Engineering                                           | 53 |
| Surveying Engineering (Offered at Wilkes-Barre)               | 55 |
THE COLLEGE OF ENGINEERING

The College of Engineering provides instruction and research opportunities for undergraduates and graduates in fields of engineering, computer science, and engineering technology that are useful in developing technological solutions to address social needs.

Students may select from many majors in the College of Engineering. These programs help the student to learn technical skills and understand the economic, social, and political world in which the student will live. Scholastic standards are set at a highly professional level. Education and training are designed to produce competent leaders in engineering, computer science, and technology who are fully aware of their social responsibilities in their local, national, and world communities.

DEGREES

The College of Engineering offers baccalaureate degrees in thirteen majors that are completed at University Park, as well as Master of Science (M.S.) and Doctor of Philosophy (Ph.D) degrees in these thirteen areas and more. All of the undergraduate majors, with the exception of Architectural Engineering, are considered four-year undergraduate programs. The Bachelor of Architectural Engineering (B.A.E.) is a five-year program. The College of Engineering also offers baccalaureate degrees in three majors that are completed at commonwealth campuses. The undergraduate majors are listed below. Each major is briefly described in Part VIII of this Programs Guide, and a link is provided to semester plans that include the courses required for the major. Information about the majors and departments can also be obtained at the College of Engineering website.

All engineering baccalaureate programs at University Park and SUR E are currently accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET*). Computer Science is not accredited by ABET because it is not an engineering major.

<table>
<thead>
<tr>
<th>Engineering Majors</th>
<th>Ending Campus</th>
<th>Minors (UP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering</td>
<td>University Park</td>
<td>Agricultural &amp; Biological Engineering</td>
</tr>
<tr>
<td>Architectural Engineering</td>
<td>University Park</td>
<td>Bioengineering</td>
</tr>
<tr>
<td>Bioengineering</td>
<td>University Park</td>
<td>Engineering Entrepreneurship</td>
</tr>
<tr>
<td>Biological Engineering</td>
<td>University Park</td>
<td>Engineering Leadership Development</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>University Park</td>
<td>Environmental Engineering</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>University Park</td>
<td>Engineering Mechanics</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>University Park</td>
<td>Nanotechnology</td>
</tr>
<tr>
<td>Computer Science</td>
<td>University Park</td>
<td>Product Realization</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>University Park</td>
<td>Six Sigma</td>
</tr>
<tr>
<td>Electro-Mechanical Engineering</td>
<td>Altoona, Berks,</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>New Kensington,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>York</td>
<td></td>
</tr>
<tr>
<td>Engineering Science</td>
<td>University Park</td>
<td></td>
</tr>
<tr>
<td>General Engineering</td>
<td>Hazleton</td>
<td></td>
</tr>
<tr>
<td>Alternative Energy and Power</td>
<td>DuBois</td>
<td></td>
</tr>
<tr>
<td>Generation Option</td>
<td>Abington, Brandywine</td>
<td></td>
</tr>
<tr>
<td>Applied Materials Option</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multidisciplinary Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Option</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>University Park</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>University Park</td>
<td></td>
</tr>
<tr>
<td>Nuclear Engineering</td>
<td>University Park</td>
<td></td>
</tr>
<tr>
<td>Surveying Engineering</td>
<td>Wilkes-Barre</td>
<td></td>
</tr>
</tbody>
</table>

• ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: 410-347-7700.
PART I: ADVISING AND OTHER ACADEMIC INFORMATION

ADVISING - Why is it Important to You?

The groundwork for future success in engineering or computer science is laid by early, careful planning with the help of academic advisers. The College of Engineering is committed to providing quality advising to students, but students have the ultimate responsibility for selecting appropriate course schedules and meeting all graduation requirements and are, therefore, encouraged to review all academic decisions with their advisers. Students are expected to read this guide and to consult with their academic adviser at least once a semester.

Consulting with an adviser is important for any student who:
• is seeking information about majors and/or differences between them,
• wishes to plan and discuss a schedule of courses for one or more semesters,
• is having difficulty with course work and is looking for resources which might help the situation,
• would like to double-check course prerequisites,
• needs to drop a class or complete any one of a number of administrative actions,
• wants to learn the truth or fiction of an academic rumor heard from a friend or acquaintance, or
• has questions or concerns about any number of miscellaneous issues related to academic success.

Responsibilities of Advisers and Advisees

The Faculty Senate has defined the role of academic advising in the University community. This section is quoted from Faculty Senate Policy 32-30 on Advising:

“Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee’s unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources. The college or department also will monitor the progress of its advisees towards satisfactory completion of all graduation requirements and inform students of their status each semester.*  Advisees in turn will routinely contact their advisers each semester and will assume final responsibility for course scheduling, program planning, and the successful completion of graduation requirements.”

*Students can check their progress each semester by using the degree audit feature on eLion.

Responsibilities of Advisers

The Academic Adviser’s Role is to:
1. Help the advisee to understand the academic and administrative processes of the University and the nature of its academic programs. The adviser also seeks to understand each advisee’s particular concerns affecting academic progress. The adviser neither grants nor denies administrative approval for particular academic actions.
2. Help the advisee to understand the expected standards of achievement and likelihood of success in certain areas of study.
3. Discuss the educational and career objectives suited to the advisee’s demonstrated abilities and expressed interests. The adviser helps the advisee to understand the relationships among the courses, programs, undergraduate research opportunities, internships, study abroad programs, and other academic experiences provided by the University.
4. Help the advisee to plan a course of study and give advice about courses and the adjustment of course loads. The adviser will inform the advisee about the prerequisites for subsequent courses in the advisee’s program.
5. Refer advisees to other resources when appropriate.
6. Participate in the adviser training sessions provided by each college or department to keep informed and current.
Responsibilities of Advisees

The Advisee’s Role in the Academic Advising Process is to:
1. Acquire the information needed to assume final responsibility for course scheduling, program planning, and the successful completion of all graduation requirements.
2. Seek the academic and career information needed to meet educational goals.
3. Become knowledgeable about the relevant policies, procedures, and rules of the University, college, and academic program.
4. Be prepared with accurate information and relevant materials when contacting the adviser.
5. Consult with the adviser at least once a semester to decide on courses, review the accuracy of the audit, check progress towards graduation, and discuss the suitability of other educational opportunities provided by the University.

The University may make changes in policies, procedures, educational offerings, and requirements at any time. Please consult a Penn State academic adviser for more detailed information.

In addition to meeting with an academic adviser, information about academic issues is available at the Advising @ PSU website.

Advising Resources in the College of Engineering

Engineering Advising Center (EAC)
The EAC advising staff includes professional advisers available year-round as well as faculty advisers from each of the College of Engineering majors at University Park who have office hours in the EAC during the Fall and Spring semesters. They serve as an information resource to students and staff at all Penn State locations. The Assistant Dean for Student Services in the College of Engineering is the director of the Engineering Advising Center.

One of the professional advisers is the Division of Undergraduate Studies (DUS) Programs Coordinator for the College of Engineering. DUS is an enrollment unit which has many functions, one of which is to advise exploratory students. The DUS Programs Coordinator advises College of Engineering students and some DUS students, but also has many other roles, such as serving as a pipeline of information between the College of Engineering and DUS.

In addition to personal advising for pre-major students, the EAC prepares this Programs Guide on a yearly basis for all College of Engineering students and relevant Penn State advisers. The EAC address is 208 Hammond Building, University Park, PA 16802. The phone number is 814-863-1033 and the fax number is 814-863-7496. You can reach the EAC advising staff by e-mail.

FINDING YOUR ADVISER

Students at University Park

Students at University Park who have a particular intended major are expected to meet with an EAC faculty adviser from that major; students who are exploratory within the College are expected to meet with one of the professional advisers. In reality, however, students are free to see any of the advisers in the Engineering Advising Center and each of these advisers can be seen about any advising issue.

To meet with an adviser, it is best to schedule an appointment. Students can stop by during office hours and, if available, an adviser may be seen on a walk-in basis. However, priority is given to those students who have made an appointment. Advising in the EAC is available Monday through Friday from 8:00 A.M. through 5:00 P.M. ENGR students at UP can request an appointment on the EAC Appointment Request System. After the PSU Access Account and Password are entered, information about advisers, times, and majors will be visible. Requests for appointments will be answered within one working day. For additional information, contact the Engineering Advising Center, 208 Hammond Building, University Park, Phone: 814-863-1033, e-mail.

Students at Commonwealth Campuses

Pre-major students and students approved for a major through the early entrance-to-major process are advised at their campus. Each campus assigns students to advisers according to the local policy. If uncertain about the identity of their adviser, students should contact the College Contact and Referral Representative at their campus.

1Pre-major Schreyer Scholars at University Park receive advising from honors faculty advisers in the department of their intended major, and those who are exploring major options, are advised by the Assistant Dean for Student Services.
Students in a major
All students who are in a major are assigned to a faculty adviser in their department, with the following exception. Second-year students at a Commonwealth campus who received early entrance to a major remain at their campus and continue to receive academic advising from their faculty adviser there. However, if they wish, students should feel free to consult their major department at University Park by phone, e-mail, letter, or visit.

ACADEMIC ASSISTANCE - How to Find Help for Academic Concerns

eLion is an expert-based, empirically-grounded advising and information system that is delivered by the latest technologies to supplement student/adviser relationships and engage students in interactive inquiry for informed educational planning. eLion offers students the opportunity to access information in real-time from Penn State databases. Through eLion, students with Penn State computer access accounts can:

1. view their grade reports, class schedules, degree audits, and transcripts,
2. update their address/telephone records and Personal Access Code (PAC) numbers,
3. check their First-Year Testing, Consulting and Advising Program (FTCAP) placement actions in English, Math, and Chemistry and read an explanation of each,
4. view their adviser assignments and related advising information,
5. calculate predicted grade-point averages and target grade-point averages and review the implications,
6. review a summary of their academic records (degree audits), including ‘Alternative Majors’ degree audits,
7. view unsatisfactory early progress reports,
8. link to other on-line academic and advising references including the University Undergraduate Advising Handbook and information of different majors,
9. check course availability,
10. register for courses,
11. late-drop a course or courses,
12. withdraw from the University,
13. obtain information about financial aid, and
14. explore majors that relate to personal interests by using the Major Themes application.
15. Register for a minor (only after being admitted to a major)

For more information, visit eLion.

Where to go for help with course work

There may be times when you experience difficulty with classes. The key to success is to seek assistance when you first experience academic difficulty. There are various offices and organizations on campus designed to help you succeed academically.

Professor/Teaching Assistant (TA) Office Hours: Professors and TA’s set office hours as a time to meet with their students about course related questions and issues. Office hours are in the syllabus and may also be announced in class. This is a starting point when you need assistance with course material. If your class schedule conflicts with the posted office hours, please contact the professor/TA to arrange an alternate time to meet.

At Commonwealth Campuses:
For information about availability of help, please consult with your location’s University Learning Center or College of Engineering Faculty Contact.

At University Park:

1. Penn State Learning, has several locations at University Park with the following free programs that are designed to help students succeed, including:
   Join a study group
   Meet a writing tutor
   Meet a math tutor
   Meet a language Tutor
   Study tips and more
   Engage a private tutor
2. Other Resources

The Multicultural Engineering Program’s Academic Excellence Center is a home base and communications hub for engineering students from under-represented groups at University Park. It provides a quiet study environment with extended hours and a center for student professional meetings, tutorial services, and workshops. It houses computers, study carrels, test files, recruitment information from employers, and a collection of engineering reference books, textbooks, engineering journals, and corporate brochures. For more information about the Center’s hours, tutoring, or other services, stop by 323 Sackett Building, University Park, or call 814-863-1990.

The Women in Engineering Program (WEP) manages a number of facilitated study groups at University Park throughout the semester. For additional information, contact WEP at 814-863-1080.

Chemistry tutoring is available Sunday through Thursday evenings from graduate chemistry students in the Chemistry Tutorial Room, 211 Whitmore Laboratory, University Park. For additional information, contact the Chemistry Department at 814-865-9391.

Physics tutoring is offered by the Physics Department at University Park.

Mathematics tutoring is offered by the Mathematics Department.

Engineering Mechanics review sessions are offered on a weekly basis through the Engineering Science and Mechanics Department. For times and locations, call 814-865-4523.

EDSGN 100 tutoring is available each semester the course is offered. The hours and location to get help will be announced in class, available from the instructor, and posted in E-News.
Transfer Credits

Students who have taken or wish to take a course at an institution other than Penn State should refer to the “Transferring Credits” link on eLion to determine if and how such a course transfers to Penn State. Courses taken at other institutions must have a grade of ‘C’ or higher to be considered for transfer to Penn State. The Office of Undergraduate Admissions maintains a database containing transfer credit information from institutions in the USA and around the world. The transfer information may yield: 1) a course that is directly equivalent to a Penn State course, 2) general credit (GEN), or 3) not transferable. If a course has not been evaluated and is therefore not listed, take the course description to the Undergraduate Admission Office for review. If 2) occurs, but the course description suggests a reasonable equivalent at Penn State, the course description and syllabus may be taken to the relevant department at Penn State for evaluation. If the course is deemed equivalent, the department will notify the Office of Admissions at Penn State. If the department determines that the course is still not equivalent to a Penn State course, the student should consult with her/his academic adviser to investigate whether or not the course could be used to substitute for a degree requirement in the student’s intended major. Note: Entrance-to-major (ETM) courses must transfer as direct equivalents to the PSU courses. Courses that transfer as GEN cannot be used to satisfy entrance-to-major requirements. See page 12 for a description of the ETM process.

Advanced Placement (AP) Credits

Many students arrive at the University with credits awarded through the College Board AP Program (Educational Testing Service, Phone: 609-921-9000). Undergraduate students interested in receiving credit for AP examinations should arrange for their official grade reports to be sent directly from ETS to the Undergraduate Admissions Office, 201 Shields Building, University Park, PA 16802. Students should make sure that their transfer credits appear on their official University transcript by the end of the first semester. Students are urged to consult with an adviser about the appropriate strategy in the use of their Advanced Placement credits. The use of these credits is an entirely individual decision. All the variables of the student’s first year must be considered in deciding their use. See page 7 for Penn State credit awarded for Advanced Placement examinations.

International Baccalaureate Higher Level Credit

A number of students arrive at the University with credits awarded through the International Baccalaureate Higher Level Exams. Undergraduate students interested in receiving credit for International Baccalaureate Higher Level examinations should arrange for their IB transcript to be sent directly to the Undergraduate Admissions Office, 201 Shields Building, University Park, PA 16802. Students should make sure that their transfer credits appear on their official University transcript by the end of the first semester. Students are urged to consult with an adviser about the appropriate strategy in the use of their International Baccalaureate Higher Level credits. The use of these credits is an entirely individual decision. All the variables of the student’s first year must be considered in deciding their use. See page 8 for Penn State credits awarded for International Baccalaureate Higher Level examinations.

GCE Advanced Levels Credits

A number of students arrive at the University with credits awarded through the GCE Advanced Levels Exams. Undergraduate students interested in receiving credit for GCE Advanced Levels examinations should arrange for their certificates to be sent directly to the Undergraduate Admissions Office, 201 Shields Building, University Park, PA 16802. Students should make sure that their transfer credits appear on their official University transcript by the end of the first semester. Students are urged to consult with an adviser about the appropriate strategy in the use of their GCE Advanced Levels credits. The use of these credits is an entirely individual decision. All the variables of the student’s first year must be considered in deciding their use. See page 8 for Penn State credit awarded for GCE Advanced Levels examinations.
<table>
<thead>
<tr>
<th>AP Test</th>
<th>*Grade for Credit</th>
<th>*PSU Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art: History of Art</td>
<td>3, 4, or 5</td>
<td>AA ART H 100 (3 cr)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4</td>
<td>CHEM 110 &amp; 111 (4 cr)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CHEM 110, 111, 112 &amp; 113 (8 cr)</td>
</tr>
<tr>
<td>Computer Science AB</td>
<td></td>
<td>Consult with CMPSC advisor, but generally, Not useful for any engr. major</td>
</tr>
<tr>
<td>Economics: Microeconomics</td>
<td>4 or 5</td>
<td>BECON 102 (3 cr)</td>
</tr>
<tr>
<td>Economics: Macroeconomics</td>
<td>4 or 5</td>
<td>BECON 104 (3 cr)</td>
</tr>
<tr>
<td>English: Literature and Composition</td>
<td>4 or 5</td>
<td>C ENGL 001 (3 cr)</td>
</tr>
<tr>
<td>Government and Politics: United States</td>
<td>4 or 5</td>
<td>BPL SC 001 (3 cr)</td>
</tr>
<tr>
<td>Government and Politics: Comparative</td>
<td>4 or 5</td>
<td>BBPL SC 003 (3 cr)</td>
</tr>
<tr>
<td>History: United States</td>
<td>4 or 5</td>
<td>CC HIST 020 &amp; 021 (6 cr)</td>
</tr>
<tr>
<td>History: European</td>
<td>4 or 5</td>
<td>CCC HIST 002 (3 cr)</td>
</tr>
<tr>
<td>History: World</td>
<td>4 or 5</td>
<td>CCC HIST 011 (3 cr)</td>
</tr>
<tr>
<td>Human Geography</td>
<td>3, 4, or 5</td>
<td>BBB GEOG 020 (3 cr)</td>
</tr>
<tr>
<td>Math: Calculus AB</td>
<td>4 or 5</td>
<td>MATH 140 (4 cr)</td>
</tr>
<tr>
<td>Math: Calculus BC</td>
<td>3</td>
<td>MATH 140 (4 cr)</td>
</tr>
<tr>
<td></td>
<td>4 or 5</td>
<td>MATH 140 &amp; 141 (8 cr)</td>
</tr>
<tr>
<td>Music: Theory</td>
<td>3, 4, or 5</td>
<td>BMUSIC 008 (3 cr)</td>
</tr>
<tr>
<td>!!! Physics C: Mechanics</td>
<td>4 or 5</td>
<td>PHYS 211 (4 cr)</td>
</tr>
<tr>
<td>!!! Physics C: Electricity and Magnetism</td>
<td>4 or 5</td>
<td>PHYS 212 (4 cr)</td>
</tr>
<tr>
<td>Psychology</td>
<td>5</td>
<td>BPSYCH 100 (3 cr)</td>
</tr>
<tr>
<td>Other AP Tests: Art Studio, Biology, Foreign Languages &amp; Literature, and Physics B*</td>
<td>Variable</td>
<td>See adviser for information</td>
</tr>
</tbody>
</table>

Please refer to the Undergraduate Admissions website for the official version:

* Subject to change without notice.

A Credits may be counted toward General Education requirements in the Arts (GA).

AA Credits may be counted toward General Education requirements in the Arts (GA) and International Cultures (IL).

B Credits may be counted toward General Education requirements in the Social and Behavioral Sciences (GS).

BB Credits may be counted toward General Education requirements in the Social and Behavioral Sciences (GS) and International Cultures (IL).

BBB Credits may be counted toward General Education requirements in the Social and Behavioral Sciences (GS) and either International Cultures (IL), or United States Cultures (US).

C Credits may be counted toward General Education requirements in the Humanities (GH).

CC Credits may be counted toward General Education requirements in the Humanities (GH) and United States Cultures (US).

CCC Credits may be counted toward General Education requirements in the Humanities (GH) and International Cultures (IL).

!!! This is the ONLY Physics AP test that can be used to meet degree requirements in the College of Engineering.

♦ Credits for the Physics B test cannot be used to meet degree requirements for any major in the College of Engineering.
### International Baccalaureate Higher Level Credit

<table>
<thead>
<tr>
<th>IB Test</th>
<th>*Grade for Credit</th>
<th>*PSU Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>5, 6, 7</td>
<td>CHEM 110 &amp; 111 (4 cr) and CHEM 112 &amp; 113 (4 cr)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>5, 6, 7</td>
<td>Not useful in meeting engineering degree requirements</td>
</tr>
<tr>
<td>Economics</td>
<td>5, 6, 7</td>
<td>^ECON 102 (3 cr) &amp; ECON 104 (3 cr)</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>5, 6, 7</td>
<td>Variable or no credit toward College of Engineering requirements</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5, 6, 7</td>
<td>MATH (4 GEN cr) &amp; MATH 140 (4 cr)</td>
</tr>
<tr>
<td>Physics</td>
<td>5, 6, 7</td>
<td>PHYS 250 (4 cr) &amp; PHYS 251 (4 cr), Note not usable in College of Engineering degrees.</td>
</tr>
<tr>
<td>Other IB: Art, Music, Philosophy, Psychology, Literature, Theater</td>
<td>5, 6, 7</td>
<td>May be useful as GA, GH, and/or GS. See adviser for info.</td>
</tr>
</tbody>
</table>

### GCE Advanced Levels Credit

<table>
<thead>
<tr>
<th>GCE Advanced Level Test</th>
<th>*Grade for Credit</th>
<th>*PSU Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>A, B, C</td>
<td>CHEM 110 &amp; 111 (4 cr) and CHEM 112 &amp; 113 (4 cr)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>A, B, C</td>
<td>Not useful in meeting engineering degree requirements</td>
</tr>
<tr>
<td>Economics</td>
<td>A, B, C</td>
<td>^ECON 102 (3 cr) &amp; ECON 104 (3 cr)</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>A, B, C</td>
<td>Variable</td>
</tr>
<tr>
<td>Mathematics**</td>
<td>A, B, C</td>
<td>MATH (4 GEN cr) &amp; MATH 140 (4 cr)</td>
</tr>
<tr>
<td>Physics**</td>
<td>A, B, C</td>
<td>PHYS 211 (4 cr), 212 (4 cr), 213 (2 cr), &amp; 214 (2 cr)</td>
</tr>
<tr>
<td>Physics AS**</td>
<td>A, B, C</td>
<td>PHYS 211 (4 cr)</td>
</tr>
<tr>
<td>Other GCE Advanced Levels: Literature, History, Political Science, Psychology</td>
<td>A, B, C</td>
<td>May be useful as GA, GH, and/or GS. See adviser for info.</td>
</tr>
</tbody>
</table>

* Subject to change without notice.
** Transfer credits for any other math or physics courses do not meet graduation requirements in the College of Engineering.
^ Credit may be counted toward General Education requirements in the Social and Behavioral Sciences (GS).
Important Academic Procedures

Drop/Add Period:
Students can add or drop courses during the drop/add period at the beginning of each semester. Since the drop/add dates vary according to the beginning and end dates of each class, it is important to use eLion to determine the drop/add dates for each class on the schedule. Use eLion and click on “course drop dates” to see the deadline for each course. Note: Irregularly scheduled courses have adjusted deadline dates. Failure to attend to these deadlines may result in an inability to add or drop such courses to or from your schedule. See the Schedule of Courses or eLion for more details.

Overload (more than 19 credits per semester):
A maximum of 19 credits per semester may be scheduled. The addition of a course or courses that bring the total semester credits over 19 requires consultation with an adviser and may not be done until the first day of classes of the semester.

Late Drop:
Courses dropped after the drop/add deadline are considered to be late-drops. You are permitted a maximum of 16 late-drop credits during your Penn State baccalaureate career. A $6.00 transaction fee will be charged and no courses may be dropped after 80% of the course has been completed. For a 15-week semester, the late-drop deadline occurs during the 12th week of classes. For a semester of less than 15 weeks and for courses that are less than a full semester in length, consult eLion for the course’s late-drop deadline. Students are billed by the Bursar’s Office.

All late-drop actions should be taken in consultation with your academic adviser. There are consequences when a course is dropped which may adversely affect financial aid, health insurance, eligibility for a major, and more! Your academic adviser can make you aware of these consequences and minimize the chance for any resulting problems. Although the late-drop action can be completed through eLion, consultation with your academic adviser is highly encouraged.

Students in ENGR (pre-major) status at University Park should come to the Engineering Advising Center to consult with their adviser about late-dropping any course. Students in a major or ENGAE should go to their departments for consultation. Students at commonwealth campus locations should see their adviser for consultation.

Late add:
Courses added after the drop/add deadline are considered to be late-adds. The signature of the course instructor is required. The course may then be added at the department offering the course or at the Registrar’s Office. A $6.00 transaction fee, billed by the Bursar’s Office, will be charged.

Deferred Grades:
In situations beyond the student’s control, such as illness, injury, emergency, etc. at the end of the semester that prevent a student from completing all course requirements, deferred grades may be requested. The request must be made to each course instructor by the last day of classes or the day of the final exam, whichever comes last. If the instructor is agreeable, then a DF grade is submitted for the course. The student will then have up to ten weeks, following the end of the semester, to complete all course requirements. If the course requirements are not completed within the allowed ten weeks, the DF will automatically become an “F”.

Exceptions:
Waivers of, exceptions to, and substitutions for degree requirements and College policies may be requested with the use of a College Petition. All such requests must be made before the semester of graduation. College Petitions will not be considered during the semester of graduation. Students should consult with their advisor before initiating such requests.

Waivers and exceptions to University academic policies for extraordinary and extenuating circumstances may be requested through a petition to the University Faculty Senate. All such requests must be submitted through the Office of the Assistant Dean for Student Services by students at University Park, or according to the campus process for students at a commonwealth campus. Students should consult with their advisor before initiating such requests.
**Withdrawing from the Semester:**
Withdrawing is not to be confused with dropping a course. When a student withdraws from the semester, ALL courses are forfeited, unless a grade is submitted before the withdrawal takes place. Withdrawal should be seen as a last resort. Often there are alternative strategies available which may solve the problem. **Furthermore, withdrawal can have consequences for financial aid, housing, health insurance, athletics, and much more!** Students are strongly encouraged to consult with their academic adviser before filing a withdrawal to make sure that they are aware of and have thought through alternative options and the consequences of withdrawal. Although the withdrawal action can be completed through eLion, consultation with your academic adviser is urged.

The deadline for filing a withdrawal is the last day of classes, for the semester. A withdrawal can be implemented through eLion. If a student chooses to return to the University, a re-enrollment application must be filed at the Registrar’s Office and a fee is charged. Withdrawal from a Summer semester does not require re-enrollment.

**Leave-of-Absence:**
A leave-of-absence can only be requested for the subsequent semester, not the current semester of enrollment. A leave-of-absence notifies the University of your absence and an anticipated date of return BEFORE the semester of absence actually begins. Re-enrollment is not required upon returning to the University, if you return at the anticipated return date. Leaves-of-absence usually last no longer than one year, although under special circumstances, may be extended to two years. Application for leave-of-absence must be made no later than the last working day before the semester begins. A leave is not required for absence during summer session.

To retain an active Computer Access Account during a leave-of-absence, the “Penn State Access Account Extension for Student Leave of Absence form” must be completed and a fee paid.

**Important Academic Information**

**Pass/Fail, Audit Grades, and Technology (T) Courses:**
See page 20.

**Fraternity/Sorority Pledging:**
Pledging a fraternity or sorority during a student’s first year of study is strongly discouraged. Many students struggle to meet academic requirements and make other adjustments without the added stress of a time-consuming activity. Poor academic performance due to pledging is not an acceptable reason for failure to qualify for a major in a timely manner.

**Reserve Officer Training Corps Program (ROTC)**

Army, Navy/Marines, and Air Force all have large and successful ROTC programs on the University Park Campus. Four-, three-, and two-year merit scholarships are available in each program with selection quotas favoring engineering majors.

Students participating in ROTC programs have additional required courses totaling from 18 to 21 credit hours. Some of these credits may be used toward graduation requirements for majors within the College of Engineering.

Students who complete the academic ROTC program can use 3 credits to substitute for the GHA requirement (see page 17) and 3 credits to substitute for a departmental requirement, decided upon by each major. Students make the request within each major by submitting a college petition to their department. Departments will not finalize the substitution for any student until and unless the academic ROTC program is completed. Students who drop out of the ROTC program will not be able to make these substitutions, even if they have at least 6 credits of ROTC courses. Since a minimum of 12 additional credits beyond the major’s curriculum is required to complete the ROTC program, contracted ROTC students usually take at least one extra semester to complete their degree requirements. This is applicable to all Engineering majors. For example, where Mechanical Engineering is described as an eight-semester program, the ROTC student should anticipate needing nine semesters to graduate.

Completion of the ROTC program can also lead to the award of an academic minor in Military Studies. Engineering students must work closely with the Engineering Advising Center and ROTC Enrollment Officers when choosing Arts, Humanities, and Social and Behavioral Science courses in order to efficiently and effectively meet the General Education Requirements of both programs. Contact the appropriate ROTC officer for additional information.

For students at University Park, ROTC Graduation Plans should be discussed with, and signed by the faculty advisor in the Engineering Advising Center from the intended major.
Change of Campus

College of Engineering students are expected to stay at their location until they formally enter a major through the regular Entrance-to-Major (ETM) process. Students at commonwealth campuses who are admitted to a University Park (UP) major will, under most circumstances, automatically be approved for a change to UP for the relevant semester and be able to register for courses at UP. Please note the exceptions described below and in the section that describes Early Entrance-to-Major on page 13.

Students at any campus who intend to seek admission to a major that ends at one of the commonwealth campuses should seek a change to that commonwealth campus as soon as practical.

Exceptions:

Architectural Engineering
Students admitted to ENGAE must change to University Park for the Fall semester of their second year. These students will be approved for a change of campus to University Park only after they are selected to ENGAE in June and agree to the conditions for the change. All ENGAE students must register for, and attempt to complete the appropriate AE and ARCH courses at University Park during their first Fall semester as ENGAE students. ENGAE students who fail to do so, will be changed to ENGR status and those who had moved from a commonwealth campus will be returned to that campus. Students who wish to be considered for ENGAE must exercise caution (i.e. wait until officially verified of their acceptance into ENGAE) before making any off-campus housing commitments in State College. Students interested in housing on University Park campus should begin contact with the Housing Office in December and review the information on their website.

Other Majors
Students who are making the suggested progress toward their intended major, as shown on the academic plan for their campus, and who make the request, will be considered for a change of campus to University Park after two or three semesters at their location. Approval of a request for early change of campus will be based on whether course work necessary to continue progress towards the major is offered at the student’s location. It will also be based on whether the prerequisite courses will have been completed for the required courses in the major that are available only at University Park. Students should note that lack of preparedness to move to UP will likely result in a delay of graduation. This is particularly relevant for BIOE and CHE because critical courses are offered only once a year.

Consideration for early change of campus will only be given for academic reasons, if students cannot continue to make adequate progress toward their major by staying at their location. Students should note that “adequate progress toward their major” can be achieved in many ways. The sample schedule of courses for each major beginning at each campus represents only one of a number of ways in which adequate progress can be made. Many other appropriate sequencing alternatives exist. Students should consult with the College Contact and Referral Representative at their location for suggestions on reasonable/necessary course sequencing variations. Because of lack of space at University Park, personal reasons cannot be considered as justification for approval of an early change of campus. Personal reasons include ROTC, athletics, Blue Band, clubs, etc. The wish to pursue a minor is also not considered adequate for early change of campus.

Engineering Newsletter:

College of Engineering Undergraduate Newsletter.
Each week of the fall and spring semesters, all undergraduates receive an electronic newsletter, called Engineering News (E-News). Students are responsible for the information that is conveyed by E-News. It is sent to each student’s PSU access account (eg. abc1234@psu.edu). E-News is used to inform students about courses, change in degree requirements, events, workshops, programs, international opportunities, professional opportunities, and funding/scholarship opportunities. All College of Engineering undergraduates at all campuses receive E-News and, cannot remove themselves from the mailing list.
Basic Entrance-to-Major Requirements for all Majors - Please read ALL entry-to-major information on pages 12 - 15

The process of admitting students to majors in the College of Engineering occurs only once a year. First-year students who enter Penn State in Summer 2012, Fall 2012, or Spring 2013, will finalize their choices for majors in Spring 2014. Therefore, they are considered to be in the Spring 2014 Entrance-to-Major (ETM) Pool.

To qualify for admission to a College of Engineering major except EMET and SUR E, a student in the Spring 2014 Pool must:

1. have completed, with a grade of “C” or better, MATH 140, MATH 141, PHYS 211, and CHEM 110 (or CHEM 106) by the end of Spring semester 2014. Computer Science majors must complete CMPSC 122 instead of CHEM 110 with a “C” or better.

2. have a cumulative GPA of at least a 2.00 (or higher for majors under enrollment control) and 3.00 for Engineering Science by the end of the Fall 2013 semester. The cumulative GPA after Spring 2014 is not used for entrance-to-major unless it has dropped below 2.00 (3.00 for Engineering Science). If that is the case, the student will be ineligible for the major. Students otherwise qualified and whose cumulative GPA was below a 2.00 after Fall 2013, will be reconsidered for available majors if their GPA is at least 2.00 after Spring 2014.

3. be in degree status and have completed at least two full semesters of course work appropriate to the desired major and, if pursuing a controlled major, be enrolled in the College of Engineering or be enrolled in DUS and declared as heading toward a major in the College of Engineering.

4. have confirmed, early in the Spring 2014 semester by the published deadline, the top three choices of major (a first major and two alternative majors, i.e., second and third choices). All students must indicate and confirm their preferences, including students who believe that they have not completed the entrance-to-major requirements described above. E-mail reminders are sent to those students who have NOT completed the entry-to-major process on eLion. It is important that students check their PSU e-mail regularly. University and College of Engineering official correspondence is conducted through e-mail, which requires that students keep their PSU access account current.

5. adhere to the Academic Load Policy:

   a. Credits - The full-time student should be accumulating credits at a minimum rate of 30 relevant credits per calendar year; otherwise, the schedule may be judged “inappropriate” and the student’s chances of gaining entrance to a major in the College of Engineering may be jeopardized.

   b. Absence from the University - A College of Engineering student who is in the Spring 2014 Pool and is participating in a Co-op, is on a leave-of-absence, or withdraws from the University during the Spring 2014 semester and intends to return must still indicate and confirm his/her preferences during the Spring of 2014 by the published deadline. Failure to do so may result in a limited choice of majors, regardless of grades.

6. adhere to appropriate course sequences in math, physics, chemistry, and engineering courses. Course scheduling will be judged inappropriate if prerequisite courses or courses in the prerequisite chain are taken out of sequence. Inappropriate scheduling will jeopardize a student’s chance of gaining entrance to a major in the College of Engineering. If a student feels that he or she would benefit by going back in a sequence to review material, such courses should be taken on a Pass/Fail or Audit (AU) basis.

1Students who have already been through the Entrance-to-Major process (ETM) and wish to change their major can only do so with departmental support, on a space-available basis, through the regular Change-of-Major process. Such requests are considered on an individual basis without guarantee of approval.

2Part-time students must also meet ALL the above criteria to be considered for admission to a major. The particular Spring Semester during which a part-time student selects a major must be determined in conjunction with, and approved by the Assistant Dean for Student Services. If there is no space available in the major of first choice, students will be considered for their designated alternative choice(s).

3See “Exceptions to the Regular ETM Process” for specifics.
Major Information

All College of Engineering undergraduate majors are listed below. Some are under administrative enrollment control (the official designation for what is commonly called controlled majors) but others are not. Although the College attempts to accommodate the requests of all students desiring a specific major, limitations of space, faculty, or other resources make this goal unattainable for some majors. Therefore, in addition to the requirements listed under “Basic Entrance-to-Major Requirements,” students considering a controlled major need to read and understand the information found on page 14. If a major is not under enrollment control, students need to meet the requirements listed under “Basic Entrance-to-Major Requirements.”

For students in the Spring 2014 Entrance-to-Major Pool:

<table>
<thead>
<tr>
<th>Majors Under Enrollment Control</th>
<th>Enrollment Limit</th>
<th>Majors Not Under Enrollment Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering</td>
<td>100</td>
<td>Biological Engineering</td>
</tr>
<tr>
<td>Architectural Engineering</td>
<td>100</td>
<td>Computer Engineering</td>
</tr>
<tr>
<td>Bioengineering</td>
<td>40</td>
<td>Computer Science</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>150</td>
<td>Electrical Engineering</td>
</tr>
</tbody>
</table>
| Civil Engineering               | 175             | Electro-Mechanical Engineering Technology ♦
| Industrial Engineering          | 160             | Engineering Science (3.00 Min GPA Required) |
| Mechanical Engineering          | 230             | General Engineering ♦               |
|                                 |                 | Nuclear Engineering                 |
|                                 |                 | Surveying Engineering ♦             |

*These majors are completed at commonwealth campuses.

Early Entrance to Major

1. ENGR students in the Spring 2014 Pool, who are qualified for a major, may ask to be considered for early entrance to a major (ETM) after Spring 2013. Students who do not qualify for early ETM and those who do not wish to be considered for early ETM will not jeopardize their standing or eligibility for a major (A E is an exception, see page 15), and will participate in the regular ETM in the Spring 2014 semester. Students who are admitted to a major after the first year must still affirm their desire for the major, or select another during the regular ETM Process at the beginning of the Spring of 2014. Early entrants into Aerospace Engineering, Bioengineering, Chemical Engineering, Civil Engineering, Industrial Engineering, and Mechanical Engineering must have the minimum GPA required for entrance to their major during the Spring 2014 ETM process to remain in the major.

2. To be considered for early entrance to a major after the Spring semester of the student’s first year, a student must:
   - indicate the desire to be considered for early entrance to a major on the Major Preference screen of eLion by the published deadline, the last day of Spring 2013 semester classes.
   - be in degree status in the College of Engineering (ENGR) and complete at least 30 credits applicable to the desired major by the end of the Spring semester of the first year.
   - earn a “C” or higher in MATH 140 and 141, PHYS 211, and CHEM 110 (or CHEM 106). For the Computer Science major, CMPSC 122 replaces CHEM 110. Note: Architectural Engineering is an exception. Please see “Exceptions to the Regular ETM Process” on page 15 and “Entrance to Major” on page 13.
   - have a cumulative GPA of 2.00 (3.00 for Engineering Science) or better at the end of the Spring semester of the first year.

3. For majors under enrollment control (except A E), a maximum of half the enrollment limit will be offered early admission to the major. The cumulative GPA of qualified students will be used to determine early admission in addition to the conditions described in 2, above.

4. Students will be notified by e-mail of the dates during which they should use eLion to indicate their major preference and their wish for consideration of early entrance to a major. Students will then be notified in June of the application results for early entrance to a major.

5. Early entrants at commonwealth campuses remain and continue to receive advising at their campus. (ENGAE is an exception, see page 15)

6. Students who are early entrants to a major will need to submit a request for a Change of Campus to their campus Registrar by the regular entrance-to-major deadline of their Pool semester. Change of Campus for early entrants is not automatic, regardless of the number of accumulated credits.

7. Some early entrants at University Park and ENGAE students will be advised in their department during their second year.
Regular Entrance to Major (ETM)

1. In the Pool semester (Spring 2014), only students who meet ALL of the criteria mentioned under “Basic Entrance-to-Major Requirements for All Majors” on page 12 will be considered for GE and the majors offered at University Park. Seven majors have additional stipulations because they admit a limited number of students each year. Because of space and faculty limitations, these seven majors - Aerospace Engineering (AERSP), Architectural Engineering (A E), Bioengineering (BIOE), Chemical Engineering (CHE), Civil Engineering (CE), Industrial Engineering (IE), and Mechanical Engineering (ME) - are under enrollment control. If you are considering concurrent majors that include a major under enrollment control, you must select the major under enrollment control as your first choice. The second choice would be the uncontrolled major.

The addition of a major that is under enrollment control, as a concurrent major, will not be possible if the major is full.

2. In December 2013, students will receive a message from the Registrar notifying them of the need to respond with major choices on eLion between certain dates in January and February, 2014, to be eligible for admission to a major effective Summer 2014. Major choices can be changed and re-confirmed an unlimited number of times before the deadline during the confirmation period. Students who fail to list their preferences and fail to click the “confirm your major preferences” button by the published deadline will not be eligible for majors under enrollment control and may not be able to register for courses.

3. Students must respond by the stated deadline to be considered for their major choice. A lack of either a second or third choice preference is interpreted as an indication that the student will not accept alternatives. Students who received e-mail about selecting a major and entry-to-major prior to the deadline, have NOT competed the entry-to-major process in eLion. Contact the Engineering Advising Center for assistance if needed. All students who are not assigned to a major during this ETM process should see an adviser regarding their future plans and appropriate actions.

4. Qualified students who request a major that is under enrollment control will be listed in descending order of cumulative GPA (the GPA at beginning of SP ’14). Beginning with the highest GPA, students will be counted until the enrollment limit is reached. If every qualified student in the Spring 2014 Pool who wanted a major that is under enrollment control is accommodated by the spaces available (see page 13) in that major, then the minimum GPA for the major for that year is listed as a 2.00. If the enrollment limit is reached before the list of students ends, the GPA of the person who gets the last spot determines the minimum GPA for the major for that year’s Pool only. Qualified students whose cumulative GPA at the beginning of their Pool semester is at least 3.30, for BIOE, or 3.00 for AERSP, A E, CHE, CE, IE, and ME are guaranteed admission to these majors. Students who confirm a major under administrative enrollment control, and do not have the cumulative GPA required for guaranteed admission, must confirm two alternative majors.

When determining the cumulative GPA to be used for admission to majors that are under enrollment control, any grades for math, chemistry, physics and engineering courses taken out of sequence will be removed. That means, for example, that grades for math courses numbered lower than 140 that are taken after completing any version of MATH 140 and grades for PHYS 250, PHYS 251 and physics courses numbered lower than 211 after completing any version of PHYS 211 will be removed, and the cumulative GPA recalculated for the purpose of entry to a major.

5. Admission to AERSP, BIOE, CHE, CE, IE or ME for students admitted to ENGR status as transfer students (with advanced standing) will be delayed until the completion of at least 2 semesters at PSU. Eligible transfer students will be notified of the conditions and cumulative GPA that will be required after at least 2 semesters at PSU for admission to these majors. A E is not available to transfer students.

6. Students who do not meet the Entrance-to-Major requirements by the end of their Pool semester will be asked to select a major in another Penn State college unless they obtain support and approval for additional time to complete their entrance-to-major requirements as an exception. Exceptions may be made for available majors under exceptional circumstances and on a case-by-case basis. Consideration for or approval of extension requests is not guaranteed. Students who wish to be considered for additional time must consult with their adviser. No exceptions can or will be made for the majors that are under enrollment control, unless space is available. After the Pool semester entrance-to-major process, NO changes of major or exceptions will be approved for majors under enrollment control. Therefore, majors under enrollment control that are full will not be available after the deadline. Requests for extensions must be received by June 1, 2014.

7. Students will be notified by e-mail in March, 2014 of their entrance-to-major status. This notification will be either: Assignment to a major of choice, conditional on meeting all Entrance-to-Major requirements by the end of the Spring 2014 semester, or No assignment to a major in the College.
Special ENGAE Designation

Interested first-year ENGR students who indicate A E as their first choice on the Major Preferences screen of eLion by the published deadline (last day of Sp’13 classes) will be considered for a special second-year status called ENGAE. Interested DUS first-year students must be identified by their advisers, who notify the College of Engineering at this time. Students are selected to ENGAE status from ENGR or DUS only. It is a special status which enables a student to enroll in certain controlled A E classes and to have an assigned A E faculty adviser. A maximum of 100 students will be offered admission to ENGAE following their first year. Students will be selected to ENGAE if they have completed the 4 entrance-to-major (ETM) courses with a minimum grade of C in each and a cumulative GPA of at least 3.00; have maintained full-time student status during the Fall and Spring semesters of their first year; and have taken courses that are appropriate for the A E major. The A E Department may also consider students who have completed 3 ETM courses with a minimum grade of C in each and a cumulative GPA of at least 3.00, as well as students who have earned a minimum grade of C in 4 ETM courses but whose GPA is a little below 3.00. Students will be notified of acceptance or non-acceptance during June, after Spring grades have been reported. Acceptance to ENGAE necessitates that students at commonwealth campuses change their location to University Park for the Fall semester of their second year. All ENGAE students must take the prescribed Fall A E and ARCH courses. Students who change to UP but do not take the prescribed courses will be changed to ENGR status and returned to their campus of admission for the Spring semester.

Students will be approved for the change to University Park only after they are selected to ENGAE in June. Therefore, commonwealth campus students who wish to be considered for ENGAE must exercise caution (i.e. wait until officially verified of their acceptance into ENGAE) before making any off-campus housing commitments in State College.

During the regular Entrance-to-Major period in the Pool semester (Spring of the second year), a student with the ENGAE designation must still confirm his/her wish to enter Architectural Engineering by the deadline and have the minimum GPA required for A E for the SP14 pool. Qualified ENGAE students who do not wish to select A E, must choose another major. Qualified students whose cumulative GPA is at least 3.00 at the beginning of the ETM Pool semester are assured admission to A E during the regular ETM process.

Exceptions to the Regular ETM Process

Engineering Science. E SC is the College’s honors major. To be eligible for the major, a student must complete, the 4 ETM courses with a grade of “C” or above and have a cumulative GPA of 3.00 or better at the time of entry to the major.

Electromechanical Engineering Technology (EMET at Altoona, Berks, New Kensington, York). Students who are admitted to one of the campuses that offers EMET can enter the major directly upon admission or, if already enrolled in a different major, through the Change-of-Major process.

Surveying Engineering (at Wilkes-Barre only). Students who are admitted to the Penn State Wilkes-Barre Campus can enter Surveying Engineering directly upon admission, or, if already enrolled in a different major, through the Change-of-Major process.
PART II: GENERAL EDUCATION AND GENERAL INFORMATION

WHAT IS GENERAL EDUCATION

The University Faculty Senate has adopted a comprehensive definition of General Education. The most recent expression of this definition is as follows:

“General Education encompasses the breadth of knowledge involving the major intellectual and aesthetic skills and achievements of humanity. This must include understanding and appreciation of the pluralistic nature of knowledge epitomized by the natural sciences, quantitative skills, social and behavioral sciences, humanities, and the arts. To achieve and share such an understanding and appreciation, skills in self-expression, quantitative analysis, information literacy, and collaborative interaction are necessary. General Education aids students in developing intellectual curiosity, strengthened ability to think, and a deeper sense of aesthetic appreciation. General Education, in essence, aims to cultivate a knowledgeable, informed, literate human being.”

How is this relevant to you as a student in the College of Engineering?

Your technical course work will impact what you know, who you are, and how you think about the world. It will provide a knowledge base in the physical sciences and foster a tendency to think of things using an analytical and problem-solution approach. This is a very positive and powerful paradigm, and it will most likely bring you great success and respect. Yet, what you learn in your courses is not the only knowledge or the only way of thinking. People you encounter in your professional and personal life will challenge you in other ways, in terms of politics, aesthetics, emotions, and morals, to name a few. You may already be comfortable and familiar with these other areas. General Education is designed to support and further develop your ability to work effectively within a wide range of work environments.

It is impossible to predict whether or not taking General Education courses will help you get a job, boost your GPA, open your mind, or make you a better professional. The point is rather that Penn State feels that, as an essential part of your education, you have the opportunity to become a well-rounded human being who can think and see things in many different ways. The bottom line, then, is that while you will have to take the General Education courses, it is up to you to take advantage of the opportunity the courses provide.
What kinds of General Education courses and Additional Degree Requirements will you need to take, and how many credits of each?

This can be answered by following the table and by looking carefully at the nuances on the next page. Courses are selected from the General Education course list.

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Code</th>
<th>Min Cred. Req’d</th>
<th>Content</th>
<th>Note: This column applies to students in the College of Engineering. Other colleges may vary in how these requirements are achieved.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing/ Speaking</td>
<td>GWS</td>
<td>9 plus a “W” course</td>
<td>ENGL 015/030 or ESL 015 Rhetoric &amp; Composition 3 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CAS 100 A/B Public Speaking 3 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ENGL 202C¹ Technical Writing 3 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“W” designation Course in your major</td>
<td></td>
</tr>
<tr>
<td>Quantification</td>
<td>GQ</td>
<td>6</td>
<td>MATH 140 Calculus I 4 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MATH 141 Calculus II 4 credits</td>
<td></td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>GN</td>
<td>9</td>
<td>PHYS 211 Mechanics 4 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PHYS 212 Electricity &amp; Magnetism 4 credits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CHEM 110² Chemical Principles 3 credits</td>
<td></td>
</tr>
<tr>
<td>First-Year Seminar or First-Year Engagement Program</td>
<td>FYS</td>
<td>1</td>
<td>At University Park and at some commonwealth campuses, the First-Year Engagement Program includes a FYS that may be a separate course (at least 1 credit) or built into another course. Such courses and FYS are designated by the suffix “S”. Students who begin at commonwealth campuses that do not offer FYS courses as part of their First-Year Engagement Program will not be required to complete a separate FYS elsewhere. However, they may need to have one extra credit in order to meet the minimum number of credits needed for their major. For Engineering FYS courses at commonwealth campuses, contact the College of Engineering Representative. At UP check the FYS site.</td>
<td></td>
</tr>
<tr>
<td>Health &amp; Physical Activity</td>
<td>GHA</td>
<td>3</td>
<td>Courses dealing with health issues and physical activities. Choose a course or courses totaling three (3) credits from the GHA on the General Education list.</td>
<td></td>
</tr>
<tr>
<td>Arts³</td>
<td>GA</td>
<td>6</td>
<td>Courses which entail “the development of aesthetic understanding and appreciation.” Choose courses from the Arts (GA) list on the General Education list.</td>
<td></td>
</tr>
<tr>
<td>Humanities</td>
<td>GH</td>
<td>6</td>
<td>Courses which focus on understanding of the human condition and the values inherent in it. Choose courses from the Humanities (GH) list on the General Education list.</td>
<td></td>
</tr>
<tr>
<td>Social &amp; Behavioral Sciences⁴</td>
<td>GS</td>
<td>6</td>
<td>Courses which use the methods of critical inquiry to examine the personal, interpersonal, and societal forces that shape people’s lives. Choose courses from the Social and Behavioral Sciences (GS) list on the General Education list.</td>
<td></td>
</tr>
<tr>
<td>US &amp; International Cultures</td>
<td>US</td>
<td>(3)</td>
<td>US-designated courses are those that strive to increase students’ understanding of contemporary US society. IL-designated courses strive to increase students’ knowledge of international societies. US,IL-designated courses meet both US &amp; IL criteria and many be used to fulfill either the US or the IL requirement. The US &amp; IL requirements may be fulfilled by double-counting with other General Education or courses in a major/minor. See page 18 for a more detailed explanation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IL</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹For students in the BE major, BE 391 and 392 replace ENGL 202C

²CMPSC majors may substitute another course for CHEM 110. Students can select from the CSE Department’s approved list of Natural Science (GN) courses. However, a student headed toward CMPSC must take both CHEM 110 and CHEM 111 to have CHEM 110 count towards the Natural Science component of General Education.

³See page 18 for special requirements that pertain to specific majors (Special Nuances - Credit Total).

⁴Students should select an IL course from the list found at found on the General Education course list.
IMPORTANT NUANCES!

The information below will guide you through the General Education course selection process to meet the General Education requirements. Please note that students may take courses that do not meet degree requirements but it is their responsibility to understand which courses do and which do not meet degree requirements.

Credit Total

There are times when multiple requirements can be met with one course. You can maximize this overlap if you pay attention to the following:

- *Architectural Engineering* requires ARCH 210 and ART H 202, both of which are also GA courses. If you are interested in A E, make sure you take these courses for your GA requirement!

- All majors *except Computer Science* have an Economics requirement. You can meet this requirement and a simultaneous GS requirement by taking ECON 102 or ECON 104.

- Make sure that the US and IL \(^1\) courses you take *also* fulfill a GA, GH, or GS requirement. Courses listed as both US and IL may be used to fulfill either category, but not both.

- Some US, IL, GA, GH, GS, and major courses may also count as a First-Year Seminar. If that is the case, students may need to acquire an extra credit to meet the minimum number of credits required for their major.

- In most cases, your GQ and GN requirements are met entirely through specific courses that are also major requirements in Mathematics, Physics, and Chemistry.

- Your writing intensive requirement is ALWAYS met by a course in your major. Such courses have a “W” or “M” next to them. This requirement is typically taken in the student’s junior or senior year. Once in your major, consult with your departmental adviser to determine an appropriate “W” course.

Substitutions

The most important consideration for General Education substitutions is that the “spirit” of the requirements is met. This means that when possible, the College of Engineering allows for flexibility in how the requirements are actually met. This may entail taking a slightly different pattern than what is indicated on the previous page, or it may mean permission to have one or more courses count for General Education that are not officially listed as General Education courses. The following are suggestions for how you might make course substitutions that still meet the spirit of the General Education requirements for College of Engineering majors (other colleges may approach this differently):

**9/6/3 sequence in the Arts (GA), Humanities (GH), and Social Sciences (GS)** - instead of taking 6 credits in each of these 3 areas, you may take 9 credits in one and balance this out by taking only 3 credits in one of the others. The remaining area would then stay at 6 required credits. Some examples of this are:

```
   GA   GH   GS
  9     6    3
```

No petition is required for a 9/6/3 sequence. When students have completed all of the courses in a planned 9/6/3 sequence (18 credits total), they should meet with their department and indicate how the courses are to meet the GA/GH/GS requirements so that the degree audit can be adjusted appropriately. Students are encouraged to discuss their planned choices with an adviser for clarification and explanations.

\(^1\)Students should select an IL course from the list found at found on the General Education course list.
• **language substitution** - A language course at the 12th credit level or higher can be substituted for 3 credits of GA, GH, or GS. Note: *If this substitution is made, it cannot be the ONLY course in a General Education category (i.e. it cannot be substituted for the 3-credit category in the 9-6-3 pattern shown on the previous page).* Beginning language courses at Penn State are 4 credits each, so the 12th credit level would be a level III course (SPAN 003, IT 003, FR 003, etc.). If a student intends to take a language course elsewhere, (s)he should consult with an adviser first, as the 12th credit level may be defined differently at other institutions. A College of Engineering General College petition does not have to be completed for this option. Students wishing to use this option should indicate their intention to their department so that their degree audit can be adjusted accordingly.

• **international cultures requirement** - students may use participation in a Study Abroad or a Work Abroad program to fulfill the IL requirement. Participation in a formal Study Abroad program will automatically fulfill the IL requirement. Participation in a Work Abroad program by registering for ENGR 195I, 295I, 395I or 495I may be used to meet the IL requirement but will necessitate a College petition for approval.

• **AP, International Baccalaureate, and GCE Advanced Levels credits** - some general credits gained through Advanced Placement tests in high school, International Baccalaureate, or GCE Advanced Levels may be petitioned to count for GA, GH, or GS courses. Students should seek the assistance of their academic advisers for the preparation and submission of such petitions. (Also see charts on pages 7 and 8.)

• **ROTC credits** - students who **complete** the academic ROTC program can use 3 credits to substitute for the GHA requirement and 3 credits to substitute for a departmental requirement, decided upon by each major. Students make the request within each major by submitting a college petition to their department. Departments will not finalize the substitution for any student until and unless the academic ROTC program is completed. Students who drop out of the ROTC program will not be able to make these substitutions, even if they have at least 6 credits of ROTC courses.

• **other course substitutions** - any course not designated as General Education, but which truly meets the spirit of the GHA, GA, GH, GS, US, or IL requirements, whether taken at Penn State or elsewhere, may be petitioned to count in the appropriate area. *The key to the success of this type of petition is detailed documentation on what the course covered and, if possible, a written statement by the instructor of the course on the appropriateness of this course as a GHA, GA, GH, GS, US, or IL.* Students should seek the assistance of their academic advisers for the preparation and submission of this type of petition.

• Students admitted as transfer students (with ADVST) are not required to take a FYS to meet graduation requirements. If they don’t, they can substitute one credit not otherwise needed for graduation to meet the required credit total.

• **All requests for course substitutions**, exceptions, and waivers must be submitted for evaluation prior to the semester that graduation is planned. Such requests will not be considered after the start of the graduating semester.

The remaining categories allow for quite a bit of choice! In the First-Year Seminar (FYS) category, for example, students can choose any course in any PSU college that has the FYS designation next to it in the Schedule of Courses for your campus.

**OTHER REQUIREMENTS**

**Engineering Design & Graphics and Architectural Graphics**
EDSGN 100, Introduction to Engineering Design & Graphics, is required for all engineering majors except:

• Computer Science
• Computer Engineering
• Architectural Engineering - A E requires EDSGN 130, Architectural Graphics and CAD, instead of EDSGN 100. However, EDSGN 130 is not offered at most commonwealth campuses. The Architectural Engineering Department recommends that students at commonwealth campuses do not wait until they arrive at University Park to take EDSGN 130, but rather, take EDSGN 100. The A E Department will accept the latter as a substitute for EDSGN 130 for commonwealth campus students as well as for University Park students. Students who have completed EDSGN 130 but change their mind and select another major may use EDSGN 130 to substitute for EDSGN 100.
**CMPSC course requirement**

Students are expected to complete the version of CMPSC that is required for their intended major. However, in the event that the required version is not available at a campus during the recommended semester, or if there is a change in a student’s intended major or major of admission after the CMPSC course has been completed, CMPSC 121 will be accepted as a substitute for CMPSC 200, 201, and 202; and CMPSC 201 will be accepted as a substitute for CMPSC 202 and 200. Such substitutions must be initiated by the student and implemented in the department after formal admission to the major.

**Foreign Language for Computer Science major**

Computer Science students MUST either have had four years of one foreign language in high school, complete the second semester level of a foreign language while at Penn State (8th credit level), or otherwise show such a level of proficiency.

**Remedial Courses**

The following courses cannot be used to satisfy degree requirements in any Baccalaureate program in the College of Engineering:

- **MATH** 001, 002, 003, 004, 005, 006, 007, 021, 022*, 026*, 030, 036, 040*, 041*, 100, 198
- **CHEM** 108, 101
- **PHYS** 100, 150, 151, 191, 215, 250, 251, 265
- **PH SC** 007, 008
- **ENGL** 004, 005
- **LL ED** 005, 010
- **ESL** 004
- **CAS** 126

However, when a deficiency must be corrected and any of these courses are taken, they will appear on the student’s transcript and the grade earned will be calculated in the student’s cumulative grade point average.

* EMET program may allow this course to fulfill degree requirements.

**TECHNOLOGY COURSES**

Technology courses (generally those that have a “T” in their title) may not be used to meet the degree requirements in any of the College of Engineering baccalaureate majors except EMET. On rare occasions, an exception may be made by a major department.

**PASS/FAIL or AUDIT GRADES**

Courses for which PASS/FAIL or AUDIT grades are assigned cannot be used to meet any degree requirements in the College of Engineering. Courses for which a grade of S (Satisfactory) is assigned may be used; for example, ENGR X95A or I (Co-op or Internship), portfolio assessment, or credit-by-exam (CRX).

**HARASSMENT POLICY**

If you believe you have been subjected to harassment, you are afforded protection under the law. It is important to remember that you are not alone and that you do not have to solve adverse situations alone. If you are uncertain, have questions, would like more information, or have experiences with which you are unhappy, be sure to contact an adviser, supervisor, faculty, or staff member whom you trust. All interactions are confidential. Above all, remember that you have the power to act. Complete information about who to contact, what to expect, and some brief case scenarios are available online.
PART III: SPECIAL PROGRAMS

OFFICE OF ENGINEERING DIVERSITY: Multicultural Engineering Program and Women in Engineering Program
Contact: Dr. Amy Freeman, Assistant Dean
Helen Edson, Administrative and Outreach Manager
Phone: 814-863-1080 or 800-848-9223 Fax: 814-863-7496 Office of Engineering Diversity

MULTICULTURAL ENGINEERING PROGRAM

The Multicultural Engineering Program (MEP) coordinates programs and activities that create a community for African/Black American, Latino/Hispanic American, and American Indian/Alaskan Native engineering students. Although MEP is located at the University Park campus, students at commonwealth campuses will receive correspondence regarding scholarship opportunities, campus visits, and much more. At University Park, programs include free one-on-one tutoring in the: Academic Excellence Center, 323 Sackett Building; two summer bridge programs and SUCCESS 101, an orientation first-year seminar course for getting started in the College of Engineering; Multicultural Engineering Program Orientation (MEPO) for mentoring and guidance in academic, career, and personal development; MEP Monthly, a year-long suite of monthly meetings designed for networking, mentoring, and career and academic development; Engineering Mentoring for Internship Excellence (EMIX), a professional development program that provides employment opportunities, and much more. Students at all locations can become involved in the Student Chapters of the American Indian Science and Engineering Society (AISES), National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), and Out in Science, Technology, Engineering, and Mathematics (OSTEM) for leadership and professional development.

Significant funding for MEP activities comes from corporations, foundations, and government agencies that support activities designed to attract under-represented groups into engineering and ultimately increase the total number of engineering graduates. Corporate funding supports the corporate interest in diversifying the workplace: a diverse workforce offers a competitive advantage. Customers are a diverse group; companies who have diverse design, manufacturing and sales teams are better able to compete. Diversity also brings greater variety of thought and experience to engineering problem-solving.

For additional information, contact: Office of Engineering Diversity,
208 Hammond Building, University Park, Phone: 814-865-7138, e-mail.
Not all programs are available at all locations.

WOMEN IN ENGINEERING PROGRAM

The Penn State Women in Engineering Program (WEP) is an excellent resource for undergraduate women engineering students and was the recipient of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring in 2004. WEP is not a club or an organization that requires dues; it is a resource provided by the College of Engineering to empower women’s success in academic and career goals. WEP offers a suite of academic enrichment programs and networking opportunities at no cost to students. For those who wish to explore career options, need information about graduate school, or have other career-oriented questions, WEP can help.

WEP offers skill-based classes for women such as Wellness for Engineering Women. WEP features WEPO (Women in Engineering Program Orientation), a three-day orientation program designed to empower incoming women engineers, and WEP Wednesdays, a year-long suite of monthly meetings designed to facilitate networking and resource development. WEP Facilitated Study Groups provide academic support, and Girl Scout Saturdays and similar workshops enable women undergraduates to engage precollege girls in hands-on engineering activities. WEP works closely with MEP and the Engineering Career Resources and Employer Relations office in support of EMIX, (“Engineering Mentoring for Internship Excellence”) career development class each spring. The WEP listserv is also a valuable resource available to students.

WEP facilitates leadership development through a vast array of opportunities. Women engineering undergraduates can serve in a leadership capacity as a Facilitator in a Facilitated Study Group, a peer instructor in a WEP skills class, a counselor in summer pre-college engineering camp, a project coordinator as a WEP intern, a recruiter as a WEP envoy, a mentor for pre-college girls in GSS workshops, or as a WEPO leadership team member for WEPO. WESAC (Women Engineering Students at the Commonwealth) provides activities and a listserv for women studying at Commonwealth campuses. WEP also supports the student chapter of Society of Women Engineers (SWE) at University Park, the Phi Sigma Rho Engineering sorority Lambda Chapter, and the SWE Committee at Altoona.

WEP activities are funded through corporations, foundations and government agencies that support activities designed to retain women in engineering and STEM fields, and ultimately, increase the diversity of gender in the engineering profession. Corporate support targets diversity workplace initiatives: a diverse workforce offers a competitive advantage. Diverse companies brings greater variety of thought and experience to engineering problem solving, and are better able to compete.

For additional information, contact: Cheryl Knobloch, Associate Director, WEP, 208 Hammond Building, University Park, Phone: 814-863-1080. Not all programs are available at all commonwealth campuses.
Description:
The Engineering Co-op & Internship Program is offered by the Engineering Career Resources & Employer Relations office. The program is designed to connect engineering students with credit-bearing, career-related work experience prior to graduation. Program participants work in both large and small corporate and government entities across the nation and around the world. In so doing, they gain valuable professional experience, including early exposure to real-life work issues and practical training in their desired career area. More than 700 students participate in the program each year. The program offers students two types of professional work experiences: internships and co-op assignments. An internship is a one-semester experience in an area related to the student’s major or intended major; in some cases, an internship can help a student choose a major. Students may complete several internships at different companies, if desired. A co-op assignment requires students to complete multiple rotations—usually three—with the same organization, allowing for both breadth and depth of experience. Co-op rotations usually alternate with semesters at Penn State. Note that a co-op assignment typically delays a student’s graduation date but does not increase the number of semesters of coursework required to earn a degree. Students do not usually begin co-op assignments until they have been admitted to a major. However, in some cases, a student who has completed an internship and wants to complete additional work rotations at the same company may choose to “roll over” the internship into the co-op program. Both internship and co-op credits may be used to satisfy degree requirements for some—but not all—majors and minors. Students should check with their departmental coordinators to determine if and how co-op/internship credits may be used. Program participation is noted on students’ transcripts; students receive a grade of “satisfactory” or “unsatisfactory” upon completion of their internship or co-op. Co-op participants who complete all required rotations also receive a Certificate of Cooperative Education at graduation.

Admissions Requirements:
Minimum 2.00 cumulative GPA
Completion of mandatory program orientation
Formal registration through the eCareer online job posting system
Co-op participants: Completion of required number and type of courses for admission to major

Program Requirements:
Successful completion of one work semester (internship) or three work semesters (co-op) prior to graduation. Work assignments may be completed in the fall, spring, or summer semesters; students completing co-ops will typically work a fall, spring, and summer semester (alternating with semesters on campus) or a combination of two summers and one spring or fall semester. Participants must be registered for their internship or co-op course, regardless of the semester in which they complete their assignment (including summer). Registration allows participants to maintain full-time student status (even while taking fewer than 6 credits), which permits them to defer financial aid repayment and retain their health insurance. Undergraduate co-op and internship course codes are as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 195A/I*</td>
<td>Undergraduate Internship</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 295A/I*</td>
<td>First Co-op Rotation</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 395A/I*</td>
<td>Second Co-op Rotation</td>
<td>1-2</td>
</tr>
<tr>
<td>ENGR 495A/I*</td>
<td>Third (or subsequent) Co-op Rotation</td>
<td>1-3</td>
</tr>
</tbody>
</table>

* The “A” designation on these courses refers to a domestic work assignment; an “I” designation refers to a work assignment outside the U.S.

† Students who complete three co-op rotations may be eligible to complete their English 202C requirement by portfolio submission.

Timeline:
Students may complete an internship anytime from the second semester of their first year through their senior year. Students who wish to complete a co-op assignment will typically seek and register for a co-op position during their sophomore and/or junior years and then complete their work rotations during their junior and senior years.

For additional information, contact: Engineering Career Resources & Employer Relations, 205 Hammond Building, University Park, PA 16802. Phone: 814-863-1032, e-mail.
GLOBAL ENGINEERING EDUCATION PROGRAMS

The College of Engineering established a goal that every student will participate in a significant international experience and be globally ready by graduation. Global Readiness is defined as having the knowledge and appreciation of the global nature of engineering and related professions, as well as the challenges and opportunities associated with contemporary worldwide issues. Students should graduate, being ready to practice their profession in a global context by being sensitive to and respectful of the differences that affect professional practice throughout the world.

In order to become globally ready, students are encouraged to learn at least one other language; find examples in which problems are defined differently than in the US culture; become exposed to and be able to work as part of a diverse group whose members communicate in a language other than English; participate in a study and/or work abroad experience; participate in a course that includes an international travel component; take at least one course that has some depth in and insight into a contemporary culture other than the United States.

The College of Engineering has identified a list of GA, GH, and GS courses that meet the International Cultures (IL) requirement and that are more likely to meet the college's goal of helping students to become globally ready. These courses have been identified because they contain some depth in and insight into a contemporary culture or include or relate to contemporary, internationally-relevant cultural issues. Therefore, students are urged to select at least one of these courses. These courses also fulfill General Education requirements.

STUDY ABROAD

Study programs in engineering are available in many countries. They include institutions that teach courses in the language of the country as well as in English. Students may take engineering courses to meet their major requirements, language courses, or courses that meet General Education requirements. Any combination of the courses is possible. Study programs last for a full academic year, a semester, or a summer. Short-term programs that include a Penn State course with a travel component are also available.

Planning for a study abroad should begin as soon as possible. The semester best suited for a study abroad, the country, and the institution will depend on the student’s interests, major, and progress toward meeting degree requirements. Students should discuss the options with their adviser as soon as they become interested in the possibility of a study abroad experience. Please note that examples of semester-by-semester plans that incorporate a semester of study abroad are provided for each major. These examples can be found at the website listed at the top of the sample scheduling plan page for each major in this Programs Guide.

GLOBAL INTERNSHIP AND COOPERATIVE EDUCATION PROGRAM

The Global Internship and Cooperative Education Program is designed to manage opportunities for work abroad during any semester, including summer. Whenever appropriate, students should consider a professional internship prior to or following a study abroad. To apply for international co-op or internship positions, log on to eCareer (the College of Engineering’s online job posting site). If you do not have an eCareer account, you can register for a free account.

INTERNATIONAL ENGINEERING CERTIFICATE

This certificate recognizes the completion of course work, language study and international experiences that contributes toward the attainment of a global perspective in engineering. The requirements for the Certificate are: 3 credits of study in a second language at the 003 (third-semester or 12th credit) level or higher as a PSU student; 6 credits (typically two courses) of study in courses approved to meet the International Cultures requirement (IL) of General Education; 1-3 credits of approved study or work abroad of at least 6 weeks duration; and completion of a College of Engineering degree. For more information or to register for the certificate, please visit, Global Engineering Education.

CAMPUS-BASED GLOBAL EDUCATION OPPORTUNITIES

Many opportunities and programs, both inside and outside the classroom, are available to help students gain a global perspective and become ‘globally ready’. For students who do not have the inclination or the resources to participate in a program that requires travel, there are many ways to become exposed to global perspectives without leaving Penn State. One example is to get involved in extra-curricular programs and activities at Penn State with students from various parts of the world and with students who have had international experience. These activities include, but are not limited to, the international buddy program, international envoy program, and international student groups. There are also opportunities to include internationalization in course work, including minors or concurrent majors in language or international studies, international courses (IL) courses, and engineering courses with an international focus. For information about available programs and opportunities, visit Global Engineering Education.

College of Engineering students are urged to select at least one IL general education course from a limited list of recommended courses to help them to become globally ready. ‘Global Readiness’ is defined as having the knowledge and appreciation of the global nature of engineering and related professions as well as the challenges and opportunities associated with contemporary worldwide issues. Students should graduate, being ready to practice their profession in a global context by being sensitive to and respectful of the differences that affect professional practice throughout the world. This recommended list of IL courses can be found at.

For additional information about Global Engineering Education Programs, contact: international@engr.psu.edu. In addition, watch for information and announcements in Engineering News (E-News).
CONCURRENT MAJORS PROGRAMS

Although many combinations of majors are possible, descriptions of some combinations have already been established and are listed below. However, some combinations are not possible, particularly those that include two majors that are under enrollment control. Concurrent majors in Computer Science and Computer Engineering are not possible. Students should consult with a College of Engineering adviser and an adviser in the college containing the concurrent major of interest. Students should be aware that concurrent majors typically require more time. All students must follow the Entry-to-Major Process in the College of Engineering.

French/Engineering, German/Engineering, and Spanish/Engineering

These programs are offered jointly by the Colleges of the Liberal Arts and Engineering as concurrent majors programs. Qualified students can pursue both a B.S. degree in an engineering major or Computer Science and a B.S. degree in either French, German, or Spanish. In addition to the credit requirements of the selected College of Engineering major, students are required to complete credits of French, German, or Spanish language and culture, and to study or intern in a French, German, or Spanish-speaking country. Students begin this program in the College of Engineering, are assigned a Pool, and must meet Entrance-to-Major requirements for the major in which they are interested. The language option is declared after students enter a College of Engineering major. Throughout this process students need to consult with advisers in both the College of Engineering and the College of Liberal Arts.

Global and International Studies (GLOBE) / Engineering:

Students who wish to combine their major with the Global and International Studies (GLOBE) major may apply for the GLOBE concurrent major after being officially admitted to their College of Engineering major. To complete the GLOBE major, 30 credits beyond the Engineering major are required, although some overlapping of credits may be possible. 12th-credit-level proficiency in one foreign language is a prerequisite for the language courses required for GLOBE. Students with an interest in this major should consult with an adviser in the Department of Comparative Literature as soon as possible to plan the appropriate course work and identify overlapping requirements. Visit the GLOBE website for Additional information about the GLOBE major.

Concurrent Majors Combinations with Majors Under Enrollment Control

If a student is undecided between two majors or is planning to complete concurrent majors, with one of the two majors being under enrollment control, the major under enrollment control must be selected during the regular entrance-to-major process. The enrollment-controlled major cannot be added as the second major for the concurrent major. For example, a student who is considering concurrent majors with Nuclear and Mechanical Engineering may be uncertain whether to do both majors or just one. Since the Mechanical Engineering major is under enrollment control, s/he must choose Mechanical Engineering as the first major choice during the regular entry-to-major process. Nuclear Engineering could then be added for a concurrent major. If s/he decides to do only Nuclear Engineering, a change of major can be processed since students in controlled majors may move into uncontrolled majors. Changes to some majors may require departmental support. Students in uncontrolled majors cannot move into controlled majors after the regular entry-to-major process. (Please see the full description of the Entry-to-Major process on pages 12-15.)

Other Concurrent Major Programs

Concurrent majors in Mechanical & Nuclear Engineering and Civil & Surveying Engineering are standing concurrent majors programs. Information about Mechanical/Nuclear Engineering is available at Mechanical and Nuclear Engineering Undergraduate Curriculum Manual (pdf).

Integrated Undergraduate – Graduate Degree Programs

Qualified students who wish to develop deeper and/or more specialized knowledge and skills through graduate study in their major may have the option of participating in the Integrated Undergraduate Graduate (IUG) Degree Program in some departments. Integrated undergraduate-graduate study provides several advantages for qualifying students by permitting coherent planning of studies through the graduate degree, reducing the total time required to reach completion of the higher degree, providing earlier contact with the rigors of graduate study and with graduate faculty, and providing access to the resources of the Graduate School. Students who are admitted to the IUG Program may apply up to 12 credits to both undergraduate and graduate degrees. A minimum of 50% of the courses to be used for both degrees must be at the 500 or 800-level. Thesis and culminating capstone experience credits may not be double-counted.

The following College of Engineering majors have approved IUG Programs: Architectural Engineering, Engineering Science, and Mechanical Engineering. Qualified students may apply for admission to the IUG Program after they are admitted to these majors. All Schreyer Scholars are eligible to participate in the IUG Program, regardless of their major, if they qualify.
## PART IV: STUDENT ORGANIZATIONS

### COLLEGE OF ENGINEERING STUDENT SOCIETIES AND ORGANIZATIONS

<table>
<thead>
<tr>
<th>Society</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>Engineering Club</td>
<td>Brandywine</td>
</tr>
<tr>
<td>Engineering Undergraduate Council (EUC)</td>
<td>University Park</td>
</tr>
<tr>
<td>Engineering Society</td>
<td>Worthington-Scranton</td>
</tr>
<tr>
<td>Engineers Without Borders</td>
<td>University Park</td>
</tr>
<tr>
<td>Engineering Students for International Outreach (ESIO)</td>
<td>University Park</td>
</tr>
<tr>
<td>International Association for the Exchange of Students for Technical Experience (IAESTE)</td>
<td>University Park</td>
</tr>
<tr>
<td>National Society of Black Engineering (NSBE)</td>
<td>University Park</td>
</tr>
<tr>
<td>Out in Science, Technology, Engineering, and Mathematics</td>
<td>University Park</td>
</tr>
<tr>
<td>Society of Hispanic Professional Engineers (SHPE)</td>
<td>University Park</td>
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<tr>
<td>Society of Women Engineers (SWE)</td>
<td>University Park</td>
</tr>
<tr>
<td>Surveying Society</td>
<td>Wilkes-Barre</td>
</tr>
<tr>
<td>Tau Beta Pi (Honor Society)</td>
<td>University Park</td>
</tr>
<tr>
<td>Women in Science, Engineering, and Technology (WISET)</td>
<td>Fayette</td>
</tr>
</tbody>
</table>

### MAJOR-RELATED SOCIETIES AND ORGANIZATIONS

Information about major-related societies and organizations can be found at the end of the major description for each major in Section VIII.
PART V: MINORS

A minor is a grouping of at least 18 credits that may be used to supplement a major. A minor program may consist of course work in a single area or courses from several discipline areas around a theme or topic, with at least 6 credits at the 400-level. Students must register for a minor in order to be awarded the minor and have it noted on their transcript and diploma. Registration is done through eLion after a student is admitted to a major and before the graduating semester.

Students may register for a minor offered by any Penn State college as long as they meet any necessary requirements for the minor. They may even register for a minor offered at another campus if the courses required for the minor may be completed at their own campus. Students may not change their campus for the purpose of completing the requirements for a minor.

Complete descriptions, course requirements, and the names and numbers of people to contact for more information about College of Engineering minors can be found on the Web sites listed below. Penn State offers over 100 minors. See the Baccalaureate Degree Programs Bulletin for minors offered by other colleges.

Minors currently offered by the College of Engineering are:

| Agricultural & Biological Engineering |
|                                       |
| Please contact Dr. Megan Marshall     |
| Bioengineering                        |
| Engineering Leadership Development    |
| Engineering Entrepreneurship          |
| Engineering Mechanics                 |
| Environmental Engineering             |
| Nanotechnology                        |
| Product Realization                   |
| Six Sigma                             |

PART VI: CERTIFICATES

A certificate program consists of 12 credits of course work grouped around a theme. The requirements for a certificate may be met by selecting certain electives within a major and/or by adding certain specified courses for the certificate. Students must register for a certificate program and upon completion of the requirements will be awarded a certificate; a notation of such will appear on their transcript. The following certificate programs have been approved in the College of Engineering. Visit and scroll to Certificate Programs for links to each Certificate.

• (Humanitarian) Engineering and Community Engagement
• Engineering Design
• Housing
• International Engineering
• Space Systems Engineering
PART VII: ALTERNATIVES to COLLEGE OF ENGINEERING BACCALAUREATE MAJORS

Alternatives

Students who are not admitted to a major in the College of Engineering or who determine that the majors in the College do not meet their educational interests, should seek a major in another college. There are several engineering and engineering-related programs available at other locations and in other colleges that can offer a satisfying and fulfilling academic experience. This section provides information about several of these options. For more information about the options described here, see Penn State’s Baccalaureate Degree Programs Bulletin or Associate Degree Programs Bulletin.

COLLEGE OF EARTH AND MINERAL SCIENCES (UP)

The **College of Earth and Mineral Sciences** offers B.S. degrees in the following five engineering programs:

- Energy Engineering (EGEE)
- Materials Science and Engineering (MATSE)
- Petroleum and Natural Gas Engineering (PNG E)
- Environmental Systems Engineering (ENVSE)
- Mining Engineering (MNG E)

Information about these five majors may be obtained in the College of Earth and Mineral Sciences Student Center (EMSSC) in Room 14 Deike Building, University Park, by calling 814-863-2751. Students interested in these majors receive advising at the EMSSC.

ALTOONA COLLEGE at Altoona, PA

**Penn State Altoona, The Altoona College** offers an engineering program leading to a B.S. degree in Rail Transportation Engineering. The Bachelor of Science in Rail Transportation Engineering (BSRTE) will provide students with the necessary skills for careers in the rail freight and passenger transportation industries. The RTE degree provides a solid background in engineering design, but also focuses on the maintenance and management skills required by the rail industry. The program provides a breadth of knowledge in the major areas associated with the design, operation, and maintenance of rail systems, including the engineering of rail and track structures, basic rail operating practices and safety, wheel/track dynamics, construction and maintenance of railroad infrastructure, and basic railroad communications and signals. Laboratories are used throughout the RTE curriculum to provide students with experiences in the field with actual rail equipment, and extensive team-based laboratory activities are used to develop the leadership qualities that are essential of rail professionals. In order to prepare students for the occupational challenges associated with careers in the rail industry, careful and candid discussions of career possibilities and working environments typical of railway professionals are provided throughout the RTE program.

For more information or contact **Ms. Irene Ferrara** or **Dr. Hai Huang**

BEHREND COLLEGE at Erie, PA

**Penn State Erie, The Behrend College** offers engineering and engineering-related programs leading to a Bachelor of Science degree. The School of Engineering and Engineering Technology offers B.S. degrees in four engineering programs, Computer Engineering, Electrical Engineering, Mechanical Engineering, and Software Engineering as well as three engineering technology programs, Electrical and Computer Engineering Technology; Mechanical Engineering Technology; and Plastics Engineering Technology. Additionally, **Penn State Erie** offers B.S. degrees in: Astronomy, Biology; Chemistry; Computer Science, Geoscience; Mathematics with options in Applied Math, Business, Computer Science, General Math, or Math Education Precertification; Physics; and Science.

For more information or contact **Dr. Ralph Ford**, Director, School of Engineering and Engineering Technology, Erie Campus, 814-898-6153.

CAPITAL COLLEGE at Harrisburg, PA


Refer to **Penn State Harrisburg** for more information or contact **Dr. Jerry Shoup**, Interim Director, School of Science, Engineering, and Technology, Harrisburg Campus, 717-948-6541.
ENGINEERING TECHNOLOGY

Penn State offers engineering technology degrees at twelve campuses throughout the Commonwealth of Pennsylvania. With five baccalaureate degrees and nine associate degrees available, Penn State’s engineering technology program is among the largest in the nation. From the first year on, all technical courses have an intensive hands-on laboratory to emphasize industry-based applications. Math and science courses are integrated throughout the curricula. Calculus-based sciences are integrated in the upper-level courses.

Courses in engineering technology at Penn State are small, personal, and taught by faculty members who have a minimum of three years of industry experience. Faculty members work closely with local and regional employers to give students the real-world knowledge and skills to perform effectively in a rapidly changing and highly technical workplace.

Baccalaureate Degree Programs:
- Electrical and Computer Engineering Technology* - Offered at Penn State Erie
- Electrical Engineering Technology* - Offered at Penn State Harrisburg and Wilkes-Barre
- Electro-Mechanical Engineering Technology* - Offered at Penn State Altoona, Berks, New Kensington, and York
- Mechanical Engineering Technology* - Offered at Penn State Erie and Harrisburg
- Plastics Engineering Technology* - Offered at Penn State Erie
- Structural Design and Construction Engineering Technology* - Offered at Penn State Harrisburg

Associate Degree Programs:
- Biomedical Engineering Technology* - Offered at Penn State New Kensington
- Building Engineering Technology (2BLET)*
  - Architectural Engineering Technology Option - Offered at Penn State Fayette and Worthington Scranton
  - Building Environmental Systems Option - Offered at Penn State Fayette
- Electrical Engineering Technology* - Offered at Penn State Altoona, Berks, Erie, Fayette, Hazleton, Wilkes-Barre, and York
- Materials Engineering Technology* - Offered at Penn State DuBois
- Mechanical Engineering Technology* - Offered at Penn State Altoona, Berks, DuBois, Erie, Hazleton, New Kensington, Shenango, and York
- Nanofabrication Manufacturing Technology - Offered at Penn State Fayette, Hazleton, Wilkes-Barre, and York
- Plastics Engineering Technology* - Offered at Penn State Erie
- Surveying Technology* - Offered at Penn State Wilkes-Barre

* These programs are accredited by the Technology Accreditation Commission of ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: 410-347-7700.

Contact Information:
- School of Engineering Design, Technology and Professional Programs (SEDTAPP) phone 814-865-7589 or e-mail
- School of Engineering and Engineering Technology, Penn State Erie, The Behrend College, phone 814-888-5153 or e-mail
- School of Science, Engineering, and Technology, Penn State Harrisburg, The Capital College, phone 1-800-438-7941 or e-mail

OTHER OPTIONS

Other possible options are a change of major into (1) the interdisciplinary science programs, SC BA or SC BS, in the Eberly College of Science, (2) the Food Science, FD SC, program in the College of Agricultural Sciences, or (3) any of the various other majors offered through Penn State at its University Park and commonwealth campus locations. Contact individual academic departments or the DUS adviser/coordinator at your location.
PART VIII: COLLEGE OF ENGINEERING MAJORS
INFORMATION ABOUT USING THE COLLEGE OF ENGINEERING MAJORS SECTION

The scheduling recommendation for each major is meant to provide general guidance and is only one example of a scheduling plan to complete degree requirements. Each student’s situation will be unique and will depend on placement test results, AP credits earned, transfer credits, course availability, or planned major. Each student is responsible for scheduling courses in a sequence that meets prerequisite requirements, and must keep these in mind when selecting courses each semester. All suggested scheduling plans, with the exception of EMET, are based on a student’s readiness to start with MATH 140 (Calculus I). If a student is not ready for MATH 140 and must begin by taking one or more pre-calculus courses, additional semesters (or summer study) may be needed to complete degree requirements.

The courses required for each major are shown in a matrix of semester-by-semester plans for students beginning at each campus. These suggested plans are subject to change depending on changes in degree requirement, course availability, and scheduling. They are intended primarily for first- and second-year students, to assist them with scheduling. Please note that some courses at some campuses are only offered once a year and therefore careful planning is required to avoid extra semesters. The required courses for any major may change at any time and if they do, the department will have an appropriate plan for those students who may be caught in the transition. At the time of entry to a major, the students will be provided with the specific course requirements for the major, in much more detail than is provided by this Programs Guide.

The flowcharts that are provided are designed to assist students with proper course planning while considering prerequisites. Many students find it helpful to use the flowchart along with the semester-by-semester plans to enable them to most effectively choose courses that allow academic progress while ensuring that courses are taken in the appropriate sequence.

If further assistance is needed for schedule planning, please consult with an academic adviser. Information is provided on page 3 and 4 about how to contact an adviser, based on campus location and major status.

WHERE TO FIND INFORMATION ABOUT COLLEGE OF ENGINEERING MAJORS

College of Engineering Website
The College of Engineering Website is www.engr.psu.edu. Take some time to explore the site to learn more about the College and what is available for students. Use the “Academic Programs” link to learn more about majors of interest.

Advising
Students at University Park interested in finding out more about a particular major offered by the College of Engineering can request an appointment in the Engineering Advising Center with a faculty member from that department by calling 814-863-1033 or on the COE website. Students can also meet with full-time advisers or the DUS Programs Coordinator for more information about the College of Engineering and available majors. Students at commonwealth campuses should consult the College of Engineering Contact and Referral Representative at their location.

Major Nights at University Park
During fall semester, each department in the College hosts a Major Night. This is an evening event during which professors and students in the major present information about careers, courses and answer questions from students. Major nights are announced in E-News and students from all campuses are welcome.

Spring and Fall Penn State Career Fairs
These programs, scheduled annually during February, March, and September, helps provide students with information about career opportunities. Personnel representatives display materials about their companies, accept résumés from students for professional internships, co-op experiences, and full-time jobs, and hold on-site placement interviews. Participation in Career Days is a beneficial educational experience even for those students not currently seeking placement with a company. For more information, contact the Engineering Career Resources & Employer Relations office, 205 Hammond, University Park, Phone: 814-865-1032, or visit Career Days online. Students at the commonwealth campuses should check with their faculty adviser to learn about planned transportation to these events. Additional Career Fairs for College of Engineering students will be announced in E-News.
Career Services
The University Office of Career Services, located in the Bank of America Career Services Center, University Park, provides information about engineering careers and occupations. Students may also investigate their interests and abilities by completing self-assessment surveys. Professional career counselors are available to provide assistance in interpreting the results and answering questions. The office also provides assistance with résumé writing, interview skills, and job-search strategies. Call 814-865-2377 for more information or visit the Career Services website. Commonwealth campus students can learn about Career Services at their location by visiting the Student Affairs website. Additional information and support are provided by the Engineering Career Resources & Employer Relations office.

First-Year Seminars
All University Park students and students at some commonwealth campuses must take a First-Year Seminar (FYS) as part of the first-year engagement requirement. Of the many different engineering seminars at University Park from which to choose, about one-third are classified as Introduction to Major wherein students learn about a specific major in the College of Engineering. For students who want to explore all of the College’s majors, ENGR 100S, Introduction to Engineering, is designed for that purpose. Visit the College of Engineering’s FYS website for the University Park listing. Contact the College of Engineering representative at your location for more information about First-Year Seminar choices at your location.

If the FYS components are included in a 3-credit course that also meets another degree requirement, for example ENGL 015S or EDSGN 100S, care must be taken to ensure that the minimum number of credits needed for the major is also met. Some commonwealth campuses do not offer any FYS courses because they have demonstrated that their students meet the first-year engagement goals in other ways. Students who begin at campuses that do not offer any FYS courses must also ensure that the minimum number of credits needed for their major are met.

Major-Related Student Societies and Organizations
Attending meetings of societies and organizations is a great way to learn about majors as well as research how to be involved outside of the classroom as an undergraduate student. In addition to learning about majors and meeting upper-class students, involvement helps develop skills that are useful in the work place.

Engineering News (E-News)
E-News is an electronic newsletter that is sent to all undergraduate students enrolled in the College of Engineering at all locations. Read E-News weekly when it arrives by e-mail to learn about events and presentations related to majors and career paths during the academic year.
More so than most other disciplines, aerospace engineering is defined largely by reference to a specific industry, one that is increasingly global and competitive. Aerospace engineers develop leading-edge technology and integrate it into aerospace vehicle systems for exploration, infrastructure, and defense applications. The work of aerospace engineers improves our quality of life and contributes to the solution of societal issues like climate change and renewable energy. Examples include air travel and overnight delivery, satellite-based remote sensing and global positioning, and wind energy. The study of aerospace engineering prepares students for the design, analysis, and testing of aeronautical and astronomical vehicles and their components, including airplanes, helicopters, launch vehicles, satellites and other spacecraft, as well as jet- and rocket-propulsion systems. A few graduates even go on to careers as pilots or astronauts! About 1 in 25 new B.S. aerospace engineers in the U.S. is a Penn State graduate.

The traditional discipline of aerospace engineering builds on the four technical pillars of aerodynamics, propulsion, structures, and controls, augmented by computing, communications, and information technology. Students take courses, including laboratories, in these foundational areas. In the senior year, students can choose to emphasize aircraft or spacecraft applications. Students also have a liberal choice of technical electives with which to expand their knowledge in these and more specialized subjects, such as airplane performance, flight testing, space propulsion, composite structures, automatic controls, orbital mechanics, and computational methods. The overall curriculum emphasizes the integration of core knowledge, practices, and technologies in vehicle systems engineering. Many hands-on elective projects serve as capstones to the vehicle design experience.

Approximately one-fifth of all engineers in the aerospace industry hold degrees in aerospace engineering, the rest having backgrounds mainly in mechanical, civil, electrical, or computer engineering. However, the aerospace engineers have the broad, multi-disciplinary understanding needed to play an important role as architects and integrators of increasingly sophisticated vehicle systems.

Is Aerospace Engineering for You?
Students in this major are often motivated by a strong interest in aeronautics and/or astronautics. The curriculum emphasizes fundamentals in mathematics and the technical disciplines, bringing them together to address vehicle performance and design. Since engineers usually work in teams as part of larger organizations, strong communications and people skills are also very important. To enable graduates to compete successfully in a truly global economy, the faculty has set high standards and students strive to meet them. Some students also elect to pursue specialized graduate education in one or more of the technical pillars of aerospace. Graduate degrees in aerospace engineering are highly valued in the industry, as the more thorough preparation enables new hires to perform at a higher level.

Aerospace engineering graduates find employment in a wide range of companies and governmental organizations and research laboratories. These include manufacturers of engines, aircraft, helicopters, wind turbines, missiles, launch vehicles, and spacecraft, as well as commercial airlines, satellite service companies, simulation software developers, government support contractors, NASA, the FAA, and a number of military research laboratories.

Examples of typical entry-level jobs include: analysis, construction, and testing of various components and systems, such as wing sections, rocket engines, composite structural parts, flight control systems, and embedded software. Additional positions involve planning, conducting, and analyzing flight tests of aircraft or spacecraft. Other possible assignments include monitoring and controlling satellites from a ground station, planning and monitoring space missions, and developing diagnostic procedures and software to monitor system performance and health. With some experience, graduates can expect to participate in vehicle configuration design and systems engineering.

Detailed Program Objectives
Aerospace Engineering B.S. graduates will be able to:

1. analyze the dynamics and control characteristics of aerospace vehicles, including the basic translational and rotational dynamics, and the basic theory and practice used to control these motions,
2. analyze fluid dynamics, including the regimes of subsonic, transonic, and supersonic flows, inviscid and viscous flows, and laminar and turbulent flows,
3. apply knowledge of the fundamentals of aeronautics, including aerodynamic characteristics or aircraft, propulsion systems, airplane performance, and elementary aircraft stability & control,
4. apply knowledge of the fundamentals of astronautics, including orbital mechanics, attitude dynamics & control, rocket propulsion, and the space environment,
5. predict performance, and conduct preliminary design, of gas turbine and rocket-based propulsion systems and their components,
6. analyze the detailed dynamics, stability and control of either aircraft or spacecraft,
7. analyze and design structural elements such as bars, beams, plates and thin-walled structures,
8. make measurements to test hypotheses or to characterize the performance of physical systems (aerodynamic, structural, and control), and analyze and interpret the data in written reports,
9. complete the successive stages of conceptual, preliminary, and detailed design of an aircraft or spacecraft mission and the associated vehicle(s),
10. function effectively on teams to solve problems in complex aerospace systems that require knowledge of multiple disciplines,
11. apply an understanding of professional and ethical responsibility to realistic situations,
12. make effective oral and written presentations in the format appropriate for the setting,
13. explain how this profession affects society as a whole, and to demonstrate an appreciation of how technical issues guide societal actions,
14. demonstrate an awareness of the need to stay abreast of technical developments throughout their working careers, and demonstrate that they are able to maintain and extend their learning, and
15. make appropriate and effective use of computer software, hardware, and state-of-the-art laboratory instrumentation.

For additional information, visit the Department of Aerospace Engineering website at www.aero.psu.edu or contact Dr. Robert G. Melton at 814-865-1185 or by e-mail at rgmelton@psu.edu. Aerospace Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; www.abet.org.

Study Abroad

Aerospace Engineering students have participated in Study Abroad at institutions such as:
The University of New South Wales (Sydney, Australia)  
University of Sydney (Sydney, Australia)  
Tohoku University (Tohoku, Japan – classes taught in English)  
RMIT (Melbourne, Australia)  
Exchange programs with universities in England and Singapore are being developed.

Since aerospace courses are offered only once a year, each student’s course schedule will be different, based on which semester or year he or she plans to be away from Penn State. Please consult with Dr. Robert Melton, Professor of Aerospace Engineering and Director of Undergraduate Studies, to formulate a semester plan for Study Abroad as soon as possible. Dr. Melton can be reached at 814-865-1185 or rgmelton@psu.edu.

Student Societies and Organizations
Advisor and contact information about the following departmental student organizations can be found at http://www.engr.psu.edu/StudentOrganizations/
1. American Helicopter Society (AHS) http://www.clubs.psu.edu/up/ahs
2. American Institute of Aeronautics and Astronautics (AIAA) http://www.clubs.psu.edu/up/aiaa/blog
3. Sigma Gamma Tau (ΣΓΤ, Honor Society)
ARCHITECTURAL ENGINEERING (A E)

Architectural Engineering (AE) is the application of scientific and engineering principles to the design and construction of buildings. The architectural engineering curriculum focuses on the methodology of engineering the architecture as well as the engineered systems within a building, including topics such as building materials, construction management, and analysis/design in the following areas: building mechanical systems, acoustics, illumination systems, electrical systems, and structural systems including sustainable and high performance building design. Architectural engineering students begin their study in the basic mathematics and sciences and proceed to the general engineering sciences before learning to apply these principles to buildings in an array of AE courses. In addition, a series of courses in general architectural design provide graduates with an understanding of the design process carried out by an architect. This series of courses in architecture begins by addressing basic design and concludes with an advanced series focusing on, building design and integrated project design. Architectural Engineering is a 5-year undergraduate program leading to a Bachelor of Architectural Engineering (B.A.E.) degree.

B.A.E. Educational Objectives

The graduates of the undergraduate program in Architectural Engineering are expected to be:

• Capable of a professional career in the building industry.
• Qualified and competent to obtain and maintain professional licensure.
• Capable of meeting the challenges of the professional engineering work environment and assuming leadership responsibilities.
• Capable of solving design and project related problems based on sound engineering principles.
• Successful in conducting multi-disciplinary/inter-disciplinary interactions.
• Engaged in service to the public and profession.
• Developing professionally by participating in continuing education, self improvement, professional conferences, and/or graduate school

Architectural Engineering synthesizes topics from architecture and a range of engineering disciplines that apply to building systems, including civil, mechanical and electrical engineering. The architectural engineering graduate is an individual with both a broad knowledge about buildings and building systems, and in-depth knowledge in one or more option area of specialization.

The first three years of study are common to all AE undergraduates and provide students with a broad understanding of building systems and fundamentals of engineering. At the end of the third year of study, each qualified B.A.E student selects one of four options for further specialization.

• Construction, which emphasizes the construction engineering and management techniques required for the construction of modern buildings.
• Lighting/Electrical Systems, which emphasizes the analysis and design of energy efficient, quality lighting systems and the development of safe and effective electrical distribution systems for buildings.
• Mechanical Systems, which includes the analysis and design of energy-efficient, high-performance heating, ventilation and air conditioning (HVAC), plumbing systems, and acoustical control for buildings.
• Building Structures, which addresses the analysis and design of systems that provide structural support for the building, including those comprised of steel, concrete, wood, and other building materials.

A number of research opportunities are available to undergraduates. Through these opportunities, students work with faculty on research and educational support activities both during the academic year and throughout the summer. Summer employment in architectural engineering fields of practice is highly encouraged, particularly for students nearing completion of the program. Many design and construction companies regularly hire AE students for full-time summer positions.

Most graduates from the Lighting/Electrical, Mechanical, and Structures options accept jobs in organizations involved in building design. These include consulting engineering and architecture/engineering firms, commercial organizations having extensive building facilities, and government agencies. Other AE graduates find employment with industries that supply building materials and components. Construction option graduates typically accept positions in large building construction and construction management firms, or leading commercial and residential developers. Some AE graduates pursue advanced degrees at Penn State or other well-regarded academic institutions.

The breadth of training provided by the architectural engineering program makes its graduates highly attractive to the building industry. Graduates are well-qualified to design and coordinate the activities of the many specialized professionals engaged in a complex building project. A significant portion of AE graduates rise to senior management positions.
It is desirable (and for some positions required) for architectural engineers to obtain the Professional Engineer (P.E.) license. Students are strongly encouraged to take the Fundamentals of Engineering examination in their 4th or 5th year and the Professional Engineering Examination after a few years of practical experience, working under the supervision of a professional engineer.

**Is Architectural Engineering For You?**

An architectural engineer must have a creative mind and be adept at solving problems. Many of the best building designs employ new concepts in solving unique design and construction problems. An architectural engineer must be an effective communicator, both verbally and graphically. Conveying information and understanding drawings requires an ability to think in three dimensions. The design and construction process involves significant teamwork and integration of disciplines. Architectural engineers who are well-organized, and who have mastered the ability to manage projects of significant scope, become leaders of project design and construction teams. They also become leaders in building-related businesses and organizations.

**Entrance to Major**

Admission to Architectural Engineering is limited (see page 13) and is accomplished in one of the following two ways.

1. **Admission into ENGAE status after the first year. (Standard / Recommended)**

   Admission into ENGAE status from ENGR or DUS after the Spring semester of the first year is based on grade point average and completion of Entrance-to-Major course requirements.
   - Interested ENGR students must indicate AE as their first choice in the Major Preferences for First-Year Students process during the Spring semester of their first year. (See page 15)
   - Interested DUS first-year students must be identified by their advisers. The advisers will notify the College of Engineering at that time.

   ENGAE is a second-year status for AE that enables students to enroll in controlled Architectural Engineering and Architecture classes and to have Architectural Engineering faculty advisers assigned to them. Preference is given to those students who have a GPA of 3.00 or greater and have completed MATH 140 and 141, PHYS211, and CHEM 110 with a grade of “C” or better. At the discretion of the Department, additional students may be selected. (See page 15) Students are notified in June if they were admitted into ENGAE status. Admission to ENGAE necessitates that students at a commonwealth campus change to University Park for the Fall semester of their second year. All ENGAE students must take the prescribed 3rd semester AE and ARCH courses.

2. **Admission into AE after the second year. (Secondary Option)**

   During the regular Entrance to Major (ETM) period in the spring of the second year, students must select AE as follows:
   - ENGAE students who wish to remain in Architectural Engineering must select and confirm Architectural Engineering by the published deadline to remain in the program. All ENGAE students (With a minimum GPA of 2.75) selecting AE will be admitted into the major.
   - ENGR or DUS students who were not previously admitted to ENGAE may request Architectural Engineering during the regular ETM period by the published deadline. Admission to the major for these students is based on available space. ENGR or DUS students who have completed the Entrance-to-Major requirements are placed in a queue in descending order by GPA and selected in that order until no spaces remain. Qualified students with a cumulative GPA of 3.00 or higher at the beginning of the pool semester having completed a significant portion of the prescribed technical coursework are offered admission to Architectural Engineering. Students’ admission status is confirmed by maintaining the qualifying GPA through the completion of the Pool semester.

For more information, please visit the Departmental web site at [http://www.engr.psu.edu/ae/](http://www.engr.psu.edu/ae/) or contact Professor Moses Ling in 104 Engineering Unit A or by e-mail at mosesling@psu.edu. Architectural Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; [http://www.abet.org/](http://www.abet.org/).

**Student Societies and Organizations**

Information regarding the following A E student organizations can be found at [http://www.engr.psu.edu/StudentOrganizations/](http://www.engr.psu.edu/StudentOrganizations/).

1. Student Society of Architectural Engineering (SSAE) (PSU Chapter of AEI)
2. American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE)
3. Design Build Institute of America (DBIA)
4. Earthquake Engineering Research Institute (EERI)
5. Illuminating Engineering Society (IES)
6. Mechanical Contracting Assoc. of America (MCAA)
7. National Association of Home Builders (NAHB)
8. National Electrical Contracting Association (NECA)
9. Phi Alpha Epsilon Honor Society
10. Structural Engineers Association (SEA)
11. Student Society of the Partnership for Achieving Construction Excellence (S:PACE)
12. United States Green Building Council (USGBC)
BIOENGINEERING (BIOE)

The Bioengineering curriculum emphasizes the continuous integration of classical and modern engineering principles with the life sciences and health care. Bioengineers apply these skills to innovation in the health care industry, basic biological sciences, and the underpinning of medical practice.

Consistent with the mission of Penn State University and the College of Engineering, the Penn State Bachelor of Science program in Bioengineering aims to create world-class engineers who will, after graduation, contribute to social and economic development through the application of engineering to the solution of problems in medicine and biology.

Three to five years after graduation, we expect our graduates to be:

- employed in industry positions which include, but are not limited to, research and development, manufacturing, quality assurance and sales and marketing, or,
- enrolled in graduate school, continuing education, or other professional development programs related to biomedical sciences and engineering, or,
- enrolled in medical school, dental school, or other health-related professional training programs.

Is Bioengineering for you?
Bioengineering is engineering applied to medicine and biology. As an engineering discipline, it rests upon the same math and physics base as other engineering disciplines. Students follow a curriculum of study designed to develop a strong foundation in the engineering sciences and a breadth of knowledge in the life sciences. Emphasis on biomedical applications requires students to develop and maintain an awareness of modern biology and develop an appreciation for the unique safety and efficacy standards which apply to medical devices.

Many employment opportunities are available for graduates. Students with interests in hands-on bench top laboratory work may be attracted to careers focusing on instrumentation, prosthetic devices, artificial organs, biosensors, medical imaging devices or physiological experimentation. Students interested in more analytical studies may have greater interests in computer modeling, physiological simulations or medical imaging. Regardless of personal choice, the undergraduate curriculum aims to provide a solid foundation in engineering fundamentals and a balanced overview of the many application areas that lead to a specific career track. Graduates have accepted positions at medical device and pharmaceutical companies as well as government and regulatory organizations. Other students choose to directly enter graduate programs or medical school. Some organizations that our graduates have accepted positions from include: Merck and Co., Johnson and Johnson, the United States Patent and Trademark Office, Boston Scientific, Regeneneron, and Abiomed. Students who are intellectually curious and academically motivated will find the program very rewarding.

Curriculum
The undergraduate curriculum consists of common core courses taken by all Bioengineering students, plus concentration in one of four option areas: chemical engineering, mechanical engineering, electrical engineering, or material science. In the first year, students receive their initial exposure to the world of Bioengineering through a seminar course designed to explore the breadth of Bioengineering. During their sophomore year, in addition to the math and physics courses, students take an entry level course in physiology and an associated lab course to gain hands-on experience with living organisms, organs, and tissues. Students also take a molecular and cell biology course similar in nature to that taken by life science students, but with a quantitative focus and informative mathematical examples.

The junior year includes a first course in linear systems analysis similar in engineering content to that in electrical engineering but with applications to the control of physiological systems. A parallel lab course gives students a first exposure to computer simulation of physiological systems. The junior year also includes the foundations of continuum mechanics as applied to solid and fluid systems to gain an understanding of the mechanical properties of tissues, such as muscles and bones, and the viscous properties of fluids, such as blood. Additionally, students take a thermodynamics course which considers the fundamentals of energy balances as applied to physiological systems. These courses are followed by the fundamentals of medical instrumentation design and further studies on the physical properties of tissues and their function. During the senior year, the students integrate many of their engineering and life science experiences into a study of the design of medical devices in a capstone design course. This course is a multidisciplinary team-based course where students work with a clinical or industrial sponsor on a design problem. Students work to understand customer and user needs, propose designs, and build a prototype device. In the past students have designed and developed devices to help patients with spinal cord injury, diabetes, ADHD, and amputation.
Throughout the curriculum, students are expected to strengthen their engineering and physical science skills by selecting one of four different options which determines their advanced coursework. Each option area consists of a sequence of 19-20 credits of prescribed coursework.

The option areas are:

1. **Electrical Engineering** - for students wishing to study the design and development of medical devices, signal processing, and medical imaging;
2. **Chemical Engineering** - for studies of transport within physiological systems, drug delivery, and development of engineered tissues;
3. **Mechanical Engineering** - for studies of the mechanics of the human body in health and disease, and applications to medical devices and orthopedics;
4. **Material Science** - for studies of biomaterials that are designed to interact with living tissues at the cellular and molecular level and tailored to affect tissues in a prescribed manner.

**Caution:** Students should not break up the 5th - 6th semester sequence of core Bioengineering courses (BIOE 301, 302, 303, 313, 401, 402, 403, 404) with Co-op or study abroad. Each of these courses are taught only once per year. To be ready for the 5th semester, MATH 251, MATH 230, BIOL 141, PHYS 212, CHEM 112, CMPSC 200, and E MCH 210 (or E MCH 211 and 213) must be completed.

The Bioengineering Department encourages students to meet with an academic adviser at least once per academic year to ensure that progress is being made toward completing degree requirements and to discuss any other academic goals (e.g. concurrent majors, minors, preparation for medical school, study abroad).

For additional information, visit the Bioengineering home page at [http://www.bioe.psu.edu/](http://www.bioe.psu.edu/) or contact the Undergraduate Office at 814-863-6614, bioemajor@engr.psu.edu or Dr. Margaret J. Slattery at mjs436@psu.edu. Bioengineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; [www.abet.org](http://www.abet.org).

**Student Societies and Organizations**

Adviser and contact information about the following departmental student organizations can be found at [http://www.engr.psu.edu/StudentOrganizations/](http://www.engr.psu.edu/StudentOrganizations/).

1. **Biomedical Engineering Society (Student Chapter)**
Biological Engineering (B E) helps prepare students for careers involving the application of engineering principles to biological and agricultural production systems, processing systems, and protection of land and water resources. Education in mathematics, physics, and engineering sciences common to all engineering disciplines is provided along with specialized training in biological, agricultural, and environmental sciences. The curriculum covers all areas of biological engineering, including food engineering and safety, post-harvest handling and processing of commodities, power and machinery development and applications, biomass utilization and bio-energy, soil and water management, structures and their environmental modifications, and product synthesis using microbiological organisms.

**Biological Engineering Program Educational Objectives**

Early career Biological Engineering graduates will be expected to:

1. Demonstrate proficiency in basic and engineering sciences related to biological processing, natural resource, and agricultural engineering fields;
2. Effectively identify, analyze and design sustainable solutions to address issues and opportunities throughout the world;
3. Have the ability to work in teams and effectively communicate within and outside the profession;
4. Demonstrate strong leadership skills, ethical integrity, and professional engagement.

**Options in Biological Engineering**

A student can select the Agricultural Engineering Option, the Food and Biological Process Engineering Option, or the Natural Resource Engineering Option.

The Agricultural Engineering Option provides emphases in the following two areas:

- Structural analysis and environmental control with a focus on design of wood structures.
- Machinery design and systems management, including off-road equipment for agricultural production, construction, forestry, and food processing.

The Food and Biological Process Engineering Option provides specialization in the many engineering aspects associated with the following two areas:

- Engineering of microbiological systems for pharmaceuticals, renewable energy, biomass conversion, vitamin and food supplements, and systems to eradicate pathogens for food safety.
- Food processing, handling, and storage from the time food is produced until it reaches consumers.

The Natural Resource Engineering Option provides emphasis in the following two areas:

- Engineering for the protection of the environment from non-point pollution, including sedimentation loss, nutrient and chemical run-off, and storm water management.
- Designing solutions for the protection of our natural resources, including stream restoration and bioremediation.

**Is Biological Engineering for You?**

There are many rewarding careers in Biological Engineering for men and women who:

- Desire to combine interests in engineering, agriculture, biological sciences, and the environment;
- Want to apply engineering to living, biological systems;
- Like to experiment with machinery, structures, processes, or electronic systems;
- Enjoy finding engineering solutions to critical problems;
- Seek challenges in integrating high-tech, cost-effective designs in a growth industry.

Biological Engineering graduates are in demand and find a variety of career opportunities. Graduates are employed in private industry, government service, universities, consulting engineering firms, and other areas. Graduates have found positions in research, design, analysis, development, testing, sales, and management. Many of these jobs are with bio-based product development (e.g. Merck, Johnson and Johnson), food processing (e.g. Hershey Foods, General Foods, Kellogg’s), off-road machinery development (e.g. New Holland, Caterpillar, John Deere), soil and water protection (e.g. Natural Resources Conservation Service, Environmental Engineering Consulting Firms), materials handling (e.g. MacLanahan Corp.), wood structures (e.g., RigidPly, Timber Tech), or plant and crop storage (e.g., Cargill). Biological engineers are uniquely qualified to deal with the various engineering aspects associated with food production and processing within the constraints of environmental protection and natural resource conservation.

For additional information, visit the Agricultural and Biological Engineering Department homepage at [http://www.abe.psu.edu/](http://www.abe.psu.edu/) or contact Dr. Megan Marshall at 814-865-3392 or by e-mail at mnm11@psu.edu. Biological Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; [www.abet.org](http://www.abet.org).

**Student Societies and Organizations**

Advisor and contact information about the following departmental student organizations can be found at [http://www.engr.psu.edu/StudentOrganizations/](http://www.engr.psu.edu/StudentOrganizations/).

1. Student Branch of the ASABE, the Society for Engineering in Agricultural, Food, and Biological Systems
Chemical Engineers are involved in a wide range of high technology industries that produce new pharmaceuticals and high value chemicals, manufacture microelectronic devices, develop high performance plastics and alternative fuels, purify therapeutic proteins, and design artificial organs. Chemical Engineering (CH E) is unique in its focus on the processes involved in making new products, including both the chemical / biological reactions and the complex physical transformations and purifications. As such, Chemical Engineering draws heavily on the basic sciences, with a particular emphasis on Physical Chemistry, Organic Chemistry, Molecular Biology, and Physics.

Program Educational Objectives
The undergraduate program in Chemical Engineering at Penn State has been designed so that students can identify and pursue their personal and professional goals while obtaining a strong foundation in the principles and practice of Chemical Engineering. The program aims to produce graduates who will attain one or more of the following:

1. Careers as practicing chemical engineers in traditional chemical and energy-related industries as well as in expanding areas of materials, environmental, pharmaceutical, and biotechnology industries.
2. Advanced degrees in chemical engineering (or a related technical discipline), medicine, law, or business.
3. Positions that provide the technical, educational, business, and / or political leadership needed in today’s rapidly changing, increasingly technological, global society.

The first two years of the undergraduate program provides the necessary foundation in mathematics, physics, chemistry, and molecular biology. Students then take the core chemical engineering courses, covering fundamentals and applications of material and energy balances, thermodynamics, heat and mass transfer, fluid mechanics, and chemical reaction engineering. The curriculum culminates in capstone laboratory and design courses, both of which give students hands-on experience with state-of-the-art equipment and computational software. Elective courses are available in bioprocessing, nanotechnology, polymers, biosensors, and process safety - all taught by Chemical Engineering faculty with extensive experience in these subjects.

Options in Chemical Engineering - Students can choose to pursue one of four undergraduate options:

General Option: Provides greatest flexibility and broadest coverage of Chemical Engineering
Energy and Fuels: Focuses on energy production and conservation including new efforts in fuel cells and hydrogen technology
Polymer Engineering: Provides a strong background in the processing, development, and properties of polymers and plastics
Biomolecular and Bioprocess Engineering: Focuses on applications in the life sciences, including pharmaceuticals, biotechnology, biosensors, and biomaterials
Research Intensive Option: This new Research Intensive Option is specifically tailored to students interested in research and graduate education

SPECIAL OPPORTUNITIES
Chemical Engineering students can participate in the Biodiesel Project, a student-run project to convert waste cooking oil into a useable biodiesel fuel. Students work on teams to operate and optimize the chemical process, test and characterize the final product, and explore potential markets for biodiesel fuel. Chemical Engineering students also participate in the Learning Factory, working on a wide range of industry-sponsored, hands-on, product design projects.

There are numerous opportunities to become involved in undergraduate research, working directly with faculty on cutting edge problems in Chemical Engineering. The Department has an endowment that provides financial support for students to spend the summer working as laboratory researchers at Penn State.

Chemical Engineering students also participate in semester abroad programs, taking courses at major universities around the world while completing their undergraduate degree program at Penn State. Many students are involved in the College’s Cooperative Education (Coop) program, alternating semesters of work and study to obtain hands-on experience in applying their chemical engineering education. A wide range of summer internships are also available.

CAREER OPPORTUNITIES
The breadth and depth of training in the sciences and engineering enable chemical engineers to work throughout the chemical, pharmaceutical, food, biotechnology, consumer products, and microelectronics industries. Specific opportunities exist in research, product development, design, and manufacturing. Starting salaries for Chemical Engineering graduates have typically been among the highest of all undergraduate majors. Many students decide to go on to graduate school (both Masters and Ph D). The strong foundation in quantitative logical thinking and problem solving also provides an outstanding background for careers in business, law, and medicine.
IS CHEMICAL ENGINEERING FOR YOU?
Chemical Engineering is ideal for students who have a strong interest in chemistry, solid quantitative and mathematical skills, and the drive to excel. The Chemical Engineering program is challenging - it provides one of the broadest backgrounds in the fundamental sciences of any of the Engineering majors. The Chemical Engineering courses place a strong emphasis on problem solving, with applications ranging from chemical reactor design to the analysis of artificial organs to the development of pollution control systems to the purification of high-value biological and chemical products.

For additional information, visit the Chemical Engineering home page at www.che.psu.edu or contact Dr. Themis Matsoukas at 814-863-2002 or at (Matsoukas@psu.edu). The B.S. Degree Program in Chemical Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; www.abet.org.

OPTIONS IN CHEMICAL ENGINEERING

General Option - This option offers maximum flexibility through selection of elective courses. For the majority of students this will be the most suitable option. For additional information please see Dr. Themis Matsoukas (Matsoukas@psu.edu) in the Department of Chemical Engineering.

Bioprocess and Biomolecular Engineering Option - This option prepares students for careers in the biotechnology and pharmaceutical industries. Recent advances in the life sciences - the sequencing of the human genome, the development of transgenic animals and plants, the use of recombinant DNA technology, and the unraveling of the molecular basis of disease - have opened up exciting new opportunities for Chemical Engineers. By combining these advances in molecular biology with the unique capabilities of chemical engineering, Chemical Engineers are making novel contributions to the production of new medicines, the development of artificial organs, the detection of biological and chemical toxins, and to our quantitative understanding of complex biological processes and systems. For more information, please contact Dr. Wayne Curtis (wrc2@psu.edu) in the Department of Chemical Engineering.

Energy and Fuels Engineering Option - This option prepares students for careers in the fields of energy production and management. Areas of study include the chemical processing issues associated with energy production and use; fuel refining, conversion and utilization, including those which may lead to potential emission of undesired products; process equipment for efficient fuel utilization and for upgrading of fuels to maximize efficient conversion of energy release and for minimizing the impact on the quality of the environment. For more information, please contact Dr. Semih Eser (sxe2@psu.edu) in the Department of Energy and Mineral Engineering.

Polymer Engineering Option - This option prepares students for careers in polymer synthesis and processing. The areas of study include polymer chemistry; synthesis and production of polymeric materials; structure of macromolecules and its relationship to physical and chemical properties; and the study of the mechanical properties of polymers. For more information, please contact Dr. Ralph Colby (rhc@plmsc.psu.edu) in the Polymer Physics Group with the Department of Materials Science and Engineering.

Research Intensive Option- This Option prepares students for graduate school and careers in research and development. Research opportunities exist throughout the entire field of Chemical Engineering including alternative energy, bioprocessing and biomolecular engineering, polymers and materials, and nanotechnology. The Option will be of particular interest to students within the Schreyer Honors College due to the direct integration of the Honors Thesis into the undergraduate curriculum. In addition, this Option has been designed to be compatible with the Integrated Undergraduate/Graduate (IUG) degree program in Chemical Engineering. For more information, please contact Dr. Andrew Zydney (zydney@engr.psu.edu) in the Department of Chemical Engineering.

Summary of Academic Requirements for the Options
The course schedules for the first four semesters of the program are identical for all four options. The core course requirements are also the same in all Options; the only difference is in the selection of the 18 credits of elective courses. The general option has 18 credits of electives classified as 6 cr. of CH E electives, 6 cr. of Engineering Electives and 6 credits of Professional Electives. The three specialized options prescribe specific courses or lists of courses for these electives. Courses for the general option and three specialized options are found on the Chemical Engineering Department web site at http://fenske.che.psu.edu/Ugrad/Handbook.

Student Societies and Organizations
The student chapter of the American Institute of Chemical Engineers (http://www.clubs.psu.edu/up/aiche/) has received national recognition and awards for its social and professional development activities. This includes extensive networking opportunities with recruiters from the chemical and pharmaceutical industries. Omega Chi Epsilon (http://www.clubs.psu.edu/up/oxe), the Chemical Engineering Honor Society, provides additional leadership and professional opportunities.
The program in Civil Engineering (C E) is designed to provide the basic undergraduate education required for private practice and public service in civil engineering, and/or continued formal education. Emphasis is placed on the fundamentals of civil engineering principles and design techniques. Students utilize basic engineering science concepts through coursework in several of the different specialty areas (e.g., geotechnical/materials, environmental, structures, transportation, and water resources). The students are able to choose an area of specialization for professional practice or graduate studies. Their coursework in their area of specialization culminates in a “capstone” design experience. The overall objectives of the program are for the students to:

- work in industries or state and federal government agencies such as departments of transportation and departments of environmental protection that design, implement, and maintain national and/or global infrastructure.
- effectively work in and lead interdisciplinary teams needed to design sustainable transportation, water, energy, environmental, and structural infrastructure.
- stay current through continuing education opportunities, professional conferences, and other self-learning experiences; have the ability to obtain and maintain professional licensing; and have the ability to attend graduate school.

Civil engineering is a customer-service profession. The water you drink and the roads you drive on are provided through the services of civil engineers. Civil engineers build hospitals, airports, bridges, dams, and other public works that are a large part of our everyday world. The realization of these essentials of modern life comes from the work of civil engineers through their involvement in the planning, design, construction, operation, maintenance, and management of these large public facilities.

Civil Engineering is traditionally divided into several sub-disciplines:

1. **Environmental Engineering** focuses on the treatment of water, air, soil, solid & hazardous wastes, and the production of renewable energy.
2. **Geotechnical and Materials Engineering** includes the characterization and improvement of civil engineering materials and soils, foundation engineering, geotechnical design and modeling, materials testing and development, pavement design and asset management, and design of sustainable infrastructure.
3. **Structural Engineering** deals with the design or rehabilitation of large public structures, such as bridges, dams, or buildings.
4. **Transportation Engineering** considers the engineering aspects of highways and streets, air transport, fixed guide way systems (e.g., railroad, monorail, or maglev), and ports and waterways.
5. **Water Resources Engineering** includes the areas of hydrology, water resource management, eco-hydraulics and fluid mechanics.

As a civil engineer, what will you do? You might manage the traffic control system for a large city. You may design buildings that can withstand the dynamic environment of an earthquake. You could interpret satellite photography to predict future droughts and famines in different parts of the world. The opportunities in the civil engineering field are great. Because of society's continuing demand for individuals to manage our modern infrastructure and our planet's fragile environment, the world needs civil engineers now and they will always be needed as long as there are people to be served. If you have an interest in working in a profession where the work that you do will have a great influence on the lives of individuals in society, then civil engineering may be the career for you.

For additional information, visit the Civil and Environmental Engineering home page at [http://www engr psu edu ce/](http://www.engr.psu.edu/ce/) or contact Dr. Norman Folmar at 814-865-3095 or by e-mail at nfolmar@engr.psu.edu. Civil Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; [www.abet.org](http://www.abet.org).

**Student Societies and Organizations**

Advisor and contact information about the following departmental student organizations can be found at [http://www engr psu edu ce/undergrad orgs html](http://www.engr.psu.edu/ce/undergrad_orgs.html)

1. American Concrete Institute/ACI
2. American Society of Civil Engineers/ASCE
3. Chi Epsilon (Honor Society)
4. Institute of Transportation Engineers/ITE
5. National Association of Home Builders/NAHB
The Computer Engineering (CMPEN) major at Penn State provides students with the experience and knowledge that will prepare them for a productive lifelong career in industry, government or further study at the graduate level. Students begin by developing a strong background in math, science, programming, and electrical circuits and signals. This is followed by a computer engineering core consisting of operating systems, data structures and algorithms, computer architecture and networks. Through electives that build on this core, students can develop expertise in digital circuits, image and signal processing, digital systems, including microprocessors, microcontrollers, field programmable gate arrays (FPGA), and very large scale integrated (VLSI) circuits. Finally, in the capstone design course, students apply this knowledge to design, fabricate, and test a complex computer system. Consequently, graduates of the program will be prepared for careers in the design, analysis and use of hardware, software, and systems. In particular within a few years after graduation, graduates in computer engineering should be able to:

1. Work in industry or government producing or evaluating components of computer hardware and/or software systems.
2. Work in teams to design, implement, and/or maintain components of computer hardware and/or software systems.
3. Stay current through professional conferences, certificate programs, post-baccalaureate degree programs, or other professional educational activities.

Periodically, faculty have supplemental grants to support research experiences for undergraduates in the department and to provide for conference and workshop attendance. Faculty are available to supervise independent study courses, and students are free to interact with mentors in other departments to further expand their opportunities.

Job opportunities are virtually limitless; graduates are employed by all sectors of industry, government, and academic institutions. Their work may involve the design of hardware and/or software for computer systems, the analysis and design of algorithms, or the use of computers for various applications. They also may work on research and development of new computer systems, study their reliability and fault tolerance, evaluate their performance, investigate computer communication requirements, or work on artificial intelligence and robotics.

Students who are interested in math and science and enjoy the prospect of solving problems are excellent candidates for the Computer Engineering major. CMPEN 270 (CMPEN 271 & CMPEN 275 at some campus locations) is an excellent introduction to this major (this is a pre-major course that is recommended for the third semester of course work). Because of the close relation to computer science, concurrent majors in computer engineering and computer science are not permitted.

For additional information, visit the Computer Science and Engineering (CSE) homepage at [http://www.cse.psu.edu](http://www.cse.psu.edu), or contact Dr. Lee Coraor, CSE Director of Academic Affairs, at 814-865-1265 or by e-mail at coraor@cse.psu.edu. Computer Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; [www.abet.org](http://www.abet.org).

**Student Societies and Organizations**

Advisor and contact information about the following departmental student organizations can be found at [http://www.engr.psu.edu/StudentOrganizations/](http://www.engr.psu.edu/StudentOrganizations/)

1. Association for Computing Machinery (ACM Student Chapter)
2. Eta Kappa Nu (Honor Society)
3. Institute of Electrical and Electronics Engineers (IEEE) Computer Society
The Computer Science (CMPSC) major at Penn State provides students with the experience and knowledge that will prepare them for a productive lifelong career in industry, government, or further study at the graduate level. Students begin by developing a solid background in math, science, and programming. This is followed by a computer science core consisting of operating systems, programming languages, data structures and algorithms, and computational theory. Through electives that build on this core, students can develop expertise in networks, security, computer graphics, databases, compilers, artificial intelligence, computer vision, numerical analysis, concurrent computing, and software engineering.

Penn State’s Department of Computer Science and Engineering merges the hardware design emphasis in computer engineering with the software design emphasis in computer science to offer students in-depth experience that ranges from the design of computers to the solution of sophisticated software problems. Faculty emphasize the theoretical and practical application of computation and computer systems to the needs of society. Research interests cover the broad areas of architecture, computational theory, computer applications, and software systems, and undergraduates are afforded the opportunity to get involved in research. The department maintains computer labs to facilitate student course work and research.

Faculty periodically have supplemental grants to support research experiences for undergraduates in the department and to provide for conference and workshop attendance. Faculty are available to supervise independent study courses, and students are free to interact with mentors in other departments to further expand their opportunities.

The baccalaureate program in computer science provides a fundamental education to prepare students for positions in industry, government, education, or commerce; or, to pursue graduate study. The computer science curriculum is organized with two goals in mind. First, upon graduation, a student must be prepared to meet immediate demands in solving computational problems. Second, a student must have sufficient understanding of basic principles and concepts in computer science to avoid technological obsolescence in the rapidly changing computer environment. Computer Science is a rapidly evolving discipline. Graduates are employed by all sectors of industry, government, and academic institutions. Their work may involve the design of software for computer systems, the analysis and design of algorithms, or the use of computers for various applications. They also may work on research and the development of new computer systems, study their reliability and fault tolerance, evaluate their performance, investigate computer communication requirements, or work on artificial intelligence and robotics.

Students who are interested in math and science and enjoy the prospect of solving problems are excellent candidates for the Computer Science major. CMPSC 122 provides an excellent introduction to this major (this is a pre-major course that is recommended for the second semester of coursework). Because of the close relation to computer engineering, concurrent majors in computer science and computer engineering are not permitted.

For additional information, visit the Computer Science and Engineering (CSE) homepage at http://www.cse.psu.edu, or contact Dr. Lee Coraor, CSE Director of Academic Affairs, at 814-865-1265 or by e-mail at coraor@cse.psu.edu.

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1. Association for Computing Machinery (ACM Student Chapter)
2. Eta Kappa Nu (Honor Society)
3. Institute of Electrical and Electronics Engineers (IEEE) Computer Society
Electrical Engineering (E E) is one of the broadest of all engineering majors and is much more than just building electrical circuits. Electrical engineering is the application of electronics, electrical science and technology, and computer systems to the needs of society. An electrical engineer is responsible for designing and integrating electronic/electrical systems in diverse industries such as defense, communications, transportation, manufacturing, health care, construction, power/energy and entertainment.

The mission of our undergraduate program is to provide a high-quality education in electrical engineering for our students and to instill in them the attitudes, values, and vision that will prepare them for lifetimes of success, continued learning, and leadership in their chosen careers. A combination of required and elective courses ensures that students acquire a broad knowledge base in electrical circuits, digital systems, electronic devices, electromagnetics, and linear systems, as well as expertise in one or more areas of specialization. Additional problem-solving skills and practical experience are developed through design projects and laboratory assignments, which also provide opportunities for developing team-building and technical communication skills.

The BSEE program provides undergraduates with the broad technical education necessary for productive employment in the public or private sector, and it develops in them an understanding of fundamentals and current issues important for future years of learning. Our program prepares student following graduation for:

1. Electrical engineering practice in technical assignments such as design, product development, research, manufacturing, consulting, testing, sales, and management;
2. Proficiency in the use of modern design tools;
3. Participation and leadership on teams comprised of individuals with diverse professional and cultural backgrounds;
4. Effective written and oral communication skills;
5. Appreciation of the implications of design in a global, societal, and ethical context;
6. Continued learning through such activities as graduate school, distance education, professional training, and membership in professional societies.

Program Structure
The BSEE degree begins with a first-year emphasis on math, physics, and chemistry common to all engineering students. In the second and third years, much of the course work consists of required E E classes and labs that provide a broad exposure to the many aspects of E E. During the final three semesters the student can select from over 30 technical electives in such areas as:

- communications, e.g., analog/digital, wireless, and satellite communications;
- control systems, e.g., servo systems, process control, robotics, and navigational systems;
- digital signal processing, e.g., digital filtering, digital audio processing, and neural networks;
- digital systems (computer engineering), e.g., micro-controllers, digital logic, and VLSI design;
- electro-optics, e.g., lasers, holography, and fiber optic communications;
- electromagnetics, e.g., radar, antenna design, and wave propagation in space;
- electronic materials and device fabrication, e.g., semi-conductors and super conductors;
- electronics, e.g., amplifier design, integrated circuits, and instrumentation;
- image processing, e.g., medical imaging and computer vision;
- power, e.g., motors, power generation, power electronics, and power plant control;
- space sciences, e.g., the study of electrical properties of the atmosphere.

The BSEE degree includes a four-year design course sequence (Engineering Design, Design Tools, Design Process, Design Experience) that culminates with a capstone design project that encompasses the various phases of creating a new product -- designing, building, testing, and even marketing. Students may also opt to participate in the co-op program, thus obtaining invaluable on-the-job technical training.

Career Opportunities
Because the electrical engineering profession is characterized by its diversity, graduates in E E hold a wide variety of jobs. Many graduates work in laboratories where their responsibilities include designing and testing new electronic systems or devices. This design work often utilizes computer programs and test equipment that are first used while in school.
Other graduates have jobs in manufacturing plants where their major responsibility is the interfacing of the electronic equipment with the rest of the plant. A growing employment opportunity within EE is in technical sales/consulting, in which graduates use their EE background as well as people skills to interface with various industrial customers. EE graduates are also found in areas such as law, marketing, finance, technical writing, and government, where they serve as technical experts. Finally, EE graduates with entrepreneurial skills are often successful by marketing themselves as consultants or starting their own companies. Regardless of which area of specialization within EE a student chooses, the job outlook remains high due to the ever-present and increasing need for electrical power, electronics, communications, and computers in all areas of our society.

Is EE for you?
Students who enjoy math, physics, and computer programming are likely to do well in EE because many EE areas of specialization build on these basic skills. For example, mathematical models are often used to design or analyze communication systems, control systems, and electronic circuits. Physics plays a key part in the fabrication of various electronic components such as electro-optical devices and semiconductors. Likewise, computer skills are important because much of EE design is done using sophisticated software packages. Computers are also important because new technology is becoming increasingly digital in nature (such as HDTV).

To provide prospective students with a broad overview of what electrical engineering has to offer, we offer a variety of first-year hands-on lab oriented courses at UP in which many of the applications of electrical engineering are touched upon. The sophomore-level introductory circuits course, EE 210 (required for all EE students), is another good indicator of future EE course content.

For additional information, visit our web site at http://www.ee.psu.edu. You can also direct specific questions to our Undergraduate Program Coordinator, Prof. David Salvia, at dsalvia@psu.edu. Electrical Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; www.abet.org.

Student Societies and Organizations
Advisor and contact information about the following departmental student organizations can be found at http://www.engr.psu.edu/StudentOrganizations/

1. Eta Kappa Nu/HKN (Honor Society)
2. Institute of Electrical and Electronics Engineers/IEEE
The Electro-Mechanical Engineering Technology (B.S. EMET) degree program provides the basic undergraduate education required for a career as an electro-mechanical engineering technologist. The program emphasizes a breadth of knowledge in all fields of engineering technology related to typical, highly-automated manufacturing, production, or assembly plant processes. Basic coverage is provided in all major areas of technology involved in the operation and control of manufacturing and production processes, including instrumentation and monitoring methods, principles of machine design, automated control techniques, thermal and fluid sciences, computerized manufacturing systems, principles of electrical and electronic circuit operation, computer-aided drafting and design, economics of production, and statistical analysis and quality control.

Program Objectives
The primary aim of the EMET program is to provide graduates with the knowledge and skills necessary to apply current methods and technology to the development, design, operation, and management of electro-mechanical systems, particularly in those industries where automated systems are prevalent. Specific educational objectives of the program are to:

• Capable of and actively involved in the specification, procurement, or integration of electromechanical systems.
• Capable of and actively involved in the operation, testing, or maintenance of electromechanical systems.
• Capable of and actively involved in project team activities, and
• Capable of and actively involved in the preparation and delivery of technical documentation and communications.

The program achieves these objectives by developing students’ abilities to accomplish a variety of specific outcomes while they are enrolled in the degree program. Once they achieve these outcomes, graduates of the EMET program will have:

1. an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined electro-mechanical engineering technology activities
2. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to electro-mechanical engineering technology problems that require the application of principles and applied procedures or methodologies
3. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
4. an ability to design systems, components, or processes for broadly-defined electro-mechanical engineering technology problems appropriate to program educational objectives
5. an ability to function effectively as a member or leader on a technical team
6. an ability to identify, analyze, and solve broadly-defined electro-mechanical engineering technology problems
7. an ability to communicate effectively regarding broadly-defined electro-mechanical engineering technology activities
8. an understanding of the need for and an ability to engage in self-directed continuing professional development
9. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
10. a knowledge of the impact of engineering technology solutions in a societal and global context
11. a commitment to quality, timeliness, and continuous improvement
12. an ability to use computer-aided drafting or design tools to prepare graphical representations of electro-mechanical systems
13. an ability to use circuit analysis, analog and digital electronics, basic instrumentation, and computers to aid in the characterization, analysis, and troubleshooting of electro-mechanical systems
14. an ability to use statistics, dynamics (or applied mechanics), strength of materials, engineering materials, and manufacturing processes to aid in the characterization, analysis, and troubleshooting of electro-mechanical systems
15. an ability to use appropriate computer programming languages for operating electro-mechanical systems
16. an ability to use electrical/electronic devices such as amplifiers, motors, relays, power systems, and computer and instrumentation systems for applied design, operation, or troubleshooting of electro-mechanical systems
17. an ability to use advanced topics in engineering mechanics, engineering materials, and fluid mechanics for applied design, operation, or troubleshooting of electro-mechanical systems.
18. an ability to use basic knowledge of control systems for the applied design, operation, or troubleshooting of electro-mechanical systems
19. an ability to use differential and integral calculus, as a minimum, to characterize the static and dynamic performance of electro-mechanical systems
20. an ability to use appropriate management techniques in the investigation, analysis, and design of electro-mechanical systems
The major is organized as a four-year baccalaureate program with the corresponding Penn State College of Engineering admission requirements. First-year students can enroll directly into the EMET program upon admission to the University. Graduates of an associate degree program in either electrical or mechanical engineering technology from Penn State may re-enroll in the EMET program with advance standing. College of Engineering ENGR students may enroll through “Change of Major” procedures. Students from an engineering technology program at another institution or community college accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering Technology (TAC of ABET) may transfer into the program with advanced standing.

A minimum of 130 credits is required to earn the B.S. degree in Electro-Mechanical Engineering Technology. The program is available at Altoona, Berks, New Kensington, and York campuses.

Career Opportunities

The growing application of automated systems across all sectors of business and industry has created a demand for individuals skilled in the design, application, operation and maintenance of these systems. An inherent feature of those systems is that they incorporate electrical, electronic, mechanical, and instrumentation components, and individuals working with the systems must be skilled in all of those areas. It is exactly these skills that the EMET program is designed to provide, and graduates from the program, with hands-on experience in all these areas, are prepared immediately to perform these duties, regardless of the particular industrial sector.

The need for cross-discipline capabilities is particularly true of small and mid-sized manufacturing and production industries where technical staffs are often small and necessarily must base to the job. As a result, EMET graduates are well suited for careers in such industries.

Altoona Campus
Professor Irene Ferrara  
E-mail: ixf107@psu.edu  
Tel: 814-949-5568

Berks Campus
Professor Terry Speicher  
E-mail: tls20@psu.edu  
Tel: 610-396-6331

New Kensington Campus
Professor Ron Land  
System-wide coordinator  
E-mail: rel9@psu.edu  
Tel: 724-334-6730

York Campus
Professor Charles Gaston  
E-mail: cag9@psu.edu  
Tel: 717-771-4155

E-mail:  
ixf107@psu.edu  
E-mail: tls20@psu.edu  
E-mail: rel9@psu.edu

For additional information, visit our website at  
http://www.et.psu.edu/baccalaureate/4emet.htm. You can also direct specific questions to Dr. Thomas Seybert at tas103@psu.edu.

Electro-Mechanical Engineering Technology is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET), at each of the campuses where it is offered. ABET may be contacted at: 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700 or via their website, www.abet.org.
Engineering Science (E SC) is a multi-disciplinary honors program that emphasizes comprehensive understanding and integrated application of the core principles of engineering, science and mathematics. The program’s uniqueness lies in the broad foundation it gives in the sciences and associated mathematics underlying engineering, and the flexible curriculum offered to students to develop a depth of knowledge in an area of their choosing through technical electives and an honors thesis. The curriculum is designed for students who seek to link the engineering disciplines with the basic sciences. In addition to taking core courses in mathematics, physics, chemistry and biology, students study a very broad array of engineering topics encompassing thermodynamics, heat transfer, electromagnetics, solid and fluid mechanics, electronic devices, materials science, bio-nano science and engineering, neural engineering and failure analysis. During the senior year, they select a focus area of study, complete an individual capstone research and design project under the guidance of a faculty member, and write a thesis that integrates the scientific principles of research, design and analysis and applies them to engineering. Focus areas of research include, but are not limited to, electrical, mechanical, civil, bioengineering, pre-medicine and materials; they are also typically interdisciplinary. Hence, Engineering Science students achieve both depth and breadth in engineering and science, are able to function across disciplines, and graduate well-prepared for advanced studies as well as professional employment.

The expected accomplishments of Engineering Science graduates in the first several years following graduation are:

1. Participate in lifelong learning activities, including the pursuit of masters, doctorate, medical, business and law degrees.
2. Engage in practice of a wide variety of fields including, but not limited to, electrical and mechanical systems, electronics, materials development, forensics, biomaterials, medicine, law, business, and government and public service.
3. Carry out research, development, design and utilization of new products, processes, materials, devices, systems and tools.
4. Communicate findings and best practices at conferences, meetings, and to the general public through technical publications (journals, reports, memoranda), presentations, intellectual property generation, and patent filings.
5. Develop and use state-of-the-art tools in exercise of the profession.
6. Actively participate in society and promote diversity.
7. Encourage and foster future generations of engineers through mentoring, service and outreach.

Engineering Science students benefit from the wide-ranging research activities of the department faculty, many of whom are leaders in their specialty and have state-of-the-art laboratory facilities. In the senior year of the program, the curriculum closely integrates course work with research and design through the Senior Design Project carried out under the guidance of the faculty, in fulfillment of thesis requirements. There also exist ample opportunities for research internships at all levels. The low student-to-faculty ratio enables close student-faculty interactions.

Enrollment in the E SC program is limited to students who have demonstrated that they can benefit from the advanced courses and academic rigor of the curriculum. A minimum GPA of 3.0 is partial evidence of such competence. The E SC program is ideal for people who want to understand interdisciplinary problems in their entirety, rather than just a portion of the problem. This makes E SC graduates well suited to lead interdisciplinary teams. Graduation with a B.S. in E SC requires 131 credits and a minimum GPA of 2.50. Students earn an Honors Diploma if they complete all the requirements and graduate with a GPA of 3.33 or higher. Qualified students are nominated for the university-wide Schreyer Honors College, and may participate in cooperative education, study abroad, and an integrated undergraduate-graduate (IUG) program that allows them to use up to 12 credits to be applied towards both bachelor’s and master’s degrees.

Approximately half of E SC graduates continue their studies nationally and internationally at top-ranked graduate programs. Recent examples include UC Berkeley, Carnegie Mellon, Cornell, Michigan, MIT, Penn State and Stanford. Employment opportunities are plentiful and varied, as intended by the curriculum, and include, business and industry, government laboratories, start-up companies created by our graduate, the patent office, and public service organizations. With the addition of a few courses, E SC offers excellent preparation for medical school and careers in the medical field. Students have found that the E SC curriculum enables their medical school applications stand out in distinction.

For more information about the department, its faculty, and curriculum, visit www.esm.psu.edu or contact Dr. Christine Masters at 814-865-6674 or cbm100@psu.edu, or Dr. Barbara Shaw at 814-865-7828 or bas13@psu.edu. Engineering Science is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; www.abet.org

**Student Societies and Organizations**

Advisor and contact information for the following departmental student organizations can be found at www.engr.psu.edu/StudentOrganizations/
1. Society of Engineering Science
The General Engineering program provides students with a broad foundation in engineering with specialization in a technically and professionally relevant topic. Topics in Alternative Energy and Power Generation at the Hazelton Campus and Applied Materials at the DuBois Campus, and Multidisciplinary Engineering Design at the Abington, Brandywine and Great Valley campuses are available to suit an individual’s technical interests. The program provides opportunities for team-based, industry supported research and design projects, thus preparing graduates for careers in for-profit or nonprofit organizations, or to further their education in graduate school.

The educational objectives of the General Engineering program are to produce graduates who, during the first few years of professional practice will:

- Be employed by industry or government in the fields, such as, design, research and development, experimentation and testing, manufacturing, and technical sales.
- Assume an increasing level of responsibility and leadership within their respective organizations.
- Communicate effectively and work collaboratively in multidisciplinary and multicultural work environments.
- Recognize and understand global, environmental, social, and ethical contexts of their work.
- Progress to an advanced degree and certificate programs and be committed to lifelong learning to enhance their careers and provide flexibility in responding to changing social and technical environments.

The degree offers students the option to select an academic track that fits their interests and regional aspirations. The first two years the degree aligns with other engineering programs and prepares students with math, science and engineering fundamentals. Both topical tracks in the degree offer multiple years of design courses culminating in a two semester senior capstone project allowing students to complete a research project from conception through prototyping.

The Alternative Energy and Power Generation Option provides students with a broad foundation in energy sources commonly used to supply utility power and alternative approaches such as nuclear, solar, and wind to supplement traditional coal and gas power. The Applied Materials Option offers students the fundamentals of materials design, processing, testing and characterization. Students work with metals, ceramics, polymers, composites and particulate materials. The Multidisciplinary Engineering Design Option provides students the background to tackle complex design problems that cross traditional engineering disciplines.

Research, Independent Study, and other Opportunities
The program faculty works closely with industry partners to provide students with opportunities to work with faculty on relevant design or research projects.

Career Opportunities
The Alternative Energy and Power Generation Option prepares graduates to enter the job market in the alternative and renewable energy sector as well as the power generation industry. The graduates of this program have the critical knowledge and skills needed to begin their careers in this growing field. They will also have a critical understanding of the environmental, social, and economic aspects of the industry. The program goal is to create graduates who will have the background, knowledge, and skills necessary to be successful in the contemporary power generation sector while being able to guide the industry toward the more environmentally-friendly use of alternative and renewable energy technologies.

The Applied Materials Option prepares students for employment in positions such as engineer, product engineer, process engineer, manufacturing engineer, development engineer, and materials engineer. Graduates of the program gain experience and knowledge of fundamental materials themes and are able to design strategies for new materials development, the application of materials into engineered products, and techniques in materials evaluation and testing. Graduates also have a hands-on knowledge of the tools and techniques commonly used in the materials field and are able to be a leader industry toward materials innovation and production.

The Multidisciplinary Engineering Design Option prepares students for employment in positions such as engineer, design engineer, product engineer, or systems engineer in aerospace, biomedical or manufacturing industries. Graduates of the program gain skills in electrical, mechanical and computer engineering and have the preparation to tackle the challenging design problems of the future. This unique program is developed to cross the traditional engineering disciplines, providing students the opportunity to view the engineering design process in a more holistic manner.

Is General Engineering for you?
Students should have a strong background in math and science, an interest in sustainability and protecting the environment. Students also should have a thirst for design elements in engineering and be able to visualize engineering concepts from idea to the tangible.

For additional information regarding the Alternative Energy and Power Production Option, contact Dr. Wieslaw Grebski at 570-450-3087 (wxg3@psu.edu). For additional information regarding the Applied Materials Option, contact Dr. Ping Werner at 814-375-4785 (plw7@psu.edu). For additional information regarding the Multidisciplinary Engineering Design Option contact Dr. James Nemes at 610-648-3335 (jan16@psu.edu).
INDUSTRIAL ENGINEERING (I E)

In a way, you might think of industrial engineers as the people who look after the health of organizations. They are responsible for the quality of the finished product, the efficiency and productivity of the operation, and the safety and morale of the employees. Most of all, industrial engineers are responsible for change – improving the effectiveness, and the competitiveness, of the organization. The Industrial Engineering (I E) major includes the following fields of study:

- **Manufacturing Systems Engineering**: apply modern manufacturing technologies to ensure the best economic manufacture of a product. Topics include manufacturing processes, automation, robotics, lean manufacturing, ergonomics and occupational safety and health.
- **Engineering Service Systems**: develop quantitative methods in order to help managers make better decisions. Topics include engineering economy, quality control, scheduling, inventory, computer simulation models, customer satisfaction and product design and usability.
- **Engineering Information Systems**: consider the physical and mental design of information technology systems required to develop applications in Industrial Engineering. Topics include enterprise information modeling, analysis of data bases, data mining, internet technologies and human-computer interfaces.

After completing courses required for the fundamental competencies in these areas, students will have the opportunity to specialize in one of the areas using nine credits of electives.

Working with people, as well as with machines, is an essential part of industrial engineering. The industrial engineer's job is to organize all parts of the company -- people, machines, material, information and energy -- into an integrated, smooth-running system. Industrial engineers can be found wherever people and technology work together as a system. That makes industrial engineering a diverse field, with a wide range of career opportunities.

**U.S. News and World Report** ranks Penn State’s IE undergraduate program in the top ten in the country. One of the main reasons is the number of hands-on laboratories that are incorporated into the curriculum. Through hands-on education, students can put into practice the theory that they learn in the classroom and enhance their ability to work in teams as well as communicate effectively. Furthermore, students are encouraged to study abroad through an IE exchange program with the University of Navarra in San Sebastian, Spain or through one of the many other programs available through Penn State. Work abroad experiences are also available through the Engineering Co-op and Internship Program.

**Career Opportunities**

A degree in Industrial Engineering provides a wide array of diverse opportunities upon graduation. The breadth of the curriculum reflects the continual shifts in IE practices, techniques, and applications. Graduates are highly recruited by companies such as Johnson & Johnson, General Electric, Boeing, Hershey Chocolate and Ingersoll-Rand. An increasing number of graduates are also obtaining positions in the service sector in companies such as UPS, the Walt Disney Company, as well as in the areas of financial services, information technology, healthcare and consulting.

**Program Educational Objectives:**
The graduates of the program are expected to:

- Use their industrial engineering knowledge to understand, analyze, and design manufacturing and service processes, systems, and work environments.
- Collect, analyze, and interpret data to make sound managerial decisions through modeling and quantitative analysis, as well as the use of information systems.
- Present work and ideas effectively through oral and written communication and demonstrate independent learning.
- Perform in a professional and ethical manner as part of a diverse team in a global society.

For additional information, visit the Industrial and Manufacturing Engineering homepage at [http://www.ie.psu.edu](http://www.ie.psu.edu) or contact Mrs. E. Joshi, Undergraduate Programs Coordinator, at 814-863-3395 or by e-mail at ejoshi@psu.edu. Industrial Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; [www.abet.org](http://www.abet.org).

**Student Societies and Organizations**

Advisor and contact information about the following departmental student organizations can be found at [http://www.engr.psu.edu/StudentOrganizations/](http://www.engr.psu.edu/StudentOrganizations/)

1. Alpha Pi Mu (Honor Society)
2. American Foundry Society/AFS
3. American Society for Quality/ASQ
4. Human Factors and Ergonomics Society/HFES
5. Institute of Industrial Engineers/IIE
6. Institute for Operations Research and the Management Sciences/INFORMS
7. Society of Manufacturing Engineers/SME
Mechanical Engineering (M E) is one of the broadest engineering disciplines. In fact, almost all other engineering disciplines have their roots in mechanical engineering. This breadth of mechanical engineering can be seen in the wide spectrum of problems that mechanical engineers solve. From creating surgical instruments to designing theme park rides to developing airport security devices, mechanical engineers help provide for our health, happiness, and safety. Mechanical engineers are making a difference in the world. For instance, one core idea of mechanical engineering is the conversion of energy from one form to another. For that reason, mechanical engineers are leaders in conventional forms of energy, such as combustion of fossil fuels, as well as alternative energy forms such as fuel cells.

Program Educational Objectives
The objective of the Mechanical Engineering program is to prepare students for a wide range of career paths that use mechanical engineering principles and methodology. We will maintain and provide a curriculum that prepares our recent graduates for:
1. working in industry and government including computer-aided design, simulation and analysis of products or systems, experimentation and testing, manufacturing, and technical sales.
2. assuming increasing levels of responsibility in project, personnel, and budget management.
3. working and leading effectively in multi-disciplinary and multi-cultural teams.
4. communicating effectively and recognizing the global, societal, and ethical contexts of their work.
5. entering into graduate and professional studies.
ME Program Outcomes can be found at http://www.mne.psu.edu/Current/UGrad/Assessment/.

Is Mechanical Engineering for You?
If you are interested in creating things that help improve our health, happiness, and safety, then mechanical engineering may be for you. As a mechanical engineering major, you will take part in a dynamic course of study involving teamwork and design projects that apply to current world problems. A degree in Mechanical Engineering will prepare you for a secure career in rapidly developing technological fields. Mechanical Engineering is divided into two broad areas: mechanical systems and thermal systems. Mechanical systems include the design of mechanisms and the analysis of strength and wear of materials. These topics are studied in courses such as Dynamics, Material Science, Engineering Mechanics, Vibrations, and Machine Design. Thermal systems include methods of energy conversions, heat transfer, and fluid flow. Thermal systems are covered in Thermodynamics, Fluid Flow and Heat Transfer. Today’s mechanical engineering majors use computers in nearly every aspect of their study. From sophisticated computer simulations of motion and deformation, to three-dimensional “virtual” prototyping, to computer aided design, mechanical engineers become proficient users of the latest technology. Typical class assignments might include the use of design software to create virtual prototypes, stress analysis software to quickly evaluate alternative designs or lab experiments to observe the behavior of a system under varying external influences.

Due to the breadth of the mechanical engineering discipline, the following technical tracks have been developed. Through proper selection of courses, students can gain a technical degree with an emphasis in any of the following areas:

- Biomedical Device Engineering
- Combustion Based Energy Conversions
- Control of Mechanical Systems
- Machinery Dynamics & Design
- Mechanical Engineering in Aerospace Applications
- Global Engineering via Study Abroad
- Mechatronics and Robotics Engineering
- New Product Design and Manufacturing
- Power Engineering
- Turbomachinery Based Energy Conversions
- Vehicle Engineering for the 21st Century

To learn more about the technical electives offered for these different tracks, visit: http://www.mne.psu.edu/Current/UGrad/Curriculum/Section3.html

Each senior is required to complete a capstone senior design project. These projects are semester long, industry sponsored team projects and involve the design of a product or process. The project involves the development, design, prototyping, technical analysis, cost analysis, and presentation of the group’s final design. Some example projects including anesthesia needle holder, the Shell Eco-Marathon car, which is an ongoing project, and a Morphing Aircraft Wing.
Career Opportunities
Mechanical engineers can work almost anywhere: in large companies, such as automotive and aerospace industries; in smaller “high tech” companies; in specialized areas such as robotics, nanotechnology, and in research centers such as government labs and universities. Within any company, mechanical engineers have many job opportunities including the development, testing, manufacturing, reliability, packaging, and distribution of a product. Some mechanical engineers pursue professional degrees in medicine or law. The need for mechanical engineers spans a large segment of both the public and private sectors, making the job market for mechanical engineering graduates very stable and diverse, as shown in the three examples below.

Janine Kowalczyk, Structural Analyst, Boeing
Janine graduated in December 2006. She works for the Boeing Satellite Development Center in El Segundo, CA. As a structural analyst, she creates and analyzes finite element models. She also supervises mechanical tests subjecting units to random vibration and pyroshock environments. She has recently taken on a temporary assignment in Seattle, WA as a structural analyst and is working on the Boeing 747-8I fuselage.

Brandon Rosati, Patent Examiner, United States Patent & Trademark Office
Brandon graduated in 2007 and now works for the Department of Commerce as a Patent Examiner. “Being a Patent Examiner allows me to apply my knowledge of engineering with my passion of law and help to preserve Intellectual Property rights for the United States.”

Brianne Wilburne, Project Development Engineer, Air Products
“While looking at engineering disciplines, I noticed most of the engineering recruiters were hiring mechanical engineers. This made evident the value of my mechanical engineering degree to corporate recruiters, resulting in multiple internship and full-time offers in a variety of industries” Brianne, a may 2009 graduate, accepted a job with Air Products in Allentown, PA. She was enrolled in a rotation career development program, starting as a global mechanical design engineer for hydrogen reforming plants. In her second job rotation, Wilburne worked as a project development engineer developing costs and project scope for new business opportunities.

Visit the Department website for more information: http://www.mne.psu.edu/
Or contact the Undergraduate Programs Office in Mechanical and Nuclear Engineering at undergrad@mne.psu.edu or by phone at 814-863-1503.

Visit the Societies & Organizations website to learn more about student organizations!
http://www.mne.psu.edu/Directories/students.html
1. American Society of Mechanical Engineers (ASME)
2. Society of Women Engineers (SWE)
3. Society of Automotive Engineers (SAE)
4. Engineers Without Borders (EWB)

Visit the Learning Factory website to learn more about senior design projects:
http://www.lf.psu.edu/
Mechanical Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; www.abet.org.
NUCLEAR ENGINEERING (NUC E)

Nuclear Engineering (NUC E) involves the practical application of the principles of nuclear science for the benefit of human kind. It provides the engineer or scientist the opportunity to work on challenging problems that are vitally important to the modern world. Nuclear engineers develop clean and safe energy systems; design and build nuclear power plants and manufacture nuclear reactor systems; evaluate the operational safety of nuclear plants, both in normal and transient conditions; help run such plants; perform reactor core analysis to determine optimal core loadings; engineer medical imaging devices and medical diagnostic techniques and equipment; design irradiation systems for food preservation and the medical industry; set standards and develop radiation detection and measurement methods; design and develop power systems and hardened electronics for space applications; and design equipment and facilities to store, monitor, and dispose of radioactive waste. The objective of the program is to provide students with a strong academic background that enables them to pursue professional careers in nuclear and radiation-based industries, or to pursue graduate study in nuclear engineering or related fields such as medical physics, health physics, or another engineering discipline. The program especially appeals to students with an interest in applying advanced technologies, mathematics, science, and computer science and engineering. Students can readily minor in Environmental Engineering or in Engineering Mechanics. A concurrent majors program with Mechanical Engineering is also offered. Students entering the concurrent majors program must first enter Mechanical Engineering and then add Nuclear Engineering as the second major.

Description of the Major
The first two years of the program stress fundamentals in mathematics, chemistry, physics, computer programming, thermal science, and engineering sciences, such as mechanics and materials. The last two years provide the breadth and depth in nuclear science, behavior of heat and fluids, reactor theory and engineering, reactor engineering, reactor physics, and radiation measurement. The laboratory work includes experiments using the University’s 1000-kilowatt research reactor. A senior capstone design course integrates the critical elements of reactor theory, reactor engineering, safety considerations, and economic optimization into a reactor design. Electives enable students to extend their knowledge in radiation science and engineering, nuclear materials, radioactive waste management, power plant modeling, or to have individualized research and design projects. A particular strength of the program is the ability of students to work one-on-one with the faculty on current research and engineering projects.

Program Educational Objectives
We will endeavor to maintain and provide a curriculum that helps prepare our graduates such that:

- Within two to three years of graduation, we expect the majority of our B.S. graduates to:
  - be working in industry, especially related to nuclear power engineering,
  - be working in government agencies or national laboratories,
  - be pursuing advanced degrees.
- We expect that our students will continue to develop professionally and establish themselves in their careers and in this they may take the opportunity to further their education and training by attending graduate school or by pursuing other professional development paths.

Program outcomes can be found at [http://www.mne.psu.edu/Current/UGrad/Assessment/](http://www.mne.psu.edu/Current/UGrad/Assessment/).

Left: The reactor core. Middle: the Breazeale Nuclear Reactor. Right: The Advanced Multi-phase Flow Laboratory.
Nuclear Engineering Scholarships

Fifth through eighth-semester students are eligible to receive departmental scholarship support through endowed scholarships and gift funds. External scholarships supported by the National Academy for Nuclear Training, the U.S. Department of Energy, and the American Nuclear Society are also available. There are numerous internships and co-op opportunities available. For example, a formal internship program exists with Exelon Corporation. Students have summer employment opportunities at government research laboratories, reactor vendors, and nuclear utilities and service groups.

Career Opportunities

Typical salaries tend to be near or at the top of all four-year engineering majors, with most students receiving multiple offers in their field. Many graduates are employed by electric power companies that use nuclear power plants, or by companies that design, service, and maintain these plants. They use their knowledge of engineering principles, radioactive decay, interactions of radiation with matter and nuclear reactor thermal hydraulics and reactor physics to help assure that the power plants meet the demand for reliable, economic electricity while ensuring a safe environment. Graduates develop and use complex computer models and sophisticated monitoring systems, design systems to handle radioactive waste, determine if the materials in the plant are degraded, or manage the fuel in the reactor to obtain maximum energy.

They also work in branches of the government as designers of the next generation of reactors for submarines, aircraft carriers, space probes, regulation of nuclear power or radiation uses; or in research to develop advanced technologies that will be used in next-generation power plants. Graduates work in industries that use radioactivity or radiation, such as medicine, food, and agriculture, to detect problems, monitor processes, and protect the public. An especially important area is the development of new instruments for medical and industrial applications. These range from life-saving cancer treatment devices to instruments that use radiation to determine thickness, detect cracks in pipe and welds, or monitor the flow of chemicals in industry or the environment. Graduates who want to enter in the fields of health physics, radiation biology, or nuclear medical applications find this degree to be a useful preparation.

For more information please visit the web site at http://www.mne.psu.edu/, or contact the Undergraduate Programs Office in Mechanical and Nuclear Engineering at undergrad@mne.psu.edu or by phone at 814-863-1503. Nuclear Engineering is accredited by the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; 410-347-7700; www.abet.org.

Student Societies and Organizations

Advisor and contact information about the following departmental student organizations can be found at http://www.mne.psu.edu/Directories/students.html

1. Alpha Nu Sigma (Honor Society)
2. American Nuclear Society (ANS)
SURVEYING ENGINEERING (SUR E)

A definition of the profession of surveying as provided by the International Federation of Surveyors is as follows:

“A surveyor is a professional person with the academic qualification and technical expertise to conduct one, or more, of the following activities;

• determine, measure and represent land, three-dimensional objects, point-fields and trajectories;
• assemble and interpret land and geographically related information,
• use that information for the planning and efficient administration of the land, the sea and any structure thereon; and,
• conduct research pursuant to the development of the above practices.”

Program Educational Objectives
The surveying engineering (SUR) major provides a basic introduction to these main activities with emphasis on land surveying. As a surveying student you will study various data collection techniques, including traditional surveying methods, aerial photography, remote sensing, and the global positioning system (GPS). These data collection techniques will support your study in the areas of statistical analysis of measurements, data quality, adjustment of survey networks, data management techniques, boundary surveying, land development, photogrammetry, geographic information science (GIS), and legal and professional issues. Through the use of elective courses, you can broaden your engineering knowledge in the areas of GIS, image analysis, boundary surveying, construction surveying, land development, and geodesy. The specific objectives of the Surveying Engineering program are to prepare graduates who, after the first few years of their professional career:

1. Proficiently use mathematics, science, measurement methods, and modern surveying tools to collect, analyze, and reduce spatial data in professional applications or advanced study in surveying engineering or a related field.
2. Proficiently apply basic principles of land surveying, professional practice, and professional ethics to design and conduct surveys, and to analyze and interpret data in surveying engineering applications.
3. Effectively convey technical and professional information in written, verbal, and graphic forms, as an individual and as a member of a professional team.
4. Demonstrate their recognition of the importance of professional organizations for advancement toward professional licensure, development of leadership skills, and maintaining a broad understanding of contemporary societal issues by participating in activities of professional organizations in capacities ultimately leading to leadership positions.
5. Demonstrate their recognition of the need for continuous, life-long learning by participating in continuing education as students or as instructors.”

Summer Job Experience
If you begin your study at the Wilkes-Barre campus, you will receive sufficient education in the practice of surveying during your first year in college to obtain summer employment in the profession. This presents you with the opportunity to have three full summers of practical experience in surveying prior to graduation. Many of our past students return to the same employer for two or more summer work experiences to create an informal internship, which can be a significant element of a graduation resume. In recent years, several of our students have obtained summer jobs with the U.S. Bureau of Land Management (BLM) in Alaska and the U.S. Forest Service (FS) in the western states of Arizona, Colorado, Montana, North Dakota and New Mexico. These summer jobs are often very unique, once-in-a-lifetime experiences for our students. Some of our graduates have remained with the BLM or FS for permanent employment.

Minor in Business
Many employers of our graduates like to see some course work in business. Several business related courses can be used as surveying engineering technical electives. If you want more business knowledge than just one or two courses, you have the option to pursue a minor in business which includes 22 credits of study in business related topics. Courses in accounting, economics, marketing, and management are used to fulfill the requirements of the minor, while also fulfilling the requirements of the major. Therefore, you can complete the minor in business by taking four additional credits beyond that required for the surveying engineering degree.

Career Opportunities
Employment opportunities for surveying engineering graduates are very plentiful. Since the program’s inception 100% of students seeking employment in the surveying profession have been placed. Most of our recent graduates have multiple job offers before graduation. Typical employers include private surveying consultants, consulting engineering firms, utility companies, state departments of transportation, state departments of conservation and environment, U.S. Bureau of Land Management, U.S. Forest Service, the U.S. National Park Service.
and the U.S. Fish and Wildlife Service. Some surveying graduates ultimately start their own consulting surveying business after gaining professional registration. To get an idea of the types of jobs available to surveying engineers, visit our program web site at [http://wb.psu.edu/Academics/Degrees/surveying.htm](http://wb.psu.edu/Academics/Degrees/surveying.htm) and click on the Jobs link. Starting salaries of our graduates are very comparable to other engineering graduates in the college. Opportunities for advancement in the profession are exceptional.

**Professional Registration**
For continued professional development, it is very desirable for surveying engineering graduates to have a Professional Land Surveyors (PLS) license. As a surveying engineering student, you will be strongly encouraged to pursue professional licensing. In Pennsylvania, this is done by passing the Fundamentals of Surveying (FS) examination, followed by four years of practical experience, and then passing the PLS examination. Our graduates consistently experience a very high success rate in passing both the FS and PLS exams.

**Concurrent Degree Program**
If you are interested in both Surveying Engineering and Civil Engineering, a concurrent degree program exists that allows you to obtain degrees in Surveying Engineering and Civil Engineering over a five year period. This program is designed for incoming first-year students who start at the Wilkes-Barre campus in Surveying Engineering. Students must participate in the regular entrance-to-major process described on page 12 and 14 and request Civil Engineering. If offered admission to Civil Engineering, a request for the concurrent majors program must then be submitted. After three years of study in surveying engineering, concurrent degree students change to the University Park campus to complete two years of civil engineering study. Certain civil engineering technical elective courses are required to satisfy the surveying engineering program requirements. Advanced standing students who are interested in this option must consult with their academic advisor or the surveying engineering program chair to make sure it is feasible in terms of eligibility and satisfactory matriculation. For more information visit [http://wb.psu.edu/Academics/Degrees/surveying.htm](http://wb.psu.edu/Academics/Degrees/surveying.htm).

**Is Surveying Engineering for You?**
Surveying appeals to people with a diverse background of interests. These interests include: applied mathematics, geography, map production, historical records, land-use planning, construction, the outdoors, computers and working with other professionals such as engineers, lawyers, and landscape architects. One of the most appealing aspects of a career in Survey Engineering is work diversity. Career types can vary significantly, and within each career, each job is typically different from the previous one. This aspect of surveying engineering offers a continuous stream of fresh challenges as one advances in the profession. To learn more about a career in Surveying Engineering visit any of the following web sites:

- International Federation of Surveyors: [http://www.fig.net](http://www.fig.net)
- American Congress on Surveying and Mapping: [http://www.acsm.net](http://www.acsm.net)
- Penn State University Surveying Program: [http://wb.psu.edu/Academics/Degrees/surveying.htm](http://wb.psu.edu/Academics/Degrees/surveying.htm)

For additional information about Wilkes-Barre campus and the Surveying Engineering major, please visit our campus web site at [http://wb.psu.edu/Academics/Degrees/surveying.htm](http://wb.psu.edu/Academics/Degrees/surveying.htm) or contact Dr. Wes Parks, Program Chair, 120 Center for Technology, Penn State Wilkes-Barre, PO Box PSU, Lehman, PA 18627-0217, or by phone at 570-675-9213 or by e-mail at wwp3@psu.edu.

**Student Societies and Organizations**
Advisor and contact information about the following departmental student organizations can be found at [http://www.clubs.psu.edu/wb/surveyingsociety/](http://www.clubs.psu.edu/wb/surveyingsociety/)

1. Lambda Sigma (Land Surveying honor society)
2. Penn State Surveying Society (a student chapter of the Pennsylvania Society of Land Surveyors)

The baccalaureate program in Surveying Engineering is accredited by the Engineering Accreditation Commission of ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: 410-347-7700, or [www.abet.org](http://www.abet.org).
Becoming a **WORLD-CLASS ENGINEER** is an exciting journey that begins with undergraduate study and requires a commitment to lifelong learning and professional development.

**WORLD-CLASS ENGINEERS** are:

**Aware of the World**
World-class Engineers are aware of the global nature of their profession, and the challenges and opportunities that it brings; they are sensitive to cultural differences and the diversity that exists within individual cultures.

**Solidly Grounded**
World-class Engineers are solidly grounded in the fundamentals of their discipline. This solid grounding allows them to tackle complex, real-world problems and serves as the foundation on which they build their knowledge and expertise through lifelong learning.

**Technically Broad**
World-class Engineers are conversant with other engineering and scientific disciplines related to their field, allowing them to work on problems that are cross-disciplinary.

**Innovative**
World-class Engineers create innovative solutions to meet societal needs. They pursue opportunities to apply their skills in both traditional and non-traditional fields such as financial services, health care, and education.

**Effective in Team Operations**
World-class Engineers are highly productive members of teams, co-located or geographically dispersed; they communicate effectively within and outside the team.

**Successful as Leaders**
World-class Engineers are effective, ethically-grounded leaders, at all levels from technical team leader to Chief Executive Officer.

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The College of Engineering

http://www.engr.psu.edu/leonhardcenter/wcedefinitions/