Biomedical Engineering Minor

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www.bme.cmu.edu (http://www.bme.cmu.edu)

The minor program is designed for engineering students who desire exposure to biomedical engineering but may not have the time to pursue the Biomedical Engineering additional major. The program is also open to students of all colleges and is popular among science majors. In conjunction with other relevant courses, the program may provide a sufficient background for jobs or graduate studies in biomedical engineering. Students interested in a medical career may also find this program helpful.

The Biomedical Engineering minor curriculum is comprised of three core courses and three electives. Students pursuing the minor may contact the BME Associate Head for Undergraduate Education (https://www.cmu.edu/bme/People/Faculty/profile/czapanta.html) (http://www.bme.cmu.edu/people/office.html#ADM) for advice. Students interested in declaring Biomedical Engineering minor should contact either the BME Associate Head for Undergraduate Education (https://www.cmu.edu/bme/People/Faculty/profile/czapanta.html) or the Biomedical Engineering Undergraduate Program Coordinator (https://www.cmu.edu/bme/People/Administration/).

Requirements

Minimum units required for minor: 57
03-121 Modern Biology 9
or 03-151 Honors Modern Biology
42-101 Introduction to Biomedical Engineering 12
42-202 Physiology 9
42-xxx BME Elective (> = 9 units). Any course offered by the Department of Biomedical Engineering numbered 42-300 or higher and worth at least 9 units
xx-xxx Elective I (> = 9 units) *
xx-xxx Elective II (> = 9 units) +

Some Special Topics, newly offered or intermittently offered 42-xxx may be acceptable as electives. Students should consult with their advisors and petition the Biomedical Engineering Undergraduate Affairs Committee for permission to include such courses.

Notes

* Elective I cannot be a required course in the student’s major. It may be
1. Any required or additional track elective course selected from any of the five Biomedical Engineering tracks. See the online catalog (https://www.cmu.edu/bme/Academic/Undergraduate%20Programs/Resources/catalog.html) for a listing of courses.
2. Any 42-xxx course with a 42-300 or higher number and worth at least 9 units.
3. 42-203 Biomedical Engineering Laboratory (or the cross-listed version 03-206 for students in the Health Professions Program); The course has a limited capacity and priority is given to students who have declared the Additional Major in Biomedical Engineering.
4. One semester of 42-200 Sophomore BME Research Project, 42-300 Junior BME Research Project, 42-400 Senior BME Research Project or 39-500 CSE Honors Research Project. The project must be supervised by a core or courtesy Biomedical Engineering faculty member and for 9 or more units.
+ Elective II must be a Biomedical Engineering Required or additional track elective.
** Priority for enrollment in 42-203 or 03-206 will be given to students who have declared the Additional Major in Biomedical Engineering. If sufficient room in the course remains after all majors have been accommodated in a given semester, students who have declared the Biomedical Engineering Designated Minor will be given the next priority for enrollment. If space still allows, other students will be enrolled.

Engineering Studies Minor

(for non-engineering students)

Kurt Larsen, Director
Location: Scaife Hall 120

Carnegie Mellon undergraduate students enrolled in colleges other than engineering can complete a Minor in Engineering Studies in addition to their regular majors. Students pursuing this minor are required to complete courses from at least two different engineering departments in order to assure some breadth of exposure to engineering. In addition, the minor provides students the opportunity to pursue an in-depth concentration in a particular field of engineering.

For the Minor in Engineering Studies, students must complete five engineering courses as follows and must earn a cumulative GPA of 2.00 in these five courses. Students may declare the minor by contacting the director after they have successfully completed one introductory engineering courses (from list #1 below).

Requirements

1. At least one and up to three of the following:
   12-100 Exploring CEE: Infrastructure and Environment in a Changing World
   18-100 Introduction to Electrical and Computer Engineering
   19-101 Introduction to Engineering and Public Policy
   24-101 Fundamentals of Mechanical Engineering
   27-100 Engineering the Materials of the Future
   42-101 Introduction to Biomedical Engineering
   06-100 Introduction to Chemical Engineering

2. Four courses of at least nine units each. Students must demonstrate both breadth and depth by taking courses from at least two of the below departments; and at least two courses from the same department.
   • Biomedical Engineering
   • Chemical Engineering
   • Civil and Environmental Engineering
   • Electrical and Computer Engineering
   • Engineering and Public Policy*
   • Materials Science and Engineering
   • Mechanical Engineering

Up to one of the following Robotics courses can count toward the ES minor. But it cannot be double-counted with the Robotics minor or double major.

1. 16-311 Introduction to Robotics 12
   16-362 Mobile Robot Algorithms Laboratory 12
   16-384 Robot Kinematics and Dynamics 12
   16-385 Computer Vision 12
   16-421 Vision Sensors 12
   16-474 Robotics Capstone 12

NOTE: The following courses may NOT be included as part of the minor in Engineering Studies.

06-262 Mathematical Methods of Chemical Engineering 12
12-201 Geology 9
12-421 Engineering Economics 6
15-213 Introduction to Computer Systems 12
18-090 Twisted Signals: Multimedia Processing for the Arts 10
18-099 Special Topics: Mobile App Design & Development 12
18-200 ECE Sophomore Seminar 1
18-202 Mathematical Foundations of Electrical Engineering 12
Introduction to Computer Systems
for a core major requirement (e.g. CS minor)

24-280 Special Topics: C++ Programming for Engineers

24-282 Special Topics: Linear Algebra and Vector Calculus for Engineers

24-311 Numerical Methods

42-202 Physiology

Double counting of core courses in student's primary major is not permitted.

*Because of the nature of the courses offered by Engineering and Public Policy, only two EPP courses (including 19-101) can be used toward the minor requirements. Most EPP courses (19-xxx) are not permissible for the minor; students need special permission to use 19-xxx toward this minor and should contact the director for prior approval. Students interested in EPP coursework should consider the Technology and Policy minor instead.

Technology and Policy Minor
(for non-engineering students)

Deanna H. Matthews, Director
Location: Baker Hall 129

The Technology and Policy Minor is administered by the Department of Engineering and Public Policy (EPP) for students who are majoring in areas other than engineering. The Technology and Policy Minor is designed to give students a basic understanding of the interactions between technology, society and policy and some project experience in problems involving technology and policy.

Pre-requisites
Students should have prerequisite knowledge in economics (73-102 Principles of Microeconomics or higher level economics course) and statistics (36-202 Methods for Statistics & Data Science or higher level statistics course) in order to pursue the Technology and Policy Minor.

Course Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-101</td>
<td>Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-301</td>
<td>Decision Making Methods for Engineers and Scientists</td>
<td>9</td>
</tr>
<tr>
<td>or 19-351</td>
<td>Applied Methods for Technology-Policy Analysis</td>
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<tr>
<td>19-451</td>
<td>EPP Projects I</td>
<td>12</td>
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<tr>
<td>or 19-452</td>
<td>EPP Projects</td>
<td></td>
</tr>
<tr>
<td>xx-xxx</td>
<td>Two EPP Technology-Policy Electives</td>
<td>18</td>
</tr>
</tbody>
</table>

EPP Technical Electives include courses in CIT, MCS, or SCS that address problems at the society-technology interface and the means of analyzing these issues. A list of qualifying Technology-Policy electives is assembled each semester and is available from the EPP Department. Example Technology-Policy electives include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>19-211</td>
<td>Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-365</td>
<td>Water Technology Innovation and Policy</td>
<td>9</td>
</tr>
<tr>
<td>19-402</td>
<td>Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>19-411</td>
<td>Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech</td>
<td>9</td>
</tr>
<tr>
<td>19-424</td>
<td>Energy and the Environment</td>
<td>9</td>
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Students must earn a cumulative QPA of 2.0 in all courses taken for the minor. Required courses taken for a student's primary major may not be counted toward the Technology and Policy Minor. Elective courses for a student’s primary major or courses fulfilling general education requirements may be counted, however.