



| <b>REQUIRED COURSES</b><br>(Circle or fill-in for courses planned in each category.)   | <b>Math</b> | <b>Science</b> | <b>Engr. Topics</b>             | <b>Semester</b><br>(FA/SP Year)           |
|--|-------------|----------------|---------------------------------|---|
| <b>Computer Science (1 course)</b><br><i>Select one:</i><br>AM 10 – Computing with Python for Scientists and Engineers<br>CS 32 – Computational Thinking and Problem Solving<br>CS 50 – Introduction to Computer Science I<br>CS 51 – Introduction to Computer Science II<br>CS 61 – Systems Programming & Machine Organization            |             |                | 1.0                             | _____                                     |
| <b>Environmental Science &amp; Engineering Core (5 courses)</b><br>Environmental Science and Engineering 6<br><i>Select four courses from (course titles shown on p. 4):</i><br>Environmental Science and Engineering 109, 115, 131, 132, 133, 137, 160, 161, 162, 163, 164, 166, 169<br>Engineering Sciences 112, 123                     |             |                | 1.0<br>1.0<br>1.0<br>1.0<br>1.0 | _____<br>_____<br>_____<br>_____<br>_____ |
| <b>Engineering Breadth (3 courses)</b><br><i>Select one upper-level course (&gt;100) from each area, see lists on pp. 4-5. (Note: ES50 may be used for the Electrical area.)</i><br><i>Area: Mechanics &amp; Materials</i><br>Course:<br><i>Area: Engineering Physics &amp; Chemistry</i><br>Course:<br><i>Area: Electrical</i><br>Course: |             |                | 1.0<br>1.0<br>1.0               | _____<br>_____<br>_____                   |
| <b>Approved Engineering Elective (1 course)</b><br><i>Select at least 1 additional course on engineering topics*</i><br>1.   |             |                | 1.0                             | _____                                     |
| <b>Engineering Design (2 courses)</b><br>Engineering Sciences 96<br>Engineering Sciences 100hf   |             |                | 1.0<br>1.0                      | _____<br>_____                            |
| <b>TOTALS</b>  | <b>/4</b>   | <b>/4</b>      | <b>/12</b>                      |   |

\* Environmental Science and Engineering 6, Engineering Sciences 50, 51, and 53: No more than three of these courses may count towards concentration credit. Engineering Sciences 50 and 53 can only count as an Engineering Elective when taken during the freshman or sophomore year. ES 91r may be included as an Engineering Elective in a Revised Plan of Study following the approval of a written petition and a signed certification that the project meets the ABET definition of an engineering topic.

**For courses co-listed in another department, students must enroll in the Engineering Sciences offering.**

**Required Signatures:**

\_\_\_\_\_  
Student

\_\_\_\_\_  
Date

\_\_\_\_\_  
Assistant/Director of Undergraduate Studies

\_\_\_\_\_  
Date

This plan *does* / *does not* meet the ABET distribution requirements.

\_\_\_\_\_  
Assistant Dean for Education

\_\_\_\_\_  
Date

## Pre-approved Courses for the SB in Engineering Sciences

### Engineering Courses

*Sorted by Depth Area and fulfills requirement for ABET engineering topics. For courses co-listed in another department, students must enroll in the Engineering Sciences offering.*

#### *Environmental*

ESE 6 – Introduction to Environmental Science & Engineering  
ESE 109 – Earth Resources and the Environment  
ES 112 – Thermodynamics by Case Study  
ESE 115 – Ecosystem Patterns and Processes: Parallels in Natural and Built Environments  
ES 123 – Intro to Fluid Mechanics & Transport Processes  
ESE 131 – Introduction to Physical Oceanography and Climate  
ESE 132 – Introduction to Meteorology and Climate  
ESE 133 – Atmospheric Chemistry  
ESE 136 – Climate and Climate Engineering  
ESE 137 – Energy within Environmental Constraints  
ESE 160 – Space Science: Theory and Applications  
ESE 161 – Applied Environmental Toxicology  
ESE 162 – Hydrology  
ESE 163 – Pollution Control in Aquatic Ecosystems  
ESE 164 – Environmental Chemistry  
ESE 166 – State-of-the-art Instrumentation in Environmental Sciences  
ESE 169 – Seminar on Global Pollution Issues

#### *Mechanics and Materials*

ES 51 – Computer Aided Machine Design  
ES 120 – Intro to the Mechanics of Solids  
ES 123 – Intro to Fluid Mechanics & Transport Processes  
ES 125 – Mechanical Systems  
ES 128 – Computational Solid & Structural Mechanics  
ES 181 – Engineering Thermodynamics  
ES 183 – Introduction to Heat Transfer  
ES 190 – Intro to Materials Science & Engineering  
ES 192 – Material Selection and Design

#### *Engineering Physics and Chemistry*

ES 112 – Thermodynamics by Case Study  
ES 170 – Engineering Quantum Mechanics  
ES 173 – Introduction to Electronic and Photonic Devices  
ES 181 – Engineering Thermodynamics  
ES 190 – Intro to Materials Science & Engineering

*Electrical*

ES 50 – Intro to Electrical Engineering  
ES 54 – Electronics for Engineers  
ES 151 – Applied Electromagnetism  
ES 152 – Circuits, Devices, and Transduction  
ES 153 – Laboratory Electronics  
ES 154 – Electronic Devices & Circuits  
ES 155 – Systems and Control  
ES 156 – Signals and Communications  
ES 157 – Biological Signal Processing  
ES 158 – Feedback Systems: Analysis and Design  
ES 159 – Intro to Robotics  
ES 170 – Engineering Quantum Mechanics  
ES 173 – Introduction to Electronic and Photonic Devices  
ES 175 – Photovoltaic Devices  
ES 175 – Introduction to Microelectromechanical System  
ES 177– Microfabrication Laboratory  
CS 141 – Computing Hardware  
CS 143 – Computer Network  
CS 146 – Computer Architecture  
CS 148 – Design of VLSI Circuits & Systems

*Biological and Biomedical*

ES 53 – Quantitative Physiology as a Basis for Bioengineering  
BE 110 – Physiological Systems Analysis  
BE 121 – Cellular Engineering  
BE 125 – Tissue Engineering  
BE 128 – Introduction to Biomedical Imaging and Systems  
BE 129 – Introduction to Bioelectronics  
BE 130 – Neural Control of Movement  
BE 131 – Neuroengineering  
BE 191 – Intro to Biomaterials  
ES 211 – Microphysiological Systems  
ES 221 – Drug Delivery  
ES 228 – Biologically-Inspired Materials

*General Engineering Electives (Cannot be used for Depth or Breadth Areas)*

ES 111 – Intro to Scientific Computing  
ES 105hfr – Humanitarian Design Projects (two semesters)  
ES 115 – Mathematical Modeling  
ES 121 – Intro to Optimization: Models & Methods  
CS 120 – Introduction to Algorithms and their limitations

**Prerequisite Planning Table for the ES SB - Environmental Science & Engineering Track**

| Typically Offered                       | Math          | Chemistry        | Physics      | Other                  | Prog. Lang.     |
|---|---------------|------------------|--------------|------------------------|-----------------|
| <i>Required Courses</i>                 |               |                  |              |                        |                 |
| ESE 6                                   | Spring        |                  |              |                        | R               |
| ES 96                                   | Fall & Spring |                  |              | Junior year            |                 |
| ES 100HF                                | Fall-Spring   |                  |              | ES 96                  |                 |
| <i>Selected Core and Breadth Course</i> |               |                  |              |                        |                 |
| ESE 109                                 | Spring (odd)  |                  |              | <i>ESE 6 or EPS 10</i> | MATLAB          |
| ESE 115                                 | Fall          | 1b               | PS 11        | ESE 6                  | R / Python      |
| ESE 131                                 | Spring (even) | 21a,b            |              | A                      | Python / MATLAB |
| ESE 132                                 | Fall (even)   | 21a,b            |              | A                      |                 |
| ESE 133                                 | Spring        | 1b               | PS 11        | Spring                 |                 |
| ESE 137                                 | Spring        | 1a               | PS 11        |                        |                 |
| ESE 160                                 | Fall          | 21a,b            |              | A,B                    | Python / MATLAB |
| ESE 161                                 | Spring        | 1a or 1b         | PS 11        |                        |                 |
| ESE 162                                 | Spring        | 21a,b            |              | A                      |                 |
| ESE 163                                 | Spring        | 21a              |              | ESE 6                  |                 |
| ESE 164                                 | Fall          |                  | PS 11        |                        |                 |
| ESE 166                                 | Spring        | 1b               | PS 11        | A,B                    |                 |
| ESE 168                                 | Fall          | <i>1b</i>        | <i>PS 11</i> | <i>A</i>               | Python / MATLAB |
| ESE 169                                 | Spring (odd)  | 1a or 1b         | PS 11        |                        | Python          |
| ES 112                                  | Spring        |                  |              |                        |                 |
| ES 120                                  | Spring        | 21a, b           |              | A                      |                 |
| ES 123                                  | Spring        | 21a              |              | A                      | Python          |
| ES 125                                  | Fall          | 21a,b            |              | A                      | Python          |
| ES 150                                  | Spring        | 21a (Co-req 21b) |              |                        | Any language    |
| ES 173                                  | Fall          | 1b               |              | A, B                   |                 |
| ES 181                                  | Fall          |                  |              | A                      |                 |
| ES 183                                  | Spring        | 21a,b            |              | A                      | MATLAB          |
| ES 190                                  | Spring        | <i>21a,b</i>     |              |                        |                 |
| ES 192                                  | Spring        | <i>21a,b</i>     |              |                        |                 |
| AM 101                                  | Fall          | 21a              |              |                        | MATLAB          |
| AM 105                                  | Spring        | 21a,b            |              |                        | MATLAB          |

<sup>1</sup>Courses listed as Recommended Preparation, and not an enforced prerequisite, are shown in grey, italics

<sup>2</sup>Equivalent courses are accepted for prerequisites (e.g., Phys 15a, PS 12a, or AP50a all count for Physics A)

<sup>3</sup> Programming language indicates the default language used for instruction (not prerequisites).