# UNIVERSITY OF THE PACIFIC

## CHANGES TO EXISTING PROGRAM PROPOSAL

Please use this form to propose any curricular revision(s) of an existing degree program, major, minor, or existing concentration that changes the catalog copy. Also use this form for proposing a new concentration. If you are proposing a new degree program, degree type (e.g., BA to BS), major, or minor, please use the New Program Proposal or Proposal for New Minor as applicable.

**Note:** All changes will become effective the following fall semester, if approved by Academic Affairs’ December meeting.

Before you proceed, please review the [approval process](#) in advance and leave time for each involved person or committee to review the proposal. Please attach new and revised course forms and syllabi for each new or revised course.

### DATE: 11/3/18
**DEPARTMENT/SCHOOL:** Bioengineering/ SOECS  
**CONTACT PERSON:** Shelly Gulati  
**PHONE/EMAIL:** 946-3178, sgulati@pacific.edu

For all changes to the program, major, minor, or concentration, list current configuration on left (below) and proposed changes on right, so the proposed changes are clear to the committee.

<table>
<thead>
<tr>
<th>School(s)</th>
<th>SOECS</th>
<th>Proposed (list only revisions here):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Bioengineering</td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>BS</td>
<td></td>
</tr>
</tbody>
</table>
| Major       | Current configuration of relevant required courses:  
  • ENGR 19 [3] | Changes to required courses:  
| Concentration | Current list of technical electives:  
  o BENG 140 Intro to Tissue Engineering  
  o BENG 154 Intro to Magnetic Resonance Imaging  
  o BIOL101 Genetics  
  o BIOL145 Microbiology  
  o BIOL153 Cell Biology  
  o BIOL 146 Industrial Microbiology  
  o CHEM 121 Organic Chemistry I  
  o CHEM 123 Organic Chemistry II  
  o CHEM 141 Analytical Chemistry  
  o CHEM 159 Biophysical Chemistry  
  o ECPE 71/71L Digital Design  
  o ECPE 121 Dig. Signal Process  
  o ECPE 141 Advanced Circuits  
  o ECPE 131/131L Electronics  
  o ENGR 121 Mech of Materials | Addition of the following courses to technical elective list:  
  • COMP 129 Software Engineering  
  • COMP 135 Human-Computer Interface Design  
  • COMP 151 Artificial Intelligence  
  • COMP 153 Computer Graphics  
  • COMP 155 Computer Simulation  
  • COMP 157 Design and Analysis of Algorithms  
  • COMP 162 Data Analytics Programming  
  • COMP 163 Database Management Systems |
1. What is the rationale for the above change?
   - **Change to options for programming class**
     Bioengineering students will be permitted to take ENGR 19 or COMP 51 or COMP 61. This change allows flexibility to students to pursue a programming class of their interest. It opens up the possibility for students to later pursue additional computer science courses where either COMP 51 or COMP 61 are pre-requisites.

   - **Additional courses added technical electives list**
     Additional courses in the area of computer science have been added to the elective list. The list of approved technical electives is given in the table above. The motivation for the change is to allow more flexibility and student choice in course selection.

2. Does this revision change the current term schedule?
   - ☒ No ☐ Yes
     If yes, please describe the changes:

3. Are there any changes to policy?
   - ☒ No ☐ Yes
     If yes, provide the existing and proposed policy changes:

4. Are there any changes to the total amount of credit units required for the degree?
   - ☐ No ☒ Yes
     If yes, provide existing and proposed unit changes, including overall program total before and after the proposed change:
     
     **Current Unit total:**
     129-133 (depending on the technical electives and 3 vs. 4 unit GE classes) + 32 co-operative education units (optional for biomedical path)
     
     **Proposed Unit total:**
     129-134 (depending on programming course selected, technical electives and 3 vs. 4 unit GE classes) + 32 co-operative education units (optional for biomedical path)

5. Will the program require review or approval of the proposed changes by an accrediting agency?
   - ☐ No ☒ Yes
     If yes, please indicate the agency and required process for review/approval: ABET

6. Are additional faculty or additional capital equipment, space modification, library resources, technology, or operational funds needed?
   - ☒ No ☐ Yes
     If yes, please describe, including the plan to obtain these resources and indicate dean approval:

7. Are other instructional departments/schools in the university affected by this proposal?
   - ☐ No ☒ Yes
     If yes, please indicate the department(s)/school(s): Computer Science/SOECS

8. Does this revision impact current students completing program?
   - ☒ No ☐ Yes
     If yes, how? Include outline plan for current students:
9. Does this revision impact enrollment numbers?
   ☒ No ☐ Yes If yes, please describe.

10. Does this revision expand the program’s % of distance modality (instruction delivered online)?
    ☒ No ☐ Yes If yes, provide existing and proposed ratios of total program in-seat instructional hours vs online
delivery and contact the Office for Strategy and Educational Effectiveness to discuss whether
WASC/WSCUC approval is needed (Accreditation Liaison Officer signature also required):

11. With the program changes, does the program meet Pacific’s credit unit policy?
    ☐ No ☒ Yes Please review the policy to be sure the program aligns with it.

12. Please attach any of the following that have been impacted by this program revision:
    (These are not required if you are only making changes to the electives in your program)
    ☐ Program goals
    ☐ Admission criteria
    ☒ Program degree requirements
    ☐ Research requirements or comprehensive examinations
    ☐ Prerequisites
    ☐ Required sequence of course offerings by semester, applicable
    ☐ Typical program of study (multi-year list of courses to complete the program)

13. For ALL programs, please attach the following:
    ☒ Statement of program learning outcomes and levels of achievement expected for all students
    by the time they graduate. For undergraduate programs, include any applicable undergraduate core
    competencies addressed in the course (critical thinking, written communication, oral communication,
    information literacy, quantitative reasoning)
    ☒ Curriculum Alignment Map (including which courses teach to each PLO and, for undergraduate programs, to
    any of the five core competencies)
    ☒ Program Assessment Plan
    ☒ Corresponding changes to your program’s catalog copy
CHANGES TO EXISTING PROGRAM PROPOSAL
APPROVAL SHEET

PROGRAM: Bioengineering

DEPARTMENT/SCHOOL: Bioengineering/SOECs

CONTACT PERSON: Shelly Gulati

PHONE/EMAIL: 946-3178, sgulati@pacific.edu

Please obtain signatures in the order they appear below, as applicable.

1. CHAIR(S) OF ALL INVOLVED DEPARTMENTS (for new courses and deletions):
   
   Shelly Cullen  
   DATE: 11/15/18

2. CHAIR(S), SCHOOL/COLLEGE CURRICULUM COMMITTEE(S):
   
   DATE: 11/15/18

3. DEAN(S) OF ALL INVOLVED SCHOOL(S)/COLLEGE:
   
   DATE: 11/15/18

4. GENERAL EDUCATION COMMITTEE (if applicable; for new courses and deletions):
   
   DATE:

5. UNIVERSITY LIBRARIAN (if applicable):
   
   DATE:

6. CHIEF INFORMATION OFFICER (if applicable):
   
   DATE:

7. REGISTRAR:
   
   DATE:

8. WASC/WSCUC ACCREDITATION LIAISON OFFICER (if applicable):
   
   DATE:

9. ACADEMIC AFFAIRS COMMITTEE ON UNDERGRADUATE OR GRADUATE STUDIES (as applicable):
   
   DATE:

10. PROVOST or Designee:
    
    DATE:
Support for Changes to Existing Program Proposal

Proposed changes to Bioengineering program degree requirements

General Engineering classes

*Current General Engineering classes*
- ENGR 010 Dean's Seminar
- ENGR 019 Computer Applications in Engineering
- ENGR 020 Engineering Mechanics I (Statics)
- ENGR 025 Professional Practice Seminar
- ENGR 110 Instrumentation and Experimental Methods
- MECH 015 Mechanical Engineering Graphics

*Proposed General Engineering core courses:*
- ENGR 010 Dean's Seminar
- Choose one of the following:
  - ENGR 019 Computer Applications in Engineering
  - COMP 051 Introduction to Computer Science
  - COMP 061 Introduction to Programming for Data Science
- ENGR 020 Engineering Mechanics I (Statics)
- ENGR 025 Professional Practice Seminar
- ENGR 110 Instrumentation and Experimental Methods
- MECH 015 Mechanical Engineering Graphics

Bioengineering core (no changes proposed)

*Current required Bioengineering core courses:*
- BENG 005 Introduction to Bioengineering
- BENG 103 Biomaterials
- BENG 104 Biomedical Imaging
- BENG 108 Engineering Physiology
- BENG 124 Biomechanics
- BENG 130 Biotransport
- BENG 194 Bioengineering Project Proposal
- BENG 195 Senior Project
- ECPE 041 Circuits
- ECPE 041L Circuits Laboratory
- ECPE 041L Circuits Laboratory

Bioengineering Technical Electives

*Current technical elective career path structure (no changes proposed):*

- Biomedical (3 technical electives)
  - CHEM 121
  - CHEM 123
  - BENG course from elective list

- Traditional (3 technical electives and cooperative education)
  - BENG course from elective list
  - 2 other courses from elective list
  - 32 units of Cooperative Education

*Current technical elective list:*
- BENG 140 Intro to Tissue Engineering
- BENG 154 Intro to Magnetic Resonance Imaging
- BIOL101 Genetics
- BIOL145 Microbiology
- BIOL153 Cell Biology
- BIOL 146 Industrial Microbiology
o CHEM 121 Organic Chemistry I
o CHEM 123 Organic Chemistry II
o CHEM 141 Analytical Chemistry
o CHEM 159 Biophysical Chemistry
o ECPE 71/71L Digital Design
o ECPE 121 Dig. Signal Process
o ECPE 141 Advanced Circuits
o ECPE 131/131L Electronics
o ENGR 121 Mech of Materials
o ENGR 120 Eng. Mech II Dynamics
o ENGR 122 Thermodynamics I
o MECH 104. Introduction to Mechatronics
o MECH 150. Heat Transfer

Proposed technical elective list:
o BENG 140 Intro to Tissue Engineering
o BENG 154 Intro to Magnetic Resonance Imaging
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o MECH 104. Introduction to Mechatronics
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## Typical program of study

<table>
<thead>
<tr>
<th>SUMMER</th>
<th>FALL</th>
<th>SPRING</th>
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<tbody>
<tr>
<td><strong>Year 1</strong></td>
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<tr>
<td></td>
<td>BENG 5 [2] INTRO BIOENG</td>
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</table>

| **Year 2** | | |

| **Year 3** | | |
| | | GEN ED IIA OR IIC [3] GENERAL EDUCATION |
| | | BENG 194 [3] BIOENGINEERING PROJECT PROPOSAL |

| **Year 4** | | |
| | | BENG 195 [3] SENIOR PROJECT |
| | | -- [3-5] TECHNICAL ELECTIVE |
| | | -- [3-5] TECHNICAL ELECTIVE |
| | | PACS 3 [3] PACIFIC SEMINAR 3 |
| | | GEN ED 1B [3-4] GENERAL EDUCATION |

**Technical electives for each path:**

- **Traditional**: 3 total (1 must be a BENG elective and 2 can be from elective list), 32 units of co-op
- **Biomedical**: 1 BENG elective, CHEM 121 Organic Chem I [5], CHEM 123 Organic Chem II [5]

* Technical electives following biomechanical, bioelectrical, or biochemical career paths are recommended, but not required.
** Co-op optional
Technical Electives list:
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BENG 154 Intro to Magnetic Resonance Imaging
BIOL101 Genetics
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ENGR 121 Mech of Materials
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ENGR 122 Thermodynamics I
MECH 104 Introduction to Mechatronics
MECH 150 Heat Transfer

Recommended courses list for each career path:

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<thead>
<tr>
<th>Biomedical</th>
<th>Bioelectrical</th>
<th>Biomechanical</th>
<th>Biochemical</th>
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<tr>
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<td>BENG 140</td>
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<td>BENG 140</td>
<td>ECPE 71/71L</td>
<td>BENG 154</td>
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<td>ECPE 121</td>
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<td>MECH 104</td>
<td>BIOL 101</td>
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<td>MECH 150</td>
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<td>BIOL 153</td>
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<td>BIOL 146</td>
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</tbody>
</table>
## 2019-20 Typical program of study

In **Yellow** are changes

- Option for programming class: ENGR 19 or COMP 51 or COMP 61
- Add courses to technical elective list

<table>
<thead>
<tr>
<th></th>
<th>SUMMER</th>
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<th>SPRING</th>
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<td><strong>BIOL 61 [5]</strong></td>
<td>PRINCIPLES OF BIOLOGY</td>
<td><strong>ENGR 10 [1]</strong> DEAN'S SEMINAR</td>
<td><strong>BIOL 51 [5]</strong> PRINCIPLES OF BIOLOGY</td>
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<td><strong>MATH 51 [4]</strong></td>
<td>CALCULUS I</td>
<td><strong>PACS 1 [4]</strong> PACIFIC SEMINAR 1</td>
<td><strong>MATH 53 [4]</strong> CALCULUS II</td>
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<td><strong>PACS 1 [4]</strong></td>
<td>INTRO BIOENG</td>
<td><strong>ENGR 20 [3]</strong> ENGINEERING MECHANICS I (STATICS)</td>
<td><strong>PACS 2 [4]</strong> PACIFIC SEMINAR 2</td>
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<td><strong>PHYS 53 [5]</strong></td>
<td>PHYSICS I</td>
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<td><strong>PHYS 53 [5]</strong> PHYSICS I</td>
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<td><strong>Year 2</strong></td>
<td><strong>19-20</strong></td>
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<td><strong>CHEM 25 [5]</strong></td>
<td>GENERAL CHEMISTRY I</td>
<td><strong>MATH 55 [4]</strong> CALCULUS III</td>
<td><strong>CHEM 27 [5]</strong> GENERAL CHEMISTRY II</td>
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<td><strong>MATH 55 [4]</strong></td>
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<td><strong>PHYS 55 [5]</strong> PHYSICS II</td>
<td><strong>MATH 57 [4]</strong> DIFFERENTIAL EQUATIONS</td>
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<td><strong>ENGR 20 [3]</strong></td>
<td>ENGINEERING MECHANICS I</td>
<td><strong>BENG 124 [4]</strong> BIOMECHANICS</td>
<td><strong>BENG 124 [4]</strong> BIOMECHANICS</td>
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<td><strong>BENG 108 [4]</strong></td>
<td>ENGG 10 [1] DEAN'S SEMINAR</td>
<td><strong>ENGR 104 [4]</strong> BIOMATERIALS IMAGING</td>
<td><strong>ENGR 19 [3]</strong> COMPUTER APPLICATIONS IN ENGINEERING or</td>
</tr>
<tr>
<td><strong>MECH 15 [3]</strong></td>
<td>MECHANICAL ENGINEERING GRAPHICS</td>
<td><strong>ECPE 41 [3]</strong> ELECTRIC CIRCUITS</td>
<td>**COMP 51 INTRO TO COMPUTER SCIENCE or COMP 61 INTRO TO PROGRAMMING FOR DATA SCIENCE)</td>
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<tr>
<td><strong>ENGR 30 [3]</strong></td>
<td>ENGR. ETHICS AND SOCIETY</td>
<td><strong>ECPE 41L [1]</strong> CIRCUITS LAB</td>
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<td><strong>GEN ED 1A [3-4]</strong></td>
<td>GENERAL EDUCATION</td>
<td><strong>ENG R 25 [1]</strong> PROFESSIONAL PRACTICE SEMINAR</td>
<td><strong>GEN ED IA OR IIC [3]</strong> GENERAL EDUCATION</td>
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<td><strong>Year 3</strong></td>
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<td><strong>ENGR 30 [3]</strong></td>
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<td><strong>ECPE 41 [3]</strong> ELECTRIC CIRCUITS</td>
<td><strong>PACS 3 [3]</strong> PACIFIC SEMINAR 3</td>
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<td><strong>GEN ED 1A [3-4]</strong></td>
<td>GENERAL EDUCATION</td>
<td></td>
<td><strong>GEN ED IA [3-4]</strong> GENERAL EDUCATION</td>
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</tbody>
</table>

### Technical electives for each path:

- **Traditional *:** 3 total (1 must be a BENG elective and 2 can be from elective list), 32 units of co-op
- **Biomedical **:** 1 BENG elective, CHEM 121 Organic Chem I [5], CHEM 123 Organic Chem II [5]

* Technical electives following biomechanical, bioelectrical, biochemical, or biocomputation career paths are recommended, **but not required**.

** Co-op optional
Technical Electives list:
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<tbody>
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<td>BENG 154</td>
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## Bioengineering Student Outcomes Assessment Process and Frequency

<table>
<thead>
<tr>
<th>Student Outcomes</th>
<th>Course: Assessment Instrument</th>
<th>Assessment Frequency</th>
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<tbody>
<tr>
<td>(a) an ability to apply knowledge of math, science, and engineering</td>
<td>ENGR 20: Embedded question(s) in final exam, ENGR 121: Embedded question(s) in final exam, ECPE 41: Embedded question(s) in quizzes, BENG 53: Embedded question(s) in final exam, BENG 130: Homework problems &amp; exam questions, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Biennial</td>
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<tr>
<td>(b) an ability to design &amp; conduct experiments as well as to analyze and interpret data</td>
<td>ENGR 45: Lab design project, ENGR 110: Lab assignments, ECPE 41L: Lab reports, BENG 63: Lab activities, BENG 104: Mini-projects, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall &amp; Spring, Fall &amp; Spring, Fall &amp; Spring, Fall, Spring, Fall, Spring, Fall, Spring, Biennial</td>
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<tr>
<td>(c) an ability to design a system, component, or process to meet desired needs within realistic constraints ...</td>
<td>MECH 15: Embedded question(s) in final exam, BENG 195: Evaluation from final report and presentation, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall &amp; Spring, Spring, Spring, Fall, Spring, &amp; Summer, Biennial</td>
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<td>(d) an ability to function on multidisciplinary teams</td>
<td>ENGR 45: Peer evaluation, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall &amp; Spring, Fall &amp; Spring, Fall, Spring, &amp; Summer, Biennial</td>
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<tr>
<td>(e) an ability to identify, formulate, &amp; solve engineering problems</td>
<td>ENGR 121: Embedded Question(s) in final exam, ECPE 41: Embedded question(s) in final exam, BENG 104: Embedded question(s) in final exam, BENG 124: Homework problems &amp; exam questions, BENG 195: Evaluation from final report and presentation, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Biennial</td>
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<tr>
<td>(f) an understanding of professional &amp; ethical responsibility</td>
<td>ENGR 30: Paper, BENG 195: Evaluation from final report and presentation, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall, Spring, &amp; Summer, Spring, Spring, Fall, Spring, &amp; Summer, Biennial</td>
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<tr>
<td>(g) an ability to communicate effectively</td>
<td>MECH 15: Embedded question(s) in final exam, ENGR 30: Paper, BENG 124: Final Project presentation, BENG 130: Literature review paper, ENGR 110: Lab project presentation, IAB evaluation of senior design project, Employer assessment of student performance, EBI (Skyfactor) Questionnaire</td>
<td>Fall &amp; Spring, Fall, Spring, &amp; Summer, Fall, Spring, &amp; Summer, Spring, Fall, Spring, &amp; Summer, Biennial</td>
</tr>
<tr>
<td>Student Outcomes</td>
<td>Course: Assessment Instrument</td>
<td>Assessment Frequency</td>
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<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
<td>ENGR 30: Paper&lt;br&gt;BENG 124: Final project presentation&lt;br&gt;BENG 195: Evaluation from final report and presentation&lt;br&gt;IAB evaluation of senior design project&lt;br&gt;Employer assessment of student performance&lt;br&gt;EBI (Skyfactor) Questionnaire</td>
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<tr>
<td>(i) a recognition of the need for, and an ability to engage in life-long learning</td>
<td>ENGR 30: Paper&lt;br&gt;BENG 124: Literature review and project presentations&lt;br&gt;BENG 195: Evaluation from final report and presentation&lt;br&gt;IAB evaluation of senior design project&lt;br&gt;Employer assessment of student performance&lt;br&gt;EBI (Skyfactor) Questionnaire</td>
<td>Fall, Spring, &amp; Summer&lt;br&gt;Fall&lt;br&gt;Spring&lt;br&gt;Spring&lt;br&gt;Fall, Spring, &amp; Summer&lt;br&gt;Biennial</td>
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<td>(j) a knowledge of contemporary issues</td>
<td>ENGR 30: Paper&lt;br&gt;BENG 124: Literature review and project presentations&lt;br&gt;IAB evaluation of senior design project&lt;br&gt;Employer assessment of student performance&lt;br&gt;EBI (Skyfactor) Questionnaire</td>
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<td>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>MECH 15: Embedded question(s) in final exam&lt;br&gt;ENGR 110: Lab assignments&lt;br&gt;ECPE 41L: Lab practical and pre-labs&lt;br&gt;BENG 130: CFD assignments&lt;br&gt;BENG 195: Evaluation from final report and presentation&lt;br&gt;IAB evaluation of senior design project&lt;br&gt;Employer assessment of student performance&lt;br&gt;EBI (Skyfactor) Questionnaire</td>
<td>Fall &amp; Spring&lt;br&gt;Fall &amp; Spring&lt;br&gt;Fall, Spring, &amp; Summer&lt;br&gt;Spring&lt;br&gt;Spring&lt;br&gt;Fall, Spring, &amp; Summer&lt;br&gt;Biennial</td>
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### BIOENGINEERING CURRICULUM MAP

<table>
<thead>
<tr>
<th>Mathematics Core 20 Units</th>
<th>General Engineering</th>
<th>Bioengineering Core</th>
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</thead>
<tbody>
<tr>
<td>ENGR 10</td>
<td>ENGR 19 or COMP 51 or COMP 61</td>
<td>BENG 5</td>
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<tr>
<td>ENGR 20</td>
<td>ENGR 25</td>
<td>BENG 103</td>
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<tr>
<td>ENGR 30</td>
<td>ENGR 110</td>
<td>BENG 104</td>
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<td>MECH 15</td>
<td>Professional Practice Co-op</td>
<td>BENG 108</td>
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<td>ECPE 41/41L</td>
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</table>

#### Technical Electives 10-19 Units

**Student outcome**

<table>
<thead>
<tr>
<th>(a) ability to apply knowledge of mathematics, science and engineering</th>
<th>(b) an ability to design and conduct experiments, as well as to analyze and interpret data</th>
<th>(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability</th>
<th>(d) an ability to function on multi-disciplinary teams</th>
<th>(e) an ability to identify, formulate, and solve engineering problems</th>
<th>(f) an understanding of professional and ethical responsibility</th>
<th>(g) an ability to communicate effectively</th>
<th>(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</th>
<th>(i) a recognition of the need for, and an ability to engage in lifelong learning</th>
<th>(j) a knowledge of contemporary issues</th>
<th>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice</th>
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Program Learning Outcomes for Bioengineering

Each engineering and computer science program accredited by ABET must assess, at a minimum, outcomes identified by ABET as Criterion 3 a-k. Each program in the school of engineering assesses all eleven outcomes. Some programs have additional outcomes.

- Outcome a: “an ability to apply knowledge of mathematics, science and engineering”
- Outcome b: “an ability to design and conduct experiments, as well as to analyze and interpret data”
- Outcome c: “an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability”
- Outcome d: “an ability to function on multi-disciplinary teams”
- Outcome e: “an ability to identify, formulate, and solve engineering problems”
- Outcome f: “an understanding of professional and ethical responsibility”
- Outcome g: “an ability to communicate effectively”
- Outcome h: “the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context”
- Outcome i: “a recognition of the need for, and an ability to engage in life-long learning”
- Outcome j: “a knowledge of contemporary issues”
- Outcome k: “an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.”

<table>
<thead>
<tr>
<th>University Core Competencies</th>
<th>SOECS Student Outcomes</th>
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<tbody>
<tr>
<td></td>
<td>a</td>
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<tr>
<td>Quantitative Reasoning</td>
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<tr>
<td>Critical Thinking</td>
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<td>Oral Communication</td>
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<td>Written Communication</td>
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<tr>
<td>Information Literacy</td>
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Levels of Achievement

For all of our acceptable targets in all outcomes it should indicate that meeting an outcome is getting a score higher than 60%. Of those, the goal is for 70% of those students to meet the outcome.