To: Enrique J. Lavernia, Dean  
College of Engineering

Robert Powell, Chair  
Academic Senate

Fr: Matthew Farrens, Chair  
Engineering Executive Committee

Re: Approval of New Minors in Engineering

The Engineering Executive Committee met and discussed two new proposed minors in Engineering at their meeting scheduled May 19, 2011. The proposed new minors are for Biomedical Engineering to be administered by the Department of Biomedical Engineering and Computational Biology and Bioinformatics administered by the Department of Computer Science. Executive Committee members approved the proposed minors.

APPROVAL RECOMMENDED:

Enrique J. Lavernia, Dean  
College of Engineering
To: College of Engineering Committee on Undergraduate Education and Policy  
From Angelique Louie, Vice Chair, Biomedical Engineering  

Re: Proposed Minor in Biomedical Engineering  

The Department of Biomedical Engineering proposes to offer a **minor in Biomedical Engineering** for all students within the College of Engineering. The new minor would allow students from any engineering discipline to build upon their existing core strengths and add expertise in biomedical applications. This additional training would help to make students more attractive to employers in the medical device industry, and also position the students for graduate training in health related applications of engineering. The proposed minor requires two life sciences courses, not typically required for engineering, at the cellular (BIM102) and physiological (NPB101 or BIM116) levels. The remaining units are to be selected in consultation with an **academic** advisor from the upper division BIM courses for a total of 21 units for the minor. Students will be advised to select additional courses to complement their existing curricula; examples of relevant coursework for different majors are provided as a reference. These listings classify the upper division BIM courses into categories and provide a suggested subset of coursework for the majors most likely to have students interested in health-related applications.

Sincerely,

Angelique Louie  
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Department of Biomedical Engineering  
University of California  
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BME Minor

Courses for the minor are listed below. **No more than one course may be counted toward both the major and the minor.** Successful completion of the minor requires the following:

1. Minimum GPA of 2.0 for coursework completed in the minor
2. No grade lower than a C- for any course counted toward the minor

Transcript notation requires successful completion of the minor. Notation will appear as minor in “Biomedical Engineering”.

Total units for the minor = 21 units. All courses must be taken for a letter grade. No grade lower than a C- will be accepted.

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>NPB 101 or BIM 116 Physiology</td>
<td>5</td>
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<tr>
<td>BIM 102</td>
<td>4</td>
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**Plus 12 units from upper division BME courses, chosen in consultation with an academic advisor**

The information below will be provided as advising materials and it not part of the catalog listing for the minor. These are suggested only, not required.

**EE/CS-Related Electives**

- BIM 108 Biomedical Signals and Control
- BIM 109 Biomaterials
- BIM 111 Biomedical Instrumentation
- BIM 117 Analysis of Molecular and Cellular Networks
- BIM 118 Microelectromechanical Systems
- BIM 142 Biomedical Imaging
- BIMxxx Bioelectricity

**ME-Related Electives**

- BIM 111 Biomedical Instrumentation
- BIM 118 Microelectromechanical Systems
BIM 126 Tissue Mechanics
BIM 141 Cell and Tissue Mechanics
BIM 151 Mechanics of DNA
BIM 167 Biomedical Fluid Mechanics

ChE/MS-Related Electives

BIM 109 Biomaterials
BIM 140 Protein Engineering
BIM 151 Mechanics of DNA
BIM 161A Biomolecular Engineering
BIM 161L Biomolecular Engineering Laboratory
BIM 162 Quantitative Concepts in Biomolecular Engineering
BIM 173 Cell and Tissue Engineering

Computational Electives

BIM 117 Analysis of Molecular and Cellular Networks
BIMxxx Molecular Control of Biosystems
BIMxxx Systems Biology
UC Davis Computational Biology and Bioinformatics Minor Program

Offered by the Department of Computer Science
2063 Kemper Hall
+1 530 752 7004

Overview: Technological advances in the past 15 years have revolutionized biological sciences, as they have allowed large-scale simulations and high-throughput experiments throughout the Tree of Life. Unarguably, there is a need for computational methods that enable us to efficiently store, analyze and visualize the plethora of biological information available. Scientific methods from many areas of computer science such as machine learning, graph theory, scientific computation, visualization and databases, have been employed to address problems in biological sciences, while projections support that biological-related research in those areas will continue to increase in the next decade.

The minor in Computational Biology and Bioinformatics (CBB) will provide to students with engineering, physical or biological majors the foundations necessary to build efficient computational models and algorithms, use state-of-the-art techniques for scientific analysis and create scalable infrastructure environments for biological and biotechnological applications.

Comparison to other minors: Despite the significant presence of biological research on campus, we currently lack a minor with a clear emphasis on computational techniques that are biology related. The only minor that has a small overlap, the minor in Quantitative Biology and Bioinformatics, puts its emphasis on the mathematical methods rather than on computational methods and does not focus on any of the biology-relevant computer science areas mentioned.

Requirements: Students must take a total of 20 upper division units, with two required courses and three electives, as specified below. At most one course may be counted toward both the student’s minor and major. A minimum GPA of 2.0 is required for coursework in the minor. Students should note that most of the courses listed below have lower division prerequisites.

- Required courses (2 courses, 8 units):
  - ECS 122A Algorithm Design and Analysis
  - ECS 124 Theory and Practice of Bioinformatics
• Electives (3 courses, 12 units):
  
  o One biology course from the following:

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MCB 121 Molecular Biology of Eukaryotic Cells</td>
<td>EVE 103 Phylogeny and Macroevolution</td>
</tr>
<tr>
<td>MCB 124 Macromolecular Structure and Function</td>
<td>EVE 104 Community Ecology</td>
</tr>
<tr>
<td>MCB 161 Molecular Genetics</td>
<td>EVE 131 Human Genetic Variation and Evolution</td>
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<tr>
<td>MCB 182 Principles of Genomics</td>
<td>BIS 101 Genes and Gene Expression</td>
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<tr>
<td>EVE 100 Introduction to Evolution</td>
<td>BIS 104 Regulation of Cell Function</td>
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<tr>
<td>EVE 101 Introduction to Ecology</td>
<td>BIS 122 Population Biology and Ecology</td>
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<tr>
<td>EVE 102 Population and Quantitative Genetics</td>
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  o One computational or statistics course from the following:

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ECS 130 Scientific Computation</td>
<td>ECS 166 Scientific data Management</td>
</tr>
<tr>
<td>ECS 132 Probability and Statistical Modeling for CS</td>
<td>ECS 170 Introduction to Artificial Intelligence</td>
</tr>
<tr>
<td>ECS 140 Programming Languages</td>
<td>ECS 177 Introduction to Visualization</td>
</tr>
<tr>
<td>ECS 145 Scripting Languages and Their Applications</td>
<td>EVE 175 Computational Genetics</td>
</tr>
<tr>
<td>ECS 156 Discrete-Event Simulation</td>
<td>STA 141 Statistical Computing</td>
</tr>
<tr>
<td>ECS 158 Programming on Parallel Architectures</td>
<td>STA 130A Brief Mathematical Statistics</td>
</tr>
<tr>
<td>ECS 160 Introduction to Software Engineering</td>
<td>BIT 150 Applied Bioinformatics</td>
</tr>
<tr>
<td>ECS 165A Database Systems</td>
<td>BIS 132 Introduction to Dynamic Models in Biology</td>
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  o One computational biology and bioinformatics course from the following:

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<tbody>
<tr>
<td>ECS 129 Computational Structural Biology</td>
<td>EVE 175 Computational Genetics</td>
</tr>
<tr>
<td>BIS 132 Introduction to Dynamic Models in Biology</td>
<td>BIT 150 Applied Bioinformatics</td>
</tr>
<tr>
<td>BIM 117 Analysis of Molecular and Cellular Networks</td>
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