EXECUTIVE COMMITTEE
BOURNS COLLEGE OF ENGINEERING

REPORT TO THE RIVERSIDE DIVISION
May 27, 2014

To be adopted:

PROPOSED CHANGE TO BIOENGINEERING UNDERGRADUATE REQUIREMENTS

PRESENT:
Bioengineering
Undergraduate Program
Major Requirements

1) Lower-division requirements (73 units)
   a) BIEN 010
   b) BIOL 005A, BIOL 05LA, BIOL 005B
   c) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC
   d) CS 010
   e) EE 001A, EE 01LA
   f) MATH 009A, MATH 009B, MATH 009C, MATH 010A, MATH 010B, MATH 046
   g) PHYS 040A, PHYS 040B,
      PHYS 040C

2) Upper-division requirements (84 units)
   a) BCH 100
   b) BIEN 105, BIEN 110, BIEN 120, BIEN 125, BIEN 130, BIEN 130L, BIEN 135, BIEN 140A/CEE 140A, BIEN 155, BIEN 159/CEE 159, BIEN 175A, BIEN 175B
   c) BIEN 115
   d) CHEM 112A, CHEM 112B, CHEM 112C
   e) STAT 155
   f) Technical electives (16 units):
      BIEN 140B, BIEN 160, BIEN 165, BIEN 197
      (4 units maximum), CEE 135, CHE 105*, CHE 122, CHE 161*, EE 100A, EE 100B, EE 105, EE 110A, EE 110B, EE

PROPOSED:
Bioengineering
Undergraduate Program
Major Requirements

1) Lower-division requirements (76 units)
   a) BIEN 001, BIEN 010
   b) BIOL 005A, BIOL 05LA, BIOL 005B
   c) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC
   d) CS 010
   e) EE 001A, EE 01LA
   f) MATH 009A, MATH 09B, MATH 009C, MATH 010A, MATH 010B, MATH 046
   g) PHYS 040A, PHYS 040B, PHYS 040C

2) Upper-division requirements (78 units)
   a) BIEN 101
   b) BIEN 105, BIEN 110, BIEN 120, BIEN 125, BIEN 130, BIEN 130L, BIEN 135, BIEN 140A/CEE 140A, BIEN 155, BIEN 159/CEE 159, BIEN 175A, BIEN 175B, BIEN 175C
   c) BIEN 115
   d) CHEM 112A, CHEM 112B
   e) STAT 155
   f) Technical electives (16 units):
      BIEN 136/MSE 136, BIEN 137, BIEN 138, BIEN 140B/CEE 140B, BIEN 142, BIEN 159/CEE 159, BIEN 160, BIEN 165, BIEN 166
138, EE 139, EE 143, EE 144, EE 146*, EE 152*, ENVE 133, ENVE 142, ENVE 171, ME 114, ME 138, ME 153, ME 180 (* require consent of instructor prior to enrollment.)

Visit the Student Affairs Office in the College of Engineering or student.engr.ucr.edu for a sample program.

JUSTIFICATION:

Regarding the addition of BIEN 001 (1):
This colloquium-based course is being added to the 1st year of the recommended course schedule and the departmental program requirements as a general introduction and survey to the field of bioengineering.

Regarding the BIEN 010 (4) change:
The revised course will include engineering design. The increased units from 2 units to 4 units are required to account for the increased work of the students. This is being moved in the recommended course schedule from the 1st year to the 2nd year in the program in order for students to maintain at least one departmental course in each of their first two years.

Regarding the addition of BIEN 101 (4):
BIEN 101 was added as substitute for BCH 100 to increase the engineering content of the major. This course replaces BCH 100 Elementary Biochemistry as a required course in the BS Bioengineering degree program. The Bioengineering Department is dropping Organic Chemistry 112C as a requirement for the BS Bioengineering degree and BCH 100 requires CHEM 112C as a prerequisite, thus bioengineering students will no longer have the prerequisites for BCH 100. Letter grade only; this course is for majors only.

Regarding the BIEN 175A-B-C changes (2-4-4):
The current BIEN 175 series spans only two quarters (4 units of BIEN 175A and 4 units of BIEN 175B). This change to a three quarter structure has been proposed to

a. accommodate increased course content, specifically the inclusion of business plan development in collaboration with the School of Business Administration and additional lectures on different job types in bioengineering industry given by alumni in those respective fields, and

b. to give students additional working time to develop and complete significantly more substantial design projects geared for competitive standing in national competitions such as the BMEStart and NIH DEBUT competitions.

There has been no reduction in the overall amount of material covered in the BIEN 175 series; these changes are proposed to provide for additional time to cover the new and increased
content introduced over the last few years of the course (2 units of BIEN 175A, 4 units of BIEN 175B, 4 units of BIEN 175C) without increasing the unit count devoted to this course during any single quarter. The grading description has been changed to reflect the proposed additional quarter of BIEN 175C.

**Regarding the removal of BIEN 159 (4):**
The primary reason for removing BIEN 159 as a required core course is that many of the topics in BIEN 159 regarding *enzymes, metabolism, and engineering of bioprocesses* are covered in the newly introduced BIEN 101 and the existing core course BIEN 125.

Here is the catalog description of BIEN 159 that is being removed as a required course

**BIEN 159 Dynamics of Biological Systems (4)**
Covers engineering principles for the analysis and modeling of biological phenomena. Topics include molecular diffusion and transport, membranes, ligand-bioreceptor interactions, *enzyme kinetics*, and dynamics of *metabolic pathways*. Examines the application of these principles to the design of bioreactors, bioassays, drug delivery systems, and artificial organs.

Here are the catalog descriptions of the courses that cover similar topics

**BIEN 101 Quantitative Biochemistry (4)**

**BIEN 125 Biotechnology and Molecular Bioengineering (4)**
Provides an overview of biochemical processes in cells and their use in developing new products and processes. Presents cellular processes such as *metabolism, protein synthesis, enzyme behavior*, and cell signaling and control from an engineering viewpoint of modeling and control.

**Regarding the removal of CHEM 112C (4):**
CHEM 112C was dropped because about half the topics are not relevant to the major, and the other topics are treated in BIEN 101, BIEN 125 and BIEN 135.

**Technical Electives:**
Over the past 3 years, a number of technical electives taught by Bioengineering faculty have been approved. The changes to the technical elective list are meant to properly reflect these new courses in departmental program requirements. Moreover, the overall number of departmental technical electives is sufficient to fulfill the 16 unit requirement without requiring students to enroll in electives taught in other departments, and so the list of pre-approved technical electives has been reduced to just the ones taught within the department. Classes outside this list can be used to fulfill the technical elective requirement with the approval of the departmental Undergraduate Advisor.

**APPROVALS:**