To: MBBE Regular Faculty
CTAHR Senate Curriculum Committee
Dr. Charles M. Kinoshita, Associate Dean for Academic Affairs, CTAHR

From: BE Curriculum Committee (Wei-Wen Su, Pengchen Fu, Daniel Jenkins, Daniel Paquin)

Date: 8/26/2005

Esteemed Colleagues,

In a series of formal and informal meetings of the BE curriculum committee between August 4 and August 19 of 2005, the committee has arrived at a series of recommendations for the modification of the curriculum for the undergraduate Bioengineering program.

These proposed modifications are in response to the results of assessment of the program by the BE faculty, students, and industry advisors. The results of these assessment tools are recorded in survey responses, and in the minutes of faculty meetings and of the BE-Educational Program Advisory Committee (BE-EPAC).

The requested changes include course deletions, modifications, and additions as summarized below:

1. Deletion of courses BE 351 and BE 351L (Energy Conversion and Power Units, Lecture and Lab). Assessment of these courses by the faculty, engineering accreditation board (ABET), and BE-EPAC indicated that these courses lacked relevancy to Bioengineering students and are not appropriate as requirements for the major.

2. Deletion of course BE 401 (Modeling and Simulation of Dynamic Systems). The material taught in BE 401 was deemed by the faculty to be more appropriately numbered as a ‘300’ level course to indicate that it should be taken before upper division BE electives. It is proposed to include the material currently covered in BE 401 in a newly proposed pair of courses BE 350 and BE 350L (see items 4 & 5 below).

3. Modification (change of course number) of course BE 413 (Transport Phenomena) to BE 373. This action is proposed because the faculty believe the material covered in this course forms a foundation for Bioengineering students in their upper division courses, and as such should be numbered as a ‘300’ level class, as is the practice of most similar academic programs including those at Cornell University, University of California at Davis, Texas A&M University, and University of Florida.

4. Addition of new course BE 350 (Dynamic Systems Modeling). A new 3 credit course BE 350 is requested to cover the material previously presented in BE 401 (see item 2 above). As discussed above, the faculty thought it more appropriate to offer this material in a ‘300’ level course to indicate that it should be taken before upper division electives.

5. Addition of new course BE 350L (Dynamic Systems Modeling Lab). This new course is intended to accompany BE 350. It is intended that this course implement some of the more beneficial field trips and lab experiences from BE 351L which is proposed for deletion, while tying these in with the underlying theory relating biological systems to...
mathematical models used to describe them. The existence of this course also allows some of the labs previously taught in the 3 unit course BE 401 to be taught concurrently with the new course BE 350, so that more time is available in BE 350 to cover the material in greater depth, and to include more relevant examples.

UHM-1 and UHM-2 forms requesting the course additions, deletions, and modifications are being submitted to the CTAHR faculty senate and Academic Affairs office concurrently with this proposal.

In addition, the following proposed changes are requested in the structure of the curriculum:

6. BE 437 (Biosystems Unit Operations) and BE 460 (Bioreactor Design and Analysis) will be changed from ‘required’ BE courses to BE electives. These courses are not considered fundamental to the Bioengineering major.

7. It is proposed to change the minimum number of BE elective courses required for graduation from two 3 credit courses to a cumulative of 15 credits. This is proposed in order to maintain a number of engineering science credits at a level acceptable for ABET, since the net effect of proposed changes 1-6 are that three fewer BE courses would be specifically required for graduation.

8. It is proposed to add CEE 355 (Geotechnical Engineering I) as a course satisfying a BE elective. This is proposed in response to suggestions from BE-EPAC that BE students have no exposure to fundamental soil mechanics, structure, and water permeation through soil which are critical for many engineering jobs in waste treatment, site preparation, and bioremediation.

A major implication of the changes proposed above is that fewer courses will specifically be required and students will have more flexibility in meeting graduation requirements. Members of BE-EPAC noted that the current structure of the curriculum is very prescribed relative to those of similar programs, and suggested this approach. A formal review of similar programs verified that the proposed structure is more common, allowing greater flexibility for students.

By having fewer required courses, it is also easier for the available instructional faculty to teach the required courses each year. Discussions with BE students identify the current course structure as a serious limitation to growth in the major. The current structure with many required courses which are mostly offered only every other year makes it difficult for students to take advantage of opportunities to study abroad, take semesters off unexpectedly, or transfer into the program while staying within the prescribed course sequence and graduate in a reasonable amount of time.

For clarity, summaries of the existing and proposed curricula for the BE undergraduate program are included on the following pages:
Bioengineering Curriculum
Effective Fall 2005

General Education Core:

*English Composition* (ENG 100, 100A, 101/101L, or ELI 100)
*Public speaking* (SP 251)
*Multicult. Persp.* (e.g. HIST 151 and 152)
*Economics* (ECON 120, 130, or 131)
*Social Sciences* (1 course)
*Humanities* (1 course)

In addition, courses must be taken fulfilling the following focus designations:

*Contemporary Ethical Issues* (1 course)
*Hawaiian, Asian, or Pacific Issues* (1 course)
*Oral Communication* (1 course)
*Writing Intensive* (5 courses)

Math and Science Core

=Math:
MATH 241-244 (Calculus I-IV) or;
MATH 251A-253A (Accel. Calculus)
Engineering Math Elective

=Biology:
BIOL 171/171L (Intro. Biol.)
BIOL 172/172L (Intro. Biol. II)
Biology Elective

Math and Science Core

=Chemistry:
CHEM 162/162L or 181/181L (General Chem.)
CHEM 272/272L (Organic Chem.)

=Physics:
PHYS 170/170L (General Phys. I)
PHYS 272/272L (General Phys. II)

=Statistics (NREM 310)

Engineering Core

**Electrical Engineering:**
EE 160 (Programming for Engr.)
EE 211 (Basic Circuit Analysis)

**Mechanical Engineering**
ME 311 (Thermodynamics)

Civil Engineering:

CEE 270 (Applied Mechanics I)
CEE 271 (Applied Mechanics II)
CEE 320 (Fluid Mechanics)

Bioengineering

**BE Core Courses (required):**
BE 351/351L (Energy Conversion & Power)
BE 360 (Mass and Energy Balances)
BE 401 (Modeling and Simulation of Dynamic Systems)
BE 413 (Transport Phenomena)
BE 437 (Biosystems Unit Operations)
BE 460 (Bioreactor Design and Analysis)
BE 481 (Senior Engineering Design I)
BE 482 (Senior Engineering Design II)

**BE Electives (must take 2):**
BE 405 (Engineering Economics)
BE 420 (Sensors and Instrumentation for Biological Systems)
BE 421 (Bioprocess Control)
BE 431 (Environmental Biotechnology)
BE 440 (Bioremediation: Principles and Practice)
Proposed Bioengineering Curriculum
Effective Fall 2006

General Education Core:
- **English Composition** (ENG 100, 100A, 101/101L, or ELI 100)
- **Public speaking** (SP 251)
- **Multicult. Persp.** (e.g. HIST 151 and 152)
- **Economics** (ECON 120, 130, or 131)
- **Social Sciences** (1 course)
- **Humanities** (1 course)

In addition, courses must be taken fulfilling the following focus designations:
- **Contemporary Ethical Issues** (1 course)
- **Hawaiian, Asian, or Pacific Issues** (1 course)
- **Oral Communication** (1 course)
- **Writing Intensive** (5 courses)

Math and Science Core

**Math:**
- MATH 241-244 (Calculus I-IV) or;
- MATH 251A-253A (Accel. Calculus)
- MATH 242L (Computer Calc. Lab)
- Engineering Math Elective

**Biology:**
- BIOL 171/171L (Intro. Biol.)
- BIOL 172/172L (Intro. Biol. II)
- Biology Elective

**Chemistry:**
- CHEM 162/162L or 181/181L (General Chem.)
- CHEM 272/272L (Organic Chem.)

**Physics:**
- PHYS 170/170L (General Phys. I)
- PHYS 272/272L (General Phys. II)

**Statistics** (NREM 310)

Engineering Core

**Electrical Engineering:**
- EE 160 (Programming for Engr.)
- EE 211 (Basic Circuit Analysis)

**Mechanical Engineering**
- ME 311 (Thermodynamics)

**Civil Engineering:**
- CEE 270 (Applied Mechanics I)
- CEE 271 (Applied Mechanics II)
- CEE 320 (Fluid Mechanics)

Bioengineering

**BE Core Courses (required):**
- BE 350/350L (Dynamic Systems Modeling)
- BE 360 (Mass and Energy Balances)
- BE 373 (Transport Phenomena)
- BE 481 (Senior Engineering Design I)
- BE 482 (Senior Engineering Design II)

**BE Electives (must sum to 15 credits):**
- BE 405 (Engineering Economics)
- BE 420 (Sensors and Instrumentation for Biological Systems)
- BE 421 (Bioprocess Control)
- BE 431 (Environmental Biotechnology)
- BE 437 (Biosystems Unit Operations)
- BE 440 (Bioremediation: Principles and Practice)
- BE 460 (Bioreactor Design and Analysis)
- CEE 355 (Geotechnical Engineering)
Based on the currently projected course scheduling, the BE curriculum committee feels that it would be smoothest to transition to the proposed structure starting Fall 2006. Because the proposed structure is more flexible than the old one (i.e., students fulfilling the requirements under the current requirements would also fulfill graduation requirements under the proposed requirements), we do not anticipate that the proposed changes will delay graduation for any students.

We would appreciate if you could indicate your approval of this proposal by having the chairs of your respective offices sign and date this memo in the spaces provided below. If you have objections to the proposed changes, please register them as soon as possible so that we can plan an alternative course of action.

Sincerely,

Daniel M. Jenkins, Ph.D.
Assistant Professor, MBBE
Director of BE Program

MBBE Chair

Signature (Harry Ako) Date

Chair of CTAHR
Senate Curriculum Committee

Signature Name (print) Date

CTAHR Dean of Academic Affairs

Signature (Charles Kinoshita) Date