Biomedical Engineering Undergraduate Curriculum Modifications Proposed for Fall 2017

These curriculum changes have been approved by the BME faculty.

I. Goal: Increase the ability of our students to solve mathematically complex biomedical problems, across all three BME tracks, without increasing the number of credits required for graduation.

Through our ABET assessment and continuous improvement processes, we have determined that our students would benefit by having a stronger foundation in applying math and computer science to solve engineering problems. We determined this could best be accomplished by requiring all our students to complete BME 422, a Matlab-based numerical methods course, prior to their upper level BME courses. BME 422 is currently an elective BME course. This change will allow upper level courses to include more rigorous track-specific Matlab-based engineering problems.

In order to achieve this goal and make the best use of the credits within each BME program of study, we will:

1) Replace CS 115 with CS 104.* This allows our students to learn fundamental programming principles using Matlab (CS 104), instead of Java (CS 115). Matlab is used in virtually every course within BME, whereas Java is not used in any BME courses. This is a net zero credit substitution.

2) Require BME 422 (3 credits) and eliminate BME 200 (2 credits) and BME 490 (1 credit) requirements. The combination of BME 422 and CS 104 makes BME 200 (Intro to MATLAB in BME; 2 credits) unnecessary, and therefore BME 200 will be removed from the curriculum. Our students need 130-133 credits to complete their programs of study, and we strongly feel that we should not increase this requirement. Furthermore, although we all appreciate the value of our seniors attending the seminars offered by BME 490 Senior Seminar, we question the value of requiring BME 490 as a graded credit. Therefore, the additional credit to support the requirement for BME 422 will be provided by eliminating BME 490. Attendance at BME Seminars will continue to be mandatory for all BME students in the spring of their senior year. An 80% attendance record will be required for graduation (this is modeled after the requirement CAE has for students to provide proof of registration for the FE exam for graduation).

II. Goal: Further enhance the BME Cell & Tissue curriculum with more relevant foundational courses that will be applied to solve engineering problems in required BME courses.

3) Change CHEM 237 (Organic Chemistry I + lab) to CHEM 235 (Organic Chemistry I, no lab)/CHEM 237 (*Cell & Tissue track only*).** **Reasoning:** The existing requirement of C&T students to take CHEM 237 (Organic I + lab) was driven largely by MCAT (pre-med) prerequisites. With the recent change in the structure of the MCAT and its impact on pre-med curriculum, most BME students are unlikely to finish both degree and pre-med requirements within four years. Hence, the increase in options for taking Organic Chemistry with our without the lab will permit students to still learn the fundamentals of this field but now offers the flexibility for students who are not in the pre-med track to take CHEM 235 (Organic I lecture only) and provide them with the option to use the additional credit hour elsewhere in the curriculum.

4) Drop CHEM 239 (Organic Chemistry II) and Add BIOL 403 (Biochemistry) (*Cell & Tissue track only*).** **Reasoning:** The existing requirement for student to take CHEM 239 (Organic Chemistry II) was also driven by MCAT (pre-med) prerequisites. However, these have changed as mentioned above and pre-med students must take both CHEM 239 and BIOL 403. With

these changes, all pre-med students must take an overloaded plan of study. To offer a broader educational experience to our Cell & Tissue students, BIOL 403 (Biochemistry) will be required instead of CHEM 239 (Organic Chemistry II), since students already receive Organic Chemistry exposure through CHEM 235/237 (see #3). This was also deemed more valuable for our students to learn Biochemistry as it can be applied to required BME courses for Cell & Tissue students including BME 335 (*Thermodynamics of living Systems*) and BME 418 (*Reaction Kinetics for Biomedical Engineers*), than to take the second semester of Organic Chemistry.

III. Goal: Enhance the exposure of programming and electrical engineering in the BME Medical Imaging curriculum.

5) Replace CS 116 (Java II), BME Elective, and ECE 216 (Circuits II no lab) (total of 8 credits) with CS 201 (Advanced intro to Java) and ECE 213 (Circuits II + lab) (total of 8 credits) (*Medical Imaging track only*).* **Reasoning:** With the removal of CS 115 (point 1), a prerequisite for CS 116, Medical Imaging students are no longer able to register for CS 116. To retain the object-oriented programming education for Medical Imaging students, the CS department recommended CS 116 be replaced with CS 201 (an advanced intro to object-oriented programming that covers the syllabus of both CS 115 and CS 116). Furthermore, to enhance the hands-on education of our Medical Imaging students in Circuits, ECE 216 (Circuits II) will be replaced with ECE 213 (Circuits II + lab). To avoid credit overload in the Medical Imaging track, 3 credits of *BME Elective* were dropped from the curriculum, as enhanced exposure to programming and circuits was deemed more educationally valuable to Medical Imaging students than the BME Elective.

*These changes have been discussed with and were supported by the CS department (we met with Matt Bauer)

**These changes have been discussed with and were supported by the Chemistry and Biology Departments (we communicated these changes to Carlo Segre in Chemistry and Tanya Bekyarova in Biology via email)