Engineering Faculty Document No 69-13

March 6, 2013

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Biomedical Engineering

RE: Changes in Undergraduate Program Degree Requirements for the Bachelor of Science in Biomedical Engineering

The Faculty of the School of Biomedical Engineering has approved the following changes to the curriculum for the B.S. degree in Biomedical Engineering effective for students entering the Weldon School for the Fall Semester 2013. This action is now submitted to the Engineering Faculty with a recommendation for approval. A revised Suggested Plan of Study is attached. New courses and changes in required courses are shown in bold.

The proposed change is as follows:

A. **Require MA 26200: Linear Algebra & Differential Equations OR MA 26500: Linear Algebra AND MA 26600: Ordinary Differential Equations**. BME Faculty indicated a lack of knowledge in Linear Algebra, as BME students were only required to take MA 26600: Ordinary Differential Equations. Our research on the subject indicated several other programs require MA 26200 or MA 26500 and MA 26600. Sufficient exposure in both areas of mathematics is needed to be successful in many technical elective courses in the student's junior and senior year.
B. **Decrease the unrestricted elective credits from 5 credits to 4 credits** – This change is a modification that allows for the change in math requirements without an increase in total number of credits required for the degree.

Reason: The proposed program changes to degree requirements for the Bachelor of Science in Biomedical Engineering are to update the minimum requirements in mathematics and unrestricted electives for this program. The proposed program changes to degree requirements provide students with the necessary basic mathematical knowledge and skills. The proposed changes to our degree program are intended to continue to satisfy ABET requirements for Biomedical Engineering. The revised suggested plan of study provides students with an integrated and efficient pathway of course selection, allowing for diversification before the final year depending on student interest.

George R. Wodicka

George R. Wodicka, Professor and Head
Weldon School of Biomedical Engineering

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE

ECC Minutes 9-6-13

Date 10/3/2013

Chairman ECC

[Current] B.S. BME Degree Program Requirements

Minimum Degree Requirements for Bachelor of Science in Biomedical Engineering (BSBME)
Credit Hours Required for Graduation: 130

All required First-Year Engineering courses * must be completed with a C- or above for entry into the BME undergraduate program = 30 credits

*No more than 8 credit hours of freshman calculus can be applied towards the BME degree.

Core Biomedical Engineering (BME) Courses (24 credit hours);
BME 20100, 20400, 20500, 20600, 25600, 29000, 30100, 30400, 30500, 30600, 39000

BME Breadth Requirement (43 credit hours):

Core Life Sciences Requirement: BIOL 23000 and two (2) additional Life Science courses† = 9 credits
Core Engineering Requirement: ECE 30100; **IE** 33000(or STAT 51100), **ME** 20000, 27000; and **MSE** 23000 = 15 credits
BME Technical Engineering Electives: Five (5) additional BME or other Engineering courses.†# At most 6 credits at the 300 level; must include at least one 3-credit 400-level BME course; must include at least one 3-credit course chosen from the Quantitative breadth list†. = 15 credits.
Senior Design Capstone Requirements: BME 48800, 48900, 49000 = 4 credits

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Advanced Physics and Math (10 credit hours):
PHYS 24100, **MA** 26100 and (**MA** 26600 or **MA** 26200)

General Education Electives (18 credit hours): Course selections must meet the General Education Program requirements. Refer to "*General Education Program.*"
Includes an ethics elective to be chosen from the Ethics list†.

Unrestricted Electives (5 credit hours): Additional coursework to fulfill the total number of credits required for graduation.

GPA Requirement: A minimum Graduation Index of at least 2.0 is required to qualify for graduation with a BSBME. A minimum BME Major GPA** of at least 2.0 is also required to qualify for graduation with a BSBME.
**Courses included in BME Major GPA: BME 20100, BME 20400, BME 20500, BME 20600, BME 25600, BME 29000, BME 30100, BME 30400, BME 30500, BME 30600, BME 39000, BME 48800, BME 48900, BME 49000, ME 20000, ME 27000, MSE 23000, ECE 30100, & IE 33000 (or STAT 51100).

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† Selected from a list of courses approved by the Biomedical Engineering faculty and maintained by the undergraduate advising office.
# must complete a 400-level BME elective with at least a B- before student can take a BME 500-level course as a technical elective.

[Current] Suggested Plan of Study - Effective Fall 2011

Credit hours required for graduation: 130

Freshman Year

First Semester	*Second Semester*
(4) MA 16500 Analytical Geom. & Calc. I	(4) MA 16600 Analytical Geom & Calc. II
(4) CHM 11500 General Chemistry	(4) CHM 11600 General Chemistry
(4) PHYS 17200 Modern Mechanics	(3) CS 15900~ Programming Apps for ENGRS
(2) ENGR 13100 Transforming Ideas to Innov I	(2) ENGR 13200 Transforming Ideas to Innov II
(3/4) ENGL 10800/10600 Accelerated / Composition	(3) General Education Elective
17/18	16

Sophomore Year

Third Semester	*Fourth Semester*
(3) BME 20100 Biomolecules: Strct, Funct & Engr Apl	(3) BME 20400 Biomechanics Hard/Soft Tissue
(3) BIOL 23000 Biology of the Living Cell	(3) MSE 23000 Structure & Properties Materials
(1) BME 20500 Biomolec & Cellular Syst Lab	(1) BME 20600 Biomechanics & Biomaterial lab
(1) BME 29000 Frontiers in BME	(3) BME 25600 Physiol Modeling Human Health
(4) MA 26100 Multivariate Calculus	(3) MA 26600 Ordinary Differential Equations
(3)ME 27000 Basic Mechanics I	(3) ME 20000 Thermodynamics I
(3) PHYS 24100 Electricity and Optics	16
18	

Junior Year

Fifth Semester	*Sixth Semester*
(3) BME 30100 Bioelectricity	(2) BME 30600 Biotransport Laboratory
(3) BME 30500 Bioinstrumentation Circuit & Meas Princip	(1) BME 39000 Profes Devlp & Design in BME
(3) BME 30400 Biomedical Transport Fundamentals	(3) ECE 30100 Signals and Systems
(3) BME Technical Elective	(3) IE 33000 Probability and Stats in Engr. II
(3) Gen. Ed. or Ethics Elective (PHIL 28000)	(3) BME Technical Elective
15	(3) Gen. Ed. or Ethics Elective (PHIL 27000)
	15

Senior Year

Seventh Semester	*Eighth Semester*
(1) BME 49000 Professional Elements of Design	(2) BME 48900 Senior Design Project Lab*
(1) BME 48800 Preliminary Project Design	(*can be taken in the Fall)
(3) BME Technical Elective#	(3) BME Technical Elective
(3) BME Technical Elective	(3) Life Science Elective
(3) Life Science Elective	(3) General Education Elective
(3) General Education Elective	(3) General Education Elective
(2) Unrestricted Elective or BME 48900*	(3) Unrestricted Elective
16 (*Senior Design Project Lab, can be taken Spring)	17

~CS 15900 is required before junior year and recommended for the first year.
Taken from the list of Quantitative Breadth courses.

[Revised] B.S. BME Degree Program Requirements

Credit Hours Required for Graduation: 130

All required First-Year Engineering courses * must be completed with a C- or above for entry into the BME undergraduate program = 30 credits

*No more than 8 credit hours of freshman calculus can be applied towards the BME degree.

Core Biomedical Engineering (BME) Courses (24 credit hours);
BME 20100, 20400, 20500, 20600, 25600, 29000, 30100, 30400, 30500, 30600, 39000

BME Breadth Requirement (43 credit hours):

Core Life Sciences Requirement: BIOL 23000 and two (2) additional Life Science courses† = 9 credits
Core Engineering Requirement: ECE 30100; **IE** 33000(or STAT 51100), **ME** 20000, 27000; and **MSE** 23000 = 15 credits
BME Technical Engineering Electives: Five (5) additional BME or other Engineering courses.†# At most 6 credits at the 300 level; must include at least one 3-credit 400-level BME course; must include at least one 3-credit course chosen from the Quantitative breadth list†. = 15 credits.
Senior Design Capstone Requirements: BME 48800, 48900, 49000 = 4 credits

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Advanced Physics and Math (11 credit hours):
PHYS 24100, **MA** 26100 and (**MA 26200** or **MA 265** and **MA 266**)

General Education Electives (18 credit hours): Course selections must meet the General Education Program requirements. Refer to "*General Education Program.*"
Includes an ethics elective to be chosen from the Ethics list†.

Unrestricted Electives (4 credit hours): Additional coursework to fulfill the total number of credits required for graduation.

GPA Requirement: A minimum Graduation Index of at least 2.0 is required to qualify for graduation with a BSBME. A minimum BME Major GPA** of at least 2.0 is also required to qualify for graduation with a BSBME.
**Courses included in BME Major GPA: BME 20100, BME 20400, BME 20500, BME 20600, BME 25600, BME 29000, BME 30100, BME 30400, BME 30500, BME 30600, BME 39000, BME 48800, BME 48900, BME 49000, ME 20000, ME 27000, MSE 23000, ECE 30100, & IE 33000 (or STAT 51100).

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† Selected from a list of courses approved by the Biomedical Engineering faculty and maintained by the undergraduate advising office.
# must complete a 400-level BME elective with at least a B- before student can take a BME 500-level course as a technical elective.
Changes in red.

[Revised] Suggested Plan of Study - Effective Fall 2013

Credit hours required for graduation: 130

Freshman Year

First Semester	*Second Semester*
(4) MA 16500 Analytical Geom. & Calc. I	(4) MA 16600 Analytical Geom & Calc. II
(4) CHM 11500 General Chemistry	(4) CHM 11600 General Chemistry
(4) PHYS 17200 Modern Mechanics	(3) CS 15900~ Programming Apps for ENGRS
(2) ENGR 13100 Transforming Ideas to Innov I	(2) ENGR 13200 Transforming Ideas to Innov II
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Third Semester	*Fourth Semester*
(3) BME 20100 Biomolecules: Strct, Funct & Engr Apl	(3) BME 20400 Biomechanics Hard/Soft Tissue
(3) BIOL 23000 Biology of the Living Cell	(3) MSE 23000 Structure & Properties Materials
(1) BME 20500 Biomolec & Cellular Syst Lab	(1) BME 20600 Biomechanics & Biomaterial lab
(1) BME 29000 Frontiers in BME	(3) BME 25600 Physiol Modeling Human Health
(4) MA 26100 Multivariate Calculus	(4) MA 26200+ Lin Algebra & Ordinary Diff. Eq.
(3)ME 27000 Basic Mechanics I	(3) ME 20000 Thermodynamics I
(3) PHYS 24100 Electricity and Optics	17
18	

Junior Year

Fifth Semester	*Sixth Semester*
(3) BME 30100 Bioelectricity	(2) BME 30600 Biotransport Laboratory
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(3) BME 30400 Biomedical Transport Fundamentals	(3) ECE 30100 Signals and Systems
(3) BME Technical Elective	(3) IE 33000 Probability and Stats in Engr. II
(3) Gen. Ed. or Ethics Elective (PHIL 28000)	(3) BME Technical Elective
15	(3) Gen. Ed. or Ethics Elective (PHIL 27000)
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Senior Year

Seventh Semester	*Eighth Semester*
(1) BME 49000 Professional Elements of Design	(2) BME 48900 Senior Design Project Lab*
(1) BME 48800 Preliminary Project Design	(*can be taken in the Fall)
(3) BME Technical Elective#	(3) BME Technical Elective
(3) BME Technical Elective	(3) Life Science Elective
(3) Life Science Elective	(3) General Education Elective
(3) General Education Elective	(3) General Education Elective
(2) Unrestricted Elective or BME 48900*	(2) Unrestricted Elective
16 (*Senior Design Project Lab, can be taken Spring)	16

~CS 15900 is required before junior year and recommended for the first year.

Taken from the list of Quantitative Breadth courses.

+ MA 26500: Linear Algebra **AND** MA 266: Ordinary Differential Equations can be taken separately to meet the MA 26200 requirement.

Changes are in red.