

Cover Sheet: Request 11373

Biomedical Engineering

Info

Process	Major Curriculum Modify Ugrad/Pro
Status	Pending
Submitter	Theus, Kristin undergrad@bme.ufl.edu
Created	12/15/2016 3:13:23 PM
Updated	2/8/2017 2:16:40 PM
Description of request	There are no changes to curriculum in this request. We are requesting to adjust the order in which our students enroll in coursework so that some critical tracking courses are completed earlier.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Biomedical Engineering 021934001	Rinaldi, Carlos		12/15/2016
Added Biomedical Engineering Catalog Entry_Dec2016.docx					12/15/2016
College	Approved	ENG - College of Engineering	Caple, Elizabeth		12/16/2016
No document changes					
University Curriculum Committee	Comment	PV - University Curriculum Committee (UCC)	Case, Brandon	Added to the February agenda.	1/23/2017
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			1/23/2017
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
Academic Assessment Committee Notified					
No document changes					
College Notified					
No document changes					

Major|Modify_Curriculum for request 11373

Info

Request: Biomedical Engineering

Description of request: There are no changes to curriculum in this request. We are requesting to adjust the order in which our students enroll in coursework so that some critical tracking courses are completed earlier.

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Responses

Major NameBiomedical Engineering

Major CodeBME

Degree Program Name Bachelor of Science in Biomedical Engineering

Effective Term Summer

Effective Year 2017

Proposed Changes No changes to curriculum. We are adjusting the suggested program of study so that some critical tracking courses are completed earlier.

Pedagogical Rationale/JustificationThe updated course sequence will allow BME students to complete EEL3111C prior to Term 5. This change opens up the summer term for students to pursue REUs or internships outside of the Gainesville area. The new sequence places the college writing requirement and two general education requirements in the summer, which can all be completed online through UF while a student is pursuing a research or internship experience. This will also alleviate problems with current course sequencing; if a student does not take EEL3111C prior to junior fall, their graduation is delayed 1 year because this course is a prereq for BME4503 (only offered in the fall).

Impact on Enrollment, Retention, GraduationNone

Assessment Data ReviewThe adjustment to the suggested program of study does not affect the SLOs for the undergraduate program in any way.

Academic Learning Compact and Academic Assessment PlanNone

Biomedical Engineering

The biomedical engineering (BME) field has grown rapidly in the last 20 years. This growth was fueled by breakthroughs in molecular biology and many engineering technologies, symbolized by the Human Genome Project, arguably the greatest biomedical engineering accomplishment ever, and realized with creation of the National Institute of Biomedical Imaging and Bioengineering. BME now is clearly recognized as an integral part of the nation's and the world's efforts to deliver more effective and efficient medical care.

About this Major

- **College:** Herbert Wertheim College of Engineering
- **Degree:** Bachelor of Science in Biomedical Engineering
- **Credits for Degree:** 132
- **Academic Learning Compact**
- **Additional Information**

To graduate with this major, students must complete all university, college, and major requirements.

Critical Tracking Model Semester Plan

A biomedical engineer uses traditional engineering expertise to analyze and solve problems in biology and medicine, providing an overall enhancement of health care. Students choose biomedical engineering to serve people, to work with living systems and to apply advanced technology to the complex problems of medical care. The biomedical engineer is called upon to design instruments, devices and software, to bring together knowledge from many technical sources to develop new procedures and to conduct the research needed to solve clinical problems.

Bioengineering integrates sciences and engineering for the study of biology, medicine, behavior or health. It advances fundamental concepts, creates knowledge for the molecular to the organ systems levels, and develops innovative biologics, materials, processes, implants and devices. Biomedical engineers create informatics approaches to prevent, diagnose and treat disease, applying systematic, quantitative and integrative thinking and solutions to problems important to biology, medical research and population studies.

BME typically is among the three most popular engineering majors and very often is the largest. The job market in biomedical engineering is the fastest growing of all engineering disciplines. It has

become clear that the nation needs a variety of engineers with knowledge of biomedicine, including a cadre of exceptional people whose education thoroughly immerses them in engineering and biomedicine. The intellectual foundation of this limited-access undergraduate program is captured in this vision: Biomedicine comprises the science core while engineering provides the framework for inquiry. The curriculum incorporates exceptional rigor in both.

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Department Vision Statement

The J. Crayton Pruitt Family Department of Biomedical Engineering will be one of the leading biomedical engineering programs in the nation. The department will leverage the unique co-localization of talent and resources in engineering, medicine, veterinary sciences, dentistry and technology commercialization to maximize opportunities for interdisciplinary student training and the clinical translation of technologies that will advance and improve health care in the state of Florida and worldwide.

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Department Mission

The department is dedicated to developing innovative and clinically translatable biomedical technologies, training future generations of biomedical engineers, and cultivating leaders, by nurturing the integration of engineering, science, and healthcare in a discovery-centered educational and research environment.

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Curriculum

Science and Math Core: 39 credits

The BME curriculum is built on a solid foundation in mathematics, physics and chemistry. Students will have the mathematical foundation of the engineer, including Calculus 1, 2 and 3, and Differential Equations. Students also take a rigorous statistics course at the level taken by engineers. The physics foundation is covered by the standard two-course engineering sequence of Physics with Calculus. Students first take the engineer's two-semester general chemistry sequence, followed by part 1 of organic chemistry and the medical school's version of biochemistry.

Biology Core: 8 credits

The biology core includes BSC 2010 Biology 1 and PCB 3713C Cellular and Systems Physiology, a new course developed by the Department of Biology in consultation with BME. Additional biology is part of the advanced physiology and molecular engineering courses. The biology core enables students to bridge the gap of knowledge from engineering to the medical sciences.

Engineering Core: 22 credits

The engineering core provides a thorough understanding of how engineers approach problems and introduces the major engineering disciplines the student will encounter over a career. The coursework consists of computer programming, thermodynamics, statics, materials, energy balances and circuits.

BME Core: 13 credits

The BME core provides basic understanding of prominent problems and methodologies used in the biomedical engineering profession.

Laboratories: 5 credits

Students will take three laboratory courses and each provides extensive hands-on experience. Laboratories enable students to put their knowledge to work, to learn specific techniques and to understand the problems that occur when putting theory to practice. In addition, students also gain laboratory experience in basic physics and chemistry courses as well as in the senior design course.

- The first junior-level lab is medical instrumentation, taught in conjunction with the biomedical instrumentation course. Students learn the basics of electronic measurements of biomedical variables, building to a short design project.
- The second laboratory, in cell and tissue engineering, provides basic skills in cell culture technique, including quantitation of important biological markers and variables.
- The third lab is a computer applications course in Matlab to analyze biomedical signals and images. This lab teaches data analysis skills for biomedical signals and images through programming projects.

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Specialization Tracks: 15 credits

BME students will complete one 15-credit specialization track in an area of their choosing, from biomechanics, biomaterials, medical physics and imaging, and neural engineering. Commonly, each track consists of one or two basic courses in an area followed by more advanced courses. Where possible, a laboratory course serves as a capstone course. Each [specialization track's content](#) is subject to creation and approval by the BME department's curriculum committee.

The purpose of more advanced study in a specialized area is two-fold: to encourage BME students to develop their particular intellectual and professional interests and to engage the student in one area at substantial depth so that a greater appreciation is gained. BME works actively with other departments and faculty to provide appropriate and engaging topical tracks.

Senior Design: 6 credits

Students take a two-semester capstone design course that meets several educational objectives: project milestone planning, teamwork, professional presentation, biomedical regulatory affairs and ethics. Logically, all projects are planned in the fall and implemented in the spring. Many projects will have strong interaction with the UF health sciences units.

Electives: 6 credits

Students are allowed six credits of elective coursework.

General Education: 18 credits

The BME program includes general education courses according to UF requirements in technical writing, diversity, humanities, international studies and social/behavioral science. These are essential elements of a well-rounded education.

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Critical Tracking

Critical Tracking records each student's progress in courses that are required for entry to each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida [Common Course Prerequisites](#) may be used for transfer students.

Semester 1

- Complete 2 of 11 critical-tracking courses with minimum grades of C within two attempts: BSC 2010; CHM 2045 or CHM 2095; CHM 2046 or CHM 2096; MAC 2311, MAC 2312, MAC 2313, MAP 2302, PHY 2048 and PHY 2049; BME 3060 and PCB 3717C
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 2

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 3

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 4

- Complete 3 additional critical-tracking courses with minimum grades of C within two attempts
- 3.0 GPA required for all critical-tracking courses
- 2.0 UF GPA required

Semester 5

- Complete all 11 critical-tracking courses with minimum grades of C within two attempts
- 2.0 UF GPA required

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Model Semester Plan

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.

Semester 1	Credits
BME 1008 Introduction to Biomedical Engineering	1
CHM 2045 General Chemistry 1 (GE-P) or CHM 2095 Chemistry for Engineers 1	3
CHM 2045L General Chemistry 1 Laboratory <i>GE-P</i>	1
<u>BSC 2010 Biology 1</u> <i>GE-B</i>	<u>3</u>
<u>BSC 2010L Biology 1 Laboratory</u> <i>GE-B</i>	<u>1</u>
<u>ENC 1101 Expository and Argumentative Writing</u> <i>State Core GE-C</i>	<u>3</u>
IUF 1000 What is the Good Life <i>GE-H</i>	3
MAC 2311 Calculus 1 <i>GE-M</i>	4

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Total ~~15-16~~

Semester 2

Credits

ENC 1101 Expository and Argumentative Writing
State Core GE-C~~BSC 2010 Biology 1~~
~~GE-B~~

~~3~~3

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BSC 2010L Biology 1 Laboratory
~~GE-B~~

~~4~~

CHM 2046 General Chemistry 2 (GE-P) or
CHM 2096 Chemistry for Engineers 2

3

CHM 2046L General Chemistry 2 Laboratory
~~GE-P~~

1

PHY 2048 Physics With Calculus 1
State Core GE-P

3

PHY 2048L Physics With Calculus 1 Laboratory
GE-P

1

MAC 2312 Calculus 2
State Core GE-M

4

Social and Behavioral Sciences
State Core GE-S

3

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Total 15

Semester 3	Credits
CHM 3217 Organic Chemistry 1 <i>Can substitute CHM 2210 and CHM 2211</i>	4
COP 2271 Computer Programming for Engineers	2
COP 2271L Computer Programming for Engineers Laboratory	1
<u>PHY 2049 Physics With Calculus 2</u> <u>GE-P</u>	<u>3</u>
<u>PHY 2049L Laboratory for Physics With Calculus 2</u> <u>GE-P</u>	<u>1</u>
MAC 2313 Analytic Geometry and Calculus 3 <i>GE-M</i>	4
PHY 2048 Physics With Calculus 1 State Core GE-P	3
PHY 2048L Physics With Calculus 1 Laboratory GE-P	1
	Total 15

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Semester 4

Credits

EMA 3010 Materials *or*
EGM 2511 Engineering Mechanics: Statics

3

BME 3060 BME Fundamentals

3

~~PHY 2049 Physics With Calculus 2~~

~~GE-P~~

~~3~~

~~PHY 2049L Laboratory for Physics With Calculus 2~~

~~GE-P~~

~~1~~

MAP 2302 Differential Equations

GE-M

3

EEL 3111C Circuits 1

4

PCB 3713C Cellular and Systems Physiology

4

Total 17

Semester 5: Summer

Credits

~~EEL 3111C Circuits 1~~

~~4~~

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~~Social and Behavioral Science **~~

~~3~~

~~GE-S, N; E6~~

~~Humanities **~~

~~3~~

~~State Core GE-H; D~~

~~EMA 3010 Materials or~~

~~3~~

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~~EGM 2511 Engineering Mechanics: Statics~~

ENC 3246 Professional Writing for Engineers

3

State Core GE-C

Total ~~10~~9

This program is limited access and competitive. Students cannot register for courses in semesters 5-8 before they have been admitted to the biomedical engineering major. Application for admission must be submitted by the deadline.

Semester 6	Credits
<u>EMA 3010 Materials</u> <i>or</i> <u>EGM 2511 Engineering Mechanics: Statics</u>	3
BME 3053C Computer Applications for BME	2
BME 4311 Molecular Biomedical Engineering	3
BME 4409 Quantitative Physiology	3
BME 4503 Biomedical Instrumentation	3
BME 4503L Biomedical Instrumentation Laboratory	1
<u>STA 3032 Engineering Statistics</u>	3
	Total 15

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Semester 7

Credits

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STA 3032 Engineering Statistics

3

BME 3323L Cellular Engineering Laboratory

3

BME 4621 Biomolecular Thermodynamics and Kinetics

3

BME 4632 Biotransport

3

BME Specialization Track *

6

Total 15

Semester 8	Credits
BME 4531 Biomedical Imaging	3
BME 4882 Senior Design, Professionalism and Ethics 1	3
<i>BME Electives **Humanities** State Core GE-H; D</i>	3
BME Specialization Track *	6
	Total 15

Semester 9 Credits

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Semester 9

Credits

BME 4883 Senior Design, Professionalism and Ethics 2	3
Social and Behavioral Science ** <i>GE-S, N; E6</i>	3
BME Electives **	6 3
BME Specialization Track *	3-6
Total	15

* BME Tracks: 15 credits of 3000/4000-level courses selected from approved lists.

** These courses should cover 12,000 words.

Students are also expected to complete the general education international (GE-N) and diversity (GE-D) requirements. This is often done concurrently with another general education requirement (typically, GE-C, H or S).

Bachelor of Science in Biomedical Engineering**2016-2017**

Suggested Plan of Study – Fall 2016 Transfer Admission

Course	CR	Course	Comments/alternate course
Term 5		<i>Fall</i>	
BME1008	1	Introduction to Biomedical Engineering	
COP2271	2	Comp Prog for Engineers (C++ or Matlab)	
COP2271L	1	Lab for COP2271 (same language)	
EEL3111C	4	Circuits 1	
EGM2511	3	Engineering Mechanics – Statics	Biomechanics track prereq
EMA3010	3	Materials	Biomaterials track prereq
Term Credits	14		
Term 6		<i>Spring</i>	
BME3060	3	BME Fundamentals	
ENC3246	3	Professional Writing for Engineers	
PCB3713C	4	Cell and Systems Physiology	
STA3032	3	Engineering Statistics	
Term Credits	13		
Term 7		<i>Fall</i>	
BME3053C	2	Computer Applications for BME	
BME4311	3	Molecular Biomedical Engineering	
BME4409	3	Quantitative Physiology	
BME4503	3	Biomedical Instrumentation	
BME4503L	1	Biomedical Instrumentation Lab	
Term Credits	12		
Term 8		<i>Spring</i>	
BCH4024	4	Intro to Biochemistry and Molecular Biology	
BME 3323L	3	Cellular Engineering Lab	
BME4621	3	Biomedical Thermodynamics and Kinetics	
BME4632	3	Biotransport	
Term Credits	13		
Term 9		<i>Fall</i>	
BME4531	3	Biomedical Imaging	
BME4882	3	Senior Design, Professionalism and Ethics 1	
BME Track	6		
Term Credits	12		
Term 10		<i>Spring</i>	
BME4883	3	Senior Design, Professionalism and Ethics 2	
BME Track	9		
Term Credits	12		
Upper Div	76		

BME Track: 15 credits of 3000/4000-level courses selected from approved lists (see advisor).

Bachelor of Science in Biomedical Engineering**2017-2018**

Suggested Plan of Study – Spring 2017 Transfer Admission

Course	CR	Course	Comments/alternate course
Term 5		<i>Spring</i>	
BME1008	1	Introduction to Biomedical Engineering	
BME3060	3	BME Fundamentals	
COP2271	2	Comp Prog for Engineers (C++ or Matlab)	
COP2271L	1	Lab for COP2271 (same language)	
EMA3010	3	Materials	Biomaterials track prereq
PCB3713C	4	Cell and Systems Physiology	
Term Credits	14		
Term 6		<i>Summer</i>	
EEL3111C	4	Circuits 1	
ENC3246	3	Professional Writing for Engineers	
STA3032	3	Engineering Statistics	
Term Credits	10		
Term 7		<i>Fall</i>	
BME3053C	2	Computer Applications for BME	
BME4311	3	Molecular Biomedical Engineering	
BME4409	3	Quantitative Physiology	
BME4503	3	Biomedical Instrumentation	
BME4503L	1	Biomedical Instrumentation Lab	
Term Credits	12		
Term 8		<i>Spring</i>	
BCH4024	4	Intro to Biochemistry and Molecular Biology	
BME 3323L	3	Cellular Engineering Lab	
BME4621	3	Biomedical Thermodynamics and Kinetics	
BME4632	3	Biotransport	
EGM2511	3	Engineering Mechanics – Statics	Biomechanics track prereq
Term Credits	16		
Term 9		<i>Fall</i>	
BME4531	3	Biomedical Imaging	
BME4882	3	Senior Design, Professionalism and Ethics 1	
BME Track	6		
Term Credits	12		
Term 10		<i>Spring</i>	
BME4883	3	Senior Design, Professionalism and Ethics 2	
BME Track	9		
Term Credits	12		
Upper Div	76		

BME Track: 15 credits of 3000/4000-level courses selected from approved lists (see advisor).

Bachelor of Science in Biomedical Engineering**2017-2018**

Suggested Plan of Study – Fall 2017 Transfer Admission

Course	CR	Course	Comments/alternate course
Term 5		<i>Fall</i>	
BME1008	1	Introduction to Biomedical Engineering	
EEL3111C	4	Circuits 1	
ENC3246	3	Professional Writing for Engineers	
EGM2511 or	3	Engineering Mechanics – Statics or	Biomechanics track prereq
EMA3010		Materials	Biomaterials track prereq
Term Credits	11		
Term 6		<i>Spring</i>	
BME3060	3	BME Fundamentals	
COP2271	2	Comp Prog for Engineers (C++ or Matlab)	COP2271
COP2271L	1	Lab for COP2271 (same language)	COP2271L
PCB3713C	4	Cell and Systems Physiology	
EGM2511 or	3	Engineering Mechanics – Statics or	Biomechanics track prereq
EMA3010		Materials	Biomaterials track prereq
Term Credits	13		
Term 7		<i>Fall</i>	
BME3053C	2	Computer Applications for BME	
BME4311	3	Molecular Biomedical Engineering	
BME4409	3	Quantitative Physiology	
BME4503	3	Biomedical Instrumentation	
BME4503L	1	Biomedical Instrumentation Lab	
Term Credits	12		
Term 8		<i>Spring</i>	
STA3032	3	Engineering Statistics	
BME 3323L	3	Cellular Engineering Lab	
BME4621	3	Biomedical Thermodynamics and Kinetics	
BME4632	3	Biotransport	
Term Credits	12		
Term 9		<i>Fall</i>	
BME4531	3	Biomedical Imaging	
BME4882	3	Senior Design, Professionalism and Ethics 1	
BME Track	6		
Term Credits	12		
Term 10		<i>Spring</i>	
BME4883	3	Senior Design, Professionalism and Ethics 2	
BME Track	9		
Term Credits	12		
Upper Div	72		

BME Track: 15 credits of 3000/4000-level courses selected from approved lists (see advisor).

Bachelor of Science in Biomedical Engineering**2017-2018**

Suggested Plan of Study – Spring 2018 Transfer Admission

Course	CR	Course	Comments/alternate course
Term 5		<i>Spring</i>	
BME1008	1	Introduction to Biomedical Engineering	
BME3060	3	BME Fundamentals	
COP2271	2	Comp Prog for Engineers (C++ or Matlab)	
COP2271L	1	Lab for COP2271 (same language)	
EGM2511 or EMA3010	3	Engineering Mechanics – Statics or Materials	Biomechanics track prereq Biomaterials track prereq
PCB3713C	4	Cell and Systems Physiology	
Term Credits	14		
Term 6		<i>Summer</i>	
EEL3111C	4	Circuits 1	
ENC3246	3	Professional Writing for Engineers	
EGM2511 or EMA3010	3	Engineering Mechanics – Statics or Materials	Biomechanics track prereq Biomaterials track prereq
Term Credits	10		
Term 7		<i>Fall</i>	
BME3053C	2	Computer Applications for BME	
BME4311	3	Molecular Biomedical Engineering	
BME4409	3	Quantitative Physiology	
BME4503	3	Biomedical Instrumentation	
BME4503L	1	Biomedical Instrumentation Lab	
Term Credits	12		
Term 8		<i>Spring</i>	
STA3032	3	Engineering Statistics	
BME 3323L	3	Cellular Engineering Lab	
BME4621	3	Biomedical Thermodynamics and Kinetics	
BME4632	3	Biotransport	
Term Credits	12		
Term 9		<i>Fall</i>	
BME4531	3	Biomedical Imaging	
BME4882	3	Senior Design, Professionalism and Ethics 1	
BME Track	6		
Term Credits	12		
Term 10		<i>Spring</i>	
BME4883	3	Senior Design, Professionalism and Ethics 2	
BME Track	9		
Term Credits	12		
Upper Div	72		

BME Track: 15 credits of 3000/4000-level courses selected from approved lists (see advisor).