DOCUMENTS OF THE GENERAL FACULTY

PROPOSED CHANGES TO THE BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE *UNDERGRADUATE CATALOG, 2016-2018*

Dean Sharon L. Wood in the Cockrell School of Engineering has filed with the secretary of the Faculty Council the following changes to the *Undergraduate Catalog, 2016-2018*. The secretary has classified this proposal as legislation of *exclusive* interest to only one college or school.

The Committee on Undergraduate Degree Program Review recommended approval of the changes on January 6, 2016, and forwarded the proposal to the Office of the General Faculty. The Faculty Council has the authority to approve this legislation on behalf of the General Faculty. The authority to grant final approval on this legislation resides with UT System.

If no objection is filed with the Office of the General Faculty by the date specified below, the legislation will be held to have been approved by the Faculty Council. If an objection is filed within the prescribed period, the legislation will be presented to the Faculty Council at its next meeting. The objection, with reasons, must be signed by a member of the Faculty Council.

To be counted, a protest must be received in the Office of the General Faculty by January 20, 2016.

Hillary Hart, Secretary
General Faculty and Faculty Council

Posted on the Faculty Council website (http://www.utexas.edu/faculty/council/) on January 13, 2016.

PROPOSED CHANGES TO THE BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE *UNDERGRADUATE CATALOG, 2016-2018*

Type of Change ☒ Academic Change
☐ Degree Program Change (THECB form required)

Proposed classification ☒ Exclusive ☐ General ☐ Major

1. IF THE ANSWER TO ANY OF THE FOLLOWING QUESTIONS IS YES, THE COLLEGE MUST CONSULT LINDA DICKENS, DIRECTOR OF ACCREDITATION AND ASSESSMENT, TO DETERMINE IF SACS-COC APPROVAL IS REQUIRED.

- Is this a new degree program? Yes ☐ No ☒
- Does the program offer courses that will be taught off campus? Yes ☐ No ☒
- Will courses in this program be delivered electronically? Yes ☐ No ☒

2. EXPLAIN CHANGE TO DEGREE PROGRAM AND GIVE A DETAILED RATIONALE FOR EACH INDIVIDUAL CHANGE:

A. **M 427J:** Per Mathematics department changes to M 427K and 427J, either 427K or 427J will count toward the Advanced Calculus requirement for the BS BME degree. This was added to both the list of required courses and Suggested Arrangement of Courses sections.

B. **Technical Area 1, Career Emphasis B:** Addition for **BME 354** *Molecular Sensors and Nanodevices for Biomedical Engineering Applications* to elective list offers more flexibility and options for students to complete Technical Electives requirements. Offered by Biomedical Engineering.

C. **Technical Area 4:** Addition for **BME 346** *Computational Biomolecular Engineering,* and **BME 347** *Fundamentals of Biomedical Optics* to elective list offers more flexibility and options for students to complete Technical Electives requirements. Both offered by Biomedical Engineering.

D. **Suggested Arrangement of Courses: BME 343** must be taken after BME 113L; therefore BME 343 was moved from Second Year Second Term to Third Year First Time. In order to adjust for this change so that the Third Year First Term does not exceed 17 hours and all prerequisites are accounted for, the following adjustments were made:
   a. BME 344 moved from Third Year First Term to Second Year Second Term.
   b. BME 349 moved from Third Year First Term to Third Year Second Term.
   c. BME 352 moved from Third Year Second Term to Third Year First Term.
   d. E 316L, 316M, 316N or 316P moved from Third Year Second Term to Third Year First Term.
   e. BME 353 moved from Third Year First Term to Third year Second Term.

E. **Suggested Arrangement of Courses: GOV 312P** added as option for government core course requirement in Fourth Year Second Term.

F. **Suggested Arrangement of Courses: CH 353 or 353M** will be removed from the required courses. (-3 credit hours)
   a. Aspects of physical chemistry and thermodynamics required for biomedical engineers will be covered in BME 355 Molecular Engineering, and will therefore be removed. College of Natural Sciences has been contacted on Friday, September 4, 2015, that 85-105 BME undergraduates will not be enrolling in CH 353 or 353M starting no later than spring 2018. See attached email correspondence documentation.

G. **Suggested Arrangement of Courses: BME 203L and 113L** will be increased to BME 303L and 313L, respectively. **(+3 credit hours)**
   a. BME 203L and 113L are important first- and second-year laboratories that require more contact time. Starting in the 16-18 catalog, the hours for these courses will be increased to 3 credit hours each. The total change in the curriculum required hours is net 0 hours (removal of CH 353 or 353M requirement).

3. THIS PROPOSAL INVOLVES (Please check all that apply)

☒ Courses in other colleges ☐ Courses in proposer's college that ☒ Flags

	are frequently taken by students in other colleges	
☐ Course in the core curriculum	☒ Change in course sequencing for an existing program	☐ Courses that have to be added to the inventory
☐ Change in admission requirements (external or internal)	☐ Requirements not explicit in the catalog language (e.g., lists of acceptable courses maintained by department office)	

4. SCOPE OF PROPOSED CHANGE

a. Does this proposal impact other colleges/schools? Yes ☒ No ☐
If yes, then how?

b. Do you anticipate a net change in the number of students in your college? Yes ☐ No ☒
If yes, how many more (or fewer) students do you expect?

c. Do you anticipate a net increase (or decrease) in the number of students from outside of your college taking classes in your college? Yes ☐ No ☒
If yes, please indicate the number of students and/or class seats involved.

d. Do you anticipate a net increase (or decrease) in the number of students from your college taking courses in other colleges? Yes ☐ No ☒
If yes, please indicate the number of students and/or class seats involved.

If 4 a, b, c, or d was answered with yes, please answer the following questions. If the proposal has potential budgetary impacts for another college/school, such as requiring new sections or a non-negligible increase in the number of seats offered, at least one contact must be at the college-level.

How many students do you expect to be impacted? 85-105 students per year; all BME undergraduates
Impacted schools must be contacted and their response(s) included:
Person communicated with: Dr. Vanden Bout, College of National Sciences
Date of communication: September 4, 2015
Response: Pending

e. Does this proposal involve changes to the core curriculum or other basic education requirements (42-hour core, signature courses, flags)? If yes, explain:
If yes, undergraduate studies must be informed of the proposed changes and their response included:
Person communicated with:
Date of communication:
Response:

f. Will this proposal change the number of hours required for degree completion? If yes, explain:

5. COLLEGE/SCHOOL APPROVAL PROCESS

Department approval date: February 19, 2015 for items A-D; August 24, 2015 for items E-G
College approval date: March 27, 2015 for items A-D; September 11, 2015 for items E-G
Dean approval date: April 29, 2015 for items A-D; September 25, 2015 for items E-G

PROPOSED NEW CATALOG TEXT:

BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING

The mission of the Department of Biomedical Engineering is to develop clinically translatable solutions for human health by training the next generation of biomedical engineers, cultivating leaders, and nurturing the integration of science, engineering, and medicine in a discovery-centered environment. The main educational objective is to provide a thorough training in the fundamentals of engineering science, design, and biology. The curriculum is designed to provide concepts central to understanding living systems from the molecular and cellular levels to the tissue and organismal levels. The curriculum incorporates principles of vertical integration, leading to the choice of a technical area (biomedical imaging and instrumentation, cellular and biomolecular engineering, computational biomedical engineering, or biomechanics), and culminates in a

team capstone design experience. Students are expected to develop an understanding of industrial, research, and clinical biomedical engineering environments; an understanding of regulatory issues and biomedical ethics; the ability to create, identify, formulate, and solve biomedical engineering problems; the ability to design systems to meet needs in medical/life science applications; an understanding of life processes at the molecular, cellular, tissue, and organismal levels; the ability to use instrumentation and to make measurements and interpret data in living systems; and an appreciation of the interdisciplinary nature of biomedical engineering research.

Portable Computing Devices

Students entering biomedical engineering are required to have a laptop computer at their disposal. Laptops do not need to be brought to campus on a daily basis, but individual courses may require that a laptop be brought to certain lectures, labs, and/or exams. Minimum requirements for the laptop are listed on the department's website.

~~Program~~ Student Outcomes

Graduates of the biomedical engineering program are expected to have:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multidisciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand what impact engineering solutions have in global, economic, environmental, and societal contexts
- A recognition of the need for and an ability to engage in lifelong learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Program Educational Objectives

Achievement of the preceding program outcomes gives students the foundation for accomplishing the biomedical engineering program educational objectives. A few years after graduation, students are expected to be able to:

- Conduct themselves with exemplary professional ethics and highest integrity
- Demonstrate a quantitative, analytical, and systems approach to problem solving in their professional practice
- Demonstrate a continuous quest for professional excellence and success
- Participate in continuing education to expand their knowledge of contemporary professional issues
- Exhibit effective scientific, technical, communication, and resource management skills in their professional practice

Curriculum

Course requirements include courses within the Cockrell School of Engineering ~~are divided into three categories: basic sequence courses, major sequence courses,~~ and other required courses. In addition, each student must complete the University's core curriculum. In some cases, a course that fulfills one of the following requirements may also be counted toward core curriculum or flag requirements; these courses are identified below.

~~To ensure that courses used to fulfill the social and behavioral sciences and visual and performing arts requirements of the core curriculum also meet ABET criteria, students should follow the guidance given in Degrees.~~

In the process of fulfilling engineering degree requirements, students must also complete coursework to satisfy the following flag requirements: one independent inquiry flag, one quantitative reasoning flag, one ethics and leadership flag, one global cultures flag, one cultural diversity in the United States flag, and two writing flags. The independent inquiry flag, the quantitative reasoning flag, the ethics and leadership flag, and the two writing flags are carried by courses specifically required for the degree; these courses are identified below. Courses that may be used to fulfill flag requirements are identified in the *Course Schedule*.

~~The first three long semesters of the curriculum consist of basic sequence and supporting courses for all biomedical engineering students. Subsequent enrollment in major sequence courses starting the fourth semester, and one of four technical areas is restricted to students who have received credit for all of the basic sequence courses and have been admitted to the major sequence. Requirements for admission to a major sequence are given in Admission and Registration. Enrollment in other required courses is not restricted by completion of the basic sequence.~~

Prior to registration, students must receive approval from the Biomedical Engineering Academic Advising Office for courses to be used to fulfill technical and nontechnical course requirements. The student must take all courses required for the degree on the letter-grade basis and must earn a grade of at least *C-* in each, except for those listed as Remaining Core Curriculum Courses.

	Requirements	**Hours**
~~Basic Sequence Courses~~		
~~Biology~~		
~~BIO 206L~~	~~Introductory Laboratory Experiments in Biology~~	~~2~~
~~BIO 311C~~	~~Introductory Biology I~~	~~3~~
Biomedical Engineering Courses		
BME ~~113L~~ 313L	Introduction to Numerical Methods in Biomedical Engineering	~~1~~ 3
BME ~~203L~~ 303L	Introduction to Biomedical Engineering Design	~~2~~ 3
BME 214L	Computational Fundamentals of Biomedical Engineering Design	2
BME 245L	Experimental Principles of Biomedical Engineering Design (writing flag)	2
BME 261L	Development and Analysis in Biomedical Engineering Design	2
BME 303	Introduction to Computing	3
BME 311	Network Analysis in Biomedical Engineering	3
BME 333T	Engineering Communication (writing and an ethics and leadership flag)	3
BME 335	Engineering Probability and Statistics	3
BME 343	Biomedical Engineering Signal and Systems Analysis	3
BME 344	Biomechanics	3
BME 349	Biomedical Instrumentation	3
BME 352	Engineering Biomaterials	3
BME 353	Transport Phenomena in Living Systems	3
BME 355	Molecular Engineering	3
BME 365R	Quantitative Engineering Physiology I	3
BME 365S	Quantitative Engineering Physiology II	3
BME 370	Biomedical Engineering Capstone Design I (writing flag)	3
BME 371	Biomedical Engineering Capstone Design II (independent inquiry flag)	3
Approved technical area electives		12

Biology		
BIO 206L	Introductory Laboratory Experiments in Biology	2
BIO 311C	Introductory Biology I	3
Biochemistry and Chemistry		
BCH 369	Fundamentals of Biochemistry	3
CH 128K	Organic Chemistry Laboratory	1
CH 204	Introduction to Chemical Practice	2
CH 301	Principles of Chemistry I	3
CH 302	Principles of Chemistry II	3
CH 320M or CH 328M	Organic Chemistry I Organic Chemistry I-CH/BCH Major	3
~~CH 353~~ ~~or CH 353M~~	~~Physical Chemistry I~~ ~~Physical Chemistry I for Life Sciences~~	~~3~~
Mathematics		
M 408C	Differential and Integral Calculus (mathematics; quantitative reasoning flag)	4
M 408D	Sequences, Series, and Multivariable Calculus	4
M 427K or M 427J	Advanced Calculus for Applications I (quantitative reasoning flag)	4
Physics		
PHY 103M	Laboratory for Physics 303K	1
PHY 103N	Laboratory for Physics 303L	1
PHY 303K	Engineering Physics I (part I science and technology; quantitative reasoning flag)	3
PHY 303L	Engineering Physics II (part I science and technology; quantitative reasoning flag)	3
Rhetoric and Writing		
RHE 306	Rhetoric and Writing (English composition)	3
~~Major Sequence Courses~~		
~~Biomedical Engineering~~		
~~BME 335~~	~~Engineering Probability and Statistics~~	~~3~~
~~BME 343~~	~~Biomedical Engineering Signal and Systems Analysis~~	~~3~~
~~BME 344~~	~~Biomechanics~~	~~3~~
~~BME 245L~~	~~Experimental Principles of Biomedical Engineering Design (writing flag)~~	~~2~~
~~BME 349~~	~~Biomedical Instrumentation~~	~~3~~
~~BME 352~~	~~Engineering Biomaterials~~	~~3~~
~~BME 353~~	~~Transport Phenomena in Living Systems~~	~~3~~
~~BME 355~~	~~Molecular Engineering~~	~~3~~
~~BME 261L~~	~~Development and Analysis in Biomedical Engineering Design~~	~~2~~
~~BME 365R~~	~~Quantitative Engineering Physiology I~~	~~3~~
~~BME 365S~~	~~Quantitative Engineering Physiology II~~	~~3~~
~~BME 370~~	~~Biomedical Engineering Capstone Design I (writing flag)~~	~~3~~
~~BME 371~~	~~Biomedical Engineering Capstone Design II (independent inquiry flag)~~	~~3~~
~~**Other Required Courses**~~		
~~CH 128K~~	~~Organic Chemistry Laboratory~~	~~1~~
~~CH 353~~ ~~or CH 353M~~	~~Physical Chemistry I~~ ~~Physical Chemistry I for Life Sciences~~	~~3~~
~~BCH 369~~	~~Fundamentals of Biochemistry~~	~~3~~
Remaining Core Curriculum Courses		
E 316L	British Literature (humanities) (some sections carry a global cultures flag)	3

	American Literature (some sections carry a cultural diversity flag)	
or E 316M	World Literature (some sections carry a global cultures flag)	
or E 316N	Masterworks of Literature	
or E 316P		
American and Texas government (some sections carry a global cultures and/or cultural diversity flag)		6
American history (some sections carry a cultural diversity flag)		6
Social and behavioral sciences (some sections carry a global cultures and/or cultural diversity flag)		3
Visual and performing arts (some sections carry a global cultures and/or cultural diversity flag)		3
UGS 302	First-Year Signature Course (~~some~~ all sections carry a writing flag)	3
or UGS 303	First-Year Signature Course (some sections carry a writing flag)	
Minimum Required		133

Technical Area Options

The technical area option allows the student to build on the biomedical engineering core curriculum by choosing twelve semester hours of technical area coursework in biomedical imaging and instrumentation, cellular and biomolecular engineering, computational biomedical engineering, or biomechanics. Within some technical areas, career emphases are available for students to focus coursework toward a particular career track. Students have flexibility to take technical elective coursework from more than one career emphasis under the same technical area. Each student should choose a technical area by the end of the sophomore year and plan an academic program to meet the area requirements during the next two years.

Preparation for health professions. Students who plan to attend medical, veterinary, or dental school in Texas must complete coursework in addition to that required for the BS in Biomedical Engineering in order to meet professional school admission requirements; those who plan to attend schools outside Texas may need additional coursework. The student is responsible for knowing and meeting these additional requirements, but assistance and information are available from full-time pre-health professions coaches and part-time peer mentors in the Health Professions Office in the College of Natural Sciences, PAI 5.03. Additional information about preparation for health professions is available online at http://cns.utexas.edu/careers/health-professions/.

Preparation for law. There is no sequential arrangement of courses prescribed for a pre-law program. The Association of American Law Schools puts special emphasis on comprehension and expression in words, critical understanding of the human institutions and values with which the law deals, and analytical power in thinking. Courses relevant to these objectives deal with communication of ideas, logic, mathematics, social sciences, history, philosophy, and the physical sciences. Services for pre-law students are provided to students in all colleges by Liberal Arts Career Services in FAC 18 ~~the Center for Strategic Advising & Career Counseling, JES A115~~ and to engineering students by the Engineering Career Assistance Center (ECAC) in ECJ 3.256 ~~2.400~~. Additional information about preparation for law is available online.

Plan II Honors Program. Students enrolled in the Plan II Honors Program are encouraged to contact the Biomedical Engineering Academic Advising Office, in addition to the Plan II Office to ensure that requirements for both programs are met. Plan II courses may count toward biomedical engineering program requirements.

Certificate programs. Biomedical engineering students may enrich their education through the following certificate programs.

Business Foundations Program. Students who wish to learn about fundamental business concepts and practices may take supplemental coursework that leads to the Business Foundations Certificate, awarded by the Red McCombs School of Business. The program is described in Degrees and Programs of the McCombs School. More information about the Business Foundations Program is available at http://new.mccombs.utexas.edu/bba/business-foundations and from the McCombs School.

Elements of Computing. Students who wish to learn about computer science may take the coursework that leads to the certificate in the Elements of Computing, awarded by the Department of Computer Science. The program is described in Degrees of the College of Natural Science. More information about the Elements of Computing Program is available at https://www.cs.utexas.edu/undergraduate-program/academics/elements-computing, and from the Department of Computer Science.

Technical Area 1, Biomedical Imaging and Instrumentation

This technical area is designed for students interested in the general area of medical imaging science and instrumentation design. Two career emphases are available in this area: biomedical imaging and biomedical instrumentation.

Career Emphasis A: Biomedical Imaging

The main objective of this emphasis is to prepare students for a career in biomedical imaging. A solid foundation, practical knowledge, and skills are established in optics, imaging modalities, and image and signal processing.

While students are required to select twelve hours from any of the Technical Area 1 electives, the following are recommended for the biomedical imaging career emphasis:

Biomedical Engineering 347, *Fundamentals of Biomedical Optics*
Biomedical Engineering 357, *Biomedical Imaging Modalities*
Electrical Engineering 347, *Modern Optics*
Electrical Engineering 351M, *Digital Signal Processing*
Electrical Engineering 371R, *Digital Image and Video Processing*
An approved upper-division biomedical engineering, electrical engineering, or physics course

Career Emphasis B: Biomedical Instrumentation

The main objective of this emphasis is to prepare students to design and use biomedical instrumentation for imaging, diagnostic, and therapeutic applications. A solid foundation, practical knowledge, and skills are established in analog and digital network analysis, software and hardware programming, electronic circuits, sensors, data acquisition systems, image and signal processing, and computational analysis of data as it applies to living systems.

While students are required to select twelve hours from any of the Technical Area 1 course options, the following are recommended for the biomedical instrumentation career emphasis:

Biomedical Engineering 354, *Molecular Sensors and Nanodevices for Biomedical Engineering Applications*
Biomedical Engineering 374K, *Biomedical Instrument Design*
Biomedical Engineering 374L, *Applications of Biomedical Engineering Laboratory*
Electrical Engineering 312, *Software Design and Implementation I*
Electrical Engineering 319K, *Introduction to Embedded Systems*
Electrical Engineering 438, *Fundamentals of Electronic Circuits I Laboratory*
Electrical Engineering 445L, *Embedded Systems Design Laboratory* Electrical Engineering 445M, *Embedded and Real-Time Systems Laboratory* Electrical Engineering 445S, *Real-Time Digital Signal Processing Laboratory* Electrical Engineering 351M, *Digital Signal Processing*

Technical Area 2, Cellular and Biomolecular Engineering

The major objective of this area is to teach students how to integrate knowledge in cell and molecular biology with engineering analysis, so that they can address problems in molecular-based medicine. Two career emphases are available in this area: biomaterials/regenerative medicine and nanotechnology.

Career Emphasis A: Biomaterials/Regenerative Medicine

The objective of this emphasis is to prepare students for a career in biomaterials and regenerative medicine engineering. This emphasis includes solid foundation in cell and tissue engineering, biomaterials, and pharmacology. While students are required to select twelve hours from any of the Technical Area 2 course options, the following are recommended for the biomaterials/regenerative medicine career emphasis:

Biology 320, *Cell Biology*
Biology 325, *Genetics*
Biology 326M, *Introductory Medical Microbiology and Immunology*
Biomedical Engineering 339, *Biochemical Engineering*
Biomedical Engineering 376, *Cell Engineering*
Biomedical Engineering 379, *Tissue Engineering*
An approved topic of Chemical Engineering 379, *Topics in Chemical Engineering*
Chemistry 320N, *Organic Chemistry II* and 220C, *Organic Chemistry Laboratory*; or 328N, *Organic Chemistry II* and 128L, *Organic Chemistry Laboratory*
Pharmacy 338, *Introduction to Pharmacology*
An approved upper-division biomedical engineering, chemical engineering or mechanical engineering course

Career Emphasis B: Nanotechnology

The objective of this emphasis is to prepare students for a career in nanotechnology. This emphasis includes solid foundation in nanodevices and sensors, biological physics, and nanocomposites. While students are required to select twelve hours from any of the Technical Area 2 course options, the following are recommended for the nanotechnology career emphasis:

Biomedical Engineering 346, *Computational Biomolecular Engineering*
Biomedical Engineering 354, *Molecular Sensors and Nanodevices for Biomedical Engineering Applications*
Chemical Engineering 322, *Thermodynamics*
Chemical Engineering 339P, *Introduction to Biological Physics*
An approved topic of Chemical Engineering 379, *Topics in Chemical Engineering*
Chemistry 320N, *Organic Chemistry II* and 220C, *Organic Chemistry Laboratory*; or 328N, *Organic Chemistry II* and 128L, *Organic Chemistry Laboratory*
An approved topic of Mechanical Engineering 379M, *Topics in Mechanical Engineering*
An approved upper-division biomedical engineering, chemical engineering or mechanical engineering course

Technical Area 3, Computational Biomedical Engineering

The objective of this area is to provide students with the knowledge and skills that will enable them to design and use computational algorithms to address problems in biomedical research and health care. Examples include (a) designing medical decision aids using statistical and machine learning models, (b) dynamic modeling and computer simulation to study the biomechanics and control of movement, (c) development of thermodynamic models of dynamic processes at the microscopic and macroscopic scales in biological systems, and (d) image processing techniques for quantitative measurement and interpretation of biomedical images.

Students must select twelve hours from the following:
Biomedical Engineering 345, *Graphics and Visualization Laboratory* Biomedical Engineering 346, *Computational Biomolecular Engineering*
Biomedical Engineering 348, *Modeling of Biomedical Engineering Systems* Biomedical Engineering 358, *Medical Decision Making*
Electrical Engineering 312, *Software Design and Implementation I*
Electrical Engineering 319K, *Introduction to Embedded Systems*
Electrical Engineering 422C, *Software Design and Implementation II*
Electrical Engineering 360C, *Algorithms*

Electrical Engineering 371R, *Digital Image and Video Processing*
Mathematics 325K, *Discrete Mathematics*
Mathematics 340L, *Matrices and Matrix Calculations*
A computer science course from an approved list

Technical Area 4, Biomechanics

The major objective of this area is to provide students with knowledge of the structure and function of biological systems by means of the methods of mechanics. Students will learn skills to apply engineering principles to understand how living systems function at all scales of organization and to translate this understanding to the design of devices and procedures that will improve diagnostic and therapeutic methods in health care.

Students must select twelve hours from the following:
Biomedical Engineering 342, *Biomechanics of Human Movement*
Biomedical Engineering 346, *Computational Biomolecular Engineering*
Biomedical Engineering 347, *Fundamentals of Biomedical Optics*
Biomedical Engineering 359, *Cellular and Molecular Biomechanics*
Biomedical Engineering 362, *Introduction to Nonlinear Dynamics in Biological Systems*
Chemical Engineering 339P, *Introduction to Biological Physics*
Kinesiology 326K, *Kinesiology: Biomechanical Analysis of Movement*
Mechanical Engineering 324, *Dynamics*
Mechanical Engineering 326, *Thermodynamics*
Mechanical Engineering 344, *Dynamic Systems and Controls* and 144L, *Dynamic Systems and Controls Laboratory*
Mechanical Engineering 354, *Introduction to Biomechanical Engineering*
Mechanical Engineering 372J, *Robotics and Automation*
An approved upper-division biomedical engineering or mechanical engineering course

Suggested Arrangement of Courses

First Year

First Term	Hours	**Second Term**	Hours
BIO 311C	3	BME 303	3
BME ~~203L~~ 303L	~~2~~ 3	CH 302	3
UGS 302 or 303	3	CH 204	2
BIO 206L	2	M 408D	4
CH 301	3	PHY 303K	3
M 408C	4	PHY 103M	1
		RHE 306	3
	~~17~~ 18		19

Second Year

First Term	Hours	**Second Term**	Hours
BME 214L	2	BME 333T	3
CH 320M or 328M	3	BME ~~113L~~ 313L	~~1~~ 3
CH 128K	1	BME 344 ~~BME 343~~	3
BME 311	3	BME 335	3
M 427J or M 427K	4	~~CH 353M or 353~~	~~3~~
PHY 303L	3	BCH 369	3
PHY 103N	1		

	17		~~16~~ 15

Third Year

First Term	Hours	**Second Term**	Hours
BME 245L	2	BME 261L	2
BME 343 ~~BME 344~~	3	BME 355	3
BME 352 ~~BME 349~~	3	BME 349 ~~BME 352~~	3
BME 365R	3	BME 365S	3
E 316L, 316M, 316N, or 316P ~~BME 353~~	3	Technical area elective	3
Technical area elective	3	BME 353 ~~E 316L, 316M, 316N, or 316P~~	3
	17		17

Fourth Year

First Term	Hours	**Second Term**	Hours
BME 370	3	BME 371	3
GOV 310L	3	GOV 312L/P	3
Technical area elective	3	Visual and performing arts	3
American history	3	Technical area elective	3
Social and behavioral sciences	3	American history	3
	15		15

Total credit hours: 133