

UNIVERSITY FACULTY SENATE FORMS

Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. For more information, call the Faculty Senate Office at 831-2921.

Submitted by: Jill Higginson
phone number 302.831.6622

Department: Biomedical Engineering
email address higginson@udel.edu

Action: modify Bachelor of Biomedical Engineering degree program

(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

Effective term 13F
(use format 04F, 05W)

Current degree BBE
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed change leads to the degree of: BBE
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed name: not applicable
Proposed new name for revised or new major / minor / concentration / academic unit
(if applicable)

Revising or Deleting:

Undergraduate major / Concentration: Biomedical Engineering
(Example: Applied Music – Instrumental degree BMAS)

Undergraduate minor: _____
(Example: African Studies, Business Administration, English, Leadership, etc.)

Graduate Program Policy statement change: _____
(Must attach your Graduate Program Policy Statement)

Graduate Program of Study: _____
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

Graduate minor / concentration: _____

Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, highlighting the changes made to the original policy document.

List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?

We propose to:

- (1) Replace EGGG101 with BMEG101 for all BMEG majors.
- (2) Update BMEG 450 from 4 to 6 credits (and omit 1 technical elective requirement)
- (3) Replace MEEG 483 by BMEG 311 in core curriculum

We will introduce a new course BMEG101 based on a previously offered course BMEG 167 to replace EGGG101. This new course will satisfy FYE requirements and will become a required course for all incoming BMEG students. The course description is as follows (submitted through course inventory in current cycle):

BMEG 101 (Introduction to Biomedical Engineering): Introduces first year students to college life and provides a learning experience vital to their success at the University, in Engineering, and in Biomedical Engineering. Course content includes that of the university First Year Seminar, technical skills for engineers, and career opportunities in biomedical engineering. (2 credits, FYE)

BMEG 450 Biomedical Engineering Design will be offered in conjunction with the successful senior design program in Mechanical Engineering (MEEG 401). This joint senior design program will enable interdisciplinary team projects, is a natural extension of ongoing collaborations between these units (i.e. joint faculty appointments, existing biomedical projects), and will allow BME to benefit and learn from the successful framework provided by the ME program.

We have opted to design a course series in Bioengineering Mechanics I and II (BMEG 310 and 311) which includes fundamentals of statics, dynamics and mechanics of solids with integrated biomedical applications. This sequence will replace the originally proposed two semester sequence (BMEG 310 and MEEG 483).

Explain, when appropriate, how this new/revised curriculum supports the 10 goals of undergraduate education: <http://www.ugs.udel.edu/gened/>

This curriculum addresses the following goals of undergraduate education:

1. Attain effective skills in oral and written communication, quantitative reasoning, and the use of information technology.
2. Learn to think critically to solve problems.
3. Be able to work and learn both independently and collaboratively.
4. Engage questions of ethics and recognize responsibilities to self, community, and society at large.
6. Develop the intellectual curiosity, confidence, and engagement that will lead to lifelong learning.
7. Develop the ability to integrate academic knowledge with experiences that extend the boundaries of the classroom.
10. Develop an international perspective in order to live and work effectively in an increasingly global society.

In addition, we aim for students to:

- Develop a plan to ensure academic success at UD while benefiting from available resources.
- Develop mentoring relationships.
- Develop an understanding of career options, begin selecting a career path and career goals, and begin developing a plan to prepare to achieve those career goals.

Identify other units affected by the proposed changes:

(Attach permission from the affected units. If no other unit is affected, enter "None")

- (1) The class size in EGGG101 will be reduced by approximately 50 students. No other affected units.
- (2) BMEG 450 and MEEG 401 will have shared lectures and interdisciplinary design teams. We will need to arrange for 50 additional seats (and 12-14 additional teams) in classrooms and presentation formats.

(3) MEEG 483 has not been offered yet to BME students, thus no changes will be made to this course.

Describe the rationale for the proposed program change(s):

(Explain your reasons for creating, revising, or deleting the curriculum or program.)

This new freshman course BMEG 101 is proposed in order to (1) introduce BME students to the profession, (2) prepare students for a successful academic career while satisfying FYE requirements and (3) establish a sense of community among each cohort. This course replaces EGGG101 for BME students. In the previous curriculum, BME students were not engaged as a stand-alone cohort until junior year, which prevented them from meeting their peers, forming study groups, and forming a BME identity. We found students became confused about whether they were in the right major, since they had no opportunity until junior year to take a course in their major. The feedback on BMEG167, the experimental version of this course, was outstanding, and students felt connected and excited about their major and their future in this field. This course is part of the core BMEG curriculum and will be taught by faculty with primary/joint appointments as well as guest lecturers from across campus and within the biomedical community.

BMEG 450 will be offered in conjunction with the ME senior design course MEEG 401. In order to be consistent across departments (i.e., MEEG 401 is offered at 6 credits; electrical engineering students take two 3-credit courses for senior design), BMEG 450 which was originally listed as 4 credits should be upgraded to 6 credits. Because BME will benefit from the history and network opportunities provided by this partnership, the student teams should be able to complete functional prototypes and professional presentations with their project sponsors during the course of the semester which is a substantial improvement over the originally proposed version. Since we do not wish to increase the total number of credits required to graduate, and since BME students take a variety of technical electives through their core curriculum (e.g. ELEG 479, MSEG 460), we will omit one required technical elective, effectively reducing the total credit count by 1 (i.e., total=125 not 126).

The course series in Bioengineering Mechanics I and II (BMEG 310 and 311) includes fundamentals of statics, dynamics and mechanics of solids with integrated biomedical applications (BMEG 310 already in catalog; BMEG 311 in current course inventory cycle). This sequence will replace the originally proposed two semester sequence (BMEG 310 and MEEG 483) in order to incorporate biomedical applications at the appropriate places in the curriculum. This increases the teaching burden on BME but reduces the burden on MEEG.

Program Requirements:

(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a side-by-side comparison** of the credit distribution before and after the proposed change.)

ORIGINAL CATALOG DESCRIPTION

DEGREE: BACHELOR OF BIOMEDICAL ENGINEERING

MAJOR: BIOMEDICAL ENGINEERING

CURRICULUM

CREDITS

Parenthesized figures indicate year (1 = freshman, 2 = sophomore, 3 = junior, 4 = senior) and semester (F = fall, S = spring).

UNIVERSITY REQUIREMENTS

<u>ENGL 110</u>	Critical Reading and Writing (minimum grade C-)	3 (1F)
<u>First Year Experience</u> (FYE)		0-4
<u>Breadth Requirements</u>		12
<u>Discovery Learning Experience</u> (DLE)		3
<u>Multicultural Course(s)</u>		3

MAJOR REQUIREMENTS

College of Engineering Breadth Requirements	21
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The College of Engineering requires 21 total Breadth Requirement credits (essentially 9 credits in addition to the University Breadth Requirement.)

- If chosen carefully, up to 3 credits from each of the University Breadth Requirement categories may be used to simultaneously satisfy the College of Engineering Breadth Requirements for this major.
- Of the 21 credits, 6 credits must be at the Upper Level (usually 300-level or higher) as designated on the College of Engineering Breadth Requirement list.
- Of the 21 credits, 3 credits may be used to satisfy the University Multicultural Requirement (recommended for timely progress toward degree completion.)
- All Breadth Requirement coursework must be passed with a minimum grade of C-.

Core Courses

<u>BISC 207</u>	Introductory Biology I	4 (1S)
<u>BISC 208</u>	Introductory Biology II	4 (2F)
<u>BMEG 401</u>	<i>Systems Physiology I</i>	3 (3F)
<u>BMEG 402</u>	<i>Systems Physiology II</i>	3 (3S)
<u>BMEG 310</u>	Bioengineering Mechanics	4 (3F)
<u>BMEG 320</u>	Cell and Tissue Transport	3 (3S)
<u>BMEG 330</u>	Medical Instrumentation/Electronics Lab	3 (3S)
<u>BMEG 450</u>	Biomedical Engineering Design (DLE)	4 (4F)
<u>CHEG 404</u>	Probability and Statistics for Engineers	3 (3S)
<u>CHEM 103</u>	General Chemistry I	4 (1F)

<u>CHEM 104</u>	General Chemistry II	4 (1S)
<u>CHEM 321</u>	Organic Chemistry I	4 (2F)
<u>CHEM 322</u>	Organic Chemistry II	4 (2S)
<u>CHEM 527</u>	Introduction to Biochemistry	3 (3F)
<u>CISC 106</u>	General Computer Science for Engineers	3 (1F)
<u>EGGG 101</u>	Introduction to Engineering (FYE)	2 (1F)
<u>ELEG 305</u>	Signals and Systems	3 (2S)
<u>ELEG 479</u>	Introduction to Medical Imaging Systems	3 (4S)
<u>MATH 241</u>	Analytic Geometry and Calculus A	4 (1F)
<u>MATH 242</u>	Analytic Geometry and Calculus B	4 (1S)
<u>MATH 243</u>	Analytic Geometry and Calculus C	4 (2F)
<u>MATH 305</u>	Applied Mathematics for Chemical Engineers	3 (2S)
<u>MEEG 483</u>	Orthopaedic Biomechanics	3 (3S)
<u>MSEG 302</u>	Materials Science for Engineers	3 (3F)
<u>MSEG 460</u>	Biomaterials and Tissue Engineering	3 (4F)
<u>PHIL 444</u>	Medical Ethics	3 (4S)
<u>PHYS 207</u>	Fundamentals of Physics I	4 (2F)
<u>PHYS 208</u>	Fundamentals of Physics II	4 (2S)

NOTES:

- Italicized courses are under development. See website for course descriptions.
- For students desiring more advanced training in mathematics, the 2-course sequence of MATH 351 and MATH 352 or MATH 351 and MATH 353 may be substituted for MATH 305 and one Technical Elective.
- PHIL 444 counts as an Upper Level Breadth Requirement.

TECHNICAL ELECTIVES

Technical electives in the Bachelor of Biomedical Engineering curriculum provide the student with an opportunity to pursue areas of particular interest. Technical elective credits demonstrate technical depth and are typically courses at or above the 400 level which are taken after much of the basic engineering science has been mastered and comprise a minimum of 12 credits. Although the majority of the technical depth electives are typically drawn from the College of Engineering, courses from other departments and colleges can be selected with the approval of the departmental advisor.

CREDITS TO TOTAL A MINIMUM OF

126

PROPOSED CATALOG DESCRIPTION

Note: Additions are shown in RED text (includes font changes or changes approved in last year's revision cycle – such as course names for BMEG 320, 330, 401, 402 and notes). Omissions are shown with strike-through marks.

DEGREE: BACHELOR OF BIOMEDICAL ENGINEERING

MAJOR: BIOMEDICAL ENGINEERING

CURRICULUM

CREDITS

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<u>Multicultural Course(s)</u>		3

MAJOR REQUIREMENTS

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- Of the 21 credits, 3 credits may be used to satisfy the University Multicultural Requirement (recommended for timely progress toward degree completion.)
- All Breadth Requirement coursework must be passed with a minimum grade of C-.

Core Courses

<u>BISC 207</u>	Introductory Biology I	4 (1S)
<u>BISC 208</u>	Introductory Biology II	4 (2F)
<u>BMEG 101</u>	Introduction to Biomedical Engineering (FYE)	2 (1F)
<u>BMEG 310</u>	Bioengineering Mechanics I	4 (3F)
<u>BMEG 311</u>	Bioengineering Mechanics II	3 (3S)
<u>BMEG 320</u>	Biological Transport Phenomena- Cell and Tissue Transport	3 (3S)
<u>BMEG 330</u>	Biomedical Instrumentation- Medical Instrumentation/Electronics Lab	3 (3S)
<u>BMEG 401</u>	Systems Physiology I	3 (3F)
<u>BMEG 402</u>	Systems Physiology II	3 (3S)
<u>BMEG 450</u>	Biomedical Engineering Design (DLE)	6 4 (4F)
<u>CHEG 404</u>	Probability and Statistics for Engineers	3 (3S)

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<u>MATH 242</u>	Analytic Geometry and Calculus B	4 (1S)
<u>MATH 243</u>	Analytic Geometry and Calculus C	4 (2F)
<u>MATH 305</u>	Applied Mathematics for Chemical Engineers	3 (2S)
<u>MEEG 483</u>	Orthopaedic Biomechanics	3 (3S)
<u>MSEG 302</u>	Materials Science for Engineers	3 (3F)
<u>MSEG 460</u>	Biomaterials and Tissue Engineering	3 (4F)
<u>PHIL 444</u>	Medical Ethics	3 (4S)
<u>PHYS 207</u>	Fundamentals of Physics I	4 (2F)
<u>PHYS 208</u>	Fundamentals of Physics II	4 (2S)

NOTES:

- ~~Italicized courses are under development. See website for course descriptions.~~
- ~~For students desiring more advanced training in mathematics, the 2 course sequence of MATH 351 and MATH 352 or MATH 351 and MATH 353 may be substituted for MATH 305 and one Technical Elective.~~
- ~~PHIL 444 counts as an Upper Level Breadth Requirement.~~

TECHNICAL ELECTIVES

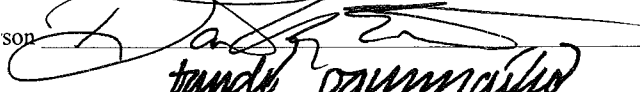
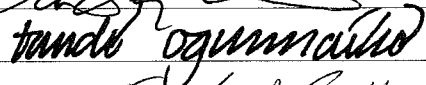
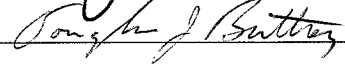
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Students must take 9 credits (usually 3 courses) of Technical Electives from an approved list of courses. Independent Study, Senior Research, and additional courses for satisfying this requirement can be approved by the advisor.

CREDITS TO TOTAL A MINIMUM OF

125 ~~126~~

ROUTING AND AUTHORIZATION: (Please do not remove supporting documentation.)

Department Chairperson  Date 11-22-12
Dean of College  Date DEC 10, 2012
Chairperson, College Curriculum Committee  Date Dec 11, 2012
Chairperson, Senate Com. on UG or GR Studies _____ Date _____
Chairperson, Senate Coordinating Com. _____ Date _____
Secretary, Faculty Senate _____ Date _____
Date of Senate Resolution _____ Date to be Effective _____
Registrar _____ Program Code _____ Date _____
Vice Provost for Academic Affairs & International Programs _____ Date _____
Provost _____ Date _____
Board of Trustee Notification _____ Date _____

Higginson, Jill Startzell

From: Advani, Suresh G
Sent: Thursday, November 15, 2012 12:57 PM
To: Higginson, Jill Startzell
Cc: Dawn Elliott (delliott@mail.med.upenn.edu)
Subject: FacSen-BMEG101-450-311 (3)
Attachments: FacSen-BMEG101-450-311 (3).doc

Dear Jill,

I support the integration of the senior design program with Biomedical Engineering. Two parallel courses (MEEG 401 and BMEG 450) will be offered as combined lectures and will enable all students to participate on interdisciplinary design teams. We will work together to find sponsors and suitable projects that span biomedical and mechanical engineering and will share the infrastructure that supports our successful senior design program.

In addition, I understand that the new course sequence in Bioengineering Mechanics (BMEG 310 and 311) will omit the need for MEEG 482 as a required course in the BME curriculum. The new course sequence has been developed by faculty with joint appointments in ME and BME and will better suit the needs of the BME students.

I support the proposed changes in the curriculum.

Suresh G. Advani

Suresh G Advani

George W. Laird Professor
Chair of Mechanical Engineering and
Associate Director, Center for
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