

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) Update list of technical electives for the Bachelors of Biomedical Engineering degree.
- (2) Revise BMEG330 to become a 4-credit course
- (3) Revise catalog to list BMEG 479 instead of ELEG 479
- (4) Replace CHEG 404 with BMEG 304 as required statistics course

In the 2011-2012 review cycle, we proposed to maintain the list of technical electives on the Biomedical Engineering webpage. Although approved at the time, the Registrar's Office has now advised that placing required curriculum on a department website is not a recommended practice since the UD Catalog is the official location of coursework to be completed for a degree. Additionally, in their experience, departments take liberties with changing the courses on lists like these without getting proper approval through the faculty senate. We propose to update the list of approved technical electives to appear in the UD Catalog (and linked from the BME website).

We have been offering BMEG330 Biomedical Instrumentation since Spring 2012. It is a central part of the BME curriculum and has received 3 credits despite requiring three lectures plus 1 lab per week. We have submitted the change through course inventory, but wish to update the credit counts in the UD Catalog.

Students in BME have been required to take ELEG 479 Intro to Medical Imaging Systems which is now cross-listed as BMEG 479. We wish the catalog to reflect the BMEG prefix.

Students in BME have been required to take CHEG 404 Engineering Probability and Statistics. We wish to offer our own course BMEG 304 Design of Experiments and Biostatistics which covers descriptive and inferential statistics plus fundamental principles of design of experiments. Topics include hypothesis testing, multiple regression, analysis of variance randomized and factorial designs with emphasis on biomedical applications. The new course (BMEG 304) has been submitted through the course inventory system and the catalog should reflect this change. The Department of Chemical and Biomolecular Engineering who have been responsible for CHEG 404 concur with this program change, and are concurrently making changes to CHEG 404 content.

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:

2. Learn to think critically to solve problems.
3. Be able to work and learn both independently and collaboratively.
6. Develop the intellectual curiosity, confidence, and engagement that will lead to lifelong learning.

Identify other units affected by the proposed changes:

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

- (1) Students will no longer be required to take CHEG404 which should reduce the class size by about 50 students, leaving only CHEG students in the newly revised course. (see attached letter of support)

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

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

- (1) The registrar's office recommends that the UD Catalog is the repository for the coursework needed to complete a degree and as such technical electives should be published there and referenced by departmental

sites.

- (2) Students and faculty devote time and effort commensurate with a 4-credit class for BMEG330 (with three lectures plus one lab per week). This course is listed with 3 credits, but should be adjusted so that the appropriate amount of time is allocated when scheduling courses. This change will result in a typical load of 16 credits instead of 15 during the junior spring semester. This would result in an increase of 1 credit required by the BME curriculum.
- (3) ELEG 479 has been cross-listed with BMEG 479. For clarity, the BME curriculum in the UD catalog and other sources should reflect this change.
- (4) Biomedical engineers need the fundamentals of statistics and design of experiments for careers in research, medicine or industry. The current curriculum requires CHEG 404 which emphasizes probability and has limited coverage of practical applications for biomedical engineers. This course is part of the core BMEG curriculum and will be taught with a series of applied problems in biomedical engineering and will use a biostatistics textbook for reference.

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 (1S)
<u>First Year Experience (FYE)</u>		0-4
<u>Breadth Requirements</u>		12
<u>Discovery Learning Experience (DLE)</u>		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 101</u>	Introduction to Biomedical Engineering (FYE)	2 (1F)
<u>BMEG 310</u>	Bioengineering Mechanics	4 (3F)
<u>BMEG 311</u>	Bioengineering Mechanics II	3 (3S)
<u>BMEG 320</u>	Biological Transport Phenomena	3 (3S)
<u>BMEG 330</u>	Biomedical Instrumentation	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 (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>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>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)

TECHNICAL ELECTIVES

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

PROPOSED CATALOG DESCRIPTION

Note: Additions are shown in RED text. Omissions are shown with strike-through marks.

DEGREE: BACHELOR OF BIOMEDICAL ENGINEERING

MAJOR: BIOMEDICAL ENGINEERING

CURRICULUM

CREDITS

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Core Courses

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<u>BMEG 101</u>	Introduction to Biomedical Engineering (FYE)	2 (1F)
<u>BMEG 304</u>	Design of Experiments and Biostatistics	3 (3S)
<u>BMEG 310</u>	Bioengineering Mechanics	4 (3F)
<u>BMEG 311</u>	Bioengineering Mechanics II	3 (3S)
<u>BMEG 320</u>	Biological Transport Phenomena	3 (3S)
<u>BMEG 330</u>	Biomedical Instrumentation	4 3 (3S)
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<u>PHYS 208</u>	Fundamentals of Physics II	4 (2S)

TECHNICAL ELECTIVES

Students must take 9 credits (usually 3 courses) of Technical Electives. Technical electives in the Bachelor of Biomedical Engineering curriculum provide the students with an opportunity to pursue areas of particular interest. Because of the breadth of technical areas in which biomedical engineers work, the approved list of technical electives include upper level courses across departments:

At least two courses must be selected from the College of Engineering:

Biomedical Engineering: BMEG 350, 400-699
 Chemical Engineering: CHEG 325, 326, 400-699 (except 404, 595)
 Civil and Environmental Eng: CIEG 301, 302, 305, 311, 331, 351, 400-699
 Computer and Information Sciences: 181, 220, 260, 275, 280, 303, 304, 310, 320, 360, 361, 400-699
 Computer Engineering: CPEG 202, 222, 400-699
 Electrical Engineering: ELEG 306, 320, 400-699
 Materials Science and Engineering: MSEG 400-699 (except 420, 425, 443)
 Mechanical Eng: MEEG 300-699 (except 483)

Additional courses **may** be selected from other departments:


Biology: BISC 400-699
 Chemistry: CHEM 322, 400-699 (except 527)
 Kinesiology and Applied Physiology: KAAP 220, 309, 428, 430
 Mathematics: MATH 315, 352 or 353, 389, 400-699
 Medical Laboratory Sciences: MEDT 360, 390, 401, 403, 406
 Neuroscience: NSCI 320
 Physics: PHYS 309, 310, 313, 400-699
 Statistics: STAT 400-699
 Thesis: UNIV 401, 402 (topic must be approved by academic advisor)

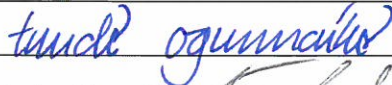
Additional upper-level and graduate-level courses may also be approved by the academic advisor. An independent study project approved by the academic advisor (3 credits) can also count as a technical elective.


CREDITS TO TOTAL A MINIMUM OF

126 125

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

Department Chairperson  Date 11/25/2013

Dean of College  Date 11/27/2013

Chairperson, College Curriculum Committee  Date 11/26/2013

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 _____

Revised 10/23/2007 /khs

Higginson, Jill Startzell

From: Elliott, Dawn
Sent: Thursday, August 29, 2013 9:56 AM
To: Lenhoff, Abraham M; Higginson, Jill Startzell
Subject: Re: CHEG404

Thanks Bramie. I will let Jill and the BME undergrad committee know. I think we will plan a change for this Spring but will let Jill confirm that with you.

Dawn

Dawn Elliott
Professor and Director
Biomedical Engineering
www.bme.udel.edu
delliott@udel.edu

On Jul 8, 2013, at 6:52 PM, A. M. Lenhoff <lenhoff@UDel.Edu> wrote:

Hi Dawn,

It's of course your prerogative to design your own statistics course. We're likely to make CHEG 404 or a somewhat slimmed-down equivalent a required course for our students, so reducing the class size would be helpful for us as well. I'd be happy to discuss this with you in more detail if you like.

Thanks.
Bramie

On 7/8/13 12:51 PM, Elliott, Dawn wrote:
Hi Bramie,

Jill and I just met about BME curriculum and would like to consider the idea of changing the BME core curriculum to replace CHEG404 with BMEG3XX - which would be a course in statistics and also include some design component. In that case I would have a BME faculty member teach it.

Would this be something that CBE would 'welcome' and be happy for us to move forward on asap, or are there other concerns/issues which we should set up a meeting to discuss - which we would be happy to do? There are several steps to take moving forward - if this is something we agree to do.

Thanks
Dawn

Dawn Elliott
Biomedical Engineering
University of Delaware