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__12F_____
(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)?
None. We propose to replace BMEG301 (Systems Physiology I) with BISC306 (General Physiology). Additionally, we propose to replace BMEG302 (Systems Physiology II) with one of the following courses to be selected by students completing the BBE degree: BISC605 (Advanced Mammalian Physiology), BISC 606 (Advanced Mammalian Physiology II), or ELEG471 (Mathematical Physiology). BMEG301 and BMEG302 were included with the original curriculum in the proposal for the undergraduate degree program in biomedical engineering. However, these courses have not been developed nor formally submitted through the UD course approval process and we wish to replace these with existing courses which cover the desired curriculum.

In addition, we propose to update the list of available technical electives for the BBE degree. Rather than list a specific set of courses which may or may not be offered each semester, we will maintain a list of approved courses on our webpage: (http://www.engr.udel.edu/biomed/downloads/BMEG_tech_electives.pdf).

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

Not applicable.

Identify other units affected by the proposed changes:
(Attach permission from the affected units. If no other unit is affected, enter "None")

The Department of Biological Sciences will be affected by this revision with increased enrollment in BISC306, BISC605 and/or BISC606. The Department of Electrical and Computer Engineering may be affected by this revision with increased enrollment in ELEG471.

Describe the rationale for the proposed program change(s):
(Explain your reasons for creating, revising, or deleting the curriculum or program.)

The aim of our program is to provide students with the training necessary to pursue a career in medicine, engineering or biomedical research. We expect students in the biomedical engineering program to acquire a thorough understanding of physiology with an emphasis on quantitative analysis of biological systems. The proposed curriculum for the BBE degree indicated two new courses (BMEG301 and BMEG302) which together would encompass human physiology from a quantitative viewpoint including functional and structural aspects of mammalian nervous and musculoskeletal systems, and cellular mechanisms of human cardiovascular, respiratory, renal, digestive, and endocrine systems. Given the current limited resources in the College (and University), rather than developing new courses and overextending our limited teaching resources in this emerging program, we wish to take advantage of existing strengths and academically similar material in physiology instruction already available on campus. We would like to note that it is not uncommon for undergraduate students in the College of Arts and Science to enroll in 600-level courses and feel these are suitable choices for students in the BBE program. Several BISC and ECE faculty who teach these courses have joint appointments in biomedical engineering.

The proposed change to the list of technical electives is motivated by the desire for flexibility given the fluid nature of scheduling and offering non-required courses. Furthermore, we expect to pursue ABET accreditation in future years and want to limit the choice of technical electives to courses offered in the College of Engineering. The current list of approved technical electives will be posted on our webpage and is derived from the common set of courses approved as technical electives from other departments within the College.

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.)

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

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

MAJOR REQUIREMENTS

College of Engineering Breadth Requirements	21

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

BISC 207	Introductory Biology I	4 (1S)
BISC 208	Introductory Biology II	4 (2F)
~~*BMEG 301*~~	~~*Systems Physiology I*~~	~~3 (3F)~~
BISC 306	General Physiology	3 (3F)
~~*BMEG 302*~~	~~*Systems Physiology II*~~	~~3 (3S)~~
BISC 605 or	Advanced Mammalian Physiology I	
BISC 606 or	Advanced Mammalian Physiology II	3 (3S or 4F)
ELEG 471	Mathematical Physiology	
BMEG 310	Bioengineering Mechanics	4 (3F)
BMEG 320	Cell and Tissue Transport	3 (3S)

BMEG 330	Medical Instrumentation/Electronics Lab	3 (3S)
BMEG 450	Biomedical Engineering Design (DLE)	4 (4F)
CHEG 404	Probability and Statistics for Engineers	3 (3S)
CHEM 103	General Chemistry I	4 (1F)
CHEM 104	General Chemistry II	4 (1S)
CHEM 321	Organic Chemistry I	4 (2F)
CHEM 322	Organic Chemistry II	4 (2S)
CHEM 527	Introduction to Biochemistry	3 (3F)
CISC 106	General Computer Science for Engineers	3 (1F)
EGGG 101	Introduction to Engineering (FYE)	2 (1F)
ELEG 305	Signals and Systems	3 (2S)
ELEG 479	Introduction to Medical Imaging Systems	3 (4S)
MATH 241	Analytic Geometry and Calculus A	4 (1F)
MATH 242	Analytic Geometry and Calculus B	4 (1S)
MATH 243	Analytic Geometry and Calculus C	4 (2F)
MATH 305	Applied Mathematics for Chemical Engineers	3 (2S)
MEEG 483	Orthopaedic Biomechanics	3 (3S)
MSEG 302	Materials Science for Engineers	3 (3F)
MSEG 460	Biomaterials and Tissue Engineering	3 (4F)
PHIL 444	Medical Ethics	3 (4S)
PHYS 207	Fundamentals of Physics I	4 (2F)
PHYS 208	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

Students must take 12 credits (usually 4 courses) of Technical Electives from ~~the following list~~ an approved list of courses. Independent Study, Senior Research, and additional courses for satisfying this requirement can be approved by the advisor.

~~BMSC 630~~	~~Human Movement Control~~	~~3~~
~~CHEG 420~~	~~Biochemical Engineering~~	~~3~~
~~CHEG 621~~	~~Metabolic Engineering~~	~~3~~
~~CHEM 443~~	~~Physical Chemistry~~	~~3~~
~~ELEG 418~~	~~Digital Control Systems~~	~~3~~
~~ELEG 471~~	~~Mathematical Physiology~~	~~3~~
~~ELEG 478~~	~~Introduction to Nano and Biophotonics~~	~~3~~
~~ELEG 680~~	~~Immunology for Engineers~~	~~3~~
~~MEEG 482~~	~~Clinical Biomechanics~~	~~3~~
~~MEEG 485~~	~~Control of Human Movement~~	~~3~~
~~MEEG 612~~	~~Biomechanics of Human Movement~~	~~3~~
~~MSEG 630~~	~~Introduction to Science and Engineering of Polymer Systems~~	~~3~~
~~MSEG 632~~	~~Principles of Polymerization~~	~~3~~

~~MSEG 635~~	~~Principles of Polymer Physics~~	~~3~~
~~UNIV 401~~	~~Senior Thesis~~	~~2-4~~
~~UNIV 402~~	~~Senior Thesis~~	~~2-4~~

CREDITS TO TOTAL A MINIMUM OF **126**

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

Department Chairperson _____ Date 11-15-2011

Dean of College _____ Date 11-21-2011

Chairperson, College Curriculum Committee _____ Date 11/22/2011

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

UNIVERSITY OF DELAWARE

DEPARTMENT OF BIOLOGY
OFFICE OF THE CHAIR

University of Delaware
Newark, Delaware 19716-2590
Ph: 302/831-6977
Fax: 302/831-2281

Randall L. Duncan, Ph.D.
Professor and Chairman
Department of Biological Sciences
118C Wolf Hall
Telephone (302) 831-6977
Fax No. (302) 831-1033
E-mail: rlduncan@udel.edu

November 15, 2011

Dr. Dawn Elliott
Program Director
Biomedical Engineering
College of Engineering

Dear Dr. Elliott,

The Department of Biological Sciences is committed to the success of the new program in Biomedical Engineering (BME) and supports the proposed changes in curriculum to (a) replace BMEG 301 with BISC 306 *General Physiology*, and (b) replace BMEG 302 with a choice of 3 options: either BISC 605 *Advanced Mammalian Physiology I*, BISC 606 *Advanced Mammalian Physiology II* or ELEG 471. We recognize that this will result in increased enrollment in BISC 306 which is offered in multiple sections during both fall and spring semesters. Additionally, we are prepared for expanded enrollment in BISC 605 (fall) or 606 (spring) by BMEG students. Please understand that BISC 605 and 606 are "stand alone" courses that do not require students to take BISC605 as a prerequisite for BISC606. However, both BISC605 and 606 require BISC 306 as a prerequisite.

The BME executive committee has been working closely with myself and other faculty members in Biology to carefully design the curriculum that bridges the gaps between biology and engineering in order to make a profound impact on biomedical research and clinical engineering. We are dedicated to the success of this initiative and have committed faculty and laboratory resources to ameliorate some of the needs of this popular program.

Best regards,

Randall L. Duncan

Professor and Chair

UNIVERSITY OF DELAWARE

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

140 Evans Hall
University of Delaware
Newark, Delaware 19716-3130
Ph: 302/831-2405
Fax: 302/831-4316
www ee.udel.edu

November 9, 2011

Dr. Dawn Elliott
Director, Biomedical Program
201 Spencer Lab
Newark, DE 19716

RE: Departmental support for proposed change to Biomedical Engineering curriculum

Dear Dr. Elliott,

I am writing to express the support of the Department of Electrical and Computer Engineering for the proposed changes in curriculum for the undergraduate program in Biomedical Engineering. Specifically, the proposal involves replacing the planned course BMEG 302 (Systems Physiology II) with the student's choice from 3 options: either BISC 605, BISC 606 or ELEG 471. This will provide BMEG students with the opportunity to focus on the aspects of physiology central to their interests. Furthermore, we understand that this change will likely result in increased enrollment in ELEG 471 (Mathematical Physiology), already a popular course offered in our department.

Biomedical Engineering is a rapidly expanding discipline which requires interdisciplinary knowledge and collaborations. Currently, 7 of our faculty are affiliated with this program, and the most recent faculty hire has a joint appointment in Biomedical Engineering. We are excited by the potential opportunities for students and faculty enabled through increased contact in the classroom and will continue to support this emerging program.

Sincerely,

Kenneth Barner
Professor and Chair