



Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE:

Establish a Graduate Concentration in “Biomechanics” jointly in the Departments of Bioengineering and Mechanical Science and Engineering, College of Engineering

SPONSORS:

Rashid Bashir, Department Head, Bioengineering, Professor of Bioengineering and Electrical and Computer Engineering, 217-333-1867, rbashir@illinois.edu,

Placid Ferreira, Department Head, Mechanical Science and Engineering, 217-333-0639, pferreir@illinois.edu,

Deborah Leckband, Graduate Programs Director and Professor, Bioengineering, 217-244-0793, leckband@illinois.edu, and

M. Taher Saif, Gutsell Professor of Mechanical Science and Engineering, (217) 333-8552, saif@illinois.edu.

COLLEGE CONTACT:

William Buttlar, Associate Dean for Graduate and Professional Programs, College of Engineering, 217-333-5966, buttlar@illinois.edu

BRIEF DESCRIPTION:

This proposal seeks the approval of a Biomechanics Graduate Concentration to be offered jointly through the Department of Bioengineering and the Department of Mechanical Science and Engineering. The proposed concentration requires students to complete a minimum of three courses for a total of at least 12 credit hours in topics integral to Biomechanics (see Appendix A for specific requirements and course options). These courses will be chosen from existing Illinois graduate courses in engineering, biology, and the sciences, to provide an interdisciplinary experience required for cutting edge research in biomechanics.

This concentration will be open to students in relevant disciplines within the College of Engineering (Bioengineering, Electrical and Computer Engineering, Materials Science and

Engineering, and Mechanical Science and Engineering) with the hope of expanding to relevant disciplines outside the College of Engineering in the future (Biochemistry, Cell and Developmental Biology, Chemistry, etc.). This concentration will be fully compatible with traditional degree requirements in the various home departments (see Appendix B for departmental approvals). Students are expected to have graduate standing in one of the participating departments.

JUSTIFICATION:

The need for interdisciplinary solutions to complex problems, continuing advancements in computing and informatics, and shortages in the STEM (Science, Technology, Engineering, Mathematics) workforce at all levels, calls for a new generation of scientists who are equipped to face these challenges. In response, we will create and evaluate an interdisciplinary concentration that provides a diverse array of graduate students with training in the integration of biological sciences with physical and applied sciences.

Mechanical force is now recognized as a fundamental cue in biology that alters a wide range of cell functions. Biomechanical processes pervade nearly every aspect of biology from the way single proteins function to whole body mechanics. This is a new, rapidly evolving and highly interdisciplinary field of research that requires an integrative educational program that brings together the skills and expertise of applied scientists, molecular and cell biologists, surface and interfacial chemists, mechanical and bioengineers, and biophysicists. No single departmental degree program provides this breadth, and this necessitates the establishment of a multi-disciplinary, multi-departmental concentration that will provide the foundational skills needed to make substantial research advances in this evolving field.

Multiscale biomechanics (from atoms to the clinic) is a relatively new, rapidly emerging field of research and very few programs worldwide offer a focused educational program that effectively prepares students for research in this discipline. Because of its current strengths in biomechanics, the University of Illinois is well suited to assume a leadership position in biomechanics education, by establishing and offering this concentration. This concentration will allow students to focus on gaining skills uniquely suited to applications in nano engineering, biometrics, tissue engineering, wound healing, biomaterials engineering, prosthetics, drug delivery, as well as in fundamental biological research. Students with this concentration indicated on their transcript will have a significant competitive advantage over others in the applicant pool for these positions. Moreover, a clear transcriptable designation will enable us to attract the best students in this area, who would otherwise attend competing programs.

The proposed concentration spans the range of disciplines participating in this concentration. Although applications in Biomechanics are generally classified as Bioengineering, biomechanical factors are central to a broad range of disciplines. Therefore, this concentration will be jointly offered by Bioengineering and Mechanical Science and Engineering. Incorporating concepts from a variety of disciplines such as Bioengineering, Materials Science and Engineering, Mechanical Science and Engineering, and Physics will allow this group of graduate students to focus on addressing problems in human health and physiology. This concentration would provide the unique, multidisciplinary curriculum required to effectively train graduate students to advance in this dynamic, important field.

We anticipate that 10 graduate students per year will be accepted into this concentration at steady-state. Applicants will follow the established university procedures for indicating their interest in this concentration. Their application and background will be reviewed jointly by the graduate coordinators in Bioengineering and Mechanical Science and Engineering who will also provide students with details on this concentration's courses and requirements.

BUDGETARY AND STAFF IMPLICATIONS:

- a. Additional staff and dollars needed

Graduate staff in the Department of Bioengineering together with graduate staff in the Department of Mechanical Science and Engineering have the capacity to absorb this additional program. They will serve as program advisors and maintain the concentration records, process admissions, and coordinate with departments regarding awarding of this concentration.

- b. Internal reallocations (e.g., change in class size, teaching loads, student-faculty ratio, etc.)

We expect that each course could see an enrollment increase of 5-7 students per year. Each department whose course is represented in this proposal has provided a letter indicating that each course has the capacity to absorb this additional enrollment.

- c. Effect on course enrollment in other units and explanations of discussions with representatives of those departments

As per the attached letters in Appendix C, this additional enrollment can be accommodated in each course associated with this concentration.

- d. Impact on the University Library

Those admitted to this concentration will be current University of Illinois graduate students. Therefore, there would be no additional impact beyond what is already accounted for in the typical graduate student population.

- e. Impact on computer use, laboratory use, equipment, etc.

No increase in the graduate student population is expected since those admitted to this concentration will be current University of Illinois graduate students. Therefore, there would be no additional impact beyond what is already accounted for in the typical graduate student population.

DESIRED EFFECTIVE DATE: Upon approval

STATEMENT FOR PROGRAMS OF STUDY CATALOG:

For Bioengineering and Mechanical Science and Engineering who are jointly sponsoring the concentration

The Biomechanics Concentration prepares students for collaborative research across the disciplines of engineering, biology, and the sciences. Students must be enrolled in a graduate degree program from one of the participating Departments (Bioengineering, Electrical and Computer Engineering, Materials Science and Engineering, and Mechanical Science and Engineering). The Biomechanics Concentration requires students to earn a B or better in each concentration course and complete at least 12 hours. Fulfillment of these requirements will be monitored jointly by the graduate coordinators in Bioengineering and in Mechanical Science and Engineering.

Current course options include:

ABE 446	Biological Nanoengineering	4 hours
BIOE 406	Bone Biology and Biomechanics	3 hours
BIOE 479	Cancer Nanotechnology	3 hours
ME/BIOE 482	Musculoskeletal Tissue Mechanics	3 or 4 hours
ME 483	Mechanobiology	4 hours
MSE 474	Biomaterials and Nanomedicine	3 hours
PHYS 475	Biological Physics	3 or 4 hours
PHYS 550	Biomolecular Physics	4 hours
TAM 461	Cellular Biomechanics	4 hours

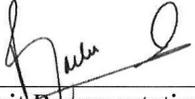
Alternate courses may be applicable to the Biomechanics Concentration pending joint approval by the Bioengineering and the Mechanical Science and Engineering Graduate Programs. Please note that students who intend to complete both a Biomechanics Concentration and a Cancer Nanotechnology Concentration may only overlap one course between the two concentrations.

Courses taken toward this concentration will count toward the student's graduate degree. Students must notify their department of their plan to pursue this concentration. When choosing courses, students must work directly with their department to ensure that all degree requirements will be met.

The Statement for Programs of Study Catalog for each major listed in the Concentration description can be found in Appendix D.

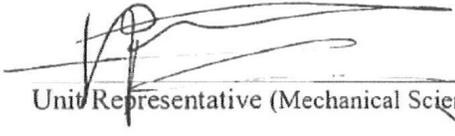
CLEARANCES: (Clearances should include signatures and dates of approval. **These signatures must appear on a separate sheet.** If multiple departments or colleges are sponsoring the proposal, please add the appropriate signature lines below.)

Signatures:



Unit Representative (Bioengineering):

10/13/14
Date:



Unit Representative (Mechanical Science and Engineering):

10/14/14
Date:



Unit Representative (Electrical and Computer Engineering):

10/14/14
Date:



Unit Representative (Materials Science and Engineering):

October 10, 2014
Date:



College Representative (Engineering):

1-21-15
Date:

Graduate College Representative:

Date:

Appendix A Concentration Courses and Requirements

The Biomechanics Concentration requires students to earn a B or better in each concentration course and complete at least 12 hours. Courses taken toward this concentration will count toward the student's graduate degree.

Current course options include:

ABE 446	Biological Nanoengineering	4 hours
BIOE 406	Bone Biology and Biomechanics	3 hours
BIOE 479	Cancer Nanotechnology	3 hours
ME/BIOE 482	Musculoskeletal Tissue Mechanics	3 or 4 hours
ME 483	Mechanobiology	4 hours
MSE 474	Biomaterials and Nanomedicine	3 hours
PHYS 475	Biological Physics	4 hours
PHYS 550	Biomolecular Physics	4 hours
TAM 461	Cellular Biomechanics	4 hours

A Biomechanics Concentration Web site will be created to inform prospective students about program requirements. The Web site will also serve as a resource for students pursuing the concentration and will be kept up-to-date with course additions and program updates.

It is understood that alternate courses may be approved to be included in the Biomechanics Concentration. In order for alternate courses to be considered, the student must submit the course syllabus to the Bioengineering graduate coordinator prior to enrolling in the course. The Bioengineering and Mechanical Science and Engineering Departments will jointly review the syllabus to determine if the course covers the appropriate topics. If approved, both the student and the student's departmental graduate contact will be notified in writing, and the approval will be noted in the student's file. A report of progress toward the concentration will be available to each student upon request.

Applicants will follow the established university procedures for indicating their interest in this concentration. The graduate coordinators in Bioengineering and Mechanical Science and Engineering will jointly review their application and background and provide students with details on the concentration's courses and requirements. There are significant prerequisites required for the courses listed in this concentration. Graduate students are responsible for ensuring that they have the appropriate background for any courses in which they enroll. The graduate coordinators will be available to discuss courses and prerequisites with students considering this concentration. At the conclusion of the student's degree, the Bioengineering graduate coordinator will work with the student's department to review concentration course progress and certify that the requirements for this concentration have been met.

Appendix C

Letters of Support for Concentration

Electrical and Computer Engineering

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Electrical and Computer Engineering
William L. Everitt Laboratory
1406 West Green Street
Urbana, IL 61801-2991



July 16, 2014

Senate Committee on Educational Policy
608 South Wright Street
Urbana, IL 61801

Dear Members of the Senate Educational Policy Committee:

The Department of Electrical and Computer Engineering supports the creation of Concentration in Biomechanics to be offered through the Department of Bioengineering. The concentration courses listed below will count toward the graduate degree programs in our Department. When choosing courses, graduate students intending to pursue the certificate must work directly with our Department to ensure that all degree requirements will be met. We will consider additional proposed courses on a case-by-case basis.

ABE 446	Biological Nanoengineering
BIOE 406	Bone Biology and Biomechanics
BIOE 479	Cancer Nanotechnology
ME/BIOE 461	Cellular Biomechanics
ME/BIOE 482	Musculoskeletal Tissue Mechanics
ME 483	Mechanobiology
MSE 474	Biomaterials and Nanomedicine
PHYS 475	Biological Physics
PHYS 550	Biomolecular Physics

We believe that the integration of biological sciences with physical and applied sciences is instrumental to adequate training in Biomechanics and that those graduate students in our Department who choose to pursue this field would benefit from the proposed concentration.

Sincerely,


William H. Sanders
Interim Department Head
Donald Biggar Willett Professor of Engineering

telephone 217-333-2300 • fax 217-244-7075

Materials Science and Engineering

Appendix C Letters Indicating that Courses can Absorb Students

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Materials Science and Engineering

College of Engineering
1304 West Green Street
Urbana, IL 61801



David G. Cahill
Willett Professor and Head

(Tel) 217-333-6753
(Fax) 217-333-2736
email: d-cahill@illinois.edu

July 14, 2014

To the Members of the Senate Educational Policy Committee:

The Department of Materials Science Engineering supports the creation of Concentration in Biomechanics to be offered through the Department of Bioengineering. The concentration courses listed below will count toward the graduate degree programs in our Department. When choosing courses, graduate students intending to pursue the certificate must work directly with our Department to ensure that all degree requirements will be met. We will consider additional proposed courses on a case-by-case basis.

ABE 446	Biological Nanoengineering
BIOE 406	Bone Biology and Biomechanics
BIOE 479	Cancer Nanotechnology
ME/BIOE 461	Cellular Biomechanics
ME/BIOE 482	Musculoskeletal Tissue Mechanics
ME 483	Mechanobiology
MSE 474	Biomaterials and Nanomedicine
PHYS 475	Biological Physics
PHYS 550	Biomolecular Physics

We believe that the integration of biological sciences with physical and applied sciences is instrumental to adequate training in Biomechanics and that those graduate students in our Department who choose to pursue this field would benefit from the proposed concentration.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Cahill'.

David Cahill
Willett Professor and Head
Department of Materials Science and Engineering
University of Illinois at Urbana-Champaign

Agricultural and Biological Engineering (ABE)

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Department of Agricultural and Biological Engineering

College of Agricultural, Consumer and Environmental
Sciences and College of Engineering
338 Agricultural Engineering Sciences Building
1304 W. Pennsylvania Avenue
Urbana, IL 61801



July 14, 2014

Members of the Senate Educational Policy Committee:

The Department of Agricultural and Biological Engineering supports the creation of a Concentration in Biomechanics to be offered through the Department of Bioengineering. The ABE concentration course listed below does have the capacity to enroll approximately 5-7 additional students per year. If enrollment surpasses course capacity, we will work with the Bioengineering Department to hire a TA or make other arrangements as necessary. We will consider additional proposed courses on a case-by-case basis.

ABE 446 Biological Nanoengineering

Sincerely,

A handwritten signature in blue ink, appearing to read 'K.C. Ting'.

K.C. Ting
Professor and Head
Department of Agricultural and Biological Engineering

*Telephone 217-333-3570 * fax 217-244-0323*
*Email abe@illinois.edu * url <http://abe.illinois.edu>*

Materials Science and Engineering (MSE)

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Materials Science and Engineering

College of Engineering
1304 West Green Street
Urbana, IL 61801



David G. Cahill
Willett Professor and Head

(Tel) 217-333-6753
(Fax) 217-333-2736
email: d-cahill@illinois.edu

July 14, 2014

To the Members of the Senate Educational Policy Committee:

The Department of Materials Science Engineering supports the creation of Concentration in Biomechanics to be offered through the Department of Bioengineering. The MSE concentration course listed below does have the capacity to enroll approximately 5-7 additional students per year. If enrollment surpasses course capacity, we will work with the Bioengineering Department to hire a TA or make other arrangements as necessary. We will consider additional proposed courses on a case-by-case basis.

MSE 474

Biomaterials and Nanomedicine

Sincerely,



David Cahill
Willett Professor and Head
Department of Materials Science and Engineering
University of Illinois at Urbana-Champaign

Physics (PHYS)

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Physics
Loomis Laboratory of Physics
1110 West Green Street
Urbana, IL 61801-3080



August 19, 2014

Educational Policy Committee
Faculty Senate
University of Illinois at Urbana-Champaign

To Members of the Senate Educational policy Committee:

The Department of Physics supports the creation of Concentration in Biomechanics to be offered through the Department of Bioengineering. The PHYS concentration courses listed below do have the capacity to enroll approximately 5-7 additional students per year. If enrollment surpasses course capacity, we will work with the Bioengineering Department to hire a TA or make other arrangements as necessary. We will consider additional proposed courses on a case-by-case basis.

PHYS 475	Biological Physics
PHYS 550	Biomolecular Physics

Sincerely,

Dale J. Van Harlingen
Head and Professor of Physics

211 Loomis Laboratory of Physics • (217) 333-0904 • dvh@illinois.edu

Appendix D

Statements for Programs of Study Catalog

Electrical and Computer Engineering

The Biomechanics Concentration prepares students for collaborative research across the disciplines of engineering, biology, and the sciences. Students must be enrolled in a graduate degree program from one of the participating Departments (Bioengineering, Electrical and Computer Engineering, Materials Science and Engineering, and Mechanical Science and Engineering). The Biomechanics Concentration requires students to earn a B or better in each concentration course and complete at least 12 hours. Fulfillment of these requirements will be monitored jointly by the graduate coordinators in Bioengineering and in Mechanical Science and Engineering.

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MSE 474	Biomaterials and Nanomedicine	3 hours
PHYS 475	Biological Physics	4 hours
PHYS 550	Biomolecular Physics	4 hours
TAM 461	Cellular Biomechanics	4 hours

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Courses taken toward this concentration will count toward the student's graduate degree. Students must notify their department of their plan to pursue this concentration. When choosing courses, students must work directly with their Department to ensure that all degree requirements will be met.

Materials Science and Engineering

The Biomechanics Concentration prepares students for collaborative research across the disciplines of engineering, biology, and the sciences. Students must be enrolled in a graduate degree program from one of the participating Departments (Bioengineering, Electrical and Computer Engineering, Materials Science and Engineering, and Mechanical Science and Engineering). The Biomechanics Concentration requires students to earn a B or better in each concentration course and complete at least 12 hours. Fulfillment of these requirements will be monitored jointly by the graduate coordinators in Bioengineering and in Mechanical Science and Engineering.

Current course options include:

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MSE 474	Biomaterials and Nanomedicine	3 hours
PHYS 475	Biological Physics	4 hours
PHYS 550	Biomolecular Physics	4 hours
TAM 461	Cellular Biomechanics	4 hours

Alternate courses may be applicable to the Biomechanics Concentration pending joint approval by the Bioengineering and the Mechanical Science and Engineering Graduate Programs. Please note that students who intend to complete both a Biomechanics Concentration and a Cancer Nanotechnology Concentration may only overlap one course between the two concentrations.

Courses taken toward this concentration will count toward the student's graduate degree. Students must notify their department of their plan to pursue this concentration. When choosing courses, students must work directly with their Department to ensure that all degree requirements will be met.



Senate Educational Policy Committee Proposal Check Sheet

PROPOSAL TITLE (Same as on proposal): Establish a Graduate Concentration in "Biomechanics" jointly in the Departments of Bioengineering and Mechanical Science and Engineering, College of Engineering

PROPOSAL TYPE (select all that apply below):

A. Proposal for a NEW or REVISED degree program. Please consult the Programs of Study Catalog for official titles of existing degree programs.

1. Degree program level:

Graduate Professional Undergraduate

2. Proposal for a new **degree** (e.g. B.S., M.A. or Ph.D.):

Degree name, "e.g., *Bachelor of Arts or Master of Science*": _____

3. Proposal for a new or revised **major, concentration, or minor**:

New or Revised **Major** in (name of existing or proposed major): _____

New or Revised **Concentration** in (name of existing or proposed concentration):
Biomechanics

New or Revised **Minor** in (name of existing or proposed minor): _____

4. Proposal to rename an existing major, concentration, or minor:

Major Concentration Minor

Current name: _____

Proposed new name: _____

5. Proposal to terminate an existing degree, major, concentration, or minor:

Degree Major Concentration Minor

Name of existing degree, major, or concentration: _____

6. Proposal involving a multi-institutional degree:

New Revision Termination

Name of existing Illinois (UIUC) degree: _____

Name of non-Illinois partnering institution: _____

Location of non-Illinois partnering institution:

State of Illinois US State: _____ Foreign country: _____

- B. Proposal to create a new academic unit (college, school, department, program or other academic unit):

Name of proposed new unit: _____

- C. Proposal to rename an existing academic unit (college, school, department, or other academic unit):

Current name of unit: _____

Proposed new name of unit: _____

- D. Proposal to reorganize existing units (colleges, schools, departments, or program):

1. Proposal to change the status of an existing and approved unit (e.g. change from a program to department)

Name of current unit including status: _____

2. Proposal to transfer an existing unit:

Current unit's name and home: _____

Proposed new home for the unit: _____

3. Proposal to merge two or more existing units (e.g., merge department A with department B):

Name and college of unit one to be merged: _____

Name and college of unit two to be merged: _____

Proposed name and college of new (merged) unit: _____

4. Proposal to terminate an existing unit:

Current unit's name and status: _____

- E. **Other educational policy proposals** (e.g., academic calendar, grading policies, etc.)

Nature of the proposal: _____

Revised 10/2012

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN

EP.15.64

Office of the Provost and Vice Chancellor
for Academic Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820



March 17, 2015

Gay Miller, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Miller:

Enclosed is a copy of a proposal from the College of Engineering to establish a Graduate Concentration in Biomechanics.

Sincerely,

A handwritten signature in cursive script that reads 'Kathryn A. Martensen'.

Kathryn A. Martensen
Assistant Provost

Enclosures

c: J. Hart
A. McKinney
W. Wimmer
C. Finnegan
R. Bashir
W. Buttlar
P. Ferreira
D. Leckband
R. McElroy
M. Taher Saif
A. Edwards

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Graduate College

204 Coble Hall
801 South Wright Street
Champaign, IL 61820-6210



RECEIVED
MAR 17 2015
Office of the Provost

Executive Committee

March 16, 2015

2014-2015 Members

Sarah Lubienski, Interim
Dean & Chair
Graduate College

Kathy Martensen
Office of the Provost
207 Swanlund MC-304

Members

Abbas Aminmansour
Architecture

Dilip Chhajed
Business Administration

Dear Kathy,

Enclosed please find the proposal to establish a Graduate Concentration in Biomechanics jointly in the Departments of Bioengineering and Mechanical Science and Engineering. The proposal was received at the Graduate College on January 27, 2015. It was reviewed by the Program Subcommittee on February 24, 2015. At that meeting it was approved to move forward to the Executive Committee pending clarification of one item:

Wojciech Chodzko-Zajko
Kinesiology & Community
Health

- The proposal now makes clear that courses from the Cancer Nanotechnology concentration (which includes courses also in this concentration's program) can be used to complete this concentration.

Susan Cole
Social Work

The revised proposal was received on March 4, 2015. It explains that students who intend to complete both a Biomechanics Concentration and a Cancer Nanotechnology Concentration may only overlap one course between the two concentrations. The proposal was forwarded to the Executive Committee and approved at their March 10, 2015 meeting. I send it to you now for further review.

John D'Angelo
Mathematics

Nicki Engeseth
Food Science & Human
Nutrition

Sincerely,

Cara A. Finnegan
Interim Associate Dean
Graduate College

Susan Fowler
Special Education

Marie Heffernan
Psychology

Paul Hergenrother
Chemistry

Jack Juvik
Crop Sciences

c: R. Bashir
W. Buttlar
P. Ferreira
D. Leckband
R. McElroy
A. McKinney
M. Taher Saif

Samantha Knoll
Mechanical Science &
Engineering

John Lambros
Aerospace Engineering

Glaucio Paulino
Civil & Environmental
Engineering

Dana Rabin
History

Carla Santos
Recreation, Sport and
Tourism

Renée Trilling
English

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

College of Engineering
Executive Committee
306 Engineering Hall, MC-266
1308 West Green Street
Urbana, IL 61801



January 21, 2015

Associate Dean Alejandro Lugo
Graduate College
204 Coble Hall
MC-322

Via: Andreas Cangellaris, Engineering College

Dear Dean Lugo:

The College of Engineering Executive Committee has reviewed and approved the following proposal:

**Graduate Concentration in "Biomechanics" jointly in the Department
of BioEngineering and Mechanical Science and Engineering, College of
Engineering**

Attached is a copy of the request

Sincerely yours,

A handwritten signature in cursive script that reads "David A. Ruzic".

David Ruzic, Vice Chair
Executive Committee

Approval Recommended:

A handwritten signature in cursive script, likely belonging to Andreas Cangellaris.

Andreas Cangellaris, Dean
College of Engineering

1-21-2015

Date

DR/rd

Bill Buttlar
Rhonda McElroy
Rashid Bashir
Placid Ferreira

Deborah Leckband
M. Taher Saif