

Adopted: March 11, 2008

**ACADEMIC SENATE  
of  
CALIFORNIA POLYTECHNIC STATE UNIVERSITY  
San Luis Obispo, CA**

**AS-664-08**

**RESOLUTION ON  
NEW MASTERS OF SCIENCE DEGREE IN  
BIOMEDICAL ENGINEERING**

- 1 WHEREAS, The Biomedical and General Engineering Department is proposing the  
2 implementation of a Masters of Science in Biomedical Engineering to be taught in  
3 addition to the Biomedical Engineering specialization in the Masters of Science in  
4 Engineering degree; and  
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- 6 WHEREAS, The existing specialization and BS degrees in Biomedical Engineering are very  
7 popular and strongly supported by the Dean of Engineering and the biomedical  
8 industry; and  
9
- 10 WHEREAS, The Academic Senate Curriculum Committee has carefully considered this  
11 proposal and recommends its approval; and  
12
- 13 WHEREAS, A summary of the proposal is attached to this resolution with the full proposal  
14 available in the Academic Senate office; therefore be it  
15
- 16 RESOLVED: That the Academic Senate of Cal Poly approve the proposal for a Masters of  
17 Science in Biomedical Engineering and that the proposal be sent to the  
18 Chancellor's Office for final approval.

Proposed by: Academic Senate Curriculum Committee  
Date: January 2, 2008  
Revised: February 5, 2008

## Cal Poly, San Luis Obispo

### Summary Statement of Proposed New Degree Program for Review by Academic Senate

#### 1. Title of Proposed Program.

Master's of Science in Biomedical Engineering

#### 2. Reason for Proposing the Program.

Currently, students can obtain a Master's of Science in Engineering with a specialization in biomedical engineering. This specialization has been on-going since 2000. The specialization was developed as a means to satisfy student demand without a formal program in biomedical engineering. It has been our intention that when a biomedical engineering department was formed, we would offer a Master's of Science in Biomedical Engineering. The Biomedical Engineering Program is now established and the MS in Engineering Specialization program is wildly popular with students within the College of Engineering, and other colleges at Cal Poly (primarily Science and Math). Furthermore, there is a profound interest from industry. Currently, we have enrolled our third distance learning cohort of students at St. Jude Medical with Abbott expressing interest in beginning a similar distance learning program at their site. All of these factors portend that the time for having a formal Master's of Science degree is now.

#### 3. Anticipated Student Demand.

	Number of Students		
	<u>at initiation</u>	<u>3 years after initiation</u>	<u>5 years after initiation</u>
<sup>1</sup> Number of Majors	60	90	120
Number of Graduates	15	35	50

**Notes:** 1. Of the student number projections for the BMED MS, approximately 40% are at St. Jude Medical in Sylmar and Sunnyvale.

#### 4. Indicate the kind of resource assessment used in developing the program proposal. If additional resources will be required, the summary should indicate the extent of department and/or college commitment(s) to allocate them.

We have examined the library resources and believe that the program can be supported by current subscriptions, textbooks, and the interlibrary loan program. In fall 2007, we have 5 new faculty as well as the support of the Dean to add

additional faculty. We have examined space allocation and have a commitment to use interdisciplinary space in Engineering IV for meeting some of the demands for space needed to support the program. We have made use of current space allocations by creating multi-purpose laboratory space that can easily be configured for a diverse set of laboratory experiences.

**5. If the program is occupational or professional, summarize evidence of need for graduates with this specific education background.**

The very nature of this complex, multidisciplinary field almost necessitates that students obtain a graduate degree. Biomedical engineering combines engineering expertise with medical needs for the enhancement of health care. It is a branch of engineering in which knowledge and skills are developed and applied to define and solve problems in biology and medicine. Students choose the biomedical engineering field to be of service to people; for the excitement of working with living systems; and to apply advanced technology to the complex problems of medical care. The biomedical engineer is a health care professional, a group which includes physicians, nurses, and technicians. Biomedical engineers may be called upon to design instruments and devices, to bring together knowledge from many sources to develop new procedures, or to carry out research to acquire knowledge needed to solve new problems. Graduates with the MS in Engineering continue to find excellent employment, with about 20 to 30 percent going on the medical schools and doctoral studies. The continued popularity of the distance learning program with industry demonstrates that industry believes that there is a chronic need engineers to have an MS degree in biomedical engineering.

**6. If the new program is currently a concentration or specialization, include a brief rationale for conversion.**

We intend to keep the current specialization in BMED as an option for students who desire additional flexibility as well as providing a degree opportunity for those who prefer a non-thesis MS. The current concentration was proposed to meet student and industry demand before a Biomedical Engineering Program existed. The overwhelming demand indicates that a named master's program will serve both students and our industrial partners.

**7. If the new program is not commonly offered as a bachelor's or master's degree, provide compelling rationale explaining how the proposed subject area constitutes a coherent, integrated degree major which has potential value for students. If the new program does not appear to conform to the CSU Board of Trustee policy calling for "broadly based programs," provide rationale:**

N/A

**8. Briefly describe how the new program fits with the department/college/university strategic plans.**

The MS in Biomedical Engineering provides a viable means to create tangible growth within the college and university by attracting students who would otherwise not come to Cal Poly. It provides a logical means for students from other engineering programs to specialize in biomedical engineering. Industry members are attracted to the program because it provides a means for obtaining a master's degree at their workplace. While other institutions offer distance learning programs, ours is synchronous, and is less expensive than private institutions. Further, Cal Poly benefits from this arrangement on many levels; for example, our students have greater access to the industry through cooperative education and internships as well as obtaining full time employment.

## Curriculum

### Total number of units required for the major.

45 units minimum

At least half of the units are 500 level

Up to nine (9) units of thesis

A list of all courses *required* for the major, specifying catalog number, *title*, units of credit, and prerequisites or co-requisites (ensuring that there are no "hidden" prerequisites that would drive the total units required to graduate beyond the total reported in 4c above).

Required Course	Units	Prerequisite
BMED 460 – Engineering Physiology	4	ZOO 331, BMED 310
BMED 512 – Biomedical Engineering Horizons	4	MATH 143, CHEM 125, PHYS 131, BIO 161
BMED 530 – Biomaterials	4	BIO 213, ENGR 213, MATE 213
BMED 550 – Current and Evolving Topics in Biomedical Engineering	4	Graduate Standing or Consent
BMED 563 – Biomedical Graduate Seminar	2	Graduate Standing or Consent
BMED 599 – Design Project (Thesis), BMED 591, BMED 592 can sub for 2 or 4 units of thesis or project	9	Graduate Standing

List of *elective* courses that can be used to satisfy requirements for the major, specifying catalog number, title, units of credit, and prerequisites or co-requisites. Include proposed catalog descriptions of all new courses.

For graduate program proposals, identify whether each course is a graduate or undergraduate offering.

Elective Courses (18 units)	Units	Prerequisites
Any BMED or ENGR Course at 400 or 500 level	Varied	varied
BIO 441 Bioinformatics Applications (4)	4	BIO 111 or 161
BIO 426 Immunology	4	BIO 351
BIO 432 Vertebrate/Human Anatomy I	5	BIO 361
BIO 433 Vertebrate/Human Anatomy II	5	BIO 361
BIO 452 Cell Biology	5	BIO 351 or CHEM 371 and CHEM 312 or CHEM 317
BIO 501 Cell & Molecular Biology	4	Graduate Standing
BIO 502 Biology of Organisms	4	BIO 501
BIO 542 Multivariate Biometry	4	2 courses in statistics
CHEM 544 Polymer Physical Chemistry and Analysis	3	CHEM 351
CHEM 545 Polymer Synthesis and Mechanisms	3	CHEM 317
CHEM 547 Polymer Characterization and Analysis Laboratory	2	CHEM 544
CHEM/MATE 446 Surface Chemistry of Materials	3	CHEM 305 or 351, or engr thermodynamics
CHEM 473 Immunochemistry	3	CHEM 371 or consent
CHEM 478 Pharmaceutical Development	3	CHEM 318
CSC 448 Bioinformatics Algorithms	4	CSC/CPE 103 or BIO 447
CE 504 Advanced Finite Element Analysis I	4	CE 501 or consent of instructor
CE 505 Advanced Finite Element Analysis II	4	CE 504
EE 513 Control Systems Theory	4	EE 301 or consent of instructor
EE 514 Advanced Topics in Automatic Control	4	EE 513
IME 437 Advanced Human Factors Engineering	3	IME 319, IME 326
ME 402 Orthopedic Biomechanics	4	ME 328 or consent
ME 404 Applied Finite Element Analysis	4	ME 329
ME 501 Continuum Mechanics and Linear Elasticity	4	ME 401 or consent
ME 502 Finite Element Analysis	4	ME 501 or consent
ME 503 Inelastic Stress Analysis	4	ME 501 or consent

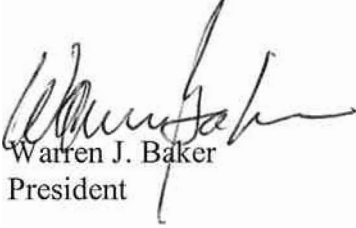
STAT 513 Applied Experimental Design and Regression Models	4	One of the following: STAT 512, STAT 217, STAT 218, STAT 221, STAT 252, STAT 312, or equivalent.
STAT 530 Statistical Computing I: SAS	4	One of the following: STAT 512, STAT 513, STAT 542
STAT 542 Statistical Methods for Engineers	4	MATH 142
MATH 418 – Partial Differential Equations	4	MATH 344, MATH 304 Recommended
MCRO 423 – Medical Microbiology	5	MCRO 225 and CHEM 312 or CHEM 316
MCRO 402 – General Virology	4	BIO 351 or CHEM 373
KINE 406 – Neuroanatomy	4	ZOO 331, ZOO 332
KINE 445 – Electrocardiography	4	KINE 303 or consent
ZOO 428 Hematology	4	BIO 351

This list is not meant to be by any means exhaustive, but rather a small sampling of some acceptable courses. There are many other acceptable courses from many other disciplines. The students will develop a detailed formal study plan in consultation with their graduate advisor.

State of California  
**Memorandum**

To: Bruno Giberti  
Chair, Academic Senate

Date: March 25, 2008

From:   
Warren J. Baker  
President

Copies: W. Durgin  
M. Noori  
D. Walsh  
S. Opava  
D. Conn  
M. Whiteford

Subject: Response to Academic Senate Resolution AS-664-08  
Resolution on New Masters of Science Degree in Biomedical Engineering

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I am pleased to approve the above-entitled resolution. The proposal will now be sent to the Chancellor's office for approval.

Please express my appreciation to the Academic Senate members for their attention to this important curricular matter.