

ATTACHMENT 3C-1

LETTER OF NOTIFICATION – 3

NEW OPTION, CONCENTRATION, EMPHASIS

(Maximum 18 semester credit hours of new theory courses and 6 credit hours of new practicum courses)

1. Institution submitting request: University of Arkansas, Fayetteville
2. Contact person/title: Sharon Gaber/Provost and Vice Chancellor for Academic Affairs
3. Phone number/e-mail address: (479)575-5459/sgaber@uark.edu
4. Proposed effective date: July 1, 2012
5. Title of degree program: PhD in Engineering
6. CIP Code: 14.0101
7. Degree Code: 7230
8. Proposed option/concentration/emphasis name: Biomedical Engineering
9. Reason for proposed action:

Biomedical Engineering is a field at the interface of engineering, medicine and biological sciences. It combines the practical problem solving ability of engineering to diagnostic, monitoring, and therapy needs of medical sciences. Even though engineers have designed medical devices for a long time, Biomedical Engineering has only been established as a discipline within the past two decades.

The evolution of academic disciplines often follows the sequence of first being a multi-disciplinary program evolving into an interdisciplinary program and then becoming a discipline in itself with a variety of sub-disciplines. Biomedical Engineering has followed that path and is now widely recognized as a separate discipline within engineering. In the United States, an undergraduate degree in Biomedical Engineering is offered at 99 universities of which three are in the SEC, but none in Arkansas. The SEC schools offering Biomedical Engineering include the University of Tennessee, University of South Carolina and Vanderbilt.

The Biomedical education and research at the University of Arkansas is currently embedded within the department of Biological and Agricultural Engineering which reports to both the College of Engineering and to the Dale Bumpers College of Agriculture and Food and Life Sciences. Undergraduate students have the opportunity to choose Biomedical Engineering as a concentration within a BS degree in Biological Engineering. This stream produces approximately ten such graduates per year. A MS degree in Biomedical Engineering was initiated in 2004 and was accredited by ABET (the national engineering accreditation board) in 2009. The number of graduates in this program range from two to three per year. Doctoral students can choose Biomedical Engineering as a research area but their degree is recognized within the Biological Engineering PhD concentration.

The numbers of graduates at all degree levels with biomedical concentration at the University of Arkansas have been much lower than the national averages. In the past ten years, enrollments at the national level in Biomedical Engineering programs have increased by more than 200% while the overall engineering enrollment increases during the same period have only been at the level of

approximately 20%. Similar impressive increases in students have also occurred at the MS and PhD levels. Significantly larger numbers of female students and faculty are attracted to this discipline because of the exciting career opportunities in the health care field. The time is right for the University of Arkansas to re-examine its position on Biomedical Engineering and develop stand-alone degrees at all levels (BS, MS and PhD). This proposal is for creating a new concentration in Biomedical Engineering within the existing PhD degree in Engineering. There are parallel proposals for creating a new undergraduate major in Biomedical Engineering and moving the existing MS degree in Biomedical Engineering into the proposed new Department of Biomedical Engineering and thereby create exciting educational opportunities in Biomedical Engineering for Arkansans at all levels.

10. New option/concentration/emphasis objective:

The Biomedical Engineering concentration for the Ph.D. degree in Engineering will be an interdisciplinary research degree awarded through the College of Engineering in cooperation with the Graduate School at the University of Arkansas. The Ph.D. degree is earned through advanced coursework and in-depth, specialized research. Graduates from this program will be well-prepared for research and/or teaching careers in academia, industry or government or as entrepreneurs in technology-based start-up companies.

11. Provide the following:

a. Curriculum outline - List of required courses

The following is a brief list of the degree requirements for the Ph.D. Concentration in Biomedical Engineering.

1. Complete at least **42 hours of graduate credits** with a minimum of **36 hours of coursework** beyond the BS degree.
2. Complete **30 hours of dissertation**. Students holding a MS degree may transfer up to 6 thesis hours with approval of their advisory committee.
3. Pass the **candidacy exam**.
4. Complete two semesters of **teaching assistant** assignments.
5. Submit and defend the final **dissertation**.

Coursework Requirements:

Students are required to complete 42 credit hours of coursework beyond the BS degree in engineering or equivalent in the following four categories. NOTE: A maximum of 4 credit hours of Special Problems listings or any other catalog offering which does not have a regular meeting schedule/syllabus may be used to fulfill coursework requirements.

(i) Biomedical Engineering (BMEG) – minimum of 17 credit hours

- The following three core courses (9 credit hours) are required for every student.
 - a) BMEG 5203 Mathematical Modeling of Physiological Systems or a graduate level modeling or applied mathematics course with biomedical focus
 - b) BENG 5103 Advanced Instrumentation or a graduate level instrumentation with biomedical focus
 - c) BENG 5703 Experimental Design and the Statistical Analysis of Experimental Data for Engineering Research
- Two courses (6 credit hours minimum) must be chosen from BMEG 5000-6000 level courses. (BMEG 5801 Graduate Seminar cannot be counted for this requirement.)
- Two semesters (2 credit hours) of BMEG 5801 Graduate Seminar.

(ii) Life Science – minimum of 6 credit hours

- Coursework must be chosen from the life sciences with the approval of the student's advisory committee.

(iii) Engineering Electives – minimum of 9 credit hours

- Coursework must be chosen from engineering with the approval of the student's advisory committee.

(iv) Electives – minimum of 6 credit hours

- Coursework must be chosen with the approval of the student's advisory committee.

b. New course descriptions

BMEG 5801 Graduate Seminar

Course Description: A weekly seminar series comprised of presentations by invited speakers and graduate students as well as didactic instruction in relevant topics including professional development, research ethics, authorship, technology transfer, intellectual property, biosafety, and the use of animals in biomedical research.

Prerequisite: Graduate standing

Objective:

- To learn about cutting edge biomedical engineering research from leaders in academia, government and industry
- To provide a forum for students to practice presentation skills and receive feedback on their research
- To engage students in discussions about the ethical and legal responsibilities of biomedical engineers

Textbook: None

c. Program goals and objectives

The Ph.D. Degree in Engineering with a concentration in Biomedical Engineering is earned through advanced coursework and in-depth, specialized research. This program prepares students to pursue research and/or teaching careers in academia, industry or government or as entrepreneurs in technology-based start-up companies.

d. Expected student learning outcomes

Our graduates will have the ability to:

- Apply math, science and engineering concepts to formulate and solve biomedical engineering problems, design and conduct scientific experiments and analyze and interpret the resulting data.
- Effectively communicate scientific and engineering results to audiences with a broad range of technical knowledge.
- Use the techniques, skills, and modern science and engineering tools necessary to pursue biomedical engineering practice, research and/or teaching in academia, industry or government or as entrepreneurs in technology-based start-up companies.

12. Will the new option be offered via distance delivery? No

13. Mode of delivery to be used: On campus

14. Explain in detail the distance delivery procedures to be used: N/A

15. Is the degree approved for distance delivery? No

16. List courses in option/concentration/emphasis. Include course descriptions for new courses.

See section 11 above.

17. Specify the amount of the additional costs required, the source of funds, and how funds will be used.

No additional costs required.

President/Chancellor Approval Date:

Board of Trustees Notification Date:

Chief Academic Officer

Date: