Annual Graduate Program Report

Biomedical Engineering Department (BMEG)
University of Arkansas

Degree Programs:
Biomedical Engineering (MSBME, non-thesis)
Biomedical Engineering (MSBME, thesis)
Doctor of Philosophy (PhD) in Engineering

Report Period
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PROGRAM GOALS FOR BMEG MS AND PHD PROGRAMS

Program goals are broad general statements of what the program intends to accomplish and describes what a student will be able to do after completing the program. The program goals are linked to the mission of the university and the new strategic plan[1] of the College of Engineering (COE).

Accordingly, the program goals of the MS and PhD programs in Biomedical Engineering at the University of Arkansas, Fayetteville are to produce graduates that are capable of:

1. Succeeding in practice at the interface between life science and engineering, or in other professional activities, or in post-master's or Ph.D. studies.
2. Utilizing their advanced engineering education in creating new knowledge or enabling technologies for improvement of human health and healthcare.
3. Continuously upgrading their knowledge in their chosen specialty by initiating self-directed learning.

STUDENT LEARNING OUTCOMES

Student Learning Outcomes are defined in terms of the knowledge, skills, and abilities that students will know and be able to do as a result of completing a program. These student learning outcomes are directly linked to the accomplishment of the program goals.

The graduates of the MS and PhD programs in Biomedical Engineering will either be capable of the following or possess the following attributes:

1. Conceiving, designing, analyzing, and implementing systems, processes and experiments related to improving human health and healthcare.
2. Functioning in multidisciplinary teams to find effective solutions to complex technical problems and/or the design of new products and processes to improve human health and health care.
3. Using modern analytical, simulation, and diagnostic tools and techniques used in healthcare industry.
4. In-depth and up-to-date knowledge within a specialized field in Biomedical Engineering.
5. An understanding of ethical and professional responsibility.
6. To effectively communicate their findings/ideas to a technical and non-technical audience.

The prescribed outcomes of the MSBME are met through the curriculum followed by the students.

[1] https://engineering.uark.edu/about-us/strategic-plan

PROCESS FOR ASSESSING STUDENT LEARNING OUTCOMES

A process must be defined and documented to regularly assess student learning and achievement of student learning outcomes. The results of the assessment must be utilized as input for the improvement of the program.

The process for assessing student outcomes (MS and PhD) are outlined in **Table 1**. The specific outcomes that each assessment measures are also listed.

Table 1. Student outcomes assessment matrix.

	Outcome 1: Conceiving, designing, analyzing, and implementing systems, processes and experiments related to improving human health and healthcare.	**Outcome 2:** Functioning in multidisciplinary teams to find effective solutions to complex technical problems and/or the design of new products and processes to improve human health and health care.	**Outcome 3:** Using modern analytical, simulation, and diagnostic tools and techniques used in healthcare industry.	**Outcome 4:** In-depth and up-to-date knowledge within a specialized field in Biomedical Engineering.	**Outcome 5:** An understanding of ethical and professional responsibility	**Outcome 6:** To effectively communicate their findings/ideas to a technical and non-technical audience
Graduating student cumulative GPA				x		
Annual student academic review				x		
Assessment of student performance in core graduate classes: **BMEG 5103** Design and Analysis of Experiments in Biomedical Research **BMEG 5203** Mathematical Modeling of Physiological Systems **BMEG 5504** Biomedical Microscopy	x x	x	x x			
Participation in graduate seminar					x	x
Comprehensive examination (MS non-thesis), Thesis (MS) Candidacy Exam (PhD) and Dissertation defense (PhD)	All outcomes					
Exit interviews	All outcomes					
Employment data	All outcomes					

PROGRAM ASSESSMENT RESULTS

1. Graduating student cumulative GPA (cGPA) – Outcome 4

Table 2 provides the results from all students graduating with a MS or PhD degree in the 2015-2016 academic year. The metric for success is for 90% of students to achieve at least a 3.0 cGPA. Based on the data below, we have achieved the stated criterion.

Table 2. Cumulative GPA for graduating BMEG students in AY2015-2016.

Degree	Student Name	Graduating Term	cGPA
MS (thesis)	Qusay Alfaori	1159	4.0
MS (non-thesis)	Annika Tabassum	1163	3.7
MS (thesis)	Josh Hutcheson	1163	3.0

2. Annual student academic review – Outcome 4

Table 3 provides the results from the 2016 annual academic review. Students are required to annually get feedback from their major advisor with regard to their progress toward graduation. The graduate school form provides for a rating of satisfactory or unsatisfactory. The metric for success is for 90% of students to achieve at least a "satisfactory" outcome. Review of this year's data shows that all students are making satisfactory progress.

Table 3. Annual student academic reviews

Academic Year	Number Satisfactory	Number Unsatisfactory
2015-2016	20	0

3. Assessment of student performance in core graduate classes

Student performance in the Core Graduate Classes as listed in Table 1 will be used to measure success in this particular assessment criterion. Each core class will be assessed via a specific assessment rubric compiled in **Appendix A** of this report.

3.1 BMEG 5103: Design and Analysis of Experiments in Biomedical Research – Outcome 1

A single exam or homework problem was identified which requires the student to conceive, design, analyze and implement systems relating to human healthcare. The criteria for success in this metric was for 90% of the students to achieve a score of 70% or more. As per the results detailed in **Appendix A.1**, we have achieved this metric. Representative student reports for this specific metric are on file in the BMEG Department and can be made available upon request.

3.2 BMEG 5203: Mathematical Modeling of Physiological Systems – Outcome 3

Data was not available for assessing this particular course in Academic Year 2015/2016.

3.3 BMEG 5504: Biomedical Microscopy – Outcomes 2 and 3

Students in this class are required to work on a team project and present a final project report and oral presentation on a microscopy technology that is currently utilized in Healthcare. The criteria for success in this metric was for 90% of the students to achieve a score of 70% or more. As per the results detailed in **Appendix A.2**, we have achieved this metric. Representative student reports for this specific metric are on file in the BMEG Department and can be made available upon request.

4. Participation in graduate seminar – Outcomes 5 and 6

All BMEG graduate students are required to enroll in the BMEG5800/01 (Fall) and BMEG5810/11 (Spring) Graduate Seminar classes each semester, excluding the Summer semester. Students are also required to give either a research presentation or a chalk-talk seminar once per year. This will ensure that MS students give at least 2 presentations, and PhD students will give at least 4-5 presentations prior to their graduation. In the 2015-2016 academic year, all graduate students have enrolled for the seminar class and have presented in-class at least once.

5. Comprehensive examination (MS non-thesis), Thesis defense (MS thesis), Candidacy examination (PhD) and Dissertation defense (PhD) – All Outcomes

The comprehensive exam (MS), candidacy exam (PhD) and dissertation defense (PhD) are key assessment metrics for a graduate student in the BMEG program. Students will graduate only if they pass these assessment points. These examinations are meant to test achievement of the student in all the Outcomes listed in **Table 1**. The MS thesis defense, PhD qualifying exam and PhD dissertation defense are assessed using grading rubrics available on file in the BMEG Department, and on the BMEG website.[2]

5.1 MS Comprehensive Examinations (Non-Thesis and Thesis)

All students in the BMEG MS Program must pass a comprehensive examination. Students may retake a failed comprehensive exam once upon the approval of the student's Thesis Committee (for Thesis option) or Advisory Committee (for Non-thesis option). A student who fails the comprehensive examination twice will be terminated from the program. Under no circumstances will a student be allowed to take the comprehensive examination more than twice.

5.1.1 MS Non-Thesis Comprehensive Examinations

For the Non-thesis option, the comprehensive examination is an extensive written test of knowledge comprised of topics covered by the Biomedical Engineering Graduate Core courses. The comprehensive examination for the Non-thesis option is administered by the Program Advisory Committee. **Table 4** compiles the list of students who have completed their MS non-thesis Comprehensive Examination.

Table 4. MS Non-Thesis Comprehensive Examination results.

Student Name	Term	Candidacy Status
Annika Tabassum	1163	Pass

5.1.2 MS Thesis Defense

For the Thesis option, the comprehensive examination is an oral defense of the Master's thesis. The student is expected to demonstrate technical competence in the field directly related to the thesis research as well as a broader understanding of biomedical engineering research and the

[2] http://biomedical-engineering.uark.edu/academics/student-resources.php

scientific method. The oral defense also assesses the student's ability to respond to questions in a rational, knowledgeable manner. The comprehensive examination for the Thesis option is administered by the Thesis Committee, and success of this metric is determined by the fact the student passed. **Table 5** compiles the list of students who have completed their MS Thesis Defense.

Table 5. MS Thesis Defense Completed.

Student Name	Term	Candidacy Status
Qusay Alfaori	1159	Pass
Joshua Hutcheson	1163	Pass

5.2 PhD Candidacy Examination

The candidacy examination/dissertation proposal is the first step in meeting the dissertation requirement. The Ph.D. candidacy examination consists of both written and oral components not only covering general didactic knowledge in biomedical engineering but also measuring the student's potential preparedness in a narrowly focused area sufficient to propose a rigorous research plan. The written component is a proposal encompassing the student's dissertation research. The oral component is a presentation of the written proposal. The candidacy exam assesses the student's understanding of the proposed research area, and why the proposed research plan is the most appropriate and practical approach given the current state of scientific understanding and the available resources. The Advisory Committee will assess the student's preparedness for continuation in the doctoral program. Final approval of the proposal is given by the student's Program Advisory Committee. **Table 6** below gives a list of the PhD candidates who passed their candidacy exams this reporting year.

Table 6. PhD Candidacy Examination results.

Student Name	Term	Candidacy Status
Asya Ozkizilcik	1163	Pass
Nasya Sturdivant	1163	Pass

5.3 PhD Dissertation Defense

The PhD Dissertation Defense is a written and oral presentation of the dissertation to the Dissertation Committee. The candidate is tasked with constructing a convincing scientific argument which demonstrates: 1) the ability to clearly define a biomedical engineering research problem; 2) technical competency within his/her field; and 3) an understanding of the impact of the project relative to a broader scientific field. Success in this metric is determined by the fact the student passed. There were no PhD graduates in the 2015-2016 academic year.

6. Exit interviews – All Outcomes

Exit interviews are conducted by the BMEG Department Head the semester of graduation. The following students graduated in the 2015-2016 academic year.

Table 7. Employment data for graduating students.

Degree	Student Name	Graduating Term	Advisor
MS (thesis)	Qusay Alfaori	1159	Saxena
MS (non-thesis)	Annika Tabassum	1163	Balachandran
MS (thesis)	Josh Hutcheson	1163	Muldoon

Exit interview data was not available for the three graduating students.

7. Employment Data – All Outcomes

Employment data for all students is compiled below. All graduating students were able to obtain gainful employment or continuation in professional/advanced degree programs within one month of graduation.

Table 8. Employment data for graduating students.

Degree	Student Name	Graduating Term	Current Position, Employer
MS (thesis)	Qusay Alfaori	1159	Ph.D. student, UAF BMEG
MS (non-thesis)	Annika Tabassum	1163	M.D. student, UAMS
MS (thesis)	Joshua Hutcheson	1163	Engineer 1, Maynard Inc.

APPENDIX A.1 – BMEG 5103 ASSESSMENT RUBRIC

BMEG Graduate Program Assessment			
Outcome: (1) Conceiving, designing, analyzing, and implementing systems, processes and experiments related to improving human health and healthcare.			
Course Information			
Course Number	**Course Title**	**Semester**	**Enrollment**
BMEG 5103	Design and Analysis of Experiments	Spring 2016	12
Direct Measure of Student Achievement [Only BMEG graduate students]	A single exam or homework problem will be identified which requires the student to conceive, design, analyze and implement systems relating to human healthcare. ***Question:*** The purpose of this assignment is to project the types of statistical analyses you will perform in your own research careers. Describe two different experiments with two different statistical analyses. Display a table or graph describing what you think the data will look like. For each data set answer/describe the following: • Describe the experiment: o What was measured? o What were the independent and dependent variables? o How many groups? o How many observations? • What statistics were performed? o What was assumed? o Were statistical tests appropriate?		

Assessment							
Student	**Score**		**Student**	**Score**		**Student**	**Score**
1	81.47						
2	99.33						
3	94.87						
4	99.55						
5	96.43						
6	96.21						
7	92.19						
8	98.88						
9	95.31						
10	95.98						
11	90.40						
12	99.00						

Number obtaining 70% or more of total points	**12**	**Percent of students meeting criteria *(target: 90%)***	**100%**
Instructor:	Priya Puvanakrishnan		
		Signature	

APPENDIX A.2 – BMEG 5504 ASSESSMENT RUBRIC

BMEG Graduate Program Assessment			
Outcome: (2) Functioning in multidisciplinary teams to find effective solutions to complex technical problems and/or the design of new products and processes to improve human health and health care. (3) Using modern analytical, simulation, and diagnostic tools and techniques used in healthcare industry.			
Course Information			
Course Number	**Course Title**	**Semester**	**Enrollment**
BMEG 5504	Biomedical Microscopy	Fall 2015	6
Direct Measure of Student Achievement [Only BMEG graduate students]	Scores from students' final presentations will be tabulated. The scoring rubric is attached below (graded out of 50 points). ***Question:*** **One significant design project will be assigned during the course of the semester. Each laboratory group will also work together for this project. Graduate students will be required to use laboratory facilities for their projects.**		

Assessment							
Student	**Score**		**Student**	**Score**		**Student**	**Score**
1	46						
2	46						
3	48						
4	48						
5	44						
6	44						

Number obtaining 70% or more of total points	**6/6**	**Percent of students meeting criteria** ***(target: 90%)***	**100%**
Instructor:			
		Signature	