Biomedical Engineering Program Assessment Plan

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Program Learning Objectives

1. Students should be able to draw upon basic knowledge in science and mathematics to address engineering problems in a biomedical context.

a. Demonstrate a working knowledge of the basic principles of chemistry, physics, calculus through differential equations and linear algebra, and biology, and demonstrate intermediate knowledge in a focused area within the biological sciences.

b. Demonstrate ability to apply basic science concepts as foundations to biomedical engineering analysis or design.

2. Students should be able to apply principles of engineering analysis to solve problems in medicine and biology.

a. Demonstrate ability to solve general engineering analysis problems and problems related to medicine and biology.

b. Demonstrate ability to use computational tools (e.g., spreadsheets, structured programming languages, analysis and data acquisition software, and simulation software) and to write logical algorithms.

3. Students should have knowledge of fundamental methods of engineering design and be able to apply design principles to solve problems in medicine and biology.

a. Demonstrate ability to design a process, component, or system to meet a specific biomedical need.

b. Demonstrate ability to solve open-ended problems.

4. Students should be able to apply the scientific method as a means to obtain a mechanistic understanding of biomedical processes.

a. Demonstrate ability to make measurements and record results.

b. Demonstrate ability to analyze results of measurements for significance.

c. Demonstrate awareness of common sources of error in experimental measurements.

d. Demonstrate ability to generate a hypothesis, and to design and/or use experimental procedures to test hypotheses.

5. Students should display good team working skills and be able to make coherent public presentations of their work.

a. Demonstrate ability and willingness to use teamwork in problem solving.

b. Demonstrate the ability to communicate effectively in oral and poster presentations.

c. Demonstrate the ability to communicate effectively in written reports of an engineering or scientific analysis or experiment.

d. Demonstrate ability to use research tools such as electronic databases of scientific articles.

6. Students should understand and practice professionalism and have well-defined career plans.

a. Articulate a workable plan of action to achieve a career as a practicing engineer or to achieve admission to graduate or professional school.

b. Demonstrate an appreciation of social responsibilities, ethics, and professionalism.

7. Students should demonstrate an awareness of the process, value, and potential of research in biomedical engineering.

a. Make effective use of the research literature in projects and reports.

b. Participate in research activities.

Program Outcome 1. Students should be able to draw upon basic knowledge in science and mathematics to address engineering problems in a biomedical context.

Performance Criteria	Contributing Courses	Assessment Methods	Context for Assessment
a. Demonstrate a working knowledge of the basic principles of chemistry, physics, calculus through differential equations and linear algebra, and biology, and demonstrate intermediate knowledge in a focused area within the biological sciences.	MTH141, MTH161/142 MTH162/143 MTH163/165 MTH164 CHM131/132 PHY121/122 BIO110 Basic Science Electives	Grades in BIO110; Selected grades on homework assignments; Grades in Biological courses taken as part of Basic Science Elective requirement; survey	BIO110 BME230 One of the following: BIO203 BIO204 CHM203 CHM204 BIO198
b. Demonstrate ability to apply basic science concepts as foundations to biomedical engineering analysis or design.	BME101, BME201 ECE210/BME210 BME221, BME230 BME260, BME295/296	Selected grades on homework assignments, final projects, and midterm exams; survey	BME260 BME201 BME210

Program Outcome 2. Students should be able to apply principles of engineering analysis to solve problems in medicine and biology.

Performance Criteria	Contributing Courses[1]	Assessment Methods	Context for Assessment
a. Demonstrate ability to solve general engineering analysis problems and problems related to medicine and biology.	BME101,BME201, BME230, BME260, BME295/296	Grades on selected homework problems; Homework grades; Mid-term Exams; Design Reports; Surveys	BME201 BME230 BME260 BME296 EBI Survey
b. Demonstrate ability to use computational tools (e.g., spreadsheets, structured programming languages, analysis and data acquisition software, and simulation software) and to write logical algorithms.	BME101, BME201,BME201L, BME221, BME230, BME260, BME295/296	Computing assignments; Final exam grade on programming concepts; Computer Lab grades; Lab reports; Surveys	BME101 BME201L BME221 BME260 EBI Survey Alumni Survey

[1] Students are also exposed to principles of engineering analysis within a specialty area of biomedical engineering in a required upper-level BME course, e.g. BME218, BME228, BME251, BME262, BME270, and BME283.

Program Outcome 3. Students should have knowledge of fundamental methods of engineering design and be able to apply design principles to solve problems in medicine and biology.

Performance Criteria	Contributing Courses[1]	Assessment Methods	Context for Assessment
a. Demonstrate ability to design a process, component, or system to meet a specific biomedical need.	ECE210/BME210, BME201, BME230, BME295/296	Selected grades on problems and lab exercises; senior design projects; survey	BME230 BME295/296 EBI Survey

b. Demonstrate ability to solve open-ended problems.	BME101, BME201, BME230, BME295/296	Select homework assignments; survey	BME201 EBI Survey

[1] Students are also exposed to open ended problems within a specialty area of biomedical engineering in required upper-level BME courses, e.g. BME218, BME228, BME251, BME262, BME270, and BME283.

Program Outcome 4. Students should be able to apply the scientific method as a means to obtain a mechanistic understanding of biomedical processes.

Performance Criteria	**Contributing Courses[1,2]**	**Assessment Methods**	**Context for Assessment**
a. Demonstrate ability to make measurements and record results	ECE210/BME210, BME230, BME260, BME295/296	Selected grades on lab exercises; lab exam; survey	BME260 BME210 EBI Survey
b. Demonstrate ability to analyze results of measurements for significance	BME101, BME221, ECE210/BME210, BME230, BME260, BME295/296	Select homework assignments; survey	BME221 EBI Survey
c. Demonstrate awareness of common sources of error in experimental measurements.	ECE210/BME210, BME230, BME260, BME295/296	Selected grades on lab exercises	BM260
d. Demonstrate ability to generate a hypothesis, and to design and/or use experimental procedures to test hypotheses.	BME230, BME260, BME295/296	Lab report for open ended assignment in which students design an experiment to test a hypothesis; survey	BME230 EBI Survey

[1] In addition to the courses listed, all students take the following lab courses: BIO110, BIO111, CHEM131/151, CHM132/152 and PHY121, PHY122, plus two upper-level basic science courses, one of which must have a lab component.

[2] Students are also exposed to the scientific method within a specialty area of biomedical engineering in a required upper-level BME course, e.g. BME218, BME228, BME251, BME262, BME270, and BME283.

Program Outcome 5. Students should display good team working skills and be able to make coherent public presentations of their work.

Performance Criteria	Contributing Courses[1]	Assessment Methods	Context for Assessment
a. Demonstrate ability and willingness to use teamwork in problem solving	BME101, BME201L, BME210, BME230, BME260, BME295/296	Peer Assessments; group dynamics essay; survey	BME 295/296 EBI Survey
b. Demonstrate the ability to communicate effectively in oral and poster presentations	BME101, BME201L, BME295/296	Poster presentations; team presentations, individual oral presentations; survey	BME 101 BME 295/6 EBI Survey
c. Demonstrate the ability to communicate effectively in written reports of an engineering or scientific analysis or experiment.	BME201, BME 221, BME230, BME260, BME295/296	Selected grades on lab reports; term papers; proposals; written design reports; survey	BME 260 BME 295/6 EBI Survey
d. Ability to use research tools such as electronic databases of scientific articles	BME101, BME260, BME295/296	Selected assignments; survey	BME 295/6 EBI Survey

[1] Students also develop presentation and communication skills within a specialty area of biomedical engineering in a required upper-level BME course, e.g. BME218, BME228, BME251, BME262, BME270, and BME283.

Program Outcome 6. Students should understand and practice professionalism and have well-defined career plans.

Performance Criteria	Contributing Courses[1]	Assessment Methods	Context for Assessment
a. Articulate a workable plan of action to achieve a career as a practicing engineer or to achieve admission to graduate or professional school.	BME101, BME295/296	Resumes Career planning form Surveys Plans after Graduation	BME295 EBI Survey
b. Demonstrate an appreciation of social responsibilities, ethics, and professionalism	BME101, BME221, BME260, BME295/296	Homework problem Ethics quiz Surveys	BME101 BME 296 EBI Survey

[1] Students are also exposed to principles of professionalism and ethics within a specialty area of biomedical engineering in a required upper-level BME course, e.g BME218, BME228, BME251, BME262, BME270, and BME283.

Program Outcome 7. Demonstrate an awareness of the process, value and potential for research in biomedical engineering.

Performance Criteria	Contributing Courses[1]	Assessment Methods	Context for Assessment
a. Make effective use of the research literature in projects and reports.	BME101, BME201, BME260,BME295/296	Final Project; Research-related problems; Term paper	BME101 BME201 BME260
b. Participation in research activities.	BME391, BME394, and Lab Positions	Surveys	EBI and Senior Exit Surveys

[1] Students are also exposed to research methods within a specialty area of biomedical engineering in a required upper-level BME course, e.g. BME218, BME228, BME251, BME262, BME270, and BME283.