Program-Level Assessment: Annual Report

Program: Biomedical Engineering	Department: Engineering
Degree or Certificate Level: B.S.	College/School: Parks College of Engineering, Aviation, and Technology
Date (Month/Year): October 2020	Primary Assessment Contact: Scott Sell
In what year was the data upon which this report is based collected? AY 2019 - 2020	
In what year was the program's assessment plan most recently reviewed/updated? 2020	

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle?

In this annual cycle we assessed all five of our stated HLC student learning outcomes. Because our ABET accreditation cycle requires outcomes to be assigned to courses, each year of a 3 year cycle (2 cycles per ABET review) we look at a different set of courses each year. This year the courses that were common to both the ABET and University assessment processes were BME 2000, 3150, 3300, 3400, 4600, 4950, and 4960.

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

BME artifacts include specific homework, quiz and exam questions, specific sections of reports from projects, oral presentations, poster presentations and prototypes of student's designs. We also have extensive student survey data, but survey data is not included in this report. For AY 2019-2020 we collected artifacts from the following courses: BME 2000, 3150, 3300, 3400, 4600, 4950, and 4960

None of the artifacts were collected from courses online, at the Madrid campus, or other off-campus locations

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and include them in/with this report.

Faculty review the artifacts and assign scores, generally 0-100 and reflecting the degree to which each artifact corresponds to the desired response. Artifact scores are converted to the letters A, B and C according to our rubric, where an A corresponds to greater than 80% of the artifacts received a passing score (>70%), B corresponds to greater than 60% of the artifacts received a passing score, and C corresponds to less than 60% of the artifacts received a passing score.

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

SLO 1: Graduates will be able to apply knowledge of i) math, ii) science, iii) engineering and iv) empirical data to solve engineering problems. This outcome was assessed through artifact collection in five courses across sophomore, junior, and senior level courses. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

SLO 2: Graduates will be able to function on multi-disciplinary teams. This outcome was assessed through artifact collection in four courses representing junior and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

SLO 3: Graduates will demonstrate an understanding of professional and ethical responsibility. This outcome was assessed through artifact collection in three courses representing junior and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

SLO 4: Graduates will be able to communicate effectively. This outcome was assessed through artifact collection in five courses representing sophomore, junior, and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

SLO 5: Graduates will be able to solve problems in biological systems using i) engineering skills and tools, and ii) empirical measurements and data from living and nonliving systems. This outcome was assessed through artifact collection in five courses representing sophomore, junior, and senior levels. In each of these courses the outcome was assessed to be at Level-A achievement (>80% of the artifacts received passing scores).

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

Our data suggests that the students are achieving the desired level of performance with respect to each of our assessed outcomes.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

Faculty discuss the assessment and scoring of outcomes annually.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

Based upon high student achievement of outcomes we are not planning for changes to curriculum. However we are currently working to generate official scoring rubrics for each outcome and associated areas of focus. We are also working to change outcomes in alignment with a change implemented by ABET. This will take place over the next year and begin in Fall 2021.

If no changes are being made, please explain why.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

In recent years we have eliminated the use of student self-evaluations and survey data from our assessments.

B. How has this change/have these changes been assessed?

Data has been collected entirely through student generated artifacts in courses.

C. What were the findings of the assessment?

We found that there was little value in the student evaluations of our outcomes, which was supported by ABET, and that it was much more meaningful to evaluate the student generated artifacts rather than have them comment on how well they felt outcomes were achieved.

D. How do you plan to (continue to) use this information moving forward?

Yes, we plan to continue to rely exclusively on student generated artifacts.

IMPORTANT: Please submit any assessment tools and/or revised/updated assessment plans along with this report.

BME Form 3.5 Faculty Course Evaluation

Course Number: BME2000
Course Title: BME Computing
Semester: Fall 2019
Instructor: Dr. Garg
Date : 09/17/2020 **Department Review Date:** ___________

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	1	2	1	2	1	8	2	4	6	22

Assessment of Student Outcomes

For each student outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(a): This course contributes to our students' ability to apply knowledge of mathematics, science, and engineering.

Methods: (1, 2, 3) Students used MATLAB® to solve engineering problems in class exercises (not graded), lab exercises, homework, quizzes, projects, and exams. Students applied knowledge of algebra, trigonometry, calculus, simple electrical circuits, statics and dynamics as well as basic concepts of chemistry and physics to solve problems.

- Lab Exercises (11 assignments): 86.99%; 46/49 > 70% (Level A)
- Homework average (2 assignments): 83.53%; 40/49 > 70% (Level A)
- Quiz average (3 quizzes): 70.85%; 30/49 > 70% (Level B)
- Mid-term Exam average: 80.79%; 37/49 > 70% (Level A)
- Final exam average: 90.97%; 43/49 > 70% (Level A)
- Project – 99.52%, 49/49 >70% (Level A)

(c): This course contributes to our students' ability to design a system, component, or process to meet desired needs.

Methods: (1, 2, 3) Students used MATLAB® to create user-defined functions for use in their own programming projects (lab exercise 8, HW 3). 2D and 3D filter design were also introduced to filter noisy signals and images (lab exercise 7). Students also learned to obtain a mathematical description of data using curve fitting and interpolation. Simulink was introduced for modeling, simulating, and analyzing systems. Students also chose one out of two projects to work on. The project options included modeling skeletal muscle's viscoelastic properties in MATLAB and simulating a traffic light signal by running a Simulink model on an Arduino board.

- Lab Exercise 7 – 92.18%, 47/49 > 70% (Level A)
- Lab Exercise 8 – 93.23%, 47/48> 70% (Level A)
- Lab Exercise 11 – 90.24%, 45/49 > 70% (Level A)
- Project – 99.52%, 49/49 >70% (Level A)

(e): **This course contributed to your ability to identify, formulate, and solve engineering problems.**

Methods: (1, 2, 3) The course introduced students to formulate problems using multidimensional numeric arrays in MATLAB® and using in-built as well as user-defined functions and script M-files to solve engineering problems. The students also learned to develop mathematical models of data or develop MATLAB® solutions to problems for which the model has already been developed. Problem solving with matrix algebra, including dot products, cross-products and the solution of linear systems of equations were discussed. Numerical methods for calculus and differential equations were also covered and students were introduced to the symbolic mathematics package.

- Lab Exercise 1 – 97.44%, 49/49 > 70% (Level A)
- Lab Exercise 2 – 92.59%, 48/49 > 70% (Level A)
- Lab Exercise 3 – 92.58%, 48/48 > 70% (Level A)
- Lab Exercise 4 – 85.4%, 43/48 > 70% (Level A)
- HW 1 – 96.15%, 44/45 > 70% (Level A)
- HW 2 - 89.21%, 42/47 > 70% (Level A)
- Project – 99.52%, 49/49 >70% (Level A)

(g): **This course contributes to our students' ability to communicate effectively.**

Methods: (1, 2, 3) Students were encouraged to add comments that describe their MATLAB code. The use of comments and code-sections also helped students in program development and testing in all lab exercises and HW assignments. The use of built-in MATLAB® input and output commands were introduced to allow a user to communicate with a written program as it executes (lab exercise 6).

- Lab Exercise 6 – 84.72%, 41/49 > 70% (Level A)
- Please see other section (a) for average of all lab exercises, project, and HW.

(k): **This course contributes to our students' ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**

Methods: (1, 2, 3) Students learned to create programs and debug them in MATLAB®. They learned the use of logical functions, conditional statements and repetition structures. Reading and writing data from text files and excel spreadsheets in MATLAB® was discussed. Graphical techniques for 2D or 3D plotting and visualization of data were presented. Curve fitting models and techniques were also discussed. Simulink was introduced for modeling, simulating, and analyzing systems.

- Lab Exercise 5 – 90.55%, 45/47 > 70% (Level A)
- Lab Exercise 6 – 84.72%, 41/49> 70% (Level A)
- Lab Exercise 9 – 92.26%, 47/48 > 70% (Level A)
- Lab Exercise 10 – 87.10%, 42/47 > 70% (Level A)
- Lab Exercise 11 – 90.24%, 45/49 > 70% (Level A)
- HW 2 - 96.15%, 44/45 > 70% (Level A)

Table F3.5-1: Summary of Student and Faculty Evaluation

Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

	Student (40/40; 100% Response Rate)				Faculty	
Outcome	**Average (1-5)**	**%A or SA**	**%NA**	**Level**	**Phase-1 Level**	**Overall Level**

Faculty Assessment: This course introduces students to the MATLAB programming environment and helps them develop algorithms and computer programs that address biomedical engineering problems. The course provides a foundation in programming and teaches how to apply the analysis tools in MATLAB to 1D and 2D data.

This semester was a significant improvement over previous ones. The content and pace of class was tailored based on student performance. For instance, more lecture time and HW assignments were dedicated to topics that students found difficult in the previous two semesters. Students would benefit from some additional lectures/exercises on Simulink and repetition structures. The inclusion of two group projects at the end of the semester was appreciated by the students.

BME Form 3.5 Faculty Course Evaluation

Course Number: **BME 3300**
Course Title: **Transport Fundamentals**
Semester: **Fall 2019**
Instructor: **Natasha Case**
Date : ________ **Department Review Date:** ________________

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	0	0	0	2	2	9	5	13	12	17

Assessment of Student Outcomes

For each student outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(a): This course contributes to our students' ability to apply knowledge of mathematics, science, and engineering.
Methods: 1, 7

- Homework assignments, quizzes, and exams - applying and solving mathematical expressions in engineering problems related to fluid, heat, or mass transfer (Cumulative Homework Score: Level A with 60/60 students > 70%; Cumulative Quiz Score: Level A with 60/60 students > 70%; Exam 1 Score: Level A with 52/60 students > 70%; Comprehensive Final Exam Score: Level B with 42/60 students > 70%)
- Class participation – qualitative and/or quantitative analysis of various types of transport situations during the class meeting, with answer submission frequently using Top Hat app (Cumulative Participation Score: Level A with 60/60 students > 70%)

(e): This course contributes to our students' ability to identify, formulate, and solve engineering problems.
Methods: 1, 2

- Homework assignments and exams – solving a variety of engineering problems related to fluid, heat or mass transfer (Cumulative Homework Score: Level A with 60/60 students > 70%; Cumulative Quiz Score: Level A with 60/60 students > 70%; Exam 1 Score: Level A with 52/60 students > 70%; Comprehensive Final Exam Score: Level B with 42/60 students > 70%)
- Computational Modeling Case Studies (Optional Assignment) – students complete a series of three molar transport case studies using the COMSOL computational modeling software (Cumulative Score: Level A with 20/20 students > 70%)

(g): This course contributes to our students' ability to communicate effectively.

Methods: 4, 5

- Group oral report – group presentation that provides a summary and transport-based analysis of a biomedical engineering/medical application, device or topic. This assignments helps students develop their oral presentation skills and learn how to present technical content. (Cumulative Score – Level A with 49/49 > 70%)
- Writing assignment – promotes the ability to read and comprehend an engineering manuscript, and importantly to translate understanding about a technical text into a written report (Cumulative Score – Level A with 51/51 > 70%)

(j): This course contributes to our students' knowledge of contemporary issues.
Methods: 4, 5

- Group oral report – choosing their own topic and being required to use multiple sources to prepare the report allows students to acquire knowledge about a relevant transport-related application. Viewing reports by other groups further expands knowledge of current applications (Cumulative Score – Level A with 49/49 > 70%)
- Writing assignment – choosing their own article to review gives students knowledge about current research in the field, and how engineering analysis can address medical problems (Cumulative Score – Level A with 51/51 > 70%)

Table F3.5-1: Summary of Student and Faculty Evaluation

Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

	Student (N/A)				**Faculty**	
Outcome	**Average (1-5)**	**%A or SA**	**%NA**	**Level**	**Phase-1 Level**	**Overall Level**

Faculty Assessment:

BME Form 3.5 Faculty Course Evaluation

Course Number: BME4600
Course Title: Quantitative Physiology 1
Semester: Fall 2019
Instructor: Dr. Sell
Date : 1/06/2020 **Department Review Date:** ______________

Course Grade Distribution

Grade	I	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	0	0	0	0	0	0	2	6	9	18	12

Assessment of Program Outcomes
For each program outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(b): This course contributes to our students' ability to design and conduct experiments, as well as to analyze and interpret data.
Methods: 1, 3, 4, 5, 7
Throughout the course, lecture materials rely heavily on dialogue and discussion to promote class engagement and active learning. This is particularly true in areas relating to excitable cell physiology (Chapter 3), muscle physiology (Chapter 3), and the sensory systems (Chapter 4). With these particular chapters we spend significant time discussing how to create an experiment to acquire information from excitable cells. Specific examples include a student team oral presentation on the Hodgkins-Huxley model of action potential propatation. Other specific examples include team-based design projects on the reverse engineering and improved design of bionic hands, or the team-based design and prototyping of a sports-specific safety helmet. These projects and topics provide the students an opportunity to experience physiology through the lens of an engineer, and to think critically about how engineers can collect, interpret, and utilize physiologic data.

(e): This course contributes to our students' ability to identify, formulate, and solve engineering problems.
Methods: 3, 4, 5, 7
While the lectures promote active learning through a number of different mechanisms, including interactive discussion of various engineering problems associated with human physiology and pathology, the most obvious example for this criterion is the written report and associated documents for students to complete the "Bionic Hands Reverse Engineering" project. For this project students are provided a video of an advanced bionic hand in use. They are tasked with reverse engineering the hand, providing a detailed explanation of the engineering that went into its use and fabrication, and then using their engineering skills to suggest improvements to the design of the hand. Other examples include projects on design of a sports-specific helmet, and projects on improving hemodialysis using engineering principles as the primary discussion point. These projects are designed to promote student problem solving using the engineering tools that they have acquired throughout their education.

(i): **This course contributes to our students' recognition of the need for, and an ability to engage in life-long learning.**
Methods: 3, 4, 5, 7
Class discussions on emerging engineering technologies are one tool used to promote life-long learning. Other tools include a series of team-based oral presentations that students provide on various technologies in the realm of human physiology (i.e. cochlear implants, cataracts, intraocular lenses, etc.) that promote student curiosity about the topic. Cultivation of inherent curiosities is a technique employed to promote life-long learning, especially when provided in the context of engineering technologies that are emerging to prevent or remedy various human pathologies.

(k): **This course contributes to our students' ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**
Method: 1, 3, 4, 5, 7
The course is designed to teach students about the interface of human physiology and engineering. The team-based projects already described ("Bionic Hand", "Sports Helmet", and "Hemodialysis Design") all teach students how to take an engineering approach to problem solving.

(l): **This course contributes to our students' understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology.**
Methods: 1, 3, 4, 5, 7
The course is a quantitative approach to teaching engineers human physiology. The textbook, homeworks, and exam problems all emphasize mathematical-based problem solving, while the design projects and oral presentations already described work to reinforce the concepts of human physiology and how it interfaces with engineering and technology.

(m): **This course contributes to our students' ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.**
Methods: 3, 4, 5, 7
The course has several components that involve interpreting data and collecting data (both team-based oral presentations and team-based design projects previously described). There is also significant class discussion focused on "where did this data come from?"; "how was this data obtained?"; "what is empirical data?"; "as engineers how can we use this data?".

Table F3.5-1: Summary of Student and Faculty Evaluation

Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

	Student (28/40,70% Response Rate)				Faculty	
Outcome	Average (1-5)	%A or SA	%NA	Level	Phase-1 Level	Overall Level
b	-	-	-	-	A	A
e	-	-	-	-	A	A
i	-	-	-	-	A	A
k	-	-	-	-	A	A
l	-	-	-	-	A	A
m	-	-	-	-	A	A

Faculty Assessment:

Reflections on BME 4600 Quantitative Physiology I in Fall 2019:

Fall 2019 was the fifth time that I have delivered the BME 4600 Quantitative Physiology I course at Saint Louis University and is really the first time that I haven't drastically changed some aspect of the course. I always tweak and refine the content, but the overall structure this semester remained the same as previous years. The basis of the course is always the presentation of human physiology through the lens of the engineer in a quantitative manner. As an instructor I emphasize active learning in my classroom, and work diligently to promote student engagement in the educational process. This culminates in a large amount of discussion in class, dialogue-heavy lectures, as well as active learning experiences and experiential learning opportunities.

Generally student response to the course has been extremely positive. I routinely have students comment about the heavy workload of the course, but state that they enjoy the topics we cover, the projects we do, and the experiences we have in the classroom. Student opinion generally indicates that despite the heavy workload and the complexity of the homework they enjoy the course and indicate that they have gained valuable knowledge and skills for their careers as biomedical engineers. They enjoy seeing the connections between the biology, math, physiology and engineering that we promote in the course.

Going forward I will continue to refine the course, and plan to continue to include more active learning experiences for the students. While some students did complain about having to give oral presentations during the class, they did feel that it was a valuable exercise. These assignments may be modified to improve student performance. Additionally, homework assignments may be modified to provide students with more immediate feedback. Additionally, I will look into incorporating more physiology experiments (from somewhere like Pasco) to promote more data collection, interpretation and analysis.

BME Form 3.5 Faculty Course Evaluation

Course Number: **BME4950**
Course Title: **Senior Project**
Semester: **Fall 2019**
Instructor: **Bledsoe**
Date : 01/15/2019 **Department Review Date:** ________________

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	0	0	0	0	0	0	2	2	16	20

Assessment of Student Outcomes
For each student outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(a): This course contributes to our students' ability to apply knowledge of mathematics, science, and engineering.

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the Oral presentation (Phase-1.4), written Report and the Proposal (Phase-1.5)**
    - PDR – Design Solution (40/40, ME or EE; Level-A)
    - PDR – Calibration (32/40, ME or EE; Level-A)
    - PDR Report (40/40 >70% Level-A)
    - Proposal – Problem Statement (38/40 > 70%; Level-A)

(b): This course contributes to our students' ability to design and conduct experiments, as well as to analyze and interpret data.

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the Oral presentation (Phase-1.4), written Report and the Proposal (Phase-1.5)**
    - PDR – Design Solution (40/40, ME or EE; Level-A)
    - PDR – Calibration (32/40, ME or EE; Level-A)
    - PDR Report (40/40 >70% Level-A)

(c): This course contributes to our students' ability to design a system, component, or process to meet desired needs.

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the Oral presentation (Phase-1.4), written Report (Phase-1.5)**
  - PDR – Design Solution (40/40, ME or EE; Level-A)
  - PDR – Calibration (32/40, ME or EE; Level-A)
  - PDR Report – Specs (38/40 >70% Level-A)
  - PDR Report (40/40 >70% Level-A)

(d): This course contributes to our students' ability to function on multi-disciplinary teams.

Methods: 5, 6, 7

- **Written team application, team reviews (Phase-1.6 & 1.7) and written report (Phase-1.5)**
  - Team Application & Resume (40/40>70% Level-A)
  - Team Peer Assessment (38/40 >70% Level-A)
  - PDR Report (40/40 >70% Level-A)

(e): This course contributes to our students' ability to identify, formulate, and solve engineering problems.

Methods: 3, 4, 5

- **Homework (Phase-1.1). This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the Oral presentation (Phase-1.4), written Report and the Proposal (Phase-1.5)**
  - PDR – Response to Questions (33/40, ME or EE; Level-A)
  - Proposal – Problem Statement (38/40 > 70%; Level-A)
  - PDR – Design Solution (40/40, ME or EE; Level-A)
  - PDR Report (40/40 >70% Level-A)

(f): **This course contributes to our students' understanding of professional and ethical responsibility.**

Methods: 1, 3, 5

- **Homework (Phase-1.1). Essay and oral discussion of current biomedical engineering topics through the review of a relevant book (Phase-1.5). This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Report and the case study reviews (Phase-1.5)**
  - Review of ethics case studies (40/40 >70% Level-A)
  - PDR Report – Social/Ethical (40/40 >70% Level-A)

(g): **This course contributes to our students' ability to communicate effectively.**

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Report (Phase-1.5) and the oral presentation (Phase-1.4).**
  - PDR – Organization (40/40, ME or EE; Level-A)
  - PDR – Visuals (40/40, ME or EE; Level-A)
  - PDR – Mechanics (40/40, ME or EE; Level-A)
  - PDR – Delivery 39/40, ME or EE; Level-A)
  - PDR – Content Knowledge (35/40, ME or EE; Level-A)
  - PDR – Response (35/40, ME or EE; Level-B)
  - PDR Report (40/40 >70% Level-A)

(h): **This course contributes to the broad education necessary for students to understand the impact of engineering solutions in a global and societal context.**

Methods: 3, 5

- **Essay and oral discussion of current biomedical engineering topics through the written review of case studies (Phase-1.5). This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Report.**
  - Review of ethics case studies (40/40 >70% Level-A)
  - PDR Report – Social/Ethical (39/40 >70% Level-A)

(i): **This course contributes to our students' recognition of the need for, and an ability to engage in life-long learning.**

Methods: 3, 5

- **Evoke recognition of the need to keep up to date with current engineering developments through written review of case studies and oral discussion of current biomedical engineering topics (Phase-1.5).**
  - Review of ethics case studies (40/40 >70% Level-A)
  - PDR Report – Social/Ethical (39/40 >70% Level-A)

(j): **This course contributes to our students' knowledge of contemporary issues.**

Methods: 1, 3, 5

- **Homework (Phase-1.1). Essay and oral discussion of current biomedical engineering topics through the review of case studies (Phase-1.5). This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Feasibility Report and the Proposal (Phase-1.5)**
  - Review of ethics case studies (40/40 >70% Level-A)
  - PDR Report – Social/Ethical (39/40 >70% Level-A)
  - PDR Report – Market (35/40 >70% Level-A)

(k): **This course contributes to our students' ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**

Methods: 3

- **Project/Demo (Phase-1.3). This method is based on grades from laboratory experiments or course projects. Demonstration of one function of final project with instrumentation to show.**
  - End of Semester Demo (35/40 >70% Level-A)

(l): **This course contributes to our students' understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology.**

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Report and the Proposal (Phase-1.5)**
  - PDR – Design Solution (40/40, ME or EE; Level-A)
  - PDR – Calibration (32/40, ME or EE; Level-A)

(m): **This course contributes to our students' ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.**

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Report and the Proposal (Phase-1.5)**
  - PDR – Design Solution (40/40, ME or EE; Level-A)
  - PDR – Calibration (32/40, ME or EE; Level-A)

Table F3.5-1: Summary of Student and Faculty Evaluation
Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

	Student (N/A)				Faculty	
Outcome	**Average (1-5)**	**%A or SA**	**%NA**	**Level**	**Phase-1 Level**	**Overall Level**
a					**A**	**A**
b					**A**	**A**
c					**A**	**A**
d					**A**	**A**
e					**A**	**A**
f					**A**	**A**
g					**A**	**A**
h					**A**	**A**
i					**A**	**A**
j					**A**	**A**
k					**A**	**A**
l					**A**	**A**
m					**A**	**A**

Commented [SAS1]: This portion is left empty since we no longer do student outcome assessments with an end of course survey.

Faculty Assessment: Great semester. Students following directions and producing quality documentation and prototyping. Still having some issues with Customer Requirements. Will consider using Ken Herold, SLU Start, for defining customer requirements, expectations, and specifications in the future.

BME Form 3.5 Faculty Course Evaluation

Course Number: **BME 3150**
Course Title: **Biomedical Instrumentation**
Semester: **Spring 2020**
Instructor: **Dr. Gai**
Date: **10/24/2020** **Department Review Date:** ________________

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	0	2	0	0	1	3	4	5	9	37

Assessment of Student Outcomes
For each student outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(c): **This course contributes to our students' ability to design a system, component, or process to meet desired needs.**
Methods: Homework (Phase-1.1)
- Homework average (96% of students > 70%, Level-A)

(d): **This course contributes to our students' ability to function on multi-disciplinary teams.**
Methods: Laboratory (Phase 1.3)
- Measure Electrocardiogram using Bioradio (95% of students > 70%, Level-A)

(f): **This course contributes to our students' understanding of professional and ethical responsibility.**
Methods: Portfolios (Phase-1.6), class participation (Phase-1.7)
- Design a product catalog, extra-credit work (60% of students finished the project, Level-B)
- Class participation (82% of students "meets expectations", Level-A)

(j): **This course contributes to our students' knowledge of contemporary issues.**
Methods: Homework (Phase-1.1)
- Homework average (96% of students > 70%, Level-A)

(l): **This course contributes to our students' understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology.**
Methods: Homework, quizzes, exams (Phase-1.1)

- Homework average (96% of students > 70%, Level-A)
- Quiz average (97% of students > 70%, Level-A)
- Exam average (98% of students > 70%, Level-A)

(m): **This course contributes to our students' ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.**
Methods: Homework, quizzes, exams (Phase-1.1)

- Homework average (96% of students > 70%, Level-A)
- Quiz average (97% of students > 70%, Level-A)
- Exam average (98% of students > 70%, Level-A)

Table F3.5-1: Summary of Student and Faculty Evaluation
Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

BME 305	Student (43/50; 86% Response Rate)				Faculty	
Outcome	**Average (1-5)**	**%A or SA**	**%NA**	**Level**	**Phase-1 Level**	**Overall Level**
a						
b						
c					A	A
d					A	A
e						
f					A	A
g						
h						
i						
j					A	A
k						
l					A	A
m					A	A

Faculty Assessment:

The nature of Biomedical Instrumentation is to cover a large range of materials, including sensors, amplifiers, filters, and various electrical, mechanical, and chemical measurements. I tried to group the topics and focus on a few themes.

We had a group laboratory lecture that was well received. Students formed groups of five, and one of them acted as the "patient". They measured ECG signals of this subject before and after the subject performed a 5-min physical exercise; then they performed signal processing and statistical tests at home. Another lab-based lecture, in which I was going to demonstrate a whole experiment of acquiring EEG signals from a student volunteer, had to be canceled due to the interruption of the COVID 19.

I will keep using the Quiz-on-the-Goes. Those quizzes were handed out at the beginning of a class, and only tested materials learned during the lecture. They said this helped them focused on the lecture, and the exams were associated with the practice.

BME Form 3.5 Faculty Course Evaluation

Course Number: BME3400
Course Title: MATERIALS SCIENCE
Semester: SPRING2020
Instructor: Marta Cooperstein
Date : 09/28/2020 Department Review Date: ________________

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	0	0	0	0	1	0	6	5	7	20

Assessment of Student Outcomes
For each student outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(a) This course contributes to our students' ability to apply knowledge of mathematics, science, and engineering.
Methods: (1) Students used math to solve engineering problems in homework, quizzes, and exams.
• Homework average (10 assignments): 94.7 %; 38/39 > 70% (Level A)
• Quiz average (9 quizzes): 82.6%; 37/39 > 70% (Level A)
• Exam average (3 exams): 85.6%; 38/39 > 70% (Level A)
• Final exam average: 92.4%; 38/39 > 70% (Level A)

(b): This course contributes to our students' ability to design and conduct experiments, as well as to analyze and interpret data.
Methods: NA

(c): This course contributes to our students' ability to design a system, component, or process to meet desired needs.
Methods: (1, 4, 5) Students worked many homework and exam problems on engineering design concepts; they also created written report and oral presentation on a design of real-life object, with the focus on how these objects were designed to meet set specifications.
• See part (a) for overall averages
• Written Project Part 1 average: 97.7%; 39/39 > 70% (Level A)
• Written Project Part 2 average: 98.2%; 39/39 > 70% (Level A)
• Final Project Presentation: 98.3%; 39/39 > 70% (Level A)

(d): This course contributes to our students' ability to function on multi-disciplinary teams.

Methods: NA

(e): This course contributes to our students' ability to identify, formulate, and solve engineering problems.
Methods: (1,7) Students were required to solve engineering problems on homework, quizzes, and exams. Students were also solving problems in class for class participation.
• Classroom participation average: 98.9%; 39/39 > 70% (Level A)
• See also summary for part (a)

(f): This course contributes to our students' understanding of professional and ethical responsibility.
Methods: NA

(g): This course contributes to our students' ability to communicate effectively.
Methods: (4,5) The students were asked to create a specification sheet, written report, and oral presentation for their project in which they needed to clearly and effectively communicate their findings.
• Written Project Part 1 average: 97.7%; 39/39 > 70% (Level A)
• Written Project Part 2 average: 98.2%; 39/39 > 70% (Level A)
• Final Project Presentation: 98.3%; 39/39 > 70% (Level A)

(h): This course contributes to the broad education necessary for students to understand the impact of engineering solutions in a global and societal context.
Methods: NA

(i): This course contributes to our students' recognition of the need for, and an ability to engage in life-long learning.
Methods: NA

(j): This course contributes to our students' knowledge of contemporary issues.
Methods: NA

(k): This course contributes to our students' ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
Methods: (1) Students worked many homework and exam problems on engineering design concepts, including material strength, failure theories, and factor of safety, to apply engineering theory to modern engineering practice.
• See summary for part (a)

(l): This course contributes to our students' understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology.
Methods: NA

(m): This course contributes to our students' ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.
Methods: NA

Table F3.5-1: Summary of Student and Faculty Evaluation

Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

	Student (N/A)				Faculty	
Outcome	**Average (1-5)**	**%A or SA**	**%NA**	**Level**	**Phase-1 Level**	**Overall Level**
					A	**A**
					A	**A**
					A	**A**
					A	**A**
					A	**A**
					A	**A**

Faculty Assessment:

The students were engaged in the class throughout the entire semester, putting a lot of effort into their project and other assignments, even though we had to switch to the online learning format in the second half of the semester.

BME Form 3.5 Faculty Course Evaluation

Course Number: BME4960
Course Title: Senior Project
Semester: Spring 2020
Instructor: Bledsoe
Date : 05/15/2020 **Department Review Date:** ________________

Course Grade Distribution

Grade	F	D	C-	C	C+	B-	B	B+	A-	A
Number of Students	0	0	0	0	0	0	2	2	16	20

Assessment of Student Outcomes
For each student outcome indicate the *Phase-I* assessment methods (1-7) used or NA if the outcome is not reflected in this particular course. For each method listed please provide a more specific description of the assessment method, rank the achievement level, and provide quantitative evidence to support the achievement level.

(a): This course contributes to our students' ability to apply knowledge of mathematics, science, and engineering.

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Final Design Report (Phase-1.5) and the Poster Presentation (Phase 1.4).**
    - CDR-Design Solution (40/40, ME or EE; Level-A)
    - CDR-Calibration and Testing (40/40, ME or EE; Level-A)
    - FDR-Design Solution (40/40, ME or EE; Level-A)
    - FDR-Calibration and Testing (40/40 ME or EE; Level-A)

(b): This course contributes to our students' ability to design and conduct experiments, as well as to analyze and interpret data.

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Final Design Report (Phase-1.5) and the Poster Presentation (Phase 1.4).**
    - Poster Methods & Results (40/40, ME or EE; Level-A)
    - FDR-Calibration and Testing (40/40, ME or EE; Level-A)

(c): This course contributes to our students' ability to design a system, component, or process to meet desired needs.

Methods: 3, 4, 5, 6

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Critical Design Report, the Final Design Report (Phase-1.5) and the Poster Presentation (Phase 1.4) and Demo (Phase 1.6).**
    - Poster (40/40, ME or EE; Level-A)
    - CDR-Design Solution 40/40, ME or EE; Level-A)
    - FDR-Design Solution (40/40, ME or EE; Level-A)
    - DEMO (40/40, ME or EE; Level-B)

(d): This course contributes to our students' ability to function on multi-disciplinary teams.

Methods: 4, 5, 6, 7

- **Poster Presentation (Phase-1.4), written Critical Design Report (Phase-1.5), and team reviews (Phase-1.6, & 1,7)**
    - CDR-Progress (40/40, ME or EE; Level-A)
    - Poster (40/40, ME or EE; Level-A)
    - Teem Peer Assessment (40/40>70% Level-A)

(e): This course contributes to our students' ability to identify, formulate, and solve engineering problems.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Final Design Report (Phase-1.5).**
    - FDR- Design Solution (40/40, ME or EE; Level-A)
    - FDR- Calibration and Testing (40/40, ME or EE; Level-A)

(f): This course contributes to our students' understanding of professional and ethical responsibility.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections in the Final Design Report (Phase-1.5)**
    - FDR – Marketing/Social/Ethical (40/40, ME or EE; Level-A)

(g): This course contributes to our students' ability to communicate effectively.

Methods: 3, 4, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from the written Final Design Report (Phase-1.5) and Poster Presentation (Phase-1.4).**
  - Poster (40/40, ME or EE; Level-A)
  - CDR-Visuals (40/40 >70% Level-A)
  - CDR-Mechanics (40/40 >70% Level-A)
  - FDR-Organization (40/40 >70% Level-A)
  - FDR-Response to Questions (40/40 >70% Level-A)
  - FDR-Report (40/40, ME or EE; Level-A)

(h): This course contributes to the broad education necessary for students to understand the impact of engineering solutions in a global and societal context.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections in the Final Design Report (Phase-1.5)**
  - FDR – Marketing/Social/Ethical (40/40, ME or EE; Level-A)

(i): This course contributes to our students' recognition of the need for, and an ability to engage in life-long learning.

Methods: 2

- **Evoke recognition of the need to keep up to date with current engineering developments through sharing of information and contributing new valuable information via the web (Phase-1.2).**
  - Web Site (39/40 >70% Level-A)

(j): This course contributes to our students' knowledge of contemporary issues.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections in the Final Design Report (Phase-1.5)**
  - FDR – Marketing/Social/Ethical (40/40, ME or EE; Level-A)

(k): This course contributes to our students' ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from Final Design Report (Phase-1.5)**
    - FDR- Report (40/40, ME or EE; Level-A)

(l): This course contributes to our students' understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections from Final Design Report (Phase-1.5)**
    - FDR- Design Solution (40/40, ME or EE; Level-A)

(m): This course contributes to our students' ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.

Methods: 3, 5

- **This capstone course focuses on the senior design project (Phase-1.3). Measures of this outcome include sections the Poster and FDR-Report (Phase-1.5)**
    - Poster (40/40 ME or EE; Level-A)
    - FDR- Report (40/40 > 70%; Level-A)

Table F3.5-1: Summary of Student and Faculty Evaluation
Summarize the phase-1 measures and, based on that data, determine the overall level of achievement. Discuss the basis for that determination in the faculty assessment section below. Please also provide your overall class assessment and, if necessary, an action plan to address concerns.

	Student (N/A)				Faculty	
Outcome	Average (1-5)	%A or SA	%NA	Level	Phase-1 Level	Overall Level
a					A	A
b					A	A
c					A	A
d					A	A
e					A	A
f					A	A
g					A	A
h					A	A
i					A	A
j					A	A
k					A	A
l					A	A
m					A	A

Commented [SAS1]: This portion is left empty since we no longer do student outcome assessments with an end of course survey.

Faculty Assessment: COVID-19 semester, dismissed in person learning at Spring Break. The course seemed to be going very well at the time of dismissal. Every group was on track to complete their work; however, dismissal meant that teams could no longer work directly together, that they did not have resources available for testing, and ultimately most teams simply cleaned up their reports and submitted their final documentation as it existed at the time of dismissal. Frankly, I think that is the best we could do.