##### BMEG 456 - Biomedical Senior Design 2

**Semester:** Spring 2019

**Prerequisites:** BMEG 455

**Format:** Seminar and Laboratory

**Schedule:** 12:30-1:45 TR

**Location:**  251 Engineering Sciences Building

**Class Instructor:** Dr. Robin Hissam, 513 Engineering Sciences Building

 293-9339; robin.hissam@mail.wvu.edu

**Office Hours:** W 2:00-3:00pm; R 2:30-3:30pm; by appointment preferred

**Project Mentors:** Dr. Jessica Allen (jessica.allen@mail.wvu.edu)

 Dr. Robin Hissam

 Dr. Shuo Wang (shuo.wang@mail.wvu.edu)

**Catalog Description:**

Planning, designing, and reporting solutions to challenging biomedical engineering problems that have clinical implication. Also covers professional topics, including ethics, liability, safety, socio-legal issues.

**Expected Learning Objectives:**

After completing this course, the students will be able to:

1. Formulate strategies to identify and solve an open-ended design problem related to biomedical engineering (*ABET Outcome 2*)
2. Demonstrate the ability to apply scientific principles and engineering skills to solve problems at the interface of medicine and biology. In particular, apply knowledge from human physiology, thermodynamics, transport in biological systems, math, chemistry, physics, biomedical instrumentation, biomechanics, etc. to complex, open-ended biomedical engineering problems (*ABET Outcome 1*)
3. Develop an ability to design and conduct experiments related to biomedical engineering that aim to solve/address a human healthcare problem, as well as analyze and interpret data related to the human healthcare problem being tackled (*ABET Outcome 6*)
4. Demonstrate the ability to perform statistical analysis to evaluate the feasibility of the proposed/developed experimental strategy or prototype obtained (*ABET Outcome 6*)
5. Address ethical, societal, health and safety issues, as well as develop management skills as associated with the biomedical engineering problem being solved (*ABET Outcome 4*)
6. Develop the abilities to work individually and in small groups in a multidisciplinary environment that promotes improving human healthcare through possible clinical applications (*ABET Outcome 5*)
7. Develop lifelong learning skills such as searching for and finding information, learning material not covered in traditional courses, and making decisions as related to biomedical engineering principles applications (*ABET Outcome 7*)
8. Present technical material in a written or oral format as well as develop the ability to communicate effectively, in writing, conversation and graphic. (*ABET Outcome 3*)

**Deliverables and Grading of the Design Project:**

*Reports (minimum of 5 reports over the semester) 15%*

Progress reports will be submitted approximately every two weeks. The reports should provide a group update of the problem being tackled. The update should be at least 2 pages and should identify what was done to solve the problem in between each meeting cycle. Reports should be submitted to faculty mentor and client. Group member contributions to the report must be indicated to ensure all members are completing their assigned tasks appropriately.

*Group Presentations 20%*

Individual groups are required to present their semester progress to both the mentor and the client. The presentation should be 30 min long with 15 min reserved for questions. The presentation should clearly define the problem being tackled and the current stage in the solution development. Aspects related to the class material should be integrated (e.g., ethical issues, professional approvals etc.).

*Final Report 25%*

The report should provide an update on the problem being tackled in a written format. The update should be at least 10 pages (single spaced) and should identify what was done and what are the challenges associated with the problem being pursued. Problem statement and pertinent references should be included. Figures are allowed; no more than 3 and no larger than ¼ page each. Recommended format is 12‐point Times or a similar font, 1.5‐line spaced, with 1‐inch margins. The recommended length is 25‐40 pages, not including references and appendices (see below a recommended outline). All writing is to be in formal technical English with appropriate in‐text citations. The rubric is shown in Supporting Information 1.

*Prototype Presentation (public) 25%*

Students will end their semester with a demonstration of their prototype in a half a day public display and they will be judged by a panel of faculty and invited guests from industry or clinicians. The students will be required to display their prototypes and supporting documentation of their design problem in a form of a poster clearly identifying the problem statement and the strategies being used to solve it.

*Peer evaluation 15%*

Student involvement with the design project as well as their individual contributions to solving the problems being proposed will be assessed through rubrics and documentation of efforts. Considerations for this grade will be based on group evaluation, Chief Engineer evaluation, and Faculty Mentor evaluation.

**Grade Assignment:** 100 – 90 A; 89 – 80 B; 79 – 70 C; 69 – 60 D; 59 – 0 F

**Policies and Statements:**

Academic Policies and Syllabus Statements found at [https://tlcommons.wvu.edu/quality matters/syllabus-policies-and-statements](https://tlcommons.wvu.edu/quality%20matters/syllabus-policies-and-statements) will be implemented and followed for this course. Please review this webpage for more information and feel free to ask any questions regarding these statements and policies.

**Supporting Information 1**

|  |  |  |
| --- | --- | --- |
| **Category** | **What should be contained/needs to be addressed** | **Points** |
| Abstract | * Brief description of the problem addressed and the solution achieved
 | /10 |
| Description of the problem | * What is the problem you have solved/attempted to solve?
* What is the clinical problem or the health and/or market need that you addressed?
 | /5/5 |
| Project objective statement | * How has your team addressed the problem?
* What is innovative about your approach?
* How does your final design solve the problem?
* What were the specifications for your final design?
 | /3/3/2/2 |
| Documentation of the design | * Provide sufficient detail and highlight innovative aspects of your design.
 | /30 |
| Prototype of the final design | * Include graphical representations, photographs, and a link to a webpage to demonstrate your prototype feasibility
 | /30 |
| Proof that the design is functional and will solve the problem | * Describe how you verified that your design reached its objectives.
* Include evidence such as test data, graphs, video etc., or comparisons to existing device outputs.
 | /10/5/5 |
| Engineering Standards  | * Identify important standards to be utilized for testing the design/prototype
* Describe how these standards are or can be applied to the design
 | /5/5 |
| Results of patent search/search for prior art, assessment and patentability  | * Results of search
* Regarding marketplace competition, what is currently being used to solve the problem and/or what are the anticipated alternate methods that could be in competition with your design or prototype in the future?
 | /5/5 |
| Anticipated regulatory pathway  | * Describe pathway you would select to reach FDA approval (510(k) vs. PMA, etc.)
* Describe how the FDA has treated analogous devices/products if applicable
 | /5/5 |
| Reimbursement | * Do you expect your device to be reimbursable by Medicare/Medicaid? Why or why not?
* Provide a cycle of care for the use of your device or product.
* Indicate the coding for your device or if you would apply for a new code.
 | /3/4/3 |
| Ethics | * Describe any ethical considerations associated with your design or application of your device.
 | /10 |
| Estimated cost of manufacturing  | * Provide brief per unit cost breakdown, including volume discount, for components, final assembly, quality assurance, etc.
 | /10 |
| Potential market and impact | * Define the potential market size, selling price, and distribution channels.
* Identify the customers (i.e., who will be purchasing the product) and end users be (i.e., who would be using the product).
 | /5/5 |
| Letter of support | * Letter from client that demonstrates the strength of the work accomplished
 | /10 |
| Paper formatting | * Correct grammar and spelling
* References
 | /5/5 |
| Required website | * Website should be designed to describe the project. Needs to include: Project Overview, Team Members, Milestones, Outcomes of the Project
 | /20 |
| Presentation | * 5 minute oral presentation (i.e. elevator pitch) that “sells” your product to potential investors or users.
* Demonstration of prototype feasibility.
* Poster display with project goals, milestones, and outcomes
 | /15/10/15 |
| **TOTAL** |  |   |