Grading Rubric for Bioengineering Capstone Team Design Project

ABET outcome	Ability	4 Exemplary	3 Proficient	2 Apprentice	1 Novice	Score
A1	**Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics:** Identify and formulate a problem in the medical or bioscience community; evaluate its relative and absolute importance; cast need as engineering challenge; demonstrate device or process that addresses the problem	Medical or scientific need is clearly explained; current costs (health, economic, social, etc.) are used to justify project; problem is cast as engineering challenge; device or process is shown to be an effective solution.	Medical or scientific need is clearly stated; current costs (health, economic, social, etc.) are mentioned; problem is cast as engineering challenge; device or process is shown to be an effective solution.	Medical or scientific need is clearly stated; some current costs are mentioned; engineering design may be inappropriate for challenge; device or process is implemented but is only partially effective.	Need is not clear, problem is not addressable by engineering solutions, and/or the project does not satisfy the stated needs.	
A2	**Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors:** Apply design plans developed in BIOEN 404 while considering multiple design options and realistic constraints (including cultural, social, and economic); modify and improve the design to meet specified needs (iterate on design); consider risks and trade-offs during design process.	Realistic design constraints, including appropriate engineering and experimental standards, were considered thoroughly during the design process. Design adaptations based on acquired results were considered to better adapt the design to the desired needs. More than one option was considered and tested and the best option was utilized. Solution meets a specified need with consideration of public health, safety, welfare, as well as global, cultural, social, environmental, and economic factors	Multiple realistic constraints (including any relevant engineering standards) were identified and incorporated into the design process. Design adaptations based on acquired results were considered to better adapt the design to the desired needs. At least one option was considered and tested.	Some realistic constraints were integrated into the design process but some may be missing. A design adaptation based on acquired results was considered to better adapt the design to the desired needs. One option was considered but not tested.	Failure to identify and/or incorporate relevant realistic constraints into design process. Original design followed without considering modifications.	

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A3	**Communicate effectively with a range of audiences:** Communicate the capstone project proposal in written form; Prepare detailed written report; demonstrate device or process to range of audience members during BioE Capstone Symposium. Maintain professional and consistent communication with mentors.	Written report is virtually error-free, logically presents project, is well organized and easy to read, contains high quality data/graphics, and draws conclusions supported by presented data. Product demonstration oral presentation is well organized, clear, and informative. Could be counted on to communicate professionally with outside collaborators.	Report is logically presented, well organized, easy to read, contains high quality data/graphics, and contains few minor grammatical and/or rhetorical errors. Conclusions drawn from presented data. Product demonstration, oral presentation is adequately organized and informative. Usually could be counted on to communicate professionally with outside collaborators.	Report is generally well written but contains some grammatical, rhetorical and/or organizational errors; project is not well explained and not fully discussed. Questionable conclusions made based on presented data. Product demonstration, oral presentation is not well organized and confusing. Sometimes lacking in communication with collaborators.	Report does not present project clearly, is poorly organized and/or contains major grammatical and/or rhetorical errors. Data does not support conclusions, or conclusions not presented. Product does not perform desired task and oral presentation is not informative or is painful to watch. Communication with collaborators was noticeably lacking and/or unprofessional.	
A4	**Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts:** Display knowledge of ethical and professional responsibilities surrounding the design, such as regulatory matters including standards, and environmental, social, legal, ethical, geopolitical consequences. Describe impact of solution in global, economic, environmental, and societal contexts	Displays knowledge of ethical and professional responsibilities surrounding the design, such as regulatory matters including standards, and environmental, social, legal, ethical, geopolitical consequences and uses that knowledge to make informed judgements during the design process. Can describe impact of solution in global, economic, environmental, and societal contexts.	Identifies a number of important global, economic, environmental, and societal considerations relevant to project and utilizes knowledge to make informed design judgements; identifies regulatory matters including current relevant standards; may include limited discussion of each category, including present ramifications.	Identifies only a few of the obvious global, economic, environmental, and societal considerations surrounding the engineering design solution, with shallow discussion of the ramifications.	Identifies only a few of the obvious global, economic, environmental, and societal considerations surrounding the engineering design solution, with no discussion of the ramifications.	

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A5	**Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives:** Work effectively in teams to complete project goals through behaviors such as contributing to team discussions and work effort, communicating with team members, colleagues, and advisors, establishing team goals and planning tasks, providing leadership to teammates and helping foster an inclusive and collaborative environment	Team member fulfills assigned roles during execution of team design project without having to be reminded, assists others, consistently does what he/she was supposed to or went beyond obligations; very well prepared, respectful, inclusive and cooperative.	Team member performs duties that are assigned, listens to teammates most of the time, usually cooperative and prepared for meetings.	Inconsistently performs duties that are assigned, may not allow others to speak or share ideas; cooperation with teammates is lacking.	Always relies on others to do the work, never listens to other teammates, does not perform duties of assigned team role.	
A6	**Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions:** Utilize BIOE skills to test experimental hypotheses or prototypes from design plans developed in BIOEN 404; correctly analyze results; compile/interpret results, and use engineering judgement to draw conclusions and improve design.	Appropriate analytical methods were selected and correctly implemented and interpreted. Quality laboratory* conduct was followed including: results compiled in a professional manner in lab notebook or written reports. Exhibits independence in selecting next steps. Testing data was correctly analyzed and interpreted to draw conclusions for prototype refinement. *laboratory or prototyping facility	Analytical methods were appropriately designed and correctly implemented and interpreted and testing results were utilized to improve design. Basic laboratory conduct was followed including lab notebook, detailed notes or written reports.	Analytical methods were appropriate, but implementation and/or interpretation may be questionable. Basic laboratory conduct was followed including lab notebook or detailed notes and reports. Testing data may be incorrectly analyzed or interpreted or data may not have been used to draw useful conclusions about design performance or iteration.	Analytical tools applied were inappropriate and/or not implemented correctly. Basic laboratory conduct was only partially followed (inadequate details in lab notebook or infrequent reports).	
A7	**Acquire and apply new knowledge as needed, using appropriate learning strategies:** Show/describe the continuous progress in the field prior to and during Capstone project via literature search and analysis.	Current literature is monitored. Student exhibits proficiency in researching prior art, including patents. Key advances relevant to the project are identified and considered as motivation for changes in the project.	Literature is monitored, and key advances and current technology relevant to the project are identified but impact on project may not be recognized.	Student reads relevant current literature when its existence is pointed out by mentors. Student is not interested in interpersonal communication as means to advance knowledge.	Either ability or motivation to engage with current literature is lacking. Never discusses literature or new related technological developments with mentors.	