BME Design evaluation and grading criteria for a score of 4 out of 4 on reports and notebooks

Outcomes (1-7) and Performance Indicators	Criteria Required for 4/4
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	
Identified and formulated biomedical problems to be solved by:	• Used appropriate empirical and theoretical approaches to inform design • No filler/irrelevant material
Applied appropriate engineering principles to solve...	• Correctly applied knowledge from engineering areas such as statics, dynamics, circuits, material science, etc.
Applied appropriate biology and physiology to solve...	• Clearly communicated bio/physio • Problem description appropriately motivated by bio/physio
Applied appropriate chemistry to solve...	• Chemical structure/functional relationships are described
Applied appropriate math (e.g. differential equations) to solve…	• Solved engineering problems with appropriate math and differential equations
Applied statistics to solve…	• Established and tested hypotheses • Used appropriate approaches for data analysis including sample sizes and statistical methods
2. an ability to 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	
Quantified the needs of the biomedical problem	• PDS quantitative and complete
Identified multiple and realistic design constraints	• Several criteria evaluated-design matrix • Criteria addressed appropriate public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
Developed and evaluated multiple viable design alternatives	• Design alternatives provided evidence of multiple viable approaches • Design matrix scores well justified
Modeled and realized the recommended solution that met or exceeded the specifications	• Final design met or exceeded client-specified and design criteria and worked as intended • Design problems identified and solutions logically presented
Considered appropriate codes and standards	• Cited ISO, ASTM, FDA, etc. • Described operating environment, used SI units etc.
3. an ability to communicate effectively with a range of audiences	
Communicated in an understandable technical style to a qualified yet unfamiliar audience	• Technical writing style (non-conversational) • Details presented such that work is repeatable
Demonstrated effective writing	• Virtually no errors in spelling or grammar
Effectively organized a written document	• Layout enhances readability • Proper reference and citation formatting
Demonstrated effective graphical presentation	• Effectively used graphics to illustrate key points including meaningful figure caption • Appropriate data presentation (e.g., labeled axes, units, sig figs.)
4. an ability to 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	
Conducted work in an ethical and professional manner	• No research ethics violations • Design concepts credited appropriately • Text references and figures cited appropriately
Considered the broader impact of the biomedical problem and solution	• Researched the overall global impact (size/demographic) of the problem and solution • Identified beyond the need of the client when appropriate and is in context • Past, current and/or future ethical considerations clearly identified and addressed including the impact in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Demonstrated a positive team environment	• Positive peer evaluations • Clustered "bonus" scores or consistent ranking • No non-contributors
Demonstrated leadership with individuals serving well-defined roles	• Identifiable individual contributions in team output • Leadership mentioned • Goals and tasks executed as planned

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Developed experimental protocols to assess criteria and evaluate function	• Experiments designed to assess all relevant PDS criteria
Conducted experiments methodically	• Experimental approach, hypotheses and protocols led to design improvements or new approaches
Analyzed the experimental results	• Sources of error identified and methods to reduce error discussed
Drew conclusions based on experimental results	• Clear conclusions stated that follow experimental data

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Cited sources of multiple types	• Several references (typically 20+) of multiple types (articles, books, websites, patents, personal communications, etc.) • Reference material enhanced the paper/presentation • Reference material in context when cited - uses multiple references for key points.
Demonstrated resourcefulness	• Employed the appropriate tools especially those available e.g. CAD (CAE software), COE Shop, BME Teaching Labs, modeling, etc. • Sought out additional tools learned new skills (as documented in peer/self eval).