# BME Design Courses
# Report Guidelines

## A. General recommendations

- Use the outline below.
- Keep in mind as you design your experiments and report: Every method should have a result, and every result should be discussed and should have a corresponding method.
- Take the time to edit and format – make the report look professional. Be thorough, yet **concise**.
- Use titles AND subtitles! MS Word will do this for you if you use the Word Heading 1, 2, 3… styles (Please modify the Word's Heading styles to make text black). Include all titles and subtitles in the table of contents.
- References: Cite sources throughout paper!! (Use IEEE formatting – see below for more information).
- Figures: All figures must be meaningful, well annotated including scale, and legible.
    - **All figures must have captions! Captions must be descriptive and help the reader interpret the figure,** it should stand alone from the text. Captions should describe the annotations or include a key as appropriate. Any figure that is not your own, must have a reference associated with it.
    - Refer to figures in the body of the document immediately before or after they are placed in the document. (In other words, place figures appropriately, near the text that refers to them.) Use the MS Word insert caption and cross-referencing (References tab). This will save you a lot of time if you need to make any changes.
- Number all pages.
- Use SI (standard international) units on all values. Providing other units common in the field of interest is acceptable in some circumstances, but these values should be accompanied by SI units.
- The PDS must be added in an appendix at the end of your paper.

## B. Construction of the Report

**Cover Page**

- Project Title
- Course name
- Date
- Client name/s and affiliation (use the format, Client:)
- Advisor name and affiliation (use the format, Advisor:)
- Team members full names and team roles (Team Members:)

**Abstract**

Always write this **LAST**! It must briefly summarize your ***entire*** paper.
Fewer than 250 words including the following: the context of the problem, then the specific problem, existing technologies/processes/procedures, your solution, testing results, & implications of data analysis. The abstract is a very important part of the report since readers will use it to decide whether to read the full article.

**Table of Contents**

Do this **AFTER** you complete your report. MS Word will do this for you based on your titles and subtitles if you use Word's Headings. (You can find it in the references tab.) Be sure to indent subtitles.

**Body of Report**

I. Introduction

- Motivation/Global and/or societal impact. Why is your device necessary? What are the demographics and context of the problem/unmet need? This should go beyond the needs of the client – use the literature to support the need. What your client wants may not be the best solution to the problem*
- Existing devices/Current Methods (include patents and products on the market)*

- Problem Statement (Focus on the problem, not on the client except under special circumstances)
- ****Must cite sources*--the bulk of your introduction should be well cited ***

II. Background
- Background research including relevant physiology and biology*
- Research required to design and build your prototype*
- Client information (1-2 sentences)
- Design Specifications (summarize key points in PDS, ***refer to full PDS in appendix***)
- ****Must cite sources*-- the bulk of your background should be well cited ***

III. Preliminary Designs
- Include all designs considered
- Neat and detailed sketches with labels and dimensions
- Written summary of each design

IV. Preliminary Design Evaluation
- Design matrix/matrices (see document on the design matrix)
- Written summary of your design matrix/matrices (be concise)
- Proposed Final Design: design choice based on your matrices and large team meeting after the preliminary presentation (note that when putting this subtitle into your table of contents use: ***Proposed Final Design***, not just Final Design)

V. Fabrication/Development Process
- Materials:
  - Concise description of all materials and rationale for use
  - Include detailed list of materials and budget in an appendix (see below)
- Methods
  - Include a brief description of your exact methods to create the prototype, start to finish (lengthy procedures/protocols should be in appendices)
  - Computer generated images used to construct your design should be in an appendix unless essential for understanding, e.g. CAD images, process/logic flow diagrams, operating state charts, etc. (i.e., not shown in your preliminary design section)
- Final Prototype
  - Include pictures of the final prototype from multiple angles and close-ups where necessary (use high quality images)
  - Figure legend, labels and dimensions must be added to pictures and drawings
- Testing
  - Tests performed and justification (details of ***exact conditions and testing***)
  - Tests should evaluate how the design meets the PDS criteria
  - Design tests that reveal sources of error or variance
  - Expected outcomes - what will the results tell you?

VI. Results
- Analyze data and use appropriate statistical methods (include p values, standard deviation, statistical significance, other statistical observations)
- Include only relevant data used to evaluate your prototype (put raw data into your appendix)
- Identification of and observations on salient features of results

VII. Discussion
- Reveal implications of results (compare to other relevant research)
- Discuss ethical considerations in the conduct of the research and ultimate use of the device
- Identify all changes made/need to be made as a result of evaluation

- Identify and describe sources of error

VIII. Conclusions
- Restate the problem and final design briefly
- Briefly summarize your findings, but do not repeat previous conclusions verbatim
- What worked and what did not work? What would you do differently next time?
- Future work

IX. References
- Cite all sources of information: books, scientific papers, articles, patents, websites, personal communications, etc. If you did not already know it, it should be cited!
- Cite all bibliography entries in the text. All in-text citations should have a bibliography entry.
- You should follow IEEE citation guidelines: http://bmedesign.engr.wisc.edu/course/files/report/ieeecitationref.pdf
- Need help finding sources?
  - Contact Wendt Commons, they are very happy to help you
  - Video and top 10 research tips can be found on the library home page.
  - Google Scholar, PubMed and Web of Knowledge are great starters for peer-reviewed scientific articles

X. Appendix
- PDS must be included
- Create a table with all materials (part numbers, place purchased, cost, and quantity) and budget, include free materials too
- Any extra data, such as computer code, or data left out of the body of the report
- Any complicated protocols followed (build upon your methods)

**C. Checklist**

Before you finalize your report, please make the following changes to improve your writing: If you make a measurement, repeat it three or more times and report the standard deviation. Use the appropriate number of significant figures (generally not more than 3). Every figure caption should explain what the figure shows and how it is important. Use SI units http://physics.nist.gov/cuu/Units/units.html inch to cm. oz to g. lbs to kg. psi to Pa. F to C. Space between number and unit 30 °C. Ohm to Ω. Volt to V. amp to A. All single letter variables should be italic. All abbreviations should be Roman. +/- to ±. X to ×. This data to these data. The report should read as if one person wrote the whole document and there was an editor.

**D. Evaluation**

See the evaluation form on the design course webpage under resources.

The BME Design courses are intended to help our students achieve all of our ABET (Accreditation) Student Outcomes.

That is, upon graduation we expect that each of our Biomedical Engineering students will demonstrate:

(a) an ability to apply knowledge of mathematics (including differential equations and statistics), science, and engineering *to solve problems at the interface of engineering and biology*

(b) an ability to design and conduct experiments *(including making measurements) on*, as well as to analyze and interpret data *from living systems; addressing the problems associated with the interaction between living and non-living materials and systems.*

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary *and diverse* teams *and provide leadership*

(e) an ability to identify, formulate, and solve *biomedical* engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively: *by oral, written and graphic modes*

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

(l) *and an understanding of biology, human physiology, and chemistry as related to biomedical engineering needs.*