FINAL PROJECT REPORT FORMAT (ENME610)

Final written report, a very important component of the course project, is due by noon on December 7, 2017 by noon. You are required to submit an e-copy of your final project report (just one copy) for your entire group to Canvas (designate an individual from your group for online submission). Submit a copy of the final project report in both MS Word and in PDF and also submit all your program files (Matlab, Excel, see below), Power Point presentation files (for midterm and final). Note that the submitted final report must follow closely the instructions given here. Your report will be partly graded based on how well you follow these instructions.

Starting with the cover page: give a title to your project together, list your names, course number (ENME610), semester (Fall 2018), and submission deadline date of 12/07/2018 -- all centered. ***The final report must be typeset with a 12 point Times New Roman typeface, on one side of 8.5×11 inch papers (single spaced with one-inch margin all around), page numbered***, and have the sections listed below:

Table of Content (with page numbers for all sections/subsections)

Abstract (about 100 words). Provide a summary of the problem (what is it that you tried to solve and why it was important: motivation and problem description). Highlight the important features of the model, approach, challenges overcame, optimized results and whether and why the results make sense, and your proposal for future directions.

1. Introduction and Literature Review. Provide a motivation, overall goal of your project, and short overview of some related technical literature (with cited references -- cited in the body the report). Use pertinent figures to make your introduction clear. Make sure you properly cite figures that are not yours!

2. Problem Definition and Formulation

2.1 Problem Definition. Explain what the problem is. It is important that you define the problem in words clearly. Again, use figures/pictures (here and elsewhere in the report) to make your points clear.

2.2 Assumptions. List your main assumptions and explain why each assumption is necessary, i.e., too overcome what issue or to simplify which model.

2.3 Formulation. Provide a description in words and then follow up by a mathematical formulation (for each objective and constraint function) of your model. Summarize the derivations in this section but provide your long derivations in Appendix III (see below). At the end of this section, provide the formulation of the entire optimization problem in an "all-at-once" format (i.e., optimization formulation of objectives and constraints altogether). In your formulations, clearly differentiate and identify design variables which being optimized versus parameters fixed during an optimization run. For clarity, I highly recommend that you use x_i, $i=1,\ldots,n$, (n is number of variables) for design variables and use other symbols for parameters.

3. Methods, Results and Discussion. Initially, formulate your optimization project problem as a single-objective optimization problem with the other objective function treated as a constraint together with all other constraints in the problem. I am expecting that you solve this single-objective optimization problem by three different single-objective optimization methods. One of these approaches should be based on a technique written by your group in Matlab, e.g., by a penalty method, by Augmented Lagrangian Method, or some other technique! The other methods should be based on a canned approach from the Matlab's optimization toolbox (e.g., fmincon) and Excel's optimization method: "Solver". Tabulate your results (i.e., give for single objective

case both initial and optimized values for objective, constraints AND variables) from the three techniques side-by-side and discuss them -- provide physical interpretation as to why the results do (or do not) make sense.

Next, formulate your project problem as a two- (bi-) objective optimization problem. I am expecting that you solve your bi-objective optimization problem by two different bi-objective methods and compare the results. These two methods can be from any two of: a canned bi-objective approach from Matlab, a bi-objective approach that is devised based on the single-objective approach (i.e., either your own single-objective or a canned single-objective from Matlab or Excel). For comparison, graph your Pareto solutions from the two methods and tabulate a few select solutions from the Pareto set (with the values of design variables and objective functions/constraints) and discuss the results. Discuss the result and explain whether or not these solutions make sense from an engineering design perspective.

4. Parametric Study. For the single objective model, take several (say 2 or 3) important design parameters (for example, modulus of elasticity, applied force, or other parameters that you consider to be important) and change them within a range and obtain a series of optimized solutions. Show these solutions graphically to demonstrate the changes in the optimized objective (and variables) values as a result of a change in the design parameter. A parametric study for the two-objective solutions is also desirable for the project report.

5. Conclusion. Provide about 100-150 words for your concluding remarks: what are the highlights of this projects, strengths and weaknesses of the optimization model, appropriateness of assumptions, highlights and insights from the results provided, whether the results are meaningful and/or realistic, and finally for possible future directions.

6. Cited References. List only references that you cite in the main body of the report. For each reference make sure you provide complete information. Also, try to avoid giving links to websites: but if you have to do, make sure you provide the date of last access.

7. Nomenclature. Define ALL symbols (alphabetically ordered) used in the formulation with their units, and numerical values for the parameters that were fixed. Clearly identify (preferably separate them) the design variables and design parameters, e.g., give design variables first followed by design parameters.

Appendix I. Provide a sample problem description file (e.g., in Matlab, and in Excel format)-objective and constraints and sample results to canned single objective optimization programs.

Appendix II. Provide a full computerized code of your single-objective optimization program written in Matlab, e.g., ALM code written in Matlab. Make sure you include comments in your program describing key sections of your software. Do the same for a sample bi-objective case. Clearly mark and distinguish between these codes with identifiable names and titles. Please do include a README file which will describe the order that your programs should be run in order to reproduce your results. We plan to verify your programs, i.e., whether or not they function correctly.

Appendix III. Give long derivations here -- can be neatly hand-written (scanned copy is ok)!

Appendix IV. Provide a copy of your midterm and final oral presentations (in Power Point format with your notes for each slide shown -- slide at the top and notes at the bottom for each page).

Again: Make sure you provide an original copy of ALL your software program files (e.g., Matlab, Excel), and Word file (again clearly labeled) of your report, presentation slides (midterm and final). Also, provide a single pdf copy of your ENTIRE report (with all of the above mentioned items).