

AME30363: Design of Machine Elements

Integration into Project Deliverables and Exam Questions:

Project Assignment

Using the reverse engineered mechanical system you created in Project 3 (or a modified system based on instructor feedback), the individual component you selected in Project 4, and the principal stresses calculated in Project 4, determine both the factor of safety guarding against yielding and the factor of safety guarding against fatigue failure. If the life of the component is not infinite, determine the number of cycles until fatigue failure.

Deliverables:

1. A single document saved as a PDF file submitted to Canvas that contains the following deliverables in the form of a technical report (all figures must be embedded within the text, be appropriately sized for legibility, include appropriate captions, and be referenced in the text):
 - a. A title that includes the name of the machine (if you are not sure of the official name, this can be the name that *you* call the device).
 - b. A 1-2 paragraph introduction from Project 1 describing why you selected the machine and what the machine does in your own words. Recall that this description should be written with your fellow AME 30363 classmates as the intended audience.
 - c. Pictures of the actual device from Project 1.
 - d. Scans of your hand-drawn skeleton diagram(s) and symbolic derivations of the mechanical advantage from Project 2. Explain how these were used to complete Projects 3 and 4 where appropriate.
 - e. A screen capture of an isometric view of your reverse engineered mechanical system in SolidWorks from Project 3 along with any other views needed to support your written content (section views, exploded views, individual component views, subsystem views, etc...).
 - f. 2-3 sentences on which machine element you selected from your system for Project 4 and why.
 - g. Scans of your hand-written work from Project 4 culminating in the calculation of the principal stresses at the point of critical stress using the estimated values you selected.
 - h. 1-2 paragraphs from Project 5 on how you would use a software package similar to Ansys Discovery to analyze both your selected machine and the individual machine element you selected.

- i. Scans of your hand-written work setting up all necessary symbolic equations and numerically solving for the factors of safety (and life in cycles where necessary) based on your calculated principal stresses.
- j. 1-2 paragraphs on the interpretation of these factors of safety. Highlight any assumptions that were made throughout the process and how confident you were/are in these assumptions. **Consider if there were any limiting factors in the analysis. Discuss who you feel is the intended user of the machine (can be based on actual literature/marketing found on-line or on personal experiences or intuition) and whether the design is appropriate for such populations/communities. As an ethical engineer, comment on what (if anything) you would change about the design to make it safer and/or more affordable for this group or for other populations/communities that may benefit from such a machine.**
- k. A 1-2 paragraph conclusion that summarizes your results/findings and includes a reflection on how you have grown/changed as an engineer and/or person as a result of this project.

Examples of Exam Question Prompts

Students are provided with a detailed problem statement that includes given information about the system (dimensions and loads) along with a table of various materials that have different yield strengths and costs per unit.

- a. Using the preferred failure theory for design, determine the factor of safety for each of the three materials.
- b. **Your company is expected to produce several thousand units that implement this new system. Your coworker wants to keep the cost as low as possible so that it can be purchased by as many different communities as possible regardless of their socioeconomic status. You are also aware that many people will come into contact with this system on a daily basis and safety is paramount. As an ethical engineer, pick one of the three materials to use in the final product and provide your justification.**