CLARKSON UNIVERSITY
ES220 Statics
Design Problem Assignments

Motivation

Engineers often develop new designs and work on solving open ended problems, where there is no single unique solution and no textbook answer. Since a broad range of expertise and perspectives is required to create the most innovative and effective designs, engineers often work in teams. The design problem component of this course is intended to give students experience working on open ended design problems, and in teams, to begin developing the skills needed to be a practicing engineer.

There will be two team design problems assigned. In addition to building your design and teamwork skills, students will also deepen their understanding of the course material, by applying it to create and analyze their design. Students will work in teams of three. Each design problem (DP) will be assigned during a Wednesday workshop and will typically be due approximately 1.5 weeks after being assigned (see Class Schedule for specific dates.) Therefore, your team will have two Wednesday workshops to work on each DP.

Peer Review

In industry, research labs and academia, it is common for engineers to review each other's work, to check for omissions or errors. Therefore, each of your design problems will be peer-reviewed by another team (the "review team"), and your team will act as the review team for another team's design problem. Additionally, after the peer review, the design problems will also be evaluated by the instructor and/or TA. The goal of the review process is to check that: 1) design objectives have been met, 2) all drawings and specifications are complete, and 3) all calculations are complete and correct. Reviews are assigned the Wednesday after the DP's are due; reviews are due back approximately 1.5 weeks after being assigned (see Class Schedule for dates); therefore, your team will have one Wednesday workshop to work on the review.

Grading

Each design problem is graded out of 100 points. The 100 design points are earned by the design team and are assigned by the course instructor and TA based on their evaluation of the design document, i.e., how well does the design meet the design objectives, is it neat and professional, etc. (see Grading Rubric for more details).

Review Points

The 15 review points for each team design problem are "in play" and can be earned by either the design team or the review team or neither team. If no errors or omissions are found by either the review team or the instructor/TA, then the design team keeps their own 15 review points. If the review team clearly demonstrates a serious effort to find all the errors and omissions, they earn 5 review points. If the review effort is cursory, then they receive 0 points. If no review is turned in, then 5 points are deducted. The review team captures an extra 10 points if they find all the errors and omissions.

> Note: if your team keeps its own review points and captures the review points from another team, then your team could get a 130 grade (out of 100) on that design problem.

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Design Document Requirements

The final design document should include the sections and items listed in the Design Problem Grading Rubric. The document does NOT have to be typed; a neat, professional handwritten document is perfectly acceptable (see example on Moodle). Pencil is fine, but all erasures must be complete and neat. If pen is used, unwanted items can be neatly crossed off using a single horizontal line through the text or equation. Drawings must be done using a straight edge and must be dimensioned (also using a straight edge). Drawings need to be large and easy to read; use at least ½ page (1 full page is better) for each drawing. Number the drawings, Fig. 1, Fig. 2, etc., and refer to these in your text and analyses. The analysis section should include a list of known values (these were either given in the assignment document, or determined from your design). For each calculation, state the Fig. you are referring to, write the symbolic equation first, then substitute the numbers, then calculate the answer.

→ A sample design problem and design document will be provided on Moodle.

Design Documents must be photocopy-ready. Grading and peer reviews will be done using a black and white photocopy of your design document. Requirements:

a) Writing and figures must be sufficiently dark to photocopy completely

b) Do not use color

c) Maintain 1 inch margins all around!

d) Single sided

e) Leave space between calculations, figures, etc., to leave room for reviewer comments

f) Place the cover sheet on top and use only one staple for the entire document

Design Review Requirements

Your team will be provided a photocopy of another team's design problem to review and mark-up. Instructions are provided on the Peer Review Design Problem Rubric.

→ A sample design review will be provided on Moodle.

Teams

Students will work in teams of three. Interested students may select their own teams; all other students will be assigned to teams by the instructor.

Roles

For each design problem, each team member will be assigned a primary role, as listed below. Team members should rotate through the roles, such that each team member fills a different role for each design problem.

- Team Leader
  - Overall coordination of the design problem execution
    - All team members participate in meaningful ways
    - Team members treat each other with respect
  - Goal: Insure that your team:
    - Completes the assignment on time
    - Meets all design objectives and documentation requirements
- Lead Internal Reviewer
  - Insure that all team members:
    - Have reviewed the design document
    - Understand and can explain all aspects of the design document

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    - Goal: your team keeps its review points
- Lead External Reviewer
    - Work with team members to set a review schedule/process
    - Insure that all team members:
        - Have reviewed the external design document
        - Understand all aspects of the external design document
    - Goal: your team captures the other team's review points

Although one person is assigned a lead role for a certain aspect of the project, all team members are required to participate in all phases of the design process. For example, even though one person is the Lead Internal Reviewer, ALL team members must still check all the work in the design document, to insure that: 1) all errors and omissions are found (so the peer review team does not capture your review points!), and 2) everyone understands and can replicate all the work (since design problems make excellent final exam problems!).

Participation Multiplier

It is expected that each student will fully participate on his/her team; in this case, each team member will receive a 1.0 "participation multiplier", so that his/her DP grade is the same as the grade assigned to the team. However, in the unfortunate (and rare) case where a team member is consistently not contributing his/her fair share of work, the team should contact the course instructor, Prof. Issen, to discuss the situation. If needed, the instructor can apply a reduced participation multiplier to the grade for the under-performing team member (e.g., a team DP grade of 100 with a reduced participation multiplier of 0.7 gives 70 DP grade to that student). Note: it is common for each team member to contribute in different ways and at different levels for different assignments, depending on individual strengths and skills, but the contributions usually even out over the semester. Therefore, teams are encouraged to only pursue the reduced participation multiplier option if there is a recurring problem with a team member.

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