Recitation 1.4 Statics Team Project

Objectives:
- Review concepts of statics through building a cantilever
- Practice idea generation skills
- Effectively work in a team to accomplish a goal

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<th>Team Members:</th>
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Task 1: (5 min) Problem Statement
When holding a weight out with your arm, it is acting like a cantilever. You are going to design and build a simple prosthetic arm using the listed materials. Your cantilever (arm) will be clamped to our testing frame and a hanging weight will be shifted down the cantilever arm from the supported end until it breaks. Your cantilever should be designed to hold 2.5 lbs at a maximum length. The deflection of the cantilever must not exceed 1”. To simulate the constraints of a true prosthetic arm, the entire structure at testing position must fit inside a 3-inch diameter pipe.

Materials:
- 1 piece of basswood (0.25”x0.25”x 24”)
- 2 ft masking tape
- 10 popsicle sticks
- 2 ft string

Each team will turn in a short report. Requirements of the report are given on the next page. It would be wise to read through these now.

Task 2: (5 min) Propose feasible solutions
Without discussion with other teammates, each person is to sketch out a potential solution. Strength, stability, and aesthetics should be considered in your design. You can use the whiteboard for your sketches. Allowable design considerations are listed on the next page.

Task 3: (5 min) Decide on a solution
Discuss your potential solutions with your teammates. Based on your discussion, decide on a design. This could be one of the individually developed solutions, a combination of the proposed solutions, or even an entirely new solution.

Task 4: (35 min) Build your cantilever and write your report.
Using the given materials, build your cantilever. You are allowed to cut the wood, popsicle sticks, and string. You need to also write your report in this time. The report needs to include a paragraph indicating why you chose the design you did, and free body diagram(s) showing the loading on the cantilever. Figure out how to work efficiently as a team. Working beyond the 35 minutes results in a disqualification.

Task 5: (15 min) Test your section’s cantilevers
Each cantilever will clamped to the testing frame. The weight will be placed at the supported end and slid slowly down the cantilever until it breaks, reaches deflection limit, or the weight reaches the end of the cantilever.

Task 6: (10 min) Finish report and turn in results
- Turn in a professional, short report (1-2 pages) with design and results of testing.
- Fill out the web-based form to report on your team experience.
- Fill out the web-based form to report on your team experience (repeated since many people forget)
**Allowable Design Considerations:**

Note: Any combination of these is acceptable, as long as the structure (at testing position) fits within a 3” dia pipe.

- Extend the cantilever beyond the testing block on the support end, not exceeding 2 inches behind front of block.
- Orient the testing block with the notch up or down.
- Place the testing block on top of or below your cantilever.
- Brace against the testing frame below the cantilever.
- Connect your cantilever to the testing frame or clamp.
- Laminate pieces horizontally, as long as the width at the support end does not exceed 1.75 inches.
- Laminate pieces vertically, as long as there is a flat surface for the testing block to rest on.

**Team Project: Cantilever Grading Rubric**

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<th>Grade Item</th>
<th>Points</th>
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<tr>
<td><strong>Format:</strong> names of team members, problem statement, all requirements (including results) included, report well organized</td>
<td>10 – Excellent&lt;br&gt;8 – Good&lt;br&gt;6 – Fair&lt;br&gt;3 – Poor</td>
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<tr>
<td><strong>Neatness:</strong> Clear writing and drawings.</td>
<td>10 – Excellent&lt;br&gt;8 – Good&lt;br&gt;6 – Fair&lt;br&gt;3 – Poor</td>
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<td><strong>Description:</strong> Clear description of cantilever, including a good sketch of your final design, free body diagram(s) showing the loading on the cantilever, and a short paragraph of why this design was chosen.</td>
<td>50 points total&lt;br&gt;▪ 20 points sketch&lt;br&gt;▪ 20 points design description&lt;br&gt;▪ 10 points free body diagram(s)</td>
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<tr>
<td><strong>Results and Conclusions:</strong> include total length, weight at distance held, reaction force and moment at cantilever support</td>
<td>15 points</td>
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<td><strong>Performance:</strong> based on failure distance</td>
<td>15 points</td>
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<tr>
<td>BONUS: Best in section: +5 pts&lt;br&gt;Most original design: +5 pts</td>
<td>Failure Distance: 1 point for each inch past the support, with no limit.</td>
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