

MECH314 - MECHANICS OF DEFORMABLE BODIES LABORATORY 1

Instructions

- Use long bond paper (8.5" x 13")
- Margins: 1" on all sides
- Activity must be handwritten.

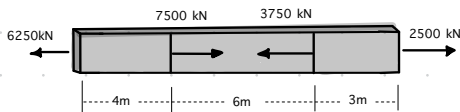
The front page must include the following:

- Laboratory Number
- Course Code
- Course Title
- Date of Submission
- Submitted by / Submitted to

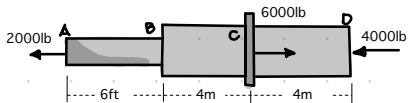
d. Write legibly 🙏

e. Provide the complete solution for each problem and box your final answer.

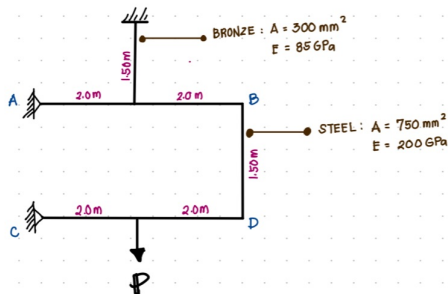
- A 4-mm diameter steel wire, 4.50m long, carries an axial load P . Find the maximum safe value of the load if the allowable normal stress is 280MPa and the elongation of the wire is limited to 4-mm. Use $E=200\text{GPa}$
- A 5.40m steel rod is subjected to an axial tensile force of 65kN and has an axial rigidity of 75,000kN. Determine the deformation, stiffness, and the flexibility of the rod.
- A steel bar carries the axial loads applied at the position shown. The cross-sectional area of the steel bar is 3250 sq.mm. Calculate for the total change in length of the bar if $E=200\text{GPa}$. Assume the bar is suitably braced to prevent lateral buckling.



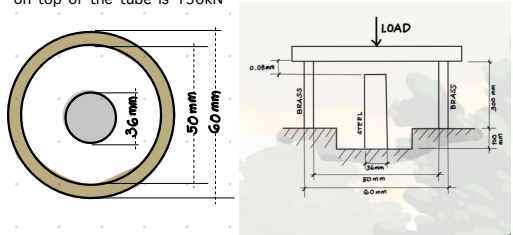
- A steel shaft in the figure shown below carries axial loads. The shaft AB has a diameter of 0.50in and shaft BC and BD has a diameter of 0.75in. Compute for the change in length of the shaft caused by these loads. Use $E=29,000,000$ psi for steel.



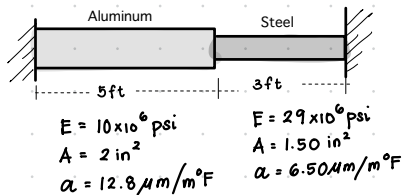
- The figure below is composed of two rigid bars (AB, CD) and two vertical rods made of bronze and steel. All connections are pin joints. Determine the maximum force P that can be applied to the structure if the vertical displacement of its point of application is limited to 8mm. Neglect the weight of the members.



- A round steel rod supported in a recess is surrounded by a co-axial brass tube as shown in the figure. The level of the upper end of the rod is 0.08mm below that of the tube. The Modulus of Elasticity of steel is 210 GPa and Modulus of Elasticity of Brass is 105GPa. Determine the magnitude of the stresses in the steel rod and in the brass tube if the load applied to the rigid plate resting on top of the tube is 150kN



- A reinforced concrete column, 5m high, has a cross section of 400mm x 400mm. It is reinforced by four steel bars each 20mm in diameter and carries a load of 1000kN. Young modulus for steel is 200,000N/mm² and that for concrete is 15000 N/mm².
 - Determine the stress of steel.
 - Determine the stress of concrete.
 - Determine the deformation of the column.
- A steel rod that spans between two solid anchor points and supports a significant tensile load of 10kN at a temperature of 25°C. However, in colder climates, such as at -20°C, the steel rod must not exceed an allowable stress of 180 MPa. Determine the minimum diameter of the rod. Assume coefficient of thermal expansion $\alpha = 11.7 \mu\text{m}/(\text{m} \cdot ^\circ\text{C})$ and modulus of elasticity $E = 200$ GPa.
- Determine the increase in stress in each segment of the compound bar shown in the figure if the temperature increases by 90°F. Assume that the supports are unyielding and that the bar is suitably braced against buckling. $\alpha = 11.7 \mu\text{m}/(\text{m} \cdot ^\circ\text{C})$



- A rigid bar ABC supported by three identical wires A, B, and C shown in the figure. Bar ABC is horizontal before the load P is applied. Assume the bar and wires are weightless.
 - Tension in wire B
 - Tension in wire C
 - Tension in wire A

