Professor (circle one)  Lowery  Fry  Kenny  Kozik

Legibly printed name ________________________________________________________

Last 5 numbers of student ID ____________ Your seat number ______________

This exam begins at 7:00 p.m. and ends sharply at 8:30 p.m.


All problems are worth 25 points each
Problem 1) A simply supported T-beam is loaded as shown. The end view of the beam shows its cross-section AND GIVES the location of the neutral axis as shown.

a) Draw a shear and moment diagram for the beam.
b) Determine and locate the sections of maximum shear and bending moment (note them on the diagrams.)
c) Determine the magnitude and location of the maximum compressive bending stress and state EXACTLY where that stress occurs.

Use the following dimensions and loads in your solution: $R_a = 5.54k$, $R_b = 5.26k$, $P_1 = 3k$, $P_2 = 3k$, $w = 0.6k/ft$, $L_1 = 3ft$, $L_2 = 8ft$. 

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[Diagram of the T-beam with loads and dimensions]
Problem 2) A solid circular shaft composed of two diameters has both of its ends rigidly fixed as shown. A torque of magnitude $T$ is applied at section B. Determine, in terms of the dimensions and torques shown, equations for the maximum torsional shearing stresses induced in the shaft. The radius of section AB is $1.5 \ R$, and the radius of section BC = $R$. Note that the bar is welded at the walls and is continuous from A to B to C. (It’s all one bar.) Use $G$ as the Modulus of Rigidity. (Shear modulus)
Problem 3) A vertical force $P$ of magnitude 20 kips is applied at a point on the cross section of the column as shown. The loading point is in the center of the beam, on the top edge. Determine the maximum normal tensile stress induced in the column.
Problem 4) A copper strip (E = 75 GPa) and an aluminum strip (Ea = 105 GPa) are bonded together to form a beam. The end view of the resulting beam is shown below. A bending moment of 35 Nm is applied to the resulting beam as shown. The width of the beam is 24 mm and the thickness of each strip is 6 mm, for a total thickness of 12 mm. Determine the maximum tensile bending stress in the aluminum and in the copper.