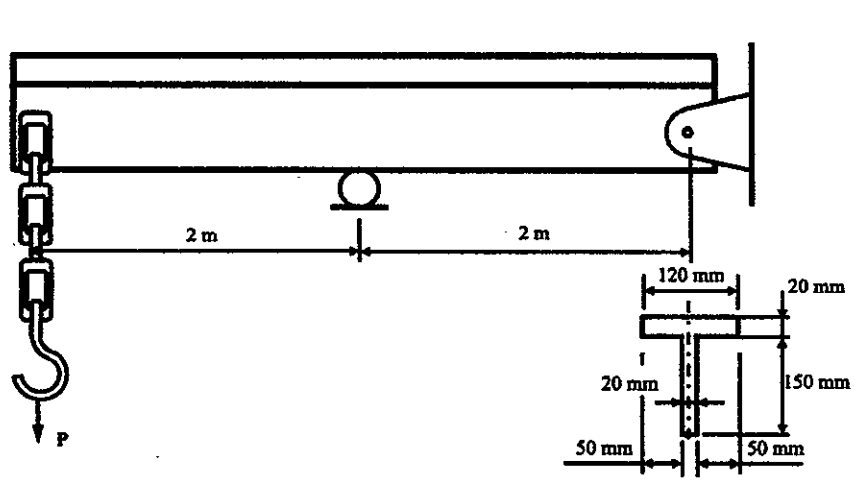
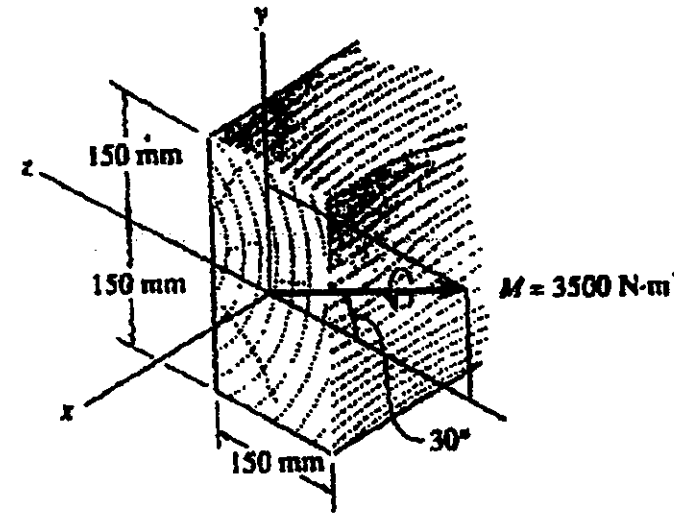
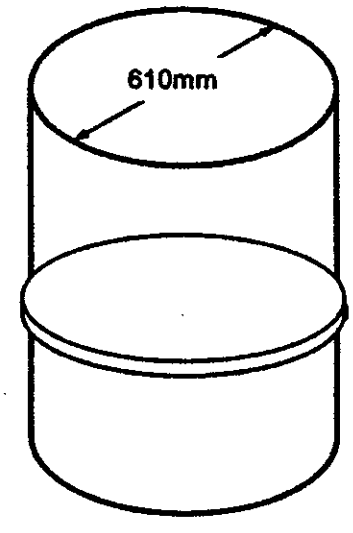
1. (20 Points) The steel beam has an allowable bending stress $\sigma_{allow} = 140$ MPa and an allowable shear stress of $\tau_{allow} = 90$ MPa. Determine the maximum load that can safely be supported.
2. (20 Points) The drive shaft of a tractor is to be designed as a thin-walled tube. The engine delivers 150 kW when the shaft is turning at 125 rad/s. Determine the minimum thickness of the wall of the shaft if the shaft's outer diameter is 75 mm. The material has an allowable shear stress of $\tau_{allow} = 48$ MPa.
3. (20 Points) The beam has a rectangular cross section. If it is subjected to a moment of $M = 3500$ N·m directed as shown, determine the maximum bending stress in the beam and the orientation of the neutral axis.
4. (20 Points) An A-36-steel hoop ($E = 210$ GPa) has an inner diameter of 609 mm, thickness of 6 mm, and width of 25 mm. If it and the 610-mm-diameter rigid cylinder have a temperature of 18°C, determine the temperature to which the hoop should be heated in order for it to just slip over the cylinder. What is the pressure the hoop exerts on the cylinder, and the tensile stress in the ring when it cools back down to 18°C?
5. (20 Points) The principal plane stresses and associated strains in a plane at a point are $\sigma_1 = 248$ MPa, $\sigma_2 = 110$ MPa, $\epsilon_1 = 1.02\times10^{-3}$, $\epsilon_2 = 0.180\times10^{-3}$. Determine the modulus of elasticity and Poisson's ratio.



Problem 1



Problem 3



Problem 4

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