國立中正大學九十二學年度碩士班招生考試試題

系所別：機電光整合工程研究所　　科　目：材料力學

1. Two rods having dimensions $L_1 = 2$ m and $L_2 = 1.5$ m is shown in figure 1. The loads applied to the rod are $P_1 = 400$ kN and $P_2 = 650$ kN. Under the action of these loads, the maximum permissible shortening of the rods is 1.0 mm. Let A_1 and A_2 represent the cross-sectional areas of the upper and lower rods.
   (a) If the area A_2 is three times the area A_1 , what is the minimum permissible area A_1 ?
   (b) If the area A_1 and A_2 are such that the compressive stresses in both rods are the same, what is the minimum permissible area A_1 ?

   (25 %)

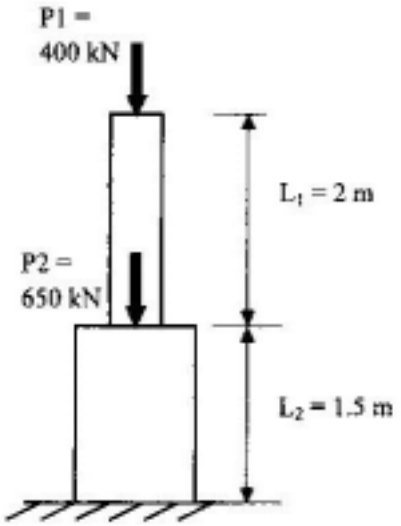

Figure 1.

2. A laminated wood beam on simple supports is built up by gluing together three 2 in. × 4 in. boards to form a solid beam 4 in. × 6 in. in cross section, as shown in figure 2. The allowable shear stress in the glued joints is 50 psi and the allowable bending stress in the wood is 1500 psi. If the beam is 6 ft long, what is the allowable load P acting at the midpoint of the beam? (Disregard the weight of the beam) (25%)

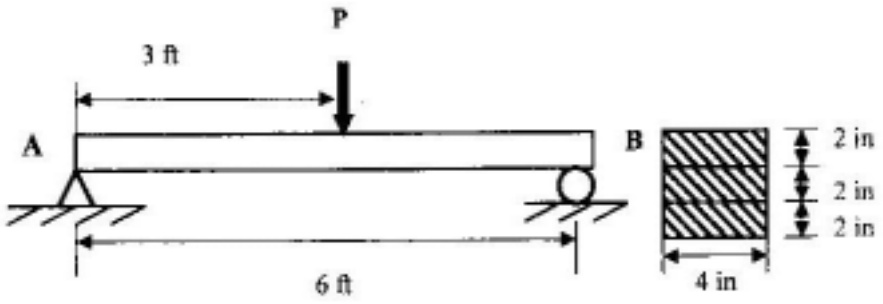

Figure 2

3. A pressurized cylindrical tank is loaded by torques T and tensile forces P as shown in figure. The tank has radius r = 50 mm and wall thickness t = 3 mm. The internal pressure p = 3.5 Mpa and the torque T = 450 N • m. What is the maximum permissible value of the force P if the allowable tensile stress in the wall of the cylinder is 72 Mpa? [note: $I_p = 2\pi r^3 t$] (25%)

4. What's the deflection curve for the beam (see following figure, EI is the flexural rigidity of the beam)? Set up equations for constants of integration, but do not need to solve for them. (25%)