1. A straight bar AB of square cross section area 1 in^2, as shown in Fig. 1, is bent to a circular shape by virtue of a rigid body CD with two force P as shown. Find the magnitude of the force P and the maximum tension stress induced in this bar. Assuming Young's modulus $E = 30 * 10^6 psi$. (20)
2. Two and three steel bars of cross section area $A = 1\ in^2$ are hinged without initial stress at room temperature 25°C, as shown in Fig. 2(a) and 2(b). If the temperature of these bars are raised to 50°C, find the stresses induced in bars (i), (ii) and (iii). Assuming the Young's modulus and thermal expansion coefficient are respectively $E = 30 * 10^6 psi$ and $\alpha = 12 * 10^{-6}/°C$. (20)
3. A simple beam is applied by a load $q(x) = q_0 \sin \pi x/L$, where q_0 is a constant, as shown in Fig. 3(a), find the maximum deflection for this beam. If the beam is hinged at both ends, as shown in Fig. 3(b), find the induced tension force S. For which a constant cross section is assumed, i.e., Young's modulus E, cross section area A and moment of inertia of area I are all constant. (20)
4. Find the principal stress at point C for a overhang beam of constant cross section, as shown in Fig. 4. (20)
5. A cicular cantilever beam of radius $R = 1\ ft$ with diameter of cross section $d = 0.5\ in$ is applied at the end by a force P, as shown in Fig. 5, assume the shear and tention strength of this beam are 150000 psi and 180000 psi respectively, find the maximum P which the beam can tolerate. (20)

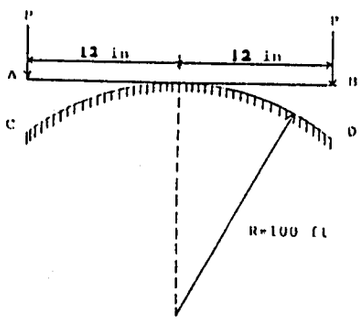

Fig. 1

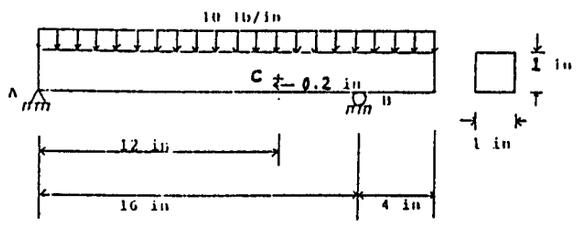

Fig. 4

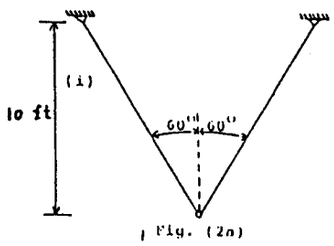

Fig. (2a)

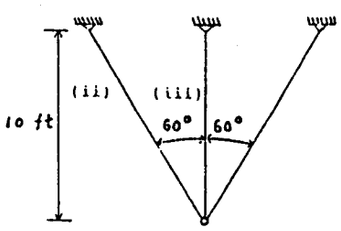

Fig. (2b)

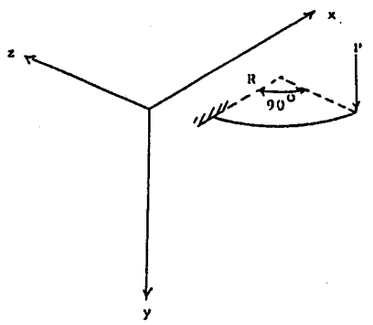

Fig. 5

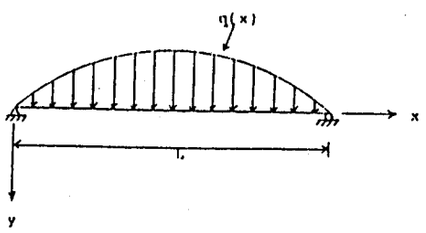

Fig. (3a)

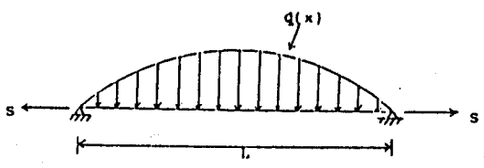

Fig. (3b)