1. Construct the shear and moment diagrams for beam ABC. (Fig. 1) (20%)

2. Beam ABCD is torsionally fixed at ends A and C. A load P is acting on member BD. It was found that torsions at both ends A and C are the same. The value of the torsions is 2 kN-m, and P is 10 kN. Construct the shear and bending diagrams for member BD. (Fig. 2) (20%)

3. A simple beam AB supports two concentrated loads P at the positions shown in the figure. A support C at the midpoint of the beam is positioned at distance d below the beam before the loads are applied. Assuming that d=10 mm, L = 6 m, E = 200 GPa, and I = 164×10^6 mm^4, calculate the magnitude of the loads P so that the beam just touches the support at C. (Fig. 3)(20%)

4. An overhanging beam ABC is supported at end A by a pin support and at B by a spring of stiffness k (see figure). Span AB has length L and carries a uniform load of intensity q. The overhang BC has length b. For what stiffness of the spring will the uniform load produce no deflection at the free end C ? (Fig. 4) (20%)
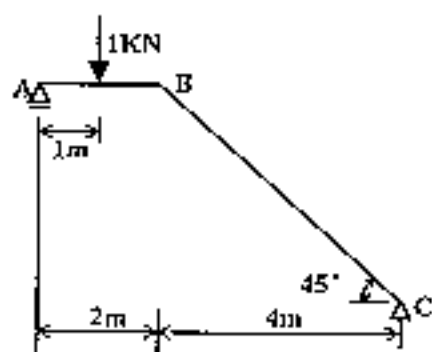
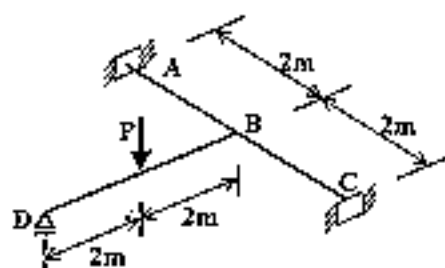5. Determine the critical load P_{cr} for the bar-spring system shown in figure 5. (20%)
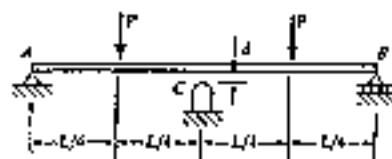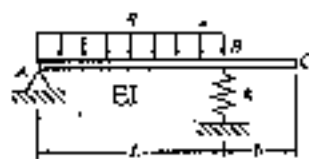

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5