No. of Printed Pages : 6

ET-502(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

00890

June, 2015

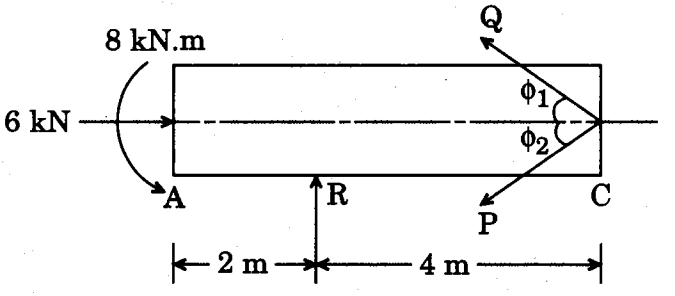
ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Assume any missing data suitably. Use of scientific calculator is permitted*

1. (a) Describe the term "Degree of indeterminacy". Give typical examples of structures of 2 and 3 degree of indeterminacy. *4*

(b) An axial force of 6 kN and moment of 8 kN.m along with the unknown forces P, Q and R is acting on a rigid body AC of 6 m length. Determine the forces P, Q and R to keep the body 'AC' in equilibrium (Figure 1). *10*



$\tan \phi_1 = 3/4$

$\tan \phi_2 = 4/3$

Figure 1

2. (a) Describe the terms 'modulus of elasticity', 'modulus of rigidity' and 'bulk modulus' and give the formula relating all the three elastic constants. *4*

(b) Find out the forces in members EF, DF and CD of the truss shown in Figure 2. (Use method of section) *10*

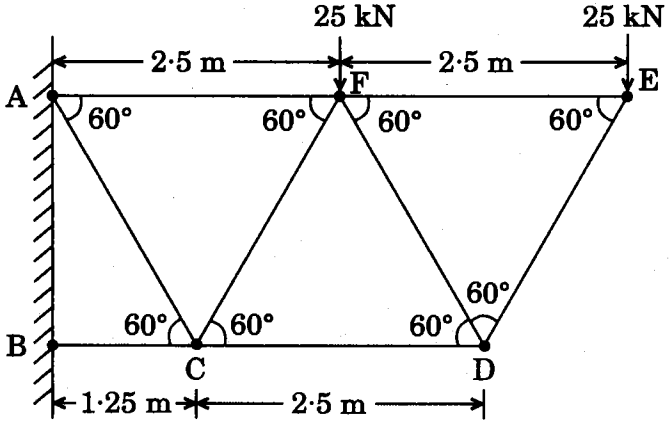
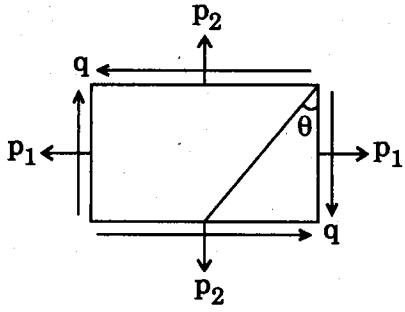


Figure 2

3. (a) Define the term Centroid of a plane figure and its radius of gyration. *4*

(b) Determine the direction and magnitude of major principal stress and minor principal stress for the rectangular block shown in Figure 3. *10*



$p_1 = 110\ N/mm^2$

$p_2 = 47\ N/mm^2$

$q = 63\ N/mm^2$

Figure 3

4. (a) A rectangular section (b × 2b) is replaced by an I-section of the same area (of cross-section) as shown in Figure 4, for a beam of uniform section. Find the ratio of "moment of resistance" for these two sections. The material is same and is able to take same maximum bending stress. *6*

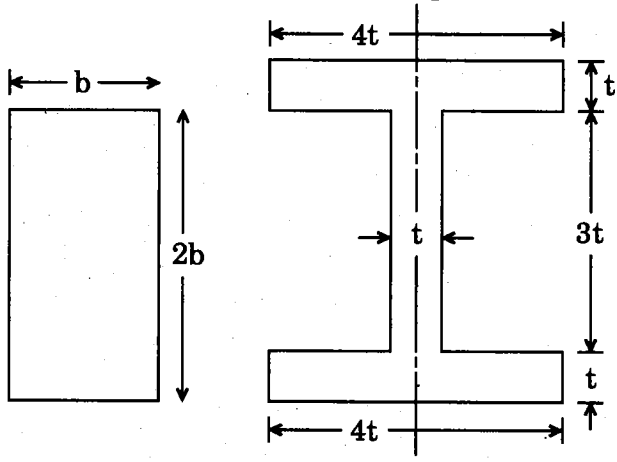


Figure 4

(b) Draw the Bending moment and Shear force diagrams for the beam shown in a Figure 5. *8*

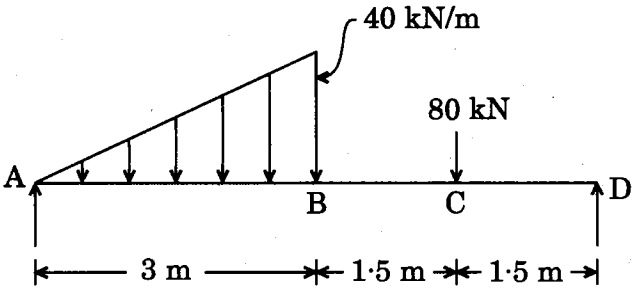
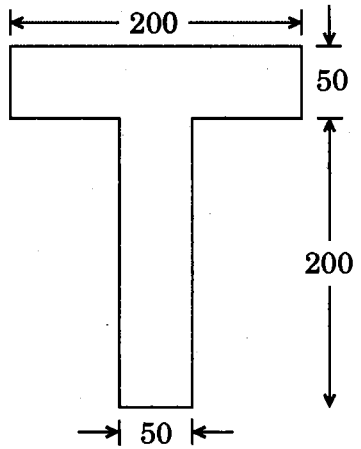


Figure 5

5. (a) State the assumptions made in theory of simple bending. *4*

(b) Calculate the sheer stresses at critical points and draw the shear stress distribution diagram for the T-section shown in Figure 6 which is subjected to a vertical shear force of 100 kN. *10*



All dimensions are in 'mm'

Figure 6

6. Find the value of 'P' for the following (Figure 7) composite beam (neglecting the self weight), if the maximum flexural stresses in steel and timber are limited to 40 MPa and 2·5 MPa.

Take $E_s = 2 \times 10^5$ N/mm^2, $E_t = 1 \times 10^4$ N/mm^2. *14*

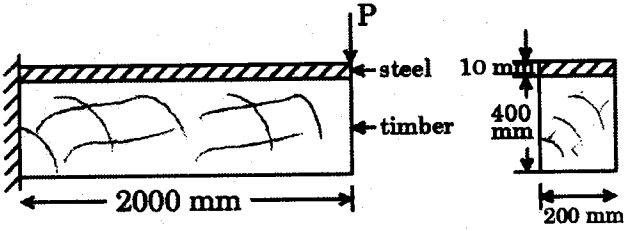


Figure 7

7. (a) A thin spherical shell of diameter 500 mm is subjected to an internal pressure of 2 MPa. Find the thickness of the shell, if the maximum stress in the shell is limited to 60 MPa. Consider the joint efficiency to be 80%. *6*

(b) A steel rod of 30 mm diameter and 5 m length is connected to two grips and the rod is maintained at a temperature of 95°C. Determine the stress and pull exerted when the temperature falls to 30°C, if

(i) the ends do not yield,

(ii) the ends yield by 1·2 mm.

Take $E = 2 \times 10^5$ MN/m^2, $\alpha = 12 \times 10^{-6}$/°C. *8*

8. Write short notes on any ***two*** of the following : *2×7=14*

(a) Stresses induced in a close-coiled helical spring when subjected to axial load

(b) Power transmitted by hollow shaft

(c) Springs in series and springs in parallel