No. of Printed Pages : **6**

ET-502(A)

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

Term-End Examination 00699

June, 2012

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) A steel bar of 25mm diameter is acted upon by forces as shown in fig 1. Determine the total elongation of bar if modulus of elasticity of bar material is 2.05×10^5 N/mm^2. **6**

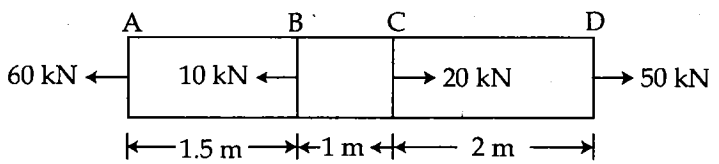


Fig. 1

(b) Determine the forces in AD, AG, DC and DG members of the truss shown in Fig.2. Point D and E are the mid points of AC and BC respectively. 8

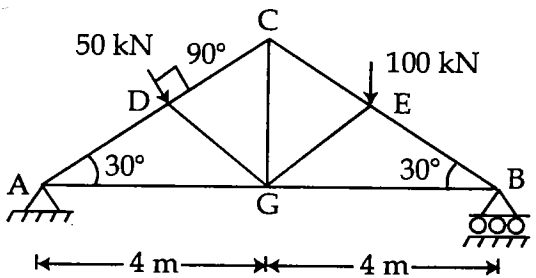


Fig. 2

2. (a) Determine the ratio of moments of resistance of a beam of square section when placed in two positions as shown in Fig. 3. 4

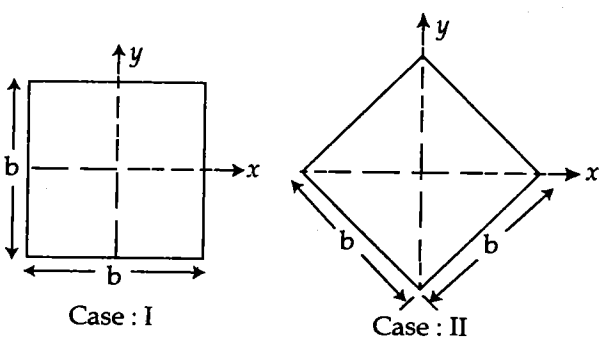


Fig. 3

(b) Find the moment of inertia of the section shown in Fig.4. about a horizontal axis passing through the C.G. of the section. **10**

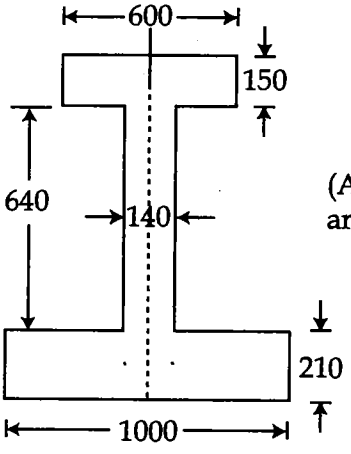


Fig. 4

3. (a) With the help of neat sketches, describe the "shafts in parallel" and "shafts in series". Also give their governing equations. **4**

(b) A rigid block ABC, weighing 180 kN is supported by three rods symmetrically placed as shown in fig.5. Assuming the block to remain horizontal all the times, determine the stress in each rod after a temperature rise of 25°C. **10**

For copper rod : $E_c = 95$ GPa $\alpha_c = 18 \times 10^{-6}/°c$

For steel rod : $E_s = 205$ GPa $\alpha_s = 11 \times 10^{-6}/°c$

Area of cross section of copper and steeld rods are $A_C = 1350\ mm^2$ $A_S = 800 mm^2$.

The lower ends of the rods are assumed to have been at the same level before the block was attached and the temperature changed.

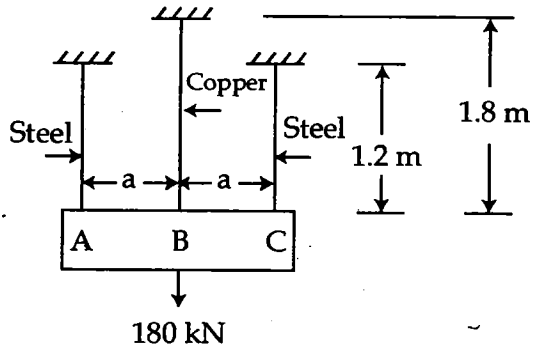


Fig. 5

4. (a) Describe the assumptions made in simple theory of bending. Also explain the term "flexural rigidity". 4

(b) Draw the Bending moment and Shear Force diagrams for the beam as shown in Fig.6 10

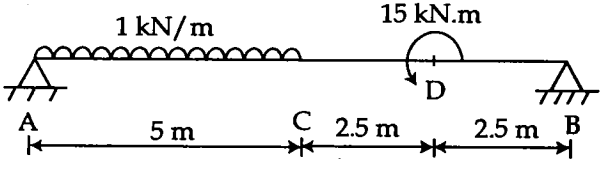


Fig. 6

5. (a) Draw the typical shape of shear stress distribution for the sections shown in fig.7. 4

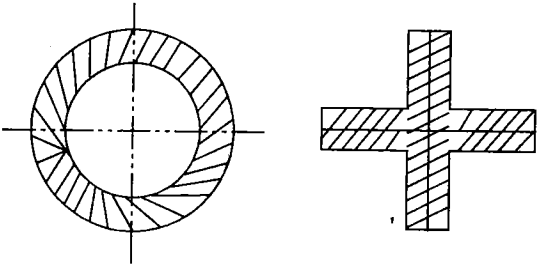


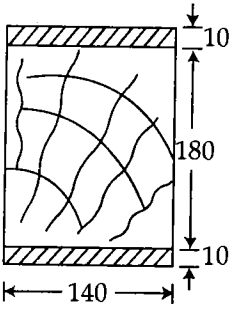
Fig.7

(b) A timber beam is reinforced by 10 mm thick steel plates at top and bottom as shown in fig.8. The beam is subjected to a bending moment of 24 kN.m. 10

Determine

(i) the stresses in beam

(ii) moment of resistance of beam if the stresses in the timber should not exceed 8 MPa. Take Es = 210 GPa and E_T = 15 GPa.



(all dimensions in mm)

Fig. 8

6. (a) Calculate the strain energy in a bar 3m long and 40 mm in diameter when it is subjected to a tensile load of 100 kN. Take E = 2.05 $\times 10^5$ N/mm^2. **4**

(b) A closely coiled helical spring made of 10mm diameter steel wire has 15 coils of 100mm mean diameter. The spring is subjected to an axial load of 100N. Calculate : **10**

(i) The maximum shear stress induced

(ii) The deflection and

(iii) Stiffness of the spring.

Take modulus of rigidity = 8.16×10^4N/mm^2.

7. (a) Describe the terms "Radius of gyration" and "Kernel of a section". **4**

(b) A cylindrical shell is 3m long and is having 1m internal diameter and 15mm thickness. Calculate the maximum intensity of shear stress induced and also the changes in the dimensions of the shell if it is subjected to an internal fluid pressure of 1.5N/mm^2. Take $E_s = 2 \times 10^5$ N/mm^2 and $\mu = 0.3$. **10**

8. Write short notes on ***any two*** of the following : **2x7=14**

(a) Principal plane and Principle stresses.

(b) Middle third rule for no tension in the section

(c) Assumptions for the analysis of plane truss.