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ET-502(A)

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

Term-End Examination 00171

December, 2012

ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Describe the term "Modulus of Resilience". **4**

(b) Compare the strain energy stored in the two bars of the same material, shown in Figure-1, if the same load is gradually applied for both the bars. Both bars have circular cross sections. **10**

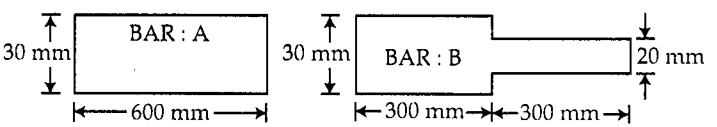

Fig. 1

2. (a) Describe the degree of redundancy. Give one example each of structure having 2 - degree of redundancy and 3 - degree of redundancy. 4

(b) The direct stresses at a point in a strained material are 100 N/mm^2 compressive and 60 N/mm^2 tensile, as shown in Figure-2. Find the stresses on the plane - AC, their resultant and direction. 10

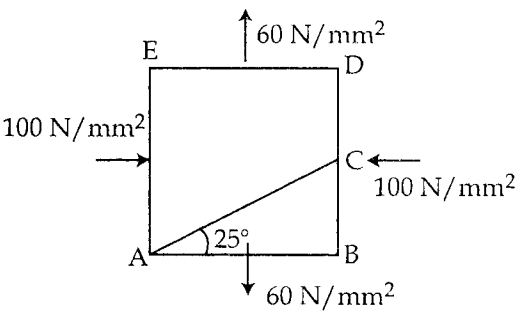

Fig. 2

3. A masonary dam, as shown in Figure-3 is subjected to a horizontal force (due to water pressure) of 397.3 kN acting at 3 m from the base. 14

Determine the maximum and minimum values of stresses at the base.

The unit weight of masonary is 22 kN/m^3.

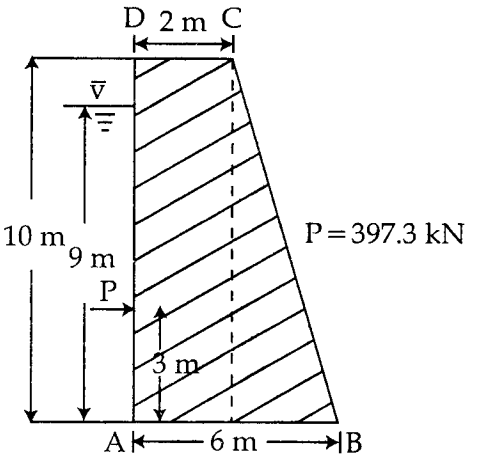

Fig. 3

4. (a) A rectangular section (b*2b) is replaced by an I-section of same area as shown in Figure-4, for a beam of uniform section. Find the ratio of "moment of Inertia" for the two sections. The material is same for both sections. **4**

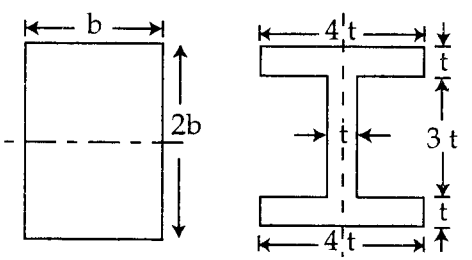

Fig. 4

(b) Draw the Bending moment and shear force diagrams for the beam shown in Figure-5. **10**

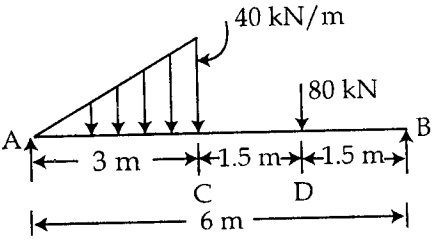

Fig. 5

5. (a) A bar, 12 mm in diameter, is acted upon by an axial load of 20 kN. The change in diameter is measured as 0.003 mm. Determine Poisson's ratio for the material. Take modulus of rigidity as 80 GPa. **4**

(b) A simply supported beam 'AB' of rectangular cross-section and span 'l' carries a load 'p' at a distance 'l/s' from the left support 'A'. The ratio of maximum allowable stress in bending and shear is 6 : 1. Find the ratio of length (l) and depth (d) of the beam such that both bending and shear stresses reach the maximum allowable limits simultaneously. **10**

6. (a) Describe the condition of springs in "series" and "parallel" and give their governing equations. 4

(b) A steel tube of 25 mm external and 15 mm internal diameters encloses a copper rod of 12 mm diameter. The assembly is held rigidly at both ends at a temperature of 20°C. Discuss how would you calculate stresses in copper rod and steel tube when the temperature is raised to 120°C. 10

7. (a) Describe the 'longitudinal stress' and "circumferential stress" in a thin cylindrical shell having wall thickness 't', internal diameter 'd', length "l" and internal pressure "p". 4

(b) A bar 'AB' tapers uniformly from a diameter d_1 to d_2 in a length of 'L' where $d_1 < d_2$. The bar is subjected to an axial force 'P'. Prove that the deformation of the bar will be $\frac{4PL}{\pi E d_1 d_2}$. 10

Where E is the modulus of elasticity of bar material.

8. (a) Give the assumptions mode for deriving the shear stresses and deformation in a circular shaft subjected to torsion. 4

(b) A steel shaft of 30 mm diameter and 1 m long is rigidly fixed at both the ends. A twisting moment of 600 N.m is applied at 250 mm from one end. Calculate : **10**

(i) fixing couple at the ends.

(ii) maximum shear stress.

(iii) angle of twist at the section where twisting moment is applied.

take modulus of rigidity

'C' $= 0.82 \times 10^5$ N/mm^2