**Reg. No. :** | | | | | | | | | | |

## Question Paper Code: 50133

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Third Semester

Civil Engineering

15UCE303 - MECHANICS OF SOLIDS - I

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Modulus of rigidity may be defined as the ratio of

   (a) linear stress to lateral strain (b) lateral strain to linear stain
   (c) linear stress to linear strain (d) shear stress to shear strain

2. When a body is subjected to a direct tensile stress (σ) in one plane accompanied by a simple shear stress (τ), the normal stress is

   (a) σ/2+1/2 (b) σ/2-1/2 (c) σ/2+1/2 (d) 1/2

3. A perfect frame should satisfy the relation

   (a) m = 2j-3 (b) m = 2j-4 (c) m = 3j-2 (d) m = 3j-3

4. The point of contra flexure is a point where

   (a) Shear force changes sign (b) Bending moment changes sign
   (c) Shear force is maximum (d) Bending moment is maximum

5. A shaft of diameter of diameter D is subjected to a twisting moment and a bending moment. if the maximum bending stress is equal to maximum shear stress developed, then M is equal to

   (a) T/2 (b) T (c) 2T (d) 4T

PART - B (5 x 2 = 10 Marks)

6. Write the relationship between bulk modulus, rigidity modulus and Poisson’s ratio.

7. Define principal stresses and principal plane.

8. How will you determine the forces in a member by method of joints?

9. State any three assumptions of Theory of simple bending.

10. What are the differences between closed coil & open coil helical springs?

PART - C (5 x 16 = 80 Marks)

11. (a) The following observations were made during a tensile test on a mild steel specimen 40 mm in diameter and 200 mm long. Elongation with 40 kN load $\delta l$ = 0.0304 mm. Yield load = 161 kN and Maximum load = 242 kN. Length of specimen at fracture = 249 mm. Determine: (i) Young's modulus of elasticity (ii) Yield point stress (iii) Ultimate stress (iv) Percentage elongation. (16)

Or

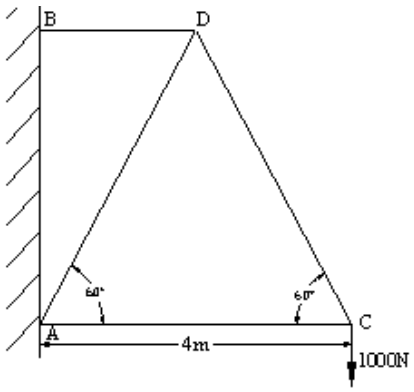
(b) A hollow cast-iron cylinder 4 m long, 300 mm outer diameter, and thickness of metal 50 mm is subjected to a central load on the top when standing straight. The stress produced is 75000 kN/m$^2$. Assume Young's modulus for cast-iron as 1.5 x $10^8$ kN/m$^2$ and find (i) magnitude of the load, (ii) longitudinal strain produced and (iii) total decrease in length. (16)

12. (a) The principal stresses in the wall of a container are 40 MN/m$^2$ and 80 MN/m$^2$. Determine the normal, shear and resultant stresses in magnitude and direction in a plane, the normal of which makes an angle of 30$^o$ with the direction of maximum principal stress. (16)

Or

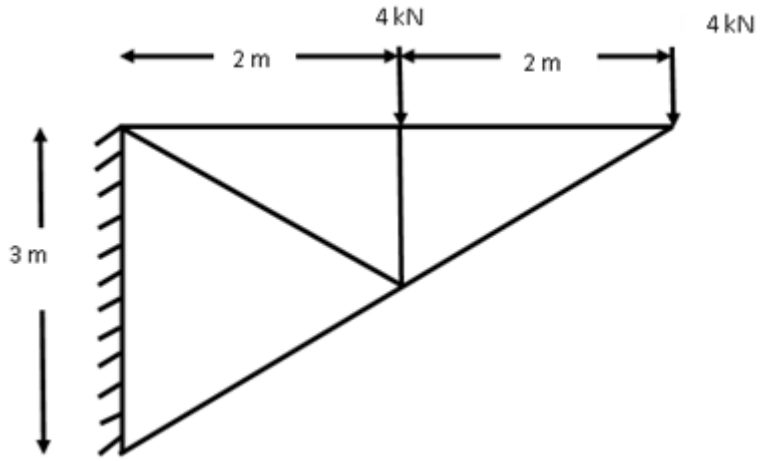
(b) A block of material is subjected to a tensile strain of 12 x $10^{-6}$ and a compressive strain of 15 x $10^{-6}$ on planes at right angles to each other. There is also a shear strain of 12 x $10^{-6}$ and there is no strain on planes at right angles to the above plane. Calculate the principal strain in magnitude and direction. (16)

13. (a) Determine the forces in all the members of a cantilever truss as shown in figure. (16)

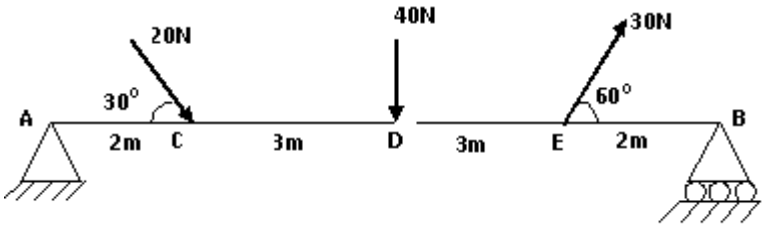


Or

(b) Determine the forces in the members of truss using tension coefficient method. (16)




14. (a) Find the reactions at supports A and B of the beam shown in figure. (16)




Or

(b) A rectangular beam 300 *mm* deep is simply supported over a span of 4 *metres*. Determine the uniformly distributed load per *metre* which the beam may carry, if the bending stress should not exceed 120 $N/mm^2$. Take $I = 8 \times 10^6$ $mm^4$. (16)

15. (a) A hollow shaft is to transmit 300 kW at 80 r.p.m. If the shear stress is not to exceed 60 $MN/m^2$ and internal diameter is 0.6 of the external diameter, find the external and internal diameters assuming that the maximum torque is 1.4 times the mean. (16)

Or

(b) A close-coiled helical spring has mean diameter of 75 mm and spring constant of 80 kN/m. It has 8 coils. What is the suitable diameter of the spring wire if maximum shear stress is not to exceed 250 $MN/m^2$? Modulus of rigidity of the spring wire material is 80 $GN/m^2$. What is the maximum axial load the spring can carry. (16)

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