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Question Paper Code: 41134

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

Third Semester

Civil Engineering

14UCE304 - MECHANICS OF SOLIDS – I

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. Within elastic limit in a loaded material, stress is_____
(a) inversely proportional to (b) directly proportional to strain
(c) equal to strain (d) not equal to strain
2. The unit of Young's modulus of the material is
(a) N/mm^2 (b) $N mm$ (c) N/mm (d) None of these
3. A perfect frame should satisfy the relation_____
(a) $m=2j+3$ (b) $m=3j-4$ (c) $m= 2j-3$ (d) $m=3j-2$
4. Moment of inertia of a circle of diameter d about its centroidal X axis is
(a) $\pi d^4 / 64$ (b) $\pi d^4 / 50$ (c) $\pi r^4 / 64$ (d) $\pi r^4 / 35$
5. If a cantilever beam of span (L) carries a point load (W) at free end of the beam then the shear force diagram will be_____
(a) rectangle (b) two equal and opposite rectangle
(c) right angled triangle (d) two equal and opposite triangle
6. If the shear force value is zero at a section, then the bending moment value will be_____.
(a) equal (b) maximum (c) minimum (d) none of these

7. Strength of a hollow shaft for the same length, material and weight is _____ a solid shaft.
- (a) less than (b) more than (c) equal to (d) none of these
8. In the torsion equation, the term J/R is called as
- (a) shear modulus (b) section modulus (c) polar modulus (d) none of these
9. Principal planes are separated by an angle
- (a) 90 (b) 45 (c) 30 (d) none of these
10. The maximum normal stress acting on a principal plane is known as
- (a) Minor principal stress (b) Major principal stress
(c) Major shear stress (d) Minor shear stress

PART - B (5 x 2 = 10 Marks)

11. State the relationship between Young's modulus and Rigidity modulus.
12. Write down the assumptions made in the analysis of truss.
13. Explain with neat sketch the types of beams.
14. List the types of springs.
15. Define principal plane.

PART - C (5 x 16 = 80 Marks)

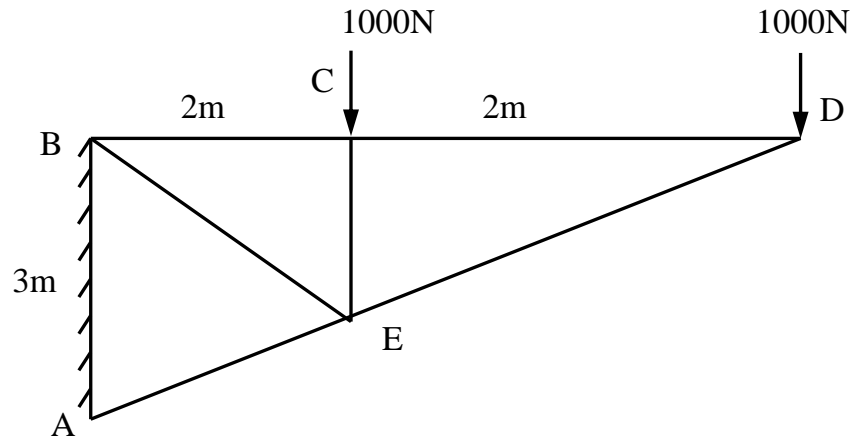
16. (a) A steel bar is placed between two copper bars each having the same area and length as the steel bar at $16^\circ C$. At this stage, they are rigidly connected together at both the ends. When temperature raised to $316^\circ C$, the length of the bar increases by 1.5 mm . Determine the final stress and strain in the bars. $E_S = 210\text{ GN/m}^2$, $E_C = 110\text{ GN/m}^2$, $\alpha_S = 0.000012\text{ per}^\circ C$, $\alpha_C = 0.0000175\text{ per}^\circ C$. (16)



Or

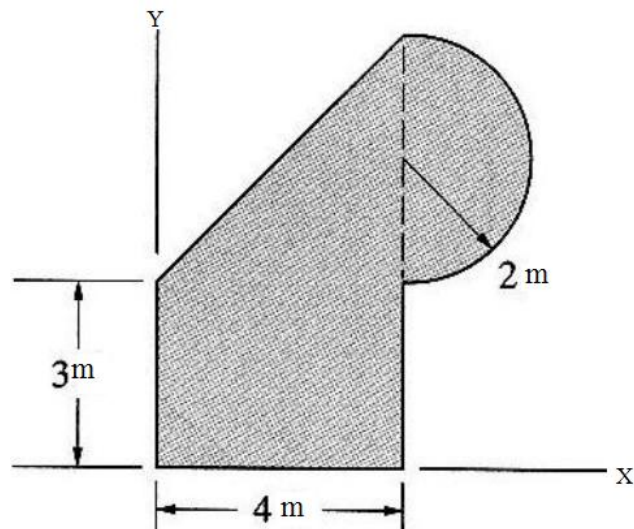
- (b) A metallic bar $300\text{mm} \times 100\text{mm} \times 40\text{mm}$ is subjected to tensile forces of 5kN , 4kN and 4kN along x , y and z directions respectively. Determine the change in volume of the block, Take Young's modulus as $2 \times 10^5 \text{N/mm}^2$ and Poisson's ratio as 0.25. (16)

17. (a) Determine the member forces in a truss structure as shown in figure by any suitable method. (16)



Or

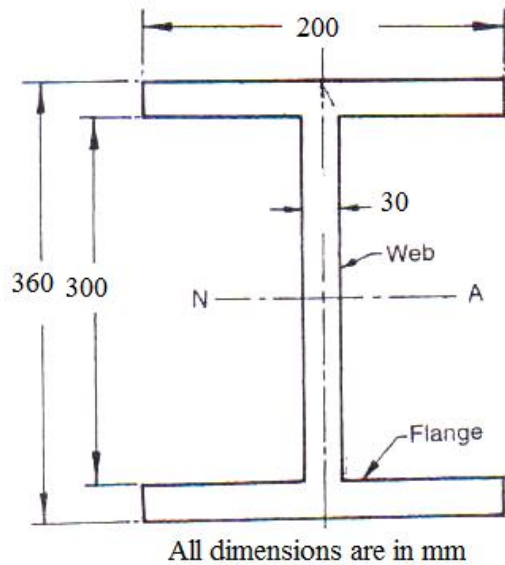
- (b) Find the centroid of the composite area shown in figure and also find moment of inertia about its common centroidal X axis. (16)



18. (a) A simply supported beam of span 7m is carrying a uniformly distributed load of 10kN/m over 3m distance from left support of beam and another uniformly distributed of 5kN/m over 2m distance from right support. Draw the shear force diagram and bending moment diagram. Also determine the maximum bending moment value. (16)

Or

- (b) A beam of I cross section of given dimension (shown in figure) carries a shearing force of 110 kN . Sketch the shear stress distribution across the cross section. (16)



19. (a) A solid shaft is subjected to a torque of 50 kNm . If angle of twist is 0.6° per metre length of the shaft and the shear stress is not to be allowed to exceed 85 MN/m^2 . Find suitable diameter of the shaft, Final maximum shear stress and maximum shear strain in the shaft. Modulus of rigidity of the material of the shaft is 80 GN/m^2 . (16)

Or

- (b) A stiffness of a closed coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 kN . The maximum shearing stress produced in the wire of the spring is 125 N/mm^2 . The solid length of spring (when coil are touching) is given as 5 cm . Find (i) Diameter of wire (ii) Mean diameter of coil (iii) Number of coil required. Take $C = 4.5 \times 10^4\text{ N/mm}^2$. (16)
20. (a) A body is subjected to stresses on two mutually perpendicular planes are 30 MN/m^2 (tensile) and 20 MN/m^2 (tensile). Shear stress across this planes are 8 MN/m^2 . Using Mohr's circle method find the magnitude and direction of the resultant stress on the plane making an angle of 35° with the plane of first stress and also find the normal and tangential stress on the plane. (16)

Or

- (b) An elemental cube is subjected to tensile stress of 30 kN/mm^2 and 10 kN/mm^2 acting on two mutually perpendicular planes and a shear stress of 10 kN/mm^2 on these planes. Draw the Mohr's circle of stresses and determine the magnitudes and direction of principle stresses and also greatest shear stress. (16)