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

Question Paper Code: 43104

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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. The unit of Young's modulus of the material is

   (a) N/mm^2 (b) $N\ mm$ (c) N/mm (d) None of the above

2. Stress developed in specimen of area of cross section A ,due to a suddenly applied load P is

   (a) P/A (b) $2P/A$ (c) $P/2A$ (d) None of the above

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) πd^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. Strain energy is the

(a) energy stored in a body when strained within elastic limits
(b) energy stored in a body when strained up to the breaking of a specimen
(c) maximum strain energy which can be stored in a body
(d) proof resilience per unit volume of a material

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. Sketch the stress strain curve of the mild steel in tension and mark the salient points.

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.

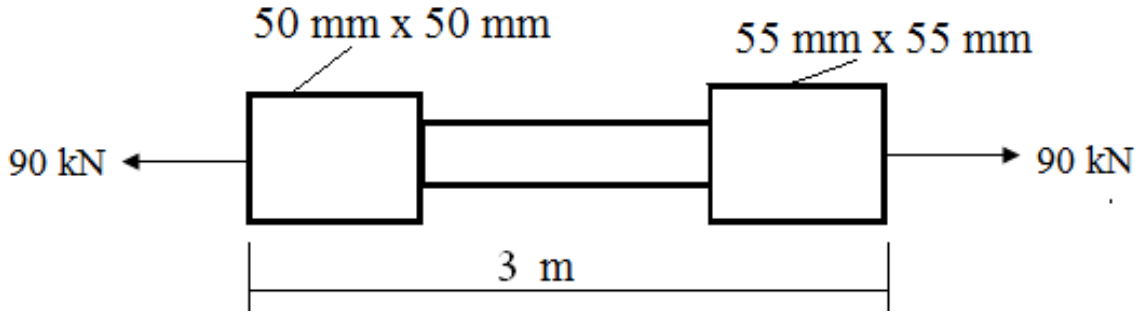
15. Define principal plane.

PART - C (5 x 16 = 80 Marks)

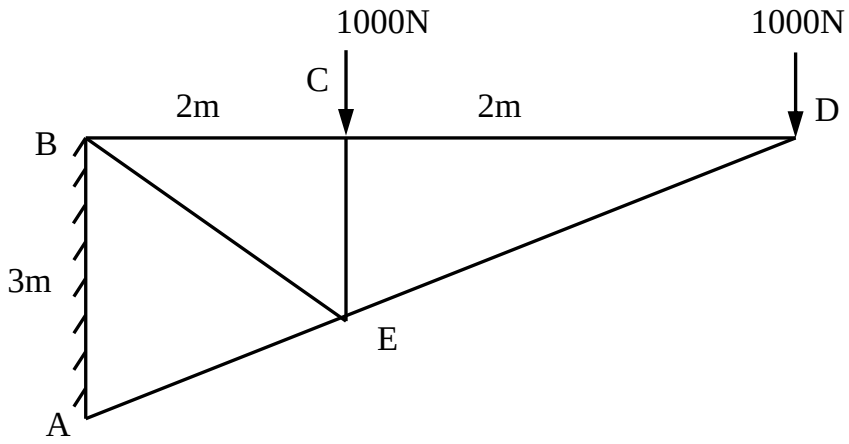
16. (a) A steel bar is placed between two copper bars each having the same area and length as t he steel bar at 16^oC. At this stage, they are rigidly connected together at both the ends. When temperature raised to 316 ^oC, the length of the bar increases by 1.5 *mm*. Determine the final stress and strain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

Or

(b) A bar of length 3 *m* has enlarged square ends of same length is loaded with an axial force 90 *kN* as shown in the figure. The cross sectional dimensions of the enlarged portions are given in the diagram. If the middle portion of the bar is also of square section, find the size and length of the middle portion, if the stress there is 150 MN/m^2, the total elongation of the bar is 0.50 *mm*. Take $E = 200\ GN/m^2$. (16)

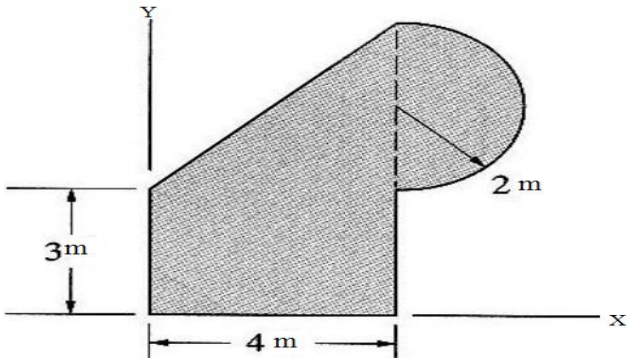


17. (a) Determine the member forces in a truss structure as shown in figure by any suitable method. (16)



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

Or

(b) A cantilever of length 2.0 *m* carries a uniformly distributed load of 1 *kN/m* run over a length of 1.5 *m* from the free end. Draw the shear force and bending moment diagram for the cantilever. (16)

19. (a) A solid shaft is subjected to a torque of 50 *kNm*. If angle of twist is 0.6^o 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 125N/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 $C = 4.5 \times 10^4 N/mm^2$. (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^o 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 30kN/mm^2 and 10kN/mm^2 acting on two mutually perpendicular planes and a shear stress of 10kN/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)
