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

Question Paper Code: 43104

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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. The bending moment on a section is maximum where shearing force is

   (a) minimum (b) maximum (c) zero (d) changing sign

6. The shear stess required to cause plastic deformation of solid metal is called

   (a) proof stress (b) flow stress (c) rupture stress (d) ultimate stress

7. Torsional rigidity of a shaft is equal to

(a) product of modulus of rigidity and polar moment of inertia
(b) sum of modulus of rigidity and polar moment of inertia
(c) difference of modulus of rigidity and polar moment of inertia
(d) ratio of modulus of rigidity and polar moment of inertia

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.

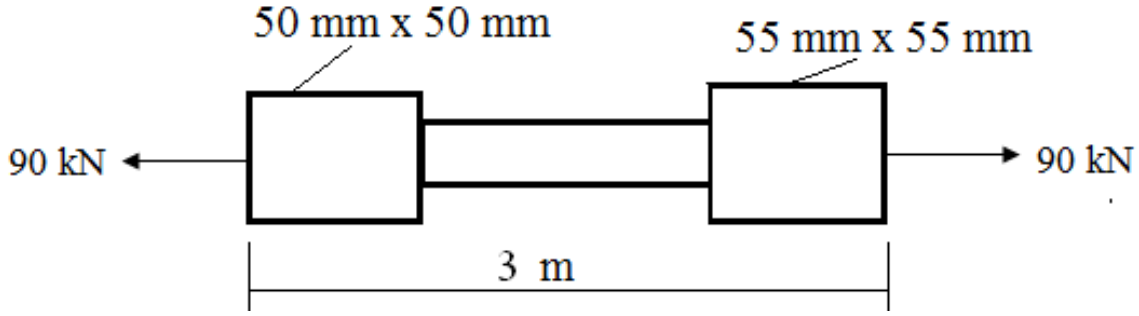
15. Define principal plane.

PART - C (5 x 16 = 80 Marks)

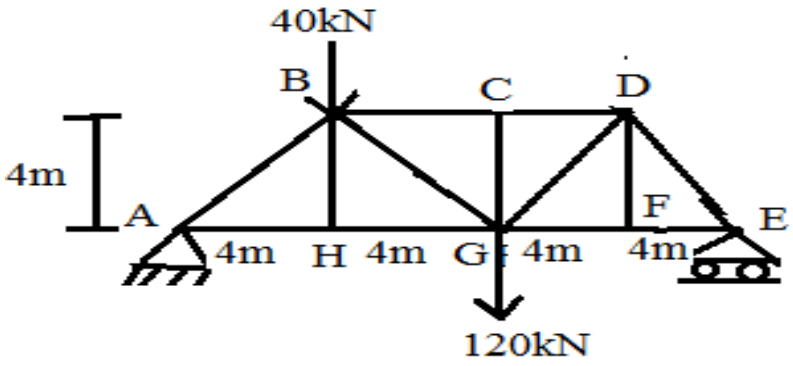
16. (a) A steel wire 2.5 *mm* dia is firmly held in a clamp which it hangs vertically. An anvil, the weight of which may be neglected is secured to the wire 1.8 *m* below the clamp. The wire is to be tested allowing a weight to slide over the wire to drop freely from 1 *m* above the anvil. Evaluate the weight required to stress the wire to 1000 N/mm^2, assuming the wire to be elastic up to this stress. Take E = 210 *Gpa*. (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)

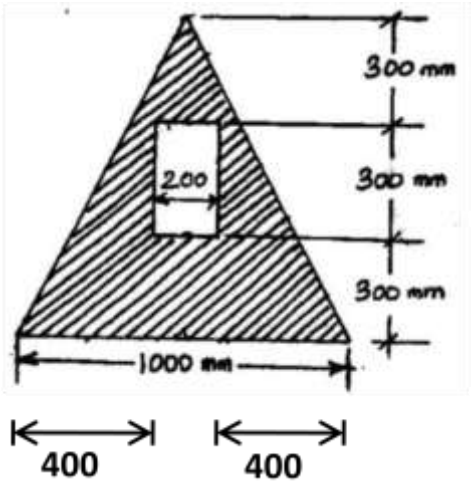


17. (a) Determine the forces in all members of a truss as shown in below figure. (16)



Or

(b) Find the moment of inertia of the shaded area shown in below figure about the vertical and horizontal centroidal axes. The width of the hole is 200 *mm*. (16)



18. (a) A simply supported beam of span 7*m* is carrying a uniformly distributed load of10*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) Two shafts of same material and same length are subjected to the same torque.If the first shaft is solid circular section and second shaft is hollow circular section, whose internal diameter is 2/3 of outside diameter and the maximum shear stress developed in each shaft is the same. Compare the weight of the shafts. (16)

Or

(b) An open coil helical spring consists of 12 *coils*, each of mean diameter 50 *mm*. The wire forming the coil being 5 *mm* in diameter. Each coil makes an angle of 30^o with the plane perpendicular to the axis of the spring. Determine the load required to elongate the spring by 30 *mm* and the bending stress caused by that load. Young's modulus of elasticity and modulus of rigidity of the material of the spring is 200 GN/m^2 and 82 GN/m^2 respectively. (16)

20. (a) A rectangular bar of cross sectional area 10000 mm^2 is subjected to an axial load of 20 *kN*. Determine the normal and shear stress on a section which is inclined at an angle of 30° with normal cross-section of the bar. (16)

Or

(b) At a point in a strained material the principle stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of major principle stress. Also determine the maximum shear stress at the point. (16)

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