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

Question Paper Code: 41314

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Third Semester

Civil Engineering

14UCE304 - MECHANICS OF SOLID - I

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The stress induced in a body, when suddenly loaded, is _____ the stress induced when the same load is applied gradually.

   (a) equal to (b) one-half (c) twice (d) four times

2. 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

3. The ratio of moment of inertia about the neutral axis to the distance of the most distance point of the section from the neutral axis is called

   (a) moment of inertia (b) section modulus
   (c) polar moment of inertia (d) modulus of rigidity

4. A fixed beam of length *(l)* carries a point load (*w*) at the centre. The number of points of contra flexure

   (a) is one (b) are two (c) are three (d) is none

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. A coil is having stiffness *k*. It is cut into halves, then the stiffness of the cut coils will be

(a) same (b) half (c) double (d) one-forth

9. The stress at which the extension of the material takes place more quickly as compared to the increase in load, is called

(a) elastic limit (b) yield point (c) ultimate point (d) breaking point

10. Mohr's circle is used to determine the stresses on an oblique section of a body subjected to

(a) direct tensile stress in one plane accompanied by a shear stress
(b) direct tensile stress in two mutually perpendicular directions
(c) direct tensile stress in two mutually perpendicular directions accompanied by a simple shear stress
(d) all of the above

PART - B (5 x 2 = 10 Marks)

11. State the relationship between Young's modulus and modulus of rigidity.

12. Explain the concept of analysis of tresses carrying horizontal loads in method of joints.

13. What is mean by positive or sagging BM?

14. Write the assumptions in the theory of pure torsion.

15. Define octahedral stresses.

PART - C (5 x 16 = 80 Marks)

16. (a) In testing a 1 *cm* dia mild steel rod in tension it was found that a load of 10 *kN* caused an extension of 0.012 *cm* on a length of 20 *cm*. The maximum load was 26 *kN* and the load beyond which stress-strain was not proportional was 11*kN*. The

extension of the 20 *cm* length was 6.15 *cm* and the diameter at fracture was 0.57 *cm*. Find

(i) The limit of proportionality

(ii) Young's modulus

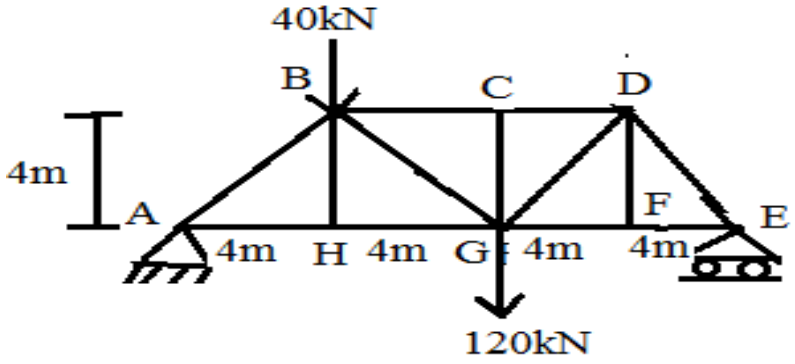
(iii) Percentage elongation and

(iv) Percentage contraction of area at fracture (16)

Or

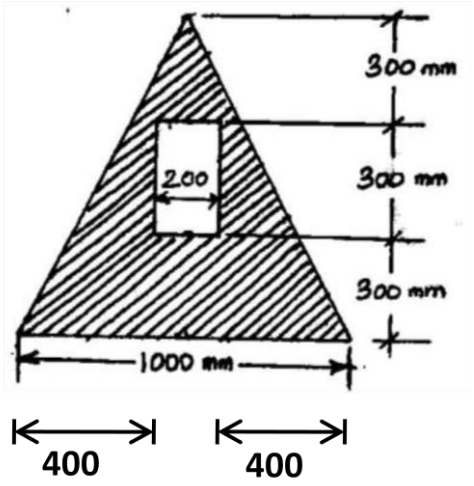
(b) A steel wire 2.5 *mm* dia is firmly held in a clamp which it hangs vertically. An anvil, the weight of which may be neglected is secured to the wire 1.8 *m* below the clamp. The wire is to be tested allowing a weight to slide over the wire to drop freely from 1 *m* above the anvil. Evaluate the weight 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)

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 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)

Or

(b) A simply supported beam of length 6 *m* carries point load of 3 *kN* and 6 *kN* at distances 2 *m* and 4 *m* from the left end. Draw the shear force and bending moment diagrams for the beam. (16)

19. (a) A close-coiled helical spring made of 12 *mm* diameter steel rod, has 12 complete turns over a mean diameter of 100*mm*. Determine

(i) Increase in the number of runs, and

(ii) Bending stress induced, if it is subjected to an axial twist of 16*N.m*

Take $E = 2 \times 10^5$ N/mm^2. Also compute the torsional stiffness of the spring. (16)

Or

(b) (i) Derive the torsion equation for a circular shaft of diameter '*d*' subjected to torque '*T*'. (8)

(ii) Find the torque that can be transmitted by a thin tube of 6 *cm* mean diameter and wall thickness of 1 *mm*. the permissible shear stress is 6000 N/cm^2. (8)

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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