F 3092 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Civil Engineering

MECHANICS OF SOLIDS (C)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Briefly discuss the ellipse of stress.
2. State the Principle of superposition.
3. Distinguish between plane bending and oblique bending.
4. Derive an expression for bending moment at various portions of a simply supported beam with both side overhangs.
5. Prove that the curvature of the axis of the beam is directly proportional to the bending moment.
6. A long rod of uniform rectangular section and thickness '*t*' originally straight is bent into the form of circular arc and the displacement '*d*' of the midpoint of length 'L' is measured by means of dial gauge. The displacement '*d*' may be regarded as small compared with the length 'L'. Show that the longitudinal surface strain in the rod is given by $e = 4\ td/L^2$.
7. Write a note on statically indeterminate torsional members.
8. Determine expressions for stresses in a thin cylindrical shell subject to internal pressure.
9. What is the effect of wind pressure on structures ?
10. Discuss the significance of slenderness ratio of compression members.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Derive an expression for elangation of a truncated cone–shaped solid bar. State all the assumptions.

Or

12. A mild–steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are brazed together, and the composite bar is subjected to an axial pull of 50 kN. If 'E' for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively, find the stresses developed in the rod and tube.

13. A lintel of 2m span carries a stone wall of 30 cm thick. Assuming that the effective load on the lintel is an equilateral triangle on the spaw as the base, calculate the maximum bending moment. Take the unit weight of masonary as 20 KN/m^3. Sketch the shear force and bending moment diagrams.

Or

14. A beam of span 'L', simply supported at the ends, is loaded with distributed load of intensity zero at the ends and 'W' per unit length at the centre. Plot the shear force and bending moment diagrams, indicating principal values.

15. A 100 mm × 200 mm rolled steel joint of I–Section has flanges 12 mm thick and web 10 mm thick. Find the safe uniformly distributed load that this section can carry over a span of 6m, if the permissible skin stress is limited to 160 N/mm^2.

Or

16. A timber beam of rectangular section is to support a load of 20 KN over a span of 4 m. If the depth of the section is to be twice the breadth, and the stress in the timber is not to exceed 60 N/mm^2, find the dimensions of the cross-sections.

17. Derive expressions for :

    (i) Resisting torque; and

    (ii) Strain energy in torsion.

Or

18. A hollow shaft, subjected to pure torque, attains a maximum shear stress of 'f's. Given that the strain energy per unit volume is $fs^2/3$ N, calculate the ratio of shaft diameters. Determine the actual diameters of such a shaft to transmit 5 MW at 120 r.p.m. when energy stored is 25,000 Nm/m^3. and N = 80,000 N/mm^2.

19. A mild–steel column is of hollow circular section 100 mm as external diameter and 80 mm as internal diameter. The column is 2.4. m long and is hinged at both the ends. Calculate the maximum permissible load with an eccentricity of 16 mm. if the maximum compressive stress is limited to 80 N/mm^2. Take E = 2 × 10^5 N/mm^2.

Or

20. An unequal angle, 100 mm × 60 mm × 10 mm is used as a strut for a length of 4m. The strut may be considered as hinged at top and fixed at bottom. Using Euler's formula, calculate the safe load the column can carry at a factor of safety of 3. Take E = 2 × 10^5 N/mm^2.

(5 × 12 = 60 marks)