F 3140 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Civil Engineering

CE 010 304—MECHANICS OF SOLIDS—I (CE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Define shear stress.
2. What are statically indeterminate beams ?
3. Write a note on : Section modulus.
4. Differentiate between close coiled and open coiled springs.
5. List two assumptions made in theory of thick cylinders.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Define and explain Poisson's ratio and Bulk modulus.
7. Differentiate between a simple support and fixed support.
8. Show that the neutral axis must pass through the centroid of a section.
9. How will you determine principal stresses in shafts under pure torsion ?
10. Distinguish between short column and long column.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. A steel bar 12 m long and of diameter 5 cm is turned over 5 cm of its length to a diameter of 2.5 cm. If an axial tensile load of 80 kN is applied, find the extension of the bar. E = 200 GN/m^2.

Or

12. Principal stress in the material of a boiler are P, P/2 and O. If E and μ are respectively Young's modulus and Poisson's ratio, find the principal strains and volumentric strain. What is the modified Young's modulus if it is based on the principal stress P and extension in the direction of P ?

13. A beam 8 cm long is simply supported at ends and carries a concentrated load of 20kN at the mid-span along with a uniformly distributed load of 30 kN/m over the left 2 m of the beam. Draw the shear force and bending moment diagrams.

Or

14. A beam OAB with OA = 1m and AB = 4 m is simply supported at A and B and carries a uniformly varying load, varying from 0 to 6 kN/m over whole of the length with zero load at end 0. Draw bending moment and shear force diagrams. Give reactions and point of contra flexure , if any. What are the maximum values of bending moment and shear force ?

15. A timber beam of 16 cm in depth and 8 cm width is reinforced with steel plates 6 mm thick along its longer sides. If the bending stresses in the composite beam are to be limited to 120 MN/m^2 in steel and 10 MN/m^2 in timber, estimate the permissible bending moment in the beam. Assume $E_s = 20\ E_t$.

Or

16. Draw the shear stress distribution for a thin circular section with mean diameter of 20 cm and a thickness of 3 mm if shear force is 90 kN.

17. A close coiled helical spring is used to connect two shafts which transmit 2 kW of power at 2400 r.p.m. Calculate the maximum normal stress and wind up angle in spring. The diameter of wire = 10 mm, the mean diameter of spring = 50 mm and the modulus of elasticity, E = 210 GPa and the number of coils = 10.

Or

18. A solid shaft 15 cm diameter transmitting a torque is to be replaced by a hollow shaft having its weight 0.75 times the weight of solid shaft. If allowable shear stress in the hollow shaft is 1. 25 times that allowed for solid shaft, find the external and internal diameters of the hollow shaft assuming same material and same length for the two shafts. Find the ratio of torsional rigidities of the two shafts.

19. A timber strut 7.5 cm × 7.5 cm in section is 3 m high. The column is fixed at the bottom end and free at the other end. The column carries an eccentric load of 1 kN at the free end with an eccentricity of 15 cm from the centre of the cross-section along one of the principal axes of the section. Find the maximum stress in the strut at the bottom of column, if $\in$ = 9 GPa.

Or

20. A steel cylinder 10 cm internal radius and 15 cm external radius is subjected to an internal pressure only. Due to corrosion, internal radius is machined to a radius of 10.2 cm. Find the percentage decrease in pressure required in the second case as compared to the first, in order to develop the same loop stress in the second case as in the first case.

(5 × 12 = 60 marks)