D 90035 (Pages 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) [14 SCHEME] DEGREE EXAMINATION, NOVEMBER 2015

CE 14 303—MECHANICS OF SOLIDS

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions out of ten.*

1. Derive the relationship between Young's modulus and bulk modulus.
2. Draw the stress strain diagram for mild steel specimen subjected to tension test and explain salient points.
3. Show that the extension produced due to self weight of a uniform c/s fixed at one end and suspended vertically is equal to half the extension produced by a load equal to self weight applied at the free end.
4. Define bending moment, shear force and point of contraflexure.
5. Obtain the relationship between udl, shear force and bending moment.
6. Derive an equation for the ratio of torsional strengths of hollow and solid circular shafts for a given length, material and mass.
7. Write the expression for maximum shear stress and deflection for a closed coil helical spring subjected to axial load.
8. Distinguish between :
   (i) Buckling and crushing ;
   (ii) Long and short column.
9. Define slope, deflection and elastic curve.
10. State the assumptions made in the moment curvature relationship derivation.

(8 × 5 = 40 marks)

Part B

Answer **all** *questions.*

11. A composite section comprises of a steel tube 100 mm internal diameter 120 mm external diameter fitted inside a brass tube of 120 mm internal diameter and 150mm external diameter. The assembly is subjected to a compressive load of 500 kN. Find the load carried by the tube and the stresses generated in them. The length of tube is 2000 mm. Take $E_{steel} = 200 \times 10^3$ N/mm^2 and $E_{brass} = 100 \times 10^3$ N/mm^2. What is change in length of tubes ?

Or

12. A steel bar 30 mm × 50 mm section and 300 mm long is subjected to an axial pull of 200 kN. $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio as 0.3. Calculate the change in dimensions of the bar, the volumetric strain and change in volume.

13. A cast iron beam is of I-section having the top flange of size 70 mm × 20 mm, bottom flange of size 150 mm × 35 mm and web of size 20 mm × 220 mm. The beam is simply supported on a span of 10 m. If the tensile stress is not to exceed 40 N/mm^2. Find the safe uniformly distributed load which the beam can able to carry. Also determine the maximum compressive stress.

Or

14. The cross-section of T beam is as follows : Flange thickness = 10mm ; width of the flange = 100mm; thickness of the web = 10 mm ; depth of the web = 120 mm ; If a shear force of 10 kN is acting at a particular section of the beam draw the shear stress distribution across the section.

15. A solid steel shaft is subjected to a torque of 45 kNm. If the angle of twist is 0.5° per metre length of the shaft and the shear stress is not to be allowed to exceed 90 MN/m^2.

find :

(i) Suitable diameter for the shaft.

(ii) Final maximum shear stress and angle of twist.

(iii) Maximum shear strain in the shaft.

Take : C = 80 GN/m^2.

Or

16. A closely coiled helical spring made out of a 10mm diameter steel bar has 12 complete coils, each of mean diameter of 100mm. Calculate the stress induced in the section of rod, the deflection under the pull and the amount of energy stored in the spring during the extension. It is subjected to an axial pull of 200 N. Modulus of rigidity is 0.84×10^5 N/mm^2.

17. A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 250 kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take crushing stress = 550 N/mm^2 and α = 1/1600 in Rankine's formula.

Or

18. A beam of length 6 m is simply supported at its ends and carries two point loads of 60 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support.

Find :

(i) Deflection under each load.

(ii) Maximum deflection.

(iii) The point at which the maximum deflection occurs.

Take $I = 85 \times 10^6$ mm^4 $E = 2 \times 10^5$ N/mm^2.

(4 × 15 = 60 marks)