Reg. No. :

Question Paper Code : 27092

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Civil Engineering

CE 6302 — MECHANICS OF SOLIDS

(Common to Environmental Engineering)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by Poisson's ratio? Which material has the higher value of Poisson's ratio?

2. Derive an expression for strain energy stored in a prismatic bar subjected to an axial load.

3. How bending moment, shear force and intensity of loadings are related?

4. Define the term 'moment of resistance'.

5. What are the advantages of Macaulay's method over double integration method for beam deflection analysis?

6. A cantilever of span 1.8 m is carrying a point load at the free end. Find the deflection at the free end, if the slope at the free end is 1^0.

7. Write an expression for stain energy stored in a shaft of uniform section subjected to torsion.

8. Mention the uses of springs.

9. What are principal planes?

10. What are the advantages of method of sections over method of joints in finding the forces in the members of a pin-jointed truss?

PART B — (5 × 16 = 80 marks)

11. (a) A composite bar is made with a copper flat of size 50 mm × 30 mm and a steel flat of 50 mm × 40 mm of length 500 mm each placed one over the other. Find the stress induced in the material, when the composite bar is subjected to an increase in temperature of 90°C. Take coefficient of thermal expansion of steel as 12×10^{-6}/ °C and that of copper as 18×10^{-6}/ °C, Modulus of elasticity of steel = 200 GPa and Modulus of elasticity of copper = 100 GPa.

Or

(b) A thin cylindrical shell, 2 m long has 800 mm internal diameter and 10mm thickness. If the shell is subjected to an internal pressure of 1.5 MPa, find

(i) the hoop and longitudinal stresses developed,

(ii) maximum shear stress induced and

(iii) the changes in diameter, length and volume. Take modulus of elasticity of the wall material as 205 GPa and Poisson's ratio as 0.3.

12. (a) An overhanging beam ABC of length 8 m is simply supported at B and C over a span of 6 m and the portion AB overhangs by 2 m. Draw the shearing force and bending moment diagrams and determine the point of contra-flexure if it is subjected to uniformly distributed loads of 3 kN/m over the portion AB and 4 kN/m over the portion BC.

Or

(b) A channel section made with 120 mm × 10 mm horizontal flanges and 160 mm × 10 mm vertical web is subjected to a vertical shearing force of 120 kN. Draw the shear stress distribution diagram across the section.

13. (a) A horizontal beam of uniform section and 6 m long is simply supported at its ends. The beam is subjected to a uniformly distributed load of 12 kN/m over the right half span. Find the maximum deflection in the beam using Macaulay's method.

Or

(b) A cantilever of span 4 m carries two point loads 10 kN and 8 kN at mid span and free end respectively. Determine the slope and deflection of the cantilever at the free end using conjugate beam method. Assume EI is uniform throughout.

14. (a) A shaft is required to transmit a power of 210 kW at 200 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not to exceed 45 N/mm² and the twist 1^0 per metre length. Determine the diameter required if

(i) the shaft is solid

(ii) the shaft is hollow with external diameter twice the internal diameter. Take modulus of rigidity = 80 kN/mm².

Or

(b) A bumper is to be designed to arrest a wagon weighing 500 kN moving at 18 km/hour. Size of the buffer springs available are having diameter 30 mm, mean radius 100 mm, number of turns 18, modulus of rigidity 80 kN/m^2 and maximum compression permitted is 200 mm. Find the number of springs required for the buffer.

15. (a) The stresses on two mutually perpendicular planes through a point on a body are 30 MPa and 20 MPa both tensile, along with a shear stress of 15 MPa. Find

(i) the position of principal planes and stresses across them.

(ii) the planes of maximum shear stress

(iii) the normal and tangential stress on the plane of maximum shear stress.

Or

(b) Analyze the cantilevered truss shown in Fig. Q.15(b) by method of sections.

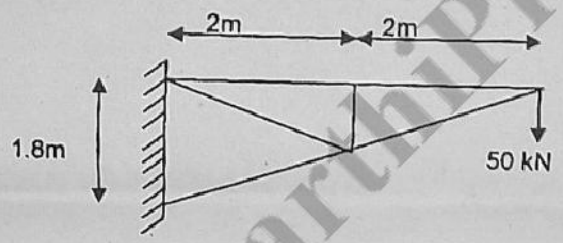

Fig. Q. 15(b)