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Question Paper Code : 20255

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Civil Engineering

CE 6302 — MECHANICS OF SOLIDS

(Regulations 2013)

(Common to Environmental Engineering)

(Also common to PTCE 6302 – Mechanics of Solids for B.E. (Part-Time) First Semester – Civil Engineering – Regulations – 2014)

Time : Three hours Maximum : 100 marks

Assume suitable data if found necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Hooke Law.
2. Define Resilience.
3. What are the different types of loadings?
4. Write the equation for simple bending theory.
5. What is a conjugate beam?
6. Enlist the methods for finding out the slope and deflection at a section.
7. Define the term polar modulus.
8. Give the expression for stiffness of a closed helical spring.
9. What are principal planes?
10. Enlist the assumptions made in analysis of a pin-joined plane truss.

PART B — (5 × 13 = 65 marks)

11. (a) A bar or 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Calculate :

    (i) Young's modulus

    (ii) Poisson's ratio and

    (iii) Bulk modulus. (13)

Or

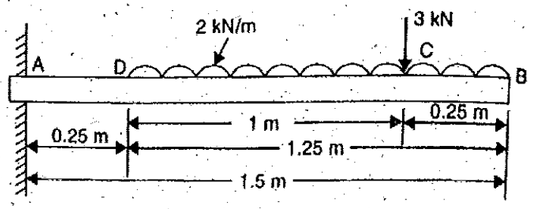
(b) A load of 100 N falls through a height of 2 cm onto a collar rigidly attached to the lower end of a vertical bar 1.5 m long and of 1.5 cm² cross sectional area. The upper end of the vertical bar is fixed. Determine

(i) maximum instantaneous stress induced in the vertical bar

(ii) maximum instantaneous elongation, and

(iii) strain energy stored in the vertical rod. Take $E = 2 \times 10^5$ N/mm². (13)

12. (a) A cantilever 1.5 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25 m from the free end. Draw the shear force and bending moment diagrams of the cantilever. (13)



Or

(b) A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm² and moment of inertia of the section if 7×10^8 mm⁴, find the span of the beam. (13)

13. (a) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left end support. Find the deflection under each load. Take $E = 2 \times 10^5$ N/mm² and $I = 85 \times 10^6$ N/mm⁴. (13)

Or

(b) A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If $E = 10^5$ N/mm² and $I = 10^8$ mm⁴ for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. (13)

14. (a) Determine the diameter of solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not exceed 30 N/mm² and twist should not be more than 1^0 in a shaft length of 2 m. Take modulus of rigidity = 1×10^5 N/mm². (13)

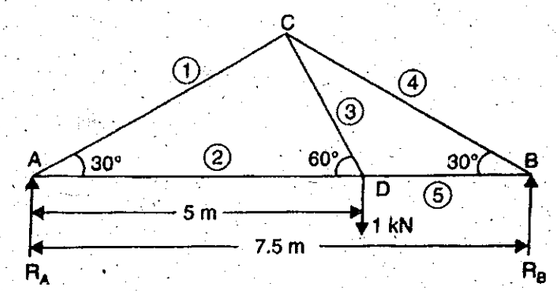
Or

(b) A close coil helical spring of 10 cm mean diameter is made up of 1 cm diameter rod and has 20 turns. The spring carries an axial load of 200 N. Determine the shearing stress. Taking the value of modulus of rigidity = 8.4×10^4 N/mm², determine the deflection when carrying this load. Also calculate the stiffness of the spring and the frequency of free vibration for a mass hanging from it. (13)

15. (a) The normal stress in the two mutually perpendicular directions are 600 N/mm² and 300 N/mm² both tensile. The complementary shear stresses in these directions are of intensity 450 N/mm². Find the normal and tangential stresses on the two planes which are equally inclined to the plane carrying the normal stresses mentioned above. (13)

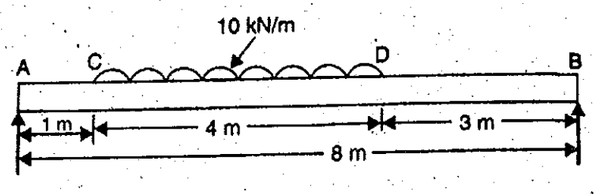
Or

(b) A truss of span 7.5 m carries a point load of 1 kN at a joint D as shown in Fig. Find the reactions and forces in the members of the truss. (13)



PART C — (1 × 15 = 15 marks)

16. (a) Draw the shear force and bending moment diagrams for a simply supported beam of length 8 m and carrying a uniformly distributed load of 10 kN/m for a distance of 4 m as shown in Fig. (15)



Or

(b) A solid circular shaft of 10 cm diameter of length 4 m is transmitting 112.5 kW power at 150 r.p.m. Determine :

(i) the maximum shear stress induced in the shaft and

(ii) Strain energy stored in the shaft. Take $C = 8 \times 10^4$ N/mm². (15)