PART C — (1 × 15 = 15 marks)

16. (a) A steel girder of 6 m length acting as a simply supported beam carries a uniformly distributed load w N/m run throughout its length. If $I = 30 \times 10^{-6}$ m^4 and depth 270 mm, calculate :

(i) The magnitude of w so that the maximum stress developed in the beam section does not exceed 72 MN/m^2.

(ii) The slope and deflection in the beam at a distance of 1.8 m from one end. Take : E = 200 GPa.

Or

(b) A wagon weighing 18 kN is moving at 5 km/hr. How many springs each of 20 coils will be required in a buffer stop to absorb the energy of motion during a compression of 175 mm. The mean diameter of coils is 250 mm and the diameter of steel rod, comprising the coil is 22 mm. Take C = 82 GPa.

Reg. No. :

Question Paper Code : 52754

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third Semester

Civil Engineering

CE 6302 – MECHANICS OF SOLIDS

(Regulation 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

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Hooke's law.

2. Draw the stress strain diagram for mild steel and indicate the salient points.

3. What is the relationship between SF and BM?

4. List out any two assumptions in simple bending.

5. What is a conjugate beam?

6. Enlist the methods for finding out the slope and deflection at a section.

7. Determine the strain energy stored in a solid circular shaft of diameter 100 mm and length 1 m when it is subjected to a torque of 20 kNm. Take the shear modulus as 80 GPa.

8. How do you determine the stiffness of an equivalence spring when two springs of different stiffness are connected in series?

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-joint 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.

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 cm^2 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

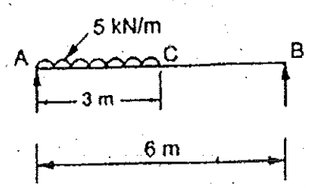
(iii) strain energy stored in the vertical rod. Take E = 2×10^5 N/mm^2.

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

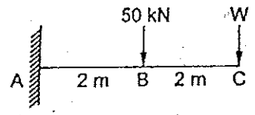
(b) A channel section made with 120 mm × 10 mm horizontal flanges and 160 mm × 10 mm vertical web is subjected to a vertical shearing force of 120 kN. Draw the shear stress distribution diagram across the section.

13. (a) A SSB of span 6 m carries UDL 5 kN/m over a length of 3 m extending from left end. Calculate deflection at mid-span. E = 2×10^5 N/mm^2, I = 6.2×10^6 mm^4.



Or

(b) A cantilever beam 4 m long carriers a load of 50 kN at a distance of 2 m from the free end, and a load of W at the free end. If the deflection at the free end is 25 mm, calculate the magnitude of the load W, and the slope at the free end, E = 200 kN/mm^2, I = 5×10^7 mm^4.



14. (a) A solid cylindrical shaft is to transmit 300 kW at 100 r.p.m.

(i) If the shear stress is not to exceed 80 MN/m^2, find its diameter.

(ii) What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, the material and maximum shear stress being the same.

Or

(b) A close-coiled helical spring of 100 mm mean diameter is made of 10 mm diameter rod and has 20 turns. The spring carries an axial load of 200N. Determine the shearing stress. Taking the value of modulus of rigidity = 84 GN/m^2, determine the deflection when carrying this load. Also calculate the stiffness of the spring.

15. (a) At a point in the web of a girder the bending stress is 60 N/mm^2 tensile and the shearing stress at the same point is 30 N/mm^2. Determine, (i) principal stresses and principal planes (ii) maximum shear stress and its orientations.

Or

(b) Analyze the simply supported truss shown below by method of joints.