C 3110

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fourth Semester

Automobile Engineering

CE 1262 — STRENGTH OF MATERIALS

(Common to Mechanical Engineering/Mechatronics Engineering/
Metallurigical Engineering/Production Engineering)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the relation between modulus of elasticity and modulus of rigidity.

2. Write the concept used for finding stresses in compound bars.

3. Write down relations for maximum shear force and bending moment in case of a cantilever beam subjected to uniformly distributed load running over entire span.

4. Mention any two assumptions made in the theory of simple bending.

5. What do you mean by torsional rigidity of a shaft? Also, give the expression for finding power transmitted by a shaft.

6. How will you find maximum shear stress induced in the wire of a close-coiled helical spring carrying an axial load?

7. What is the maximum deflection in a simply supported beam subjected to uniformly distributed load over the entire span?

8. What is crippling load? Give the effective length of columns when both ends hinged and when both ends fixed.

9. A cylindrical pipe of diameter 1.5 m and thickness 1.5 cm is subjected to an internal fluid pressure of 1.2 N/mm^2. Determine the longitudinal stress developed in the pipe.

10. How will you find major principal stress and minor principal stress? Also mention how to locate the direction of principal planes.

PART B — (5 × 16 = 80 marks) 13

11. (a) A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow upper tube of external diameter 30 mm and internal diameter of 25 mm. The ends of the tube and rods are brazed together and the composite bar is subjected to an axial pull of 40 kN. If E for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively, find the stresses developed in the rod and tube. Also, find the extension of the rod.

Or

(b) A steel rod 5 m long and 25 mm in diameter is subjected to an axial tensile load of 50 kN. Determine the change in length, diameter and volume of the rod. Take E = 2×10^5 N/mm^2 and Poisson's ratio = 0.30.

12. (a) For the simply supported beam loaded as shown in Fig. 1, draw the shear force diagram and bending moment diagram. Also, obtain the maximum bending moment.

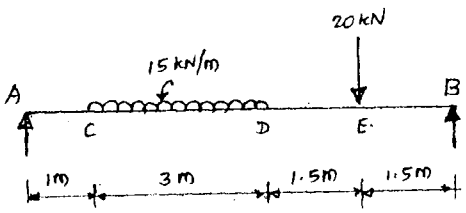

Fig. 1

Or 14.

(b) A cast iron beam is of T–section as shown in Fig. 2. The beam is simply supported on a span of 6 m. The beam carries a uniformly distributed load of 2 kN/m on the entire length (span). Determine the maximum tensile and maximum compressive stress.

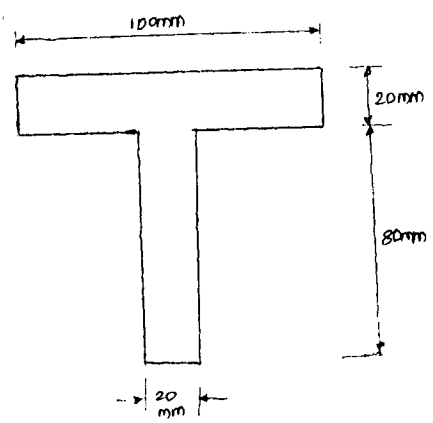

Fig. 2

13. (a) A solid cylindrical shaft is to transmit 300 kN power at 100 rpm. If the shear stress is not to exceed 60 N/mm^2, find its diameter. What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same.

Or

(b) A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 250 N. Determine

(i) the deflection of the spring

(ii) maximum shear stress in the wire and

(iii) stiffness of the spring and

(iv) frequency of vibration.

Take $C = 0.8 \times 10^5$ N/mm^2.

14. (a) A beam AB of length 8 m is simply supported at its ends and carries two point loads of 50 kN and 40 kN at a distance of 2 m and 5 m respectively from left support A. Determine, deflection under each load, maximum deflection and the position at which maximum deflection occurs. Take $E = 2 \times 10^5$ N/mm^2 and $I = 8\,5 \times 10^6$ mm^4.

Or

(b) A 1.2 m long column has a circular cross section of 45 mm diameter one of the ends of the column is fixed in direction and position and other ends is free. Taking factor of safety as 3, calculate the safe load using

(i) Rankine's formula, take yield stress = 560 N/mm^2 and a = 1/1600 for pinned ends.

(ii) Euler's formula, Young's modulus for cast iron = 1.2×10^5 N/mm^2.

15. (a) A cylindrical shell 3 m long which is closed at the ends, has an internal diameter of 1 m and a wall thickness of 20 mm. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of $2.0\ N/mm^2$. Take $E = 2 \times 10^5\ N/mm^2$ and $\frac{1}{m} = 0.3$.

Or

(b) At a point in a strained material, the principal stresses are $100\ N/mm^2$ (tensile) and $40\ N/mm^2$ (compressive). Determine analytically the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of major principal stress. What is the maximum intensity of shear stress in the material at that point?
