Question Paper Code : P 1145

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fourth Semester

Mechanical Engineering

CE 1262 — STRENGTH OF MATERIALS

(Common to Automobile Engineering/Mechatronics Engineering/
Metallurgical Engineering/Production Engineering)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between rigid and deformable bodies.

2. A short bar of length 100 mm tapers uniformly from a diameter 40 mm to a diameter of 30 mm and carries an axial compressive load of 200 kN. Find the change in length of the bar.

3. Define shear force and bending moment.

4. Draw the shear stress distribution in an T-section due to bending.

5. What are the two conditions to be satisfied in the design of a circular shaft?

6. Write down the equation for Wahl factor.

7. State Mohr's first theorem.

8. Write down the Rankine formula for columns.

9. Give the expression for strain energy due to bending of a cantilever beam carrying a point load at free end.

10. Draw a Mohr's circle for the given shear stress q.

PART B — (5 × 16 = 80 marks)

11. (a) The load P is applied on the bars as shown in Fig. 11(a). Find the safe load P if the stresses in brass and steel are not to exceed 60 N/mm² and 120 N/mm² respectively. E for steel = 200 kN/mm², E for brass = 100 kN/mm². The copper rods are 40 mm × 40 mm in section and the steel rod is 50 mm × 50 mm in section. Length of steel rod is 250 mm and copper rod is 150 mm.

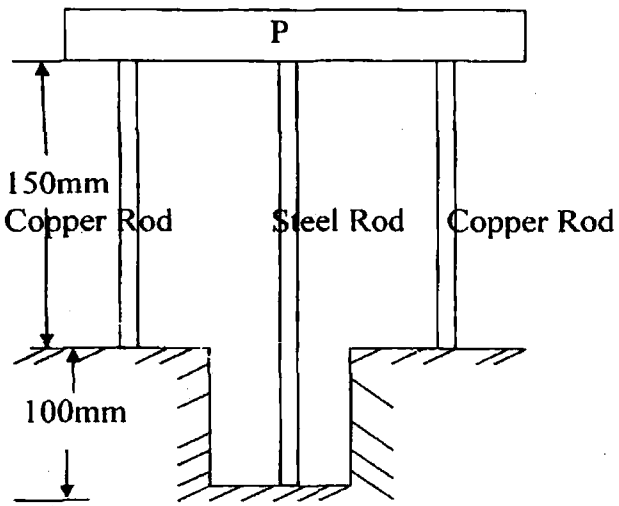

Fig. 11(a)

Or

(b) A steel rod of 20 mm passes centrally through a copper tube of 50 mm external diameter and 40 mm internal diameter. The tube and the rod is fixed at each end by rigid plates. If the temperature of the assembly is raised by 50° C, calculate the stresses developed in copper and steel. Take E_s = 200 kN/mm², E_c = 100 kN/mm², $\alpha_s = 12 \times 10^{-6}$ per °C, $\alpha_c = 18 \times 10^{-6}$ per °C.

12. (a) Draw the shear force and bending moment diagrams for the beam shown in Fig. 12(a). Also indicate the points of contra flexure if any.

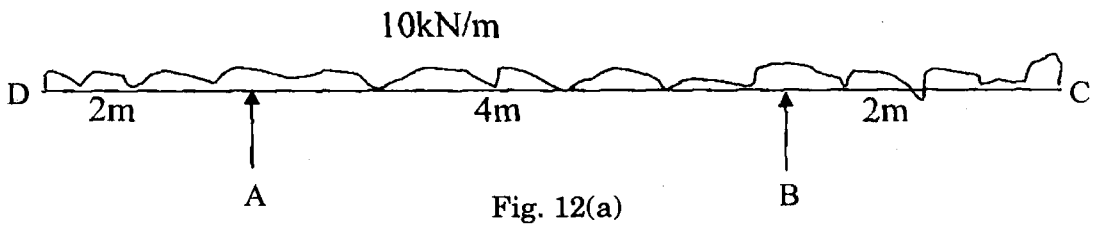

Fig. 12(a)

Or

(b) The shear force acting on a beam section is 100 kN. The cross section is shown in Fig. 12(b). I = 3142210 mm^4. Obtain shear stress distribution across the section.

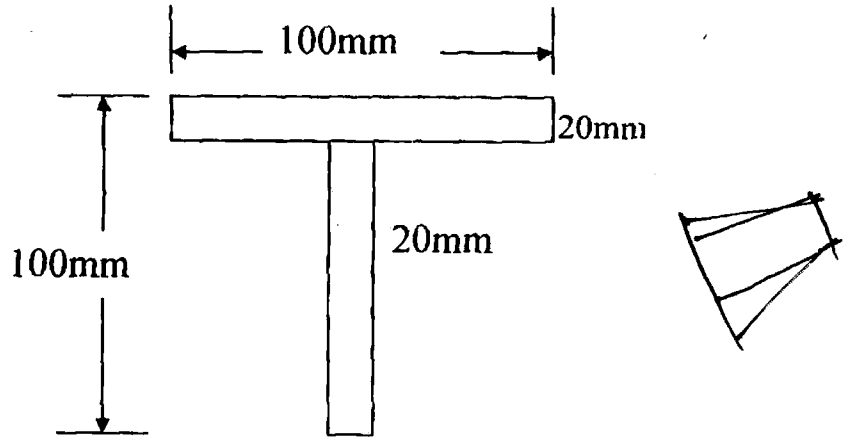

Fig. 12(b)

13. (a) A closed coiled helical spring is to have a stiffness of 1200 N/m in compression with a maximum load of 60 N and maximum shearing stress of 120 N/mm^2. The solid length of the spring (i.e., coils are touching) is 50 mm. Find the diameters and the number of coils. G = 40 kN/mm^2.

Or

(b) A hollow shaft with diameter ratio 3/8 is required to transmit 500 kW at 100 rpm, the maximum torque being 20% greater than the mean. The maximum shear stress is not to exceed 60 N/mm^2 and the twist in a length of 3 m is not to exceed 1.4°. Calculate the minimum diameters required for the shaft. C = 84 kN/mm^2.

14. (a) Find the maximum downward and upward deflections for the beam shown below in Fig. 14(a). EI = 40000 kNm^2.

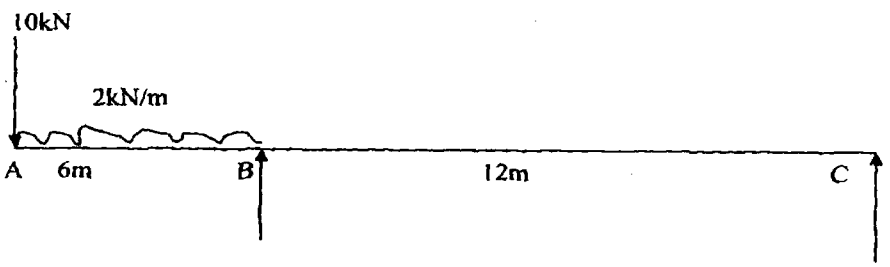

Fig. 14(a)

Or

(b) Derive an expression for critical of a long column hinged at both the ends.

15. (a) Stresses at a point are $p_x = 80$ N/mm^2, $p_y = -35$ N/mm^2, $q = 11.5$ N/mm^2. Determine principal planes, principal stresses and maximum shear stress.

Or

(b) A cylindrical drum 800 mm diameter and 3m long has a shell thickness of 10 mm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine the change in dimensions of the drum. $E = 200$ kN/mm^2, Poisson's ratio = 0.25.