Reg. No. : | | | | | | | | | | | |

J 3111

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Fourth Semester

Automobile Engineering

CE 1262 — STRENGTH OF MATERIALS

(Common to Mechanical 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. Define Poison's ratio.

2. What is thermal stress?

3. Mention the different types of beams.

4. Write the flexure formula.

5. Give torsion formula.

6. Compare closed and open coiled helical springs.

7. Write the equivalent length of the column for a column with

   (a) One end is fixed and other end is free

   (b) Both ends are fixed.

8. What is slenderness ratio?

9. What is Mohr's circle method?

10. What is principal stress?

PART B — ($5 \times 16 = 80$ marks)

11. (a) A compound tube consists of a steel tube of 140 mm internal diameter and 5 mm thickness and an outer brass tube of 150 mm internal diameter and 5 mm thick. The two tubes are of same length. Compound tube carries an axial load of 600 kN. Find the stresses carried by each tube and amount of shortening. Length of the tube is 120 mm. $Es = 2 \times 10^5 N/mm^2$ $Eb = 1 \times 10^5 N/mm^2$.

Or

(b) A steel tube of 20 mm internal diameter and 30 mm external diameter encases a copper rod of 15 mm diameter to which it is rigidly joined at each end. If the temperature of the assembly is raised by 80^0C calculate the stresses produced in the tube. $Es= 2 \times 10^5 N/mm^2$ $Ec = 1 \times 10^5 N/mm^2$. Coefficient of linear expansion of steel and copper are 11×10^{-6} per ^0C and 18×10^{-6} per ^0C.

12. (a) A simply supported beam of span 8m long is subjected to two concentrated loads of 24 kN and 48 kN at 2 m and 6 m from left support respectively. In addition it carries a UDL of 36 kN/m over the entire span. Draw shear force and bending moment diagrams. Mark the salient points.

Or

(b) A simply supported beam of span 6m and of I section has the top flange 40 mm × 5 mm. Bottom flange of 60 mm × 5 mm total depth of 100 mm and web thickness 5 mm. It carries an UDL of 2 kN/m over the full span. Calculate the maximum tensile stress and Maximum compressive stress produced.

13. (a) A solid shaft is subjected to a torque of 45 kNm. If angle of twist is 0.5 degree per metre length of the shaft and shear stress is not to exceed 90 MN/m^2 find

(i) Suitable diameter of the shaft

(ii) Final maximum shear stress and the angle of twist per metre length. Modulus of rigidity = 80 GN/m^2.

Or

(b) A closely coiled helical spring having 12 coils of wire diameter 16 mm and made with coil diameter 250 mm is subjected to an axial load of 300 N. Find axial deflection, strain energy stored and torsional shear stress. Modulus of rigidity = 80 GN/m^2.

14. (a) A simply supported beam of span 8m is subjected to concentrated loads of 24 kN, 48 kN and 72 kN at 2 m, 4 m, 6 m from left support respectively. Calculate the slope and deflection at the centre and also find maximum deflection.

Or

(b) Find Euler's crippling load for a hollow cylindrical cast iron column of 20 mm external diameter, 25 mm thick and 6 m long hinged at both ends. Compare the load with crushing load calculated from Rankine's formula. f_c = 550 N/mm^2. Rankine's constant = 1/1600 E = 1.2×10^5N/mm^2

15. (a) A cylindrical shell is 1.5 m diameter and 4 m long closed at both ends is subjected to internal pressure of 3 N/mm^2. Maximum circumferential stress is not to exceed 150 N/mm^2. Find changes in diameter, length, and volume of the cylinder. E = 2×10^5 N/mm^2, Poisson's ratio = 0.25.

Or

(b) At a point with in a body there are two mutually perpendicular stresses of 80 N/mm^2 and 40 N/mm^2 of tensile in nature. Each stress is accompanied by a shear stress of 60 N/mm^2 Determine the normal, shear and resultant stress on an oblique plane at an angle of 45 degree with the axis of the major principal stress.
