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

Question Paper Code : 77058

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Third Semester

Mechanical Engineering

CE 6306 — STRENGTH OF MATERIALS

(Common to Mechatronics Engineering, Industrial Engineering and Management, Industrial Engineering, Manufacturing Engineering, Mechanical Engineering (Sandwich) Material Science and Engineering and also Common to Fourth Semester Automobile Engineering, Mechanical and Automation Engineering and Production Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What do you mean by thermal stresses?

2. Draw the Mohr's circle for the state of pure shear in a strained body and mark all salient points in it.

3. Define :
   (a) Shearing force and
   (b) Bending moment.

4. What is neutral axis of a beam section? How do you locate it when a beam is under simple bending?

5. What is meant by torsional stiffness?

6. What are the uses of helical springs?

7. What are the advantages of Macaulay's method over other methods for the calculation of slope and deflection?

8. In a cantilever beam, the measured deflection at free end was 8 mm when a concentrated load of 12 kN was applied at its mid-span. What will be the deflection at mid-span when the same beam carries a concentrated load of 7 kN at the free end?

9. Distinguish between thin and thick shells.

10. State the assumptions made in Lame'e theorem for thick cylinder analysis.

PART B — (5 × 16 = 80 marks)

11. (a) A steel rod of diameter 32 mm and length 500 mm is placed inside an aluminium tube of internal diameter 35 mm and external diameter 45 mm which is 1 mm longer than the steel rod. A load of 300 kN is placed on the assembly through the rigid collar. Find the stress induced in steel rod and aluminium tube. Take the modulus of elasticity of steel as 200 GPa and that of aluminium as 80 GPa.

Or

(b) At a point in a strained material the resultant intensity of stress across a vertical plane is 100 MPa tensile inclined at 35° clockwise to its normal. The normal component of intensity of stress across the horizontal plane is 50 MPa compressive. Determine graphically using Mohr's circle method :

(i) The position of principal planes and stresses across them and

(ii) The normal and tangential stress across a plane which is 60° clockwise to the vertical plane.

12. (a) An overhanging beam ABC of length 7 m is simply supported at A and B over a span of 5 m and the portion BC 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 a concentrated load of 8 kN at C.

Or

(b) Three beams have the same length, the same allowable stress and the same bending moment. The cross-section of the beams are a square, a rectangle with depth twice the width and a circle. Find the ratios of weights of the circular and the rectangular beams with respect to the square beam.

13. (a) A brass tube of external diameter 80 mm and internal diameter 50 mm is closely fitted to a steel rod of 50 mm diameter to form a composite shaft. If a torque of 10 kNm is to be resisted by this shaft, find the maximum stresses developed in each material and the angle of twist in 2 m length. Take modulus of rigidity of brass and steel as 40×10^3 N/mm^2 and 80×10^3 N/mm^2 respectively.

Or

(b) A close-coiled helical spring is to have a stiffness of 900 N/m in compression, with a maximum load of 45 N and a maximum shearing stress of 120 N/mm^2. The solid length of the spring (i.e., coils touching) is 45 mm. Find :

(i) The wire diameter,

(ii) The mean coil radius, and

(iii) The number of coils. Take modulus of rigidity of the material of the spring as 0.4×10^5 N/mm^2.

14. (a) A horizontal beam of uniform section and 7 m long is simply supported at its ends. The beam is subjected to a uniformly distributed load of 6 kN/m over a length of 3 m from the left end and a concentrated load of 12 kN at 5 m from the left end. Find the maximum deflection in the beam using Macaulay's method.

Or

(b) A cantilever of span 4 m carries a uniformly distributed load of 4 kN/m over a length of 2 m from the fixed end and a concentrated load of 10 kN at the free end. Determine the slope and deflection of the cantilever at the free end using conjugate beam method. Assume EI is uniform throughout.

15. (a) A thin cylindrical shell, 2.5 m long has 700 mm internal diameter and 8 mm thickness. if the shell is subjected to an internal pressure of 1 MPa, find

(i) The hoop and longitudinal stresses developed

(ii) Maximum shear stress induced and

(iii) The changes in diameter length and volume. Take modulus of elasticity of the wall material as 200 GPa and Poisson's ratio as 0.3.

Or

(b) A thick cylinder with external diameter 320 mm and internal diameter 160 mm is subjected to an internal pressure of 8 N/mm^2. Draw the variation of radial and hoop stresses in the cylinder wall. Also determine the maximum shear stress in the cylinder wall.
