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Question Paper Code : 21565

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fourth Semester

Mechanical Engineering

ME 2254/ME 45/CE 1259/10122 ME 405/080120018 — STRENGTH OF MATERIALS

(Common to Production Engineering and Automobile Engineering)

(Regulation 2008/2010)

(Common to PTME 2254 – Strength of Materials for B.E. (Part-Time) Third Semester Mechanical Engineering, Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Hooke's law.

2. Define the term modulus of resilience.

3. Define point of contra flexure.

4. What is meant by shear flow?

5. Compute the torsional rigidity of a 100 mm diameter, 4 m length shaft $C = 80$ kN/mm^2.

6. Write any four differences between open and closed coiled springs.

7. Describe the double integration method.

8. What is slenderness ratio of a column?

9. Define principal stress and principal plane.

10. Define circumferential and Hoop stress.

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PART B — (5 × 16 = 80 marks)

11. (a) A reinforced concrete column 500 mm × 500 mm in section is reinforced with 4 steel bars of 25 mm diameter; one in each corner, the column is carrying a load of 1000 kN. Find the stresses in the concrete and steel bars. Take E for steel = 210×10^3 N/mm^2 and E for concrete = 14×10^3 N/mm^2.

Or

(b) A solid circular bar of diameter 20 mm when subjected to an axial tensile load of 40 kN, the reduction in diameter of the rod was observed as 6.4×10^{-3} mm. The bulk modulus of the material of the bar is 67 GPa. Determine the following :

(i) Young's modulus,

(ii) Poisson's ratio,

(iii) Modulus of rigidity,

(iv) Change in length per metre and

(v) Change in volume of the bar per metre length.

12. (a) A simply supported beam of span 6 m is carrying a uniformly distributed load of 2 kN/m over the entire span. Calculate the magnitude of shear force and bending moment at every section, 2 m from the left support. Also draw shear force and bending moment diagrams.

Or

(b) State the assumptions made in the theory of simple bending and derive the simple bending equation.

13. (a) A hollow shaft with diameter ratio 3/5 is required to transmit 450 kW at 120 rpm. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m is not to exceed 1°. Calculate the minimum external diameter of the shaft. C = 80 kN/mm^2.

Or

(b) Derive a relation for deflection of a closely coiled helical spring subjected to an axial downward load W.

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14. (a) A horizontal beam of length 'l' and flexural rigidity EI carries a point load W at its midspan. The beam is rigidly fixed at its left end and partially fixed at its right end in such a way that the fixing moment at the rigidly fixed left end is Wl/b. If the supports are at the same level, determine the fixing moment and slope at the right end.

Or

(b) Derive the Euler's formula for a long column with one end fixed and the other is free. Write the assumptions also.

15. (a) A thin cylinder is 3.5 m long, 90 cm in diameter, and the thickness of metal is 12 mm. it is subjected to an internal pressure of 2.8 N/mm^2. Calculate the change in dimensions of the cylinder and the maximum intensity of shear stress induced. Given E = 200 GPa and Poisson's ratio = 0.3.

Or

(b) The normal stress at a point on two mutually perpendicular planes are 140 MPa (Tensile) and 100 MPa (Compressive). Determine the shear stress on these planes if the maximum principal stress is limited to 150 MPa (Tensile). Determine also the following :

(i) Minimum principal stress,

(ii) Maximum shear stress and its plane and

(iii) Normal, shear and resultant stresses on a plane which is inclined at 30° anticlockwise to X plane.

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