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Question Paper Code : 91646

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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 2254/10122 ME 405 — Strength of Materials for B.E. (Part-Time) Third Semester, Mechanical Engineering, Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Hooke's law.

2. Draw stress strain curve for a ductile material.

3. Derive relationship between bending moment and shear force.

4. What is the section modulus of a hollow circular section?

5. Show that the shear stress distribution over a rectangular section is parabolic.

6. What is torsional rigidity?

7. Draw conjugate beam for a cantilever beam and a double side over hanging beam.

8. Write down the formula for maximum deflection of a cantilever with point load 'W' at free end.

9. Explain briefly the failure of a thin shell.

10. List any four theories of failure.

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PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw stress strain curve for mild steel and explain about the salient points. (6)

(ii) Derive a relation for change in length of a uniformly varying circular bar subjected to an axial load 'P'. (10)

Or

(b) A steel flat plate tapers uniformly from 200 mm to 100 mm width in a length of 500 mm and uniform thickness of 20 mm. Determine the elongation of the tapering plate if it is subjected to an axial pull of 40 kN. Take $E = 2 \times 10^5$ N/mm^2.

12. (a) A beam ABC 8 m long has the support at the end A and other support at B 6 m from A. It carries a uniformly distributed load of 6 kN/m over the entire length and a point load of 10 kN at the end C. Draw the shear force and bending moment diagrams.

Or

(b) A simply supported beam of span 5 m carries a gradually varying load of zero at one left end and 6 kN/m at the right end. Calculate the position and magnitude of maximum bending moment.

13. (a) Calculate the maximum intensity of shear stress induced and the angle of twist produced in degrees in solid shaft of 100 mm diameter, 12 m long, transmitting 150 kW at 200 rpm. Take $G = 82$ kN/mm^2.

Or

(b) A closely coiled helical spring is made with 10 mm diameter wire and is having mean diameter of 120 mm and 12 complete turns. The modulus of rigidity of the material of spring is 80 kN/mm^2, where a load of 480 N is applied, find

(i) Maximum shear stress. (4)

(ii) Strain energy stored. (4)

(iii) Deflection produced. (4)

(iv) Maximum bending stress. (4)

14. (a) A simply supported beam of span L is subjected to two equal loads $w/2$ at each of 1/3rd span points. Find the expressions for deflection under the loads and at mid span. Use Moment Area method.

Or

(b) A cantilever beam of length 2 m carries a point load of 15 kN at a distance of 1 m from the fixed end and another point load of 10 kN at free end. Determine the slope and deflection at free end using conjugate beam method. Take EI = 3000 kN-m^2.

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15. (a) A thin cylindrical shell 1.5 m in diameter, 3 m length and 10 mm thickness is subjected to an internal pressure of 4.6 N/mm². Calculate the stresses, strain, change in dimensions. Hence change in volume. Assume the modulus of elasticity and Poisson's ratio of the shell material as 200 kN/mm² and 0.3 respectively.

Or

(b) A thick pipe of 300 mm external diameter and 200 mm internal diameter is subjected to an internal pressure of 12 MPa. What minimum external pressure can be applied so that the tensile stress in the metal shall not exceed 16 MPa?

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