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

Question Paper Code : 23847

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth Semester

Mechanical Engineering

ME 2254 — STRENGTH OF MATERIALS

(Common to Production Engineering and Automobile Engineering)

(Regulations 2008)

(Also common to PTME 2254 – Strength of Materials for B.E. (Part-Time) Third Semester – Mechanical Engineering – Regulations 2009)

Time : Three hours Maximum : 100 marks

(Missing data if any may suitably be assumed)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Hooke's law

2. How will you find the stresses and load carried by each member of a composite bar?

3. What are the different types of beams?

4. Define: Shear force and Bending moment.

5. What are the assumptions made while deriving the torsion equation?

6. What is a spring? Name the important types of springs.

7. State any four methods to evaluate the slope and deflection of beams.

8. What are the assumptions made in Euler's column theory?

9. Define: Principal planes and Principal stresses.

10. Name the two types of stresses setup in a thin cylinder,, subjected to internal fluid pressure.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A circular rod of 20 mm diameter and length 500 mm is subjected to a tensile force 45kN. The modulus of elasticity for steel is 200kN/mm². Find the stress, strain and elongation of the rod due to applied load. (8)

(ii) A compound bar of length 500 mm consists of a strip of aluminium 50mm wide and 20 mm thick and a strip of steel 50mm wide and 15mm thick rigidly joined at ends. If the bar is subjected to a load of 50kN, find the stresses developed in each material of the bar. Take modulus of elasticity for steel as 200kN/mm² and for aluminium as 100kN/mm². (8)

Or

(b) (i) A rod is 2m long at a temperature of 10°C. Find the expansion of the rod, when the temperature is raised to 80°C. If the expansion is prevented, find the stresses induced in the material of the rod. Take $E = 1 \times 10^5$ N/mm² and $\alpha = 0.000012$ per degree centigrade. (8)

(ii) A steel rod is 2m long and 50mm in diameter. An axial pull of 100kN is suddenly applied to the rod. Calculate the instantaneous stress induced and instantaneous elongation produced in the rod. Take $E = 2 \times 10^5$ N/mm². (8)

12. (a) A cantilever of length 2m carries a uniformly distributed load of 2kN/m over the whole length and a point load of 3kN at the free end. Draw the shear force diagram and bending moment diagram for the cantilever.

Or

(b) A rectangular beam 200 mm wide and 300 mm deep is simply supported over a span of 8m. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 120N/mm².

13. (a) Determine the diameter of a solid shaft which will transmit 300kW power at 250rpm. The maximum shear stress should not exceed 30N/mm² and angle of twist should not be more than 1° in a shaft length of 2m. Take modulus of rigidity equals to 1×10^5 N/mm².

Or

(b) A close coiled helical spring made of 10mm diameter steel wire has 15 coils of 100mm mean diameter. The spring is subjected to an axial load of 100N. Calculate the maximum stress induced in the wire, deflection and stiffness of the spring. Take modulus of rigidity = 8×10^4 N/mm².

14. (a) A beam of length 6m is simply supported at its ends and carries two point loads of 48kN and 40kN at a distance of 1m and 3m respectively from the left support. Find the deflection under each load. Given $E = 2 \times 10^5 N/mm^2$ and $I = 85 \times 10^6 mm^4$.

Or

(b) A hollow mild steel tube 6m long, 40 mm internal diameter and 6mm thick is used as a compression member with both ends hinged. Find the crippling load and safe load taking a factor of safety as 3. Take $E = 200 kN/mm^2$

15. (a) A boiler is subjected to an internal steam pressure of $2N/mm^2$. The thickness of the boiler plate is 20mm and permissible tensile stress is $120N/mm^2$. Find out the maximum diameter, when the efficiencies of longitudinal joint is 90% and that of circumferential joint is 40%.

Or

(b) At a point in a strained material, the stresses on two planes at right angles to each other are $20N/mm^2$ and $10N/mm^2$ both tensile. They are accompanied by a shear stress of magnitude $10N/mm^2$. Find the location of the principal planes and evaluate the principal stresses.
