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

Question Paper Code : 31343

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Mechanical Engineering

ME 2254 — STRENGTH OF MATERIALS

(Common to Automobile Engineering and Production Engineering)

(Regulation 2008)

(Also Common to PTME 2254 – Strength of Materials for BE (Part-Time) Third Semester – Mechanical Engineering – Regulation 2009)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is point of contra flexure?

2. List the assumptions made in theory of simple bending.

3. What is point of contra flexure?

4. What is meant by shear flow?

5. Sketch the shear stress distribution on a solid circular shaft due to torsion.

6. What are the two types of shear stresses induced in a helical spring?

7. Draw the elastic curve (deflected shape) of a cantilever beam which carries of UDL throughout the span and indicate the slope and deflection at any section.

8. Determine the equivalent length of a column of height 10 m if the ends are
   (a) fixed
   (b) hinged.

9. Show the possible ways of failure of thin cylinder.

10. Sketch the radial pressure and hoop stress distribution across the section of a thick cylinder subjected to internal pressure.

PART B — (5 × 16 = 80 marks)

11. (a) Three bars made of copper, zinc and aluminium are of equal length and have cross section 50, 75 and 100 square mm respectively. They are rigidly connected at either ends. If this compound member is subjected to a longitudinal pull of 250 kN estimate the proportion of load carried on each rod, and the induced stresses. Assume E_{cu} = 130 kN/mm², E_{zinc} = 100 kN/mm² and E_{al} = 80 kN/mm².

Or

(b) A copper flat 500 mm long and 40 mm (width) × 60 mm (thickness) uniform section is acted upon by the following forces : 50 kN tensile in the direction of the length 300 kN compressive in the direction of the width and 250 kN tensile in the direction of the thickness. Determine change in dimension and hence change in volume of the flat. Assume the modulus of the elasticity and Poisson's ratio of copper as 120 KN/mm² and 0.25 respectively.

12. (a) In an overhanging beam CABD of total length 12 m, the supports A and B are at a distance of 8m from each other. Distance CA is such that the reaction at A is 2/3 of total load. The beam carries UDL of 20 kN/m over its entire length and the point load of 70 kN acts at C and the other point load of 50 kN acts at D. Determine the length of the Overhanging points CA and BD and draw SFD and BMD. Find the maximum and minimum bending moment and the points of contra flexure if any. (16)

Or

(b) Derive the shear stress equation for a rectangular cross section. (16)

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/mm² 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/mm².

Or

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

14. (a) A horizontal beam of uniform section and length 'l' rests on supports at its ends. It carries a uniformly distributed load of 'w' per unit run for a distance 'a' from the right end. Calculate the value of 'a' for which the maximum deflection will occur at the left end of the uniformly distributed load. If the maximum deflection is expressed by (wl^4 /kEI), find the value of k. (16)

Or

(b) (i) Derive an expression for the crippling load of a long column when both ends are hinged. (8)

(ii) Find the Euler's critical load for a cast iron hollow column of external diameter 200 mm, 25 mm thick and of length 6 m hinged at both ends. $E = 0.8 \times 10^4$ N/mm^2. Compare Euler's load with Rankine's critical load. Assume $f_c = 550$ N/mm^2 and $a = 1/600$. Find the length of column at which both critical loads are equal. (8)

15. (a) A boiler shell is to be made of 15 mm thick plate having tensile stress of 120 MN/m^2 If the longitudinal and circumferential efficiencies are 70% and 30% respectively, determine the maximum permissible diameter of the shell for an internal pressure of 2 MN/m^2 and permissible intensity of internal pressure when the shell diameter is 1.5 m. (16)

Or

(b) A steel cylinder is 1m inside diameter and is to be designed for an internal pressure of 8 MN/m^2. Calculate thickness if maximum shearing stress is not to exceed 35 MN/m^2. Also calculate increase in volume due to working pressure if cylinder is 6 m long with closed ends. $E = 200$ GN/m^2 and Poisson ratio = 1/3. Neglect and constraint due to ends. (16)