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Question Paper Code : 51852

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Mechanical Engineering

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

(Common to Production Engineering and Automobile Engineering)

(Regulations 2008/2010)

(Common to PTME 2254/10122 ME 405 – Strength the Materials for B.E. (Part-Time) Third Semester, Mechanical Engineering, Regulations 2009/2010)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What are the types of elastic constants.

2. Give the relation for change in length of a bar hanging freely under its own weight.

3. What is meant by Hogging bending moment ?

4. Write any two uses of a Flitched beam.

5. Define the theory of pure torsion.

6. Explain the term Torsional resilience

7. A horizontal cantilever of uniform section and length "L" carries two vertical point loads "W_1" and "W_2". "W_1" acts upwards at the free end and "W_2" acts downwards at a distance from the fixed end. Find the deflection at the free end.

8. Give the equivalent length of a column for any two end conditions.

9. A riveted boiler is made out of 20mm thick plates, to a diameter of 2m. If the efficiency of the longitudinal and circumferential joints be 75% and 60%. Find the safe pressure in the boiler if the maximum tensile stress on the plate section through rivets may not exceed 120N/mm^2.Find also the longitudinal stress on the section through the rivets.

10. What is the radius of Mohr's circle ?

PART – B (5 × 16 = 80 marks)

11. (a) A compound bar consists of a central steel strip 25mm wide and 6.40mm thick, placed between two strips of brass each 25mm wide and "t" mm thick. The strips are firmly fixed together to form a compound bar of rectangular section 25mm wide and (2t+6.4)mm thick.

Determine,

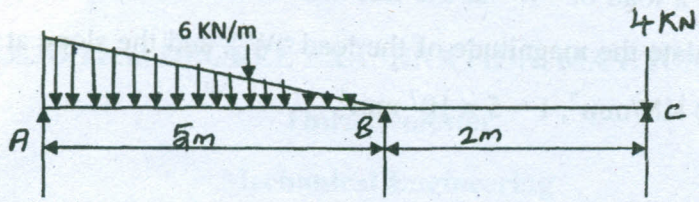
(i) the thickness of the brass strips which will make the apparent modulus of elasticity of compound bar 1.57×10^5 N/mm^2.

(ii) the maximum axial pull the bar can then carry if the stress is not to exceed 157 N/mm^2, in either the brass or the steel. Take the values of $E_{steel} = 2.07 \times 10^5$ N/mm^2, $E_{brass} = 1.14 \times 10^5$ N/mm^2 **(16)**

OR

(b) A 10mm diameter mild steel bar of length 1.50m is stressed by a weight of 120N dropping freely through 20mm before commencing to stretch bar. Find the maximum instantaneous stress and the elongation produced in the bar. Take $E = 2 \times 10^5$ N/mm^2. **(16)**

12. (a) A beam AB of length 7m is simply supported at two supports which are 5m apart with an overhang of 2m on the right side of the beam as shown in fig. The beam carries a UVL of 6 KN/m over the entire length of SSB and a concentrated load of 4 KN at the right end of the beam. Draw SFD and BMD and locate maximum BM. (16)



OR

(b) A I section beam 350mm × 200mm has a web thickness of 12:5mm and a flange thickness of 25mm.lt carries a shearing force of 20 tonnes at a section. Sketch the shear stress distribution across the section. (16)

13. (a) A solid alloy shaft 50mm diameter is to be coupled in series with a hollow steel shaft of the same external diameter. Find the internal diameter of the steel shaft if the angle of twist per unit length of steel shaft is to be 75% of that of the alloy shaft. Determine the speed at which the shafts are to be driven to transmit 18.75kW , if the limits of shearing stress are to be 56 N/mm^2 and 80 N/mm^2 in alloy and steel respectively. Take $C_{STEEL} = 2.2\ C_{ALLOY}$. (16)

OR

(b) A close coiled helical spring has a stiffness of 10 N/mm its length when fully compressed, with adjacent coils touching each other is 400mm.The modulus of rigidity of the material of the spring is 8×10^4 N/mm^2.

(i) Determine the wire diameter and the mean coil diameter if their ratio = 1/10

(ii) If the gap between any two adjacent coils is 2mm, what maximum load can be applied before the spring becomes solid.,i.e.,adjacent coils touch ?

(iii) What is the corresponding maximum shear stress in the spring ? (16)

14. (a) A cantilever of length "I" carries a concentrated load "W" at its midspan. If the free end be supported on a rigid propped, find the maximum deflection. (16)

OR

(b) A cantilever beam 4m long carries a load of 50 KN at a distance of 2m from the free end, and a load of "W" at the free end. If the deflection at the free end is 25mm. Calculate the magnitude of the load "W", and the slope at the free end. Take E = 200 KN/mm^2, 1 = 5×10^7 mm^4. (16)

15. (a) A cylindrical shell 1 metre long, 180mm internal diameter, thickness of metal 8mm is filled with a fluid at atmospheric pressure. If an additional 20000mm^3 of the fluid is pumped into the cylinder. Find the pressure exerted by the fluid on the wall of the cylinder. Find also the hoop stress induced. Take E = 2×10^5 N/mm^2 and 1/m = 0.3. (16)

OR

(b) A rectangular block of material is subjected to a tensile stress of 100 MPa and a compressive stress of 50 MPa on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 60 MPa and that associated with former tensile stress tends to rotate the block anticlockwise. Find the principal stresses and principal planes and the maximum shear stress. (16)
