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

Question Paper Code: 54705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Fourth Semester

Mechanical Engineering

01UME405 – STRENGTH OF MATERIALS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define principal planes and principal stresses.
2. Define: Resilience.
3. What do you mean by the point of contraflexure?
4. Write the equation for the simple bending theory.
5. Distinguish between closed coil helical spring and open coil helical spring.
6. What kind of stress introduced when an axial load acts on a closed and open coiled spring?
7. State the limitations of Euler's formula.
8. Explain the relations between curvatures, bending moment, shear force, slope, deflection, etc., at a section.
9. What are the two stress components that exist on a thin shell subjected to internal pressure?
10. What is the use of Mohr's circle?

PART - B (5 x 16 = 80 Marks)

11. (a) A steel rod of 20*mm* diameter passes centrally through a copper tube of 50*mm* external diameter and 40*mm* internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50 $^{\circ}C$, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 GN/m^2 and α for steel and copper as 12 x 10^{-6} per $^{\circ}C$ and 18 x 10^{-6} per $^{\circ}C$. (16)

Or

(b) A bar of 30mm dia is subjected to a pull of 60kN.The measured extension on a gauge length of 200mm is 0.09mm and the change in dia 0.0039 mm. calculate the poison, s ratio and the value of elastic constants. (16)

12. (a) A Simply supported beam 6 *m* span carries an UDL of 20 *kN/m* for left half of span and two point loads of 25 *kN* end 35 *kN* at 4 *m* and 5 *m* from left support. Find maximum shear force (SF) and bending moment (BM) and their location drawing SF and BM diagrams. (16)

Or

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

13. (a) Find the diameter of a solid shaft to transmit 120 *kW* at 180 *rpm*, such that the shear stress is limited to 70 N/mm^2. The maximum torque is likely to exceed the mean torque by 40%. Also find the permissible length of the shaft, if the twist is not to exceed 1 degree over the entire length. Take rigidity modulus as 0.8 x 10^5 N/mm^2.

(16)

Or

(b) A closed coil helical spring is required to absorb 2250 Joules of energy. Determine the diameter of the wire, the mean coil diameter of the spring and the number of coils necessary if

(i) The maximum stress is not to exceed 400 *MPa*

(ii) The maximum compression of the spring is limited to 250 *mm* and

(iii) The mean diameter of the spring is eight times the wire diameter. For spring material the modulus of rigidity is 70 *GPa*. (16)

14. (a) A cantilever of length 4 *m* carries a u.d.l of 12 *kN/m* for a length of 2.5 *m* from fixed end and a point load of 10 *kN* at free end. Determine the maximum slope and deflection using moment area method. Take $EI = 6.3 \times 10^4$ kN/m^2. (16)

Or

(b) A beam *AB* of length 8 *m* is simply supported at its ends and carries two point loads of 50 *kN* and 40 *kN* at a distance of 2 *m* and 5 *m* respectively from left support *A*. Determine, deflection under each load, maximum deflection and the position at which maximum deflection occurs. Take $E = 2 \times 10^5$ N/mm^2 and $I = 8.5 \times 10^6$ mm^4. (16)

15. (a) A point in a strained material the horizontal tensile stress is 80 N/mm^2 and the vertical compressive stress is 140 N/mm^2 The shear stress is 40N/mm^2. Find the principal stresses and the principal planes. Find also the maximum shear stress and its planes. (16)

Or

(b) At a point within a body there are two mutually perpendicular stresses of 80 N/mm^2 and 40 N/mm^2 of tensile in nature. Each stress is accomplished by a shear stress of 60 N/mm^2. Determine the normal, shear and resultant stress on an oblique plane at an angle of 45 degree with the axis of the major principal stress. (16)

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