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

Question Paper Code: 34705

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 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. Calculate the instantaneous stress produced in a bar of cross-sectional area of 1000 mm^2 and 3 *m* long by the sudden application of a tensile load of unknown magnitude, if the instantaneous extension is 1.5 *mm*. Also predict the corresponding load. Take $E = 200\ GPa$

2. What is thermal stress?

3. A simply supported beam *AB* of span 6 m is subjected to a Uniformly Distributed Load of 10 *kN/m* over the entire span. What is the maximum Bending Moment and where it will occurs?

4. Write down relations for maximum shear force and bending moment in case of a cantilever beam subjected to uniformly distributed load running over entire span.

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?

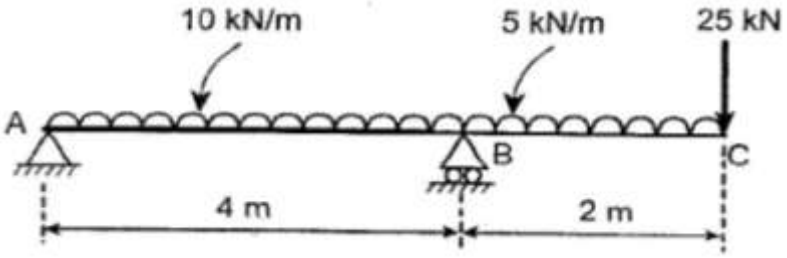
PART - B (5 x 16 = 80 Marks)

11. (a) An aluminium cylinder of diameter 60 *mm* located inside a steel cylinder of internal diameter 60 *mm* and wall thickness 15 *mm*. The assembly is subjected to a compressive force of 200 *kN*. What are the forces carried and stresses developed in steel and aluminium? Take Modulus of elasticity for steel as 200 *GPa* and aluminium as 70 *GPa*. (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) Draw the shear force and bending moment diagrams of the beam loaded as shown in below figure. Also determine the point of contraflexure if any. (16)



Or

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

13. (a) Recommend the dimensions of a hollow circular shaft with a diameter ratio 3:4 which is to transmit 60 *kW* at 200 *rpm*. The maximum shear stress in the shaft is limited to 70 *GPa* and the angle of twist is 3.8° in a length of 4*m*. For the shaft material the modulus of rigidity is 80 *GPa*. (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) The external and internal diameters of a hollow cast iron column are 50 *mm* and 40 *mm* respectively. If the length of this column is 3 *m* and both of its ends are fixed,

(i) Predict the crippling load using Euler's formula taking E = 100*GPa*

(ii) Also determine the Rankine load for the column assuming σ_c = 550 *MPa* and $\propto = \frac{1}{1600}$ (16)

Or

(b) A cantilever beam with a span of 4 *m* carries a point load at its free end. If the maximum slope is 1.5 degree, calculate the deflection at the free end. (16)

15. (a) Draw the Mohr's stress circle for direct stresses of 80 MN/m^2 (tensile) and 50 MN/m^2 (compressive) and estimate the magnitude and direction of the resultant stresses on planes making angles of 22° and 64° with the plane of the first principal stress. Find also the normal and tangential stresses on these 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)