

(Please write your Enrollment Number)

Enrollment No. _____

End-Term Examination
(CBCS)(SUBJECTIVE TYPE)(OffLine)
Course Name: B. Tech (MAE/DMAM), Semester: 3rd
(Nov-Dec, 2022)

Subject Code: BMA 203

Subject: Strength of Materials

Time : 3 Hours

Maximum Marks : 60

Note: Q. 1 is compulsory. Attempt one question each from the Units I, II, III & IV.

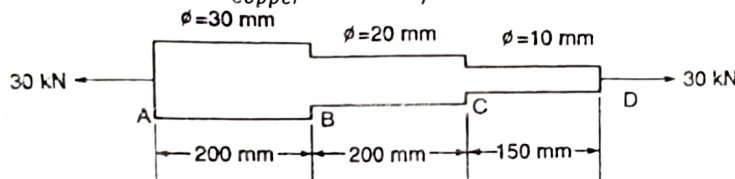
Q1

(2.5*8=20)

- (a) What is a prismatic bar? Explain.
- (b) What is Hooke's Law? Explain.
- (c) Explain the various types of beams.
- (d) What is polar modulus for solid shaft in torsion of shaft? Explain.
- (e) What is point of contraflexure? Explain with a suitable diagram.
- (f) Define the term "helical spring" with the help of suitable diagram.
- (g) What is slenderness ratio of a column?
- (h) What is the difference between thin pressure vessels and thick pressure vessels? Explain.

UNIT-I

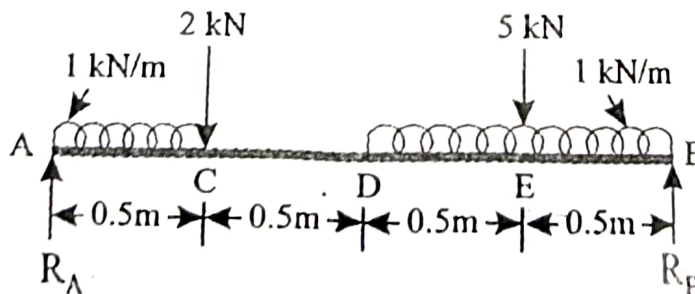
- Q2 A 550 mm long round bar of copper has a diameter of 30 mm over a length of 200 mm, diameter of 20 mm over a length of 200 mm and a diameter of 10 mm over its remaining length. Determine the stresses in each section and total elongation of the rod when it is subjected to a pull of 30 kN. Assume, $E_{\text{Copper}} = 100 \text{ kN/mm}^2$. (10)



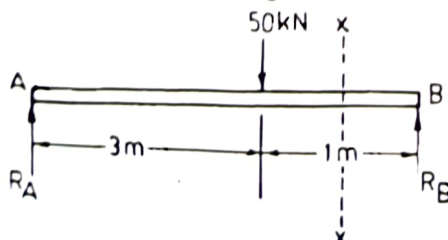
- Q3 At a point in a stressed body the principal stresses are 100 MN/m^2 (tensile) and 60 MN/m^2 (Compressive). Determine the normal stress and the shear stress on a plane inclined at 50° to the axis of major principal stress. Also calculate the maximum shear stress at the point. (10)

UNIT-II

- Q4 Draw the shear force and bending moment diagram for the beam shown in the figure below. (10)



- Q5 What is Castigliano's theorem? Using Castigliano's theorem, obtain the deflection under a single concentrated load applied to a simply supported beam as shown in the figure below. Take $EI = 2 \text{ MNm}^2$. (10)



UNIT-III

- Q6 Explain the Macaulay's method for fixed beam having point load not acting in the middle of the beam. Also find the expression for the maximum deflection of the beam and its location. (10)
- Q7 Find the maximum torque that can be applied safely to the shaft of 300 mm diameter. The permissible angle of twist is 1.5 in a length of 7.5 metre. The shearing stress should not exceed 45 N/mm^2 . Take $G = 84.4 \text{ kN/mm}^2$. (10)

UNIT-IV

- Q8 What is Lamé's Theory? According to Lamé's theorem drive the expressions for radial and circumferential stress (Hoop Stress) for thick shells. (10)
- Q9 A) A thin cylindrical steel pressure vessel 400 mm in diameter with a wall thickness of 20 mm is subjected to an internal pressure of 4.5 MN/m^2 . Calculate the hoop stress and longitudinal stresses in the steel. (5+5)
- B) A solid round bar of 6 cm in diameter and 2.5 m long is used as a strut. One end of the strut is fixed while its other end is hinged. Find the safe compressive load for this strut using Euler's formula. Assume $E = 200 \text{ GPa}$ and factor of safety=3.