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S. Y. B. TECH. (MECHANICAL) (SEMESTER - I)

COURSE NAME: STRENGTH OF MATERIALS

COURSE CODE: MEUA21174

(PATTERN 2017)

Time: [2 Hours]

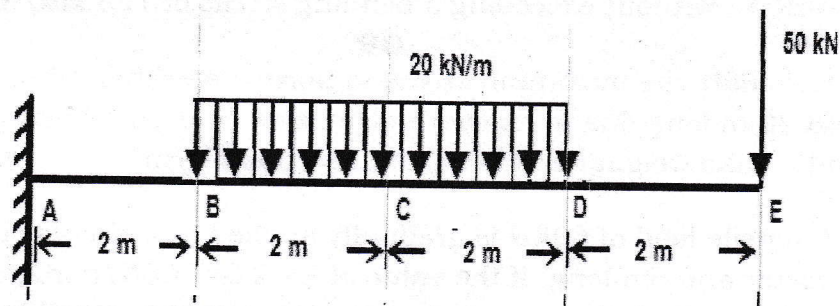
[Max. Marks: 50]

(*) Instructions to candidates:

- 1) Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator is allowed
- 4) Use suitable data where ever required

Q.1) a) Draw the shear force and bending moment diagram.

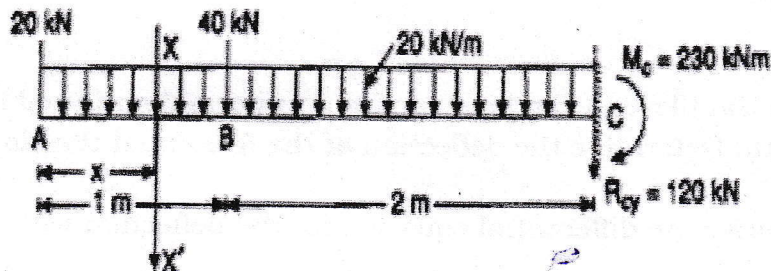
[6 Marks]



OR

b) Draw the shear force and bending moment diagram.

[6 Marks]



Q.2) a) The following observations were made during a tensile test on a mild steel specimen 40 mm in diameter and 200 mm long.

Elongation with 40KN load with in elastic limit is 0.0304mm
Yield Load = 161 KN, Maximum Load=242 KN, Length of specimen at fracture =249 mm, Determine Modulus of Elasticity, Yield point stress, Ultimate Stress and percentage elongation [6 marks]

OR

b) Determine the changes in length, breadth, and thickness of a steel bar which is 4m long, 30mm wide and 20mm thick and is subjected to a axial Pull of 30 KN in the direction of its length. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio =0.3. [6 marks]

Q.3) a) Explain the mathematical equations for Rankine theory, maximum shear stress theory and Von Mises theory. [6 marks]

OR

b) Explain graphical method for member subjected to normal stresses in two mutually Perpendicular directions accomplished by shear stress. [6 marks]

Q.4) a) A symmetric section 200 mm deep has a moment of inertia $2.26 \times 10^{-5} \text{ m}^4$ about its neutral axis. Determine the length of beam if beam carries a UDL of 4KN/m without exceeding a bending stress of 125 MN/m². [4 marks]

OR

b) Calculate the maximum stress in normal steel bar 12 mm in diameter and 20 m long due to its own weight when it is simply supported at its ends. Take weight density of steel as 78500 N/m³ [4 marks]

Q.5) a) A tensile load of 60KN is gradually applied to a circular bar of 4cm diameter and 5m long. If the value of $E = 2.0 \times 10^5 \text{ N/mm}^2$, determine stretch in rod, Stress in rod and Strain energy absorbed by the rod [6 marks]

b) Derive the equation for curvature of beam with neat sketch [4 marks]

c) Explain the details of Macaulays Method to determine the slope [4 marks]

OR

Q.6) a) A Cantilever 1.5m long carries a uniform distributed load over the entire length. Determine the deflection at the free end if the slope at the free end is 1.5° . [6 marks]

b) Derive the differential equation for the deflection with neat sketch [4 marks]

c) A simply supported beam is subjected to a uniform distributed load over its entire length. Determine maximum slope and deflection [4 marks]

- Q.7) a) A solid shaft of 160 mm diameter has the same cross section area as that of the hollow shaft of the same material of inside diameter 110 mm. Find the ratio of power transmitted by the two shafts of with considering the same angular twist. Also compare the angle of twist in equal length of these shafts when stressed equal. [6 marks]
- b) Derive the torsion equation with neat sketch. [4 marks]
- c) A hollow shaft of external diameter 120mm transmits 300KW power at 200 rpm . Determine the maximum internal diameter if the maximum stress in shaft is not to exceed 60 N/mm² [4 marks]

OR

- Q.8) a) What are the assumptions made in theory of torsion. What must be the length of 5mm diameter wire so that it can be twisted through one complete revolution without exceeding a shear stress of 42 MN/ m². The modulus of rigidity is 27 GN/mm² [6 marks]
- b) A solid circular bar 5 m long and 4 cm in diameter is found to extend under the tensile load of 48 KN. The bar is used as a strut with both end hinged. Determine the buckling load for the bar and also the safe load taking Factor of safety as 3. [4 marks]
- c) Derive the equation of buckling of column fixed at both ends [4 marks]