Extra

Paper / Subject Code: 50822 / Mechnics of Solid

SE(CIVIL) / SEM_III / R-19 / SH-22 / 23.11.22

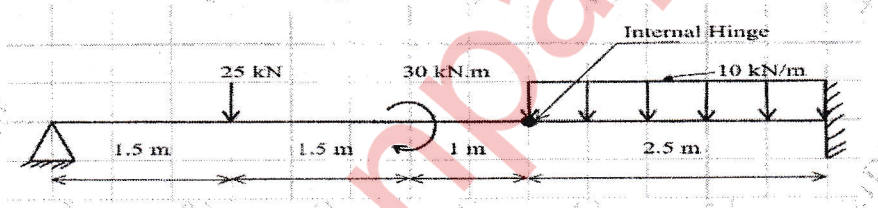
(03 Hours) Marks: 80

QP CODE : 10013179

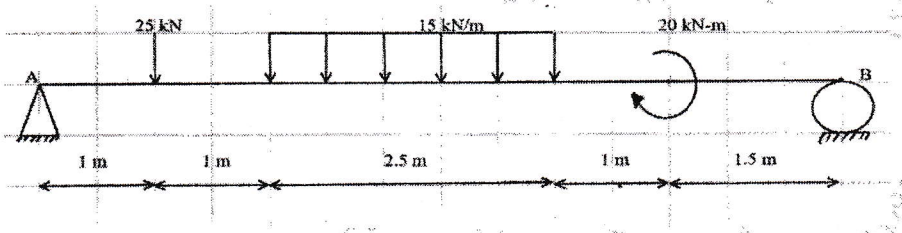
Instructions:

1. Question No. 1 is **Compulsory.**
2. Answer **any Three** Questions from the **remaining.**
3. Each **full question** carries **20 marks.**
4. **Assume** suitable data, if needed and **state** it clearly.

		Marks
Q. 1	Answer **any four**	
a	Draw SFD and BMD for a cantilever beam of span 5 m, loaded with a uniformly distributed load of 10 kN/m on entire span and a point load of 20 kN at 2 m from the fixed end.	5
b	A hollow steel pipe having yield stress = 270 MPa has to carry an axial compressive load of 1200 kN. A safety factor of 2 is to be used against yielding. If the thickness of pipe is 1/8th of its outer diameter, what will be the minimum required outer diameter?	5
c	Define core or kernel of the section. Locate Core of the solid Circular section having diameter of 300 mm.	5
d	State and explain Principle of Superposition and Principle of Virtual Work.	5
e	Determine the maximum stress and elongation of a solid circular bar 2 m long and 25 mm diameter when an axial pull of 50 kN is applied suddenly on it. Take E= 200 GPa.	5
f	Define Torsion or Twisting Moment. What are the assumptions made in theory of Pure torsion?	5
Q. 2		
a	Draw SFD and BMD for the beam shown below. Left end is roller and right end is fixed.	12



b	A hollow cylindrical column is fixed at both the ends. The column length is 4.2 m and it carries an axial load of 260 kN. Design the column by Rankine's approach. Adopt a FOS of 4.5. Internal diameter = 0.8 times of external diameter. Take crushing stress for material = 560 MPa and Rankine's constant= (1/1600)	8
Q. 3		
a	A cantilever beam has hollow rectangular section with outer dimensions (300 mm wide x 600 mm deep) and inner dimensions (200 mm wide x 400 mm deep), symmetrical about both x and y axes. The beam has a span of 3 m and is loaded with a UDL of 20 kN/m on its entire span. Determine the maximum bending stress developed.	10
b	A hollow circular steel shaft of 5.7 m length has to transmit 1900 kW power at 180 rpm. If internal diameter is 0.7 times the external diameter, total angle of twist is not to exceed 5 degrees and shear stress is limited to 64 N/mm^2, determine the diameters of the shaft. Take G = 92 kN/mm^2.	10
Q. 4		
a	Calculate slope at left support and maximum deflection by using Macaulay's double integration method. Take EI constant for the beam.	10



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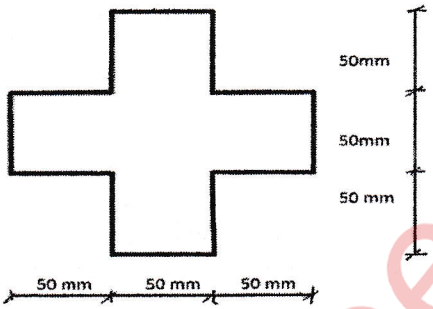
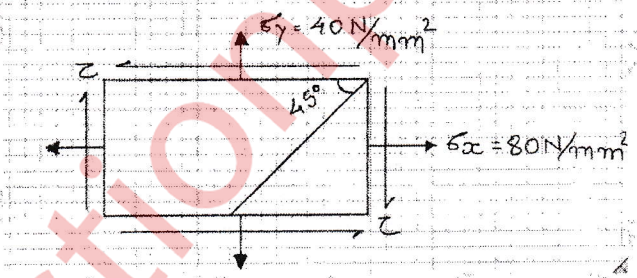
b Fig. below shows the cross-section of a beam. It is subjected to a shear force of 200 kN. Draw shear stress distribution diagram.



Q. 5

a Define Principal Plane and Principal Stresses. At a point in a two mutually perpendicular directions, stresses are 80 MPa and 40 MPa, both tensile in nature. Each of these stresses is accompanied by a shear stress of 60 MPa. Determine the normal stress, shear stress and the resultant stress and its obliquity on a plane at 45° with minor principal plane. 10



b A solid copper rod 12 mm in diameter and 400 mm long fits into a hollow aluminum tube of external diameter 20 mm and thickness 4 mm, of equal length. The assembly is held together by a rigid plate at the end and is stress-free at 20° C. Find the stresses in the two materials when it is heated to 60 °C. 10

Material	Modulus of Elasticity (GPa)	Coefficient of Thermal Expansion /⁰ C
Copper	120	$18x10^{-6}$
Aluminum	70	$23x10^{-6}$

Q. 6

a A reinforced concrete column of size (230 mm x 400 mm) has 8 steel bars of 12 mm dia. The column is subjected to an axial compressive load of 600 kN. Find the stresses developed in steel and concrete. Take modular ratio= 18.67 08

b A steel rod 30 mm in diameter is 4 m long. Find the maximum instantaneous stress induced and the work done at maximum elongation when a load of 90 kN is suddenly applied. Take E= 210 GPa. 6

c A thin spherical shell of wall thickness 5 mm and diameter 300 mm is subjected to an internal pressure of 5 N/mm². Determine hoop stress, hoop Strain & volumetric Strain 6