CBCS SCHEME

4 For

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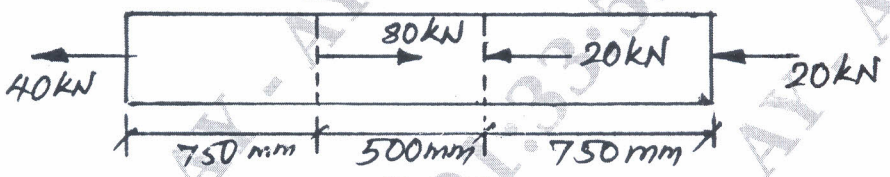
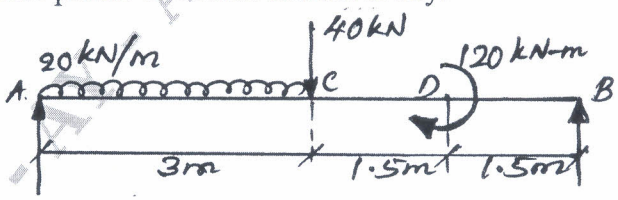
BCV301

Third Semester B.E./B.Tech Degree Supplementary Examination, June/July 2024

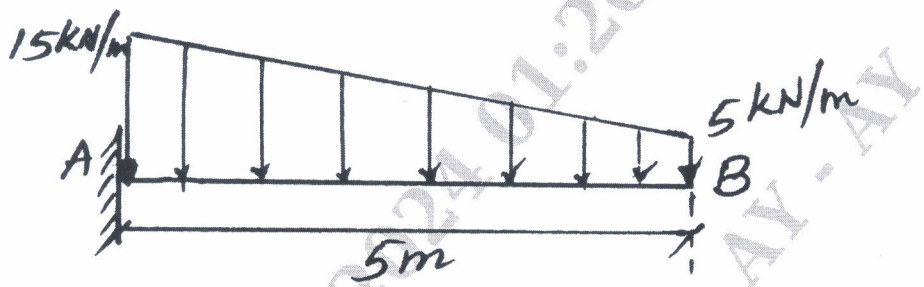
Strength of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the tension test carried out on mild steel specimen.	5	L2	CO1
	b.	A load of 5kN is to be raised with the help of a steel wire. Find the minimum diameter of the wire if the stress in the wire is not to exceed 100MPa. The length of the wire is 2m. Take E = 210×10^3N/mm^2. Also determine the elongation due to the load.	5	L3	CO1
	c.	A load of 2MN is applied on a column 500mm × 500mm. The column is reinforced with four steel bars of 10mm diameter placed in corners. Find the stress in concrete and steel bars. Take E for steel as 2×10^5N/mm^2 and for concrete as 1.4×10^4N/mm^2.	10	L3	CO1
		OR			
Q.2	a.	Define the four elastic constants.	4	L2	CO1
	b.	A steel rod has a diameter of 100mm and overall length of 2m. It is subjected to direct axial forces at different sections as shown in Fig.Q2(b). If E for steel is 210×10^3N/mm^2, determine the total deformation.  Fig.Q2(b)	6	L3	CO1
	c.	A bar tapers uniformly form a diameter of 60mm at one end to 40mm at the other end over a length of 1.5m. The bar is subjected to an axial load of 100kN. If E for bar material is 2×10^5N/mm^2. Derive the formula for elongation of tapered circular bar and obtain the elongation of the given bar.	10	L3	CO1
		Module – 2			
Q.3	a.	Define : i) Shear force ii) Bending moment iii) Point of contra flexure.	5	L2	CO2
	b.	Draw the SFD and BMD for the simply supported beam loaded as shown in Fig.Q3(b). Locate points of contra flexure if any.  Fig.Q3(b)	10	L3	CO2
	c.	Derive the relationship between load intensity (w), shear force (f) and bending moment (M) in a loaded beam.	5	L3	CO2

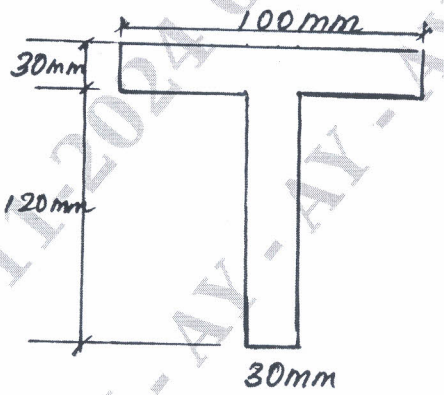
OR

Q.4	a.	A beam ABCD, 8m long has supports at 'a' and at 'C' which is 6m from 'A'. The beam carries a udl of 10kN/m between A and C. At point 'B' a 30kN concentrated load 2m from support A and a point load 15kN acts at the free end 'D'. Draw the SFD and BMD giving salient values and locate points of contra flexure if any.	14	L3	CO2
	b.	Plot the SFD and BMD for the cantilever beam shown in Fig.Q4(b).  Fig.Q4(b)	6	L3	CO2

Module – 3

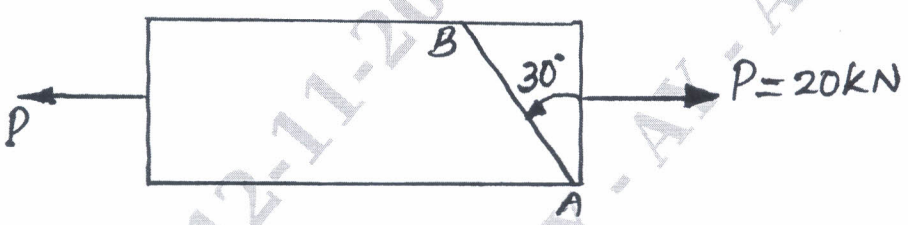
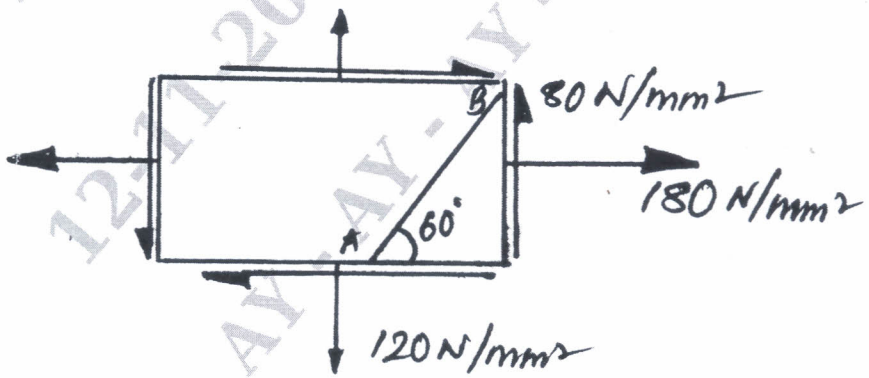
Q.5	a.	Derive the expression $\frac{M}{I}=\frac{f}{y}=\frac{E}{R}$ with usual notations.	10	L3	CO3
	b.	A hollow circular shaft rotates at a speed of 120rpm transmitting 500kN. The internal diameter of the shaft is 0.75 times its external diameter. Find the dimensions of the shaft if the shear stress is limited to 80N/mm^2 and angle of twists limited to 1° in a length of 2m. Assume maximum torque to be greater than mean torque by 20%. Take G = 85GPa.	10	L3	CO3

OR

Q.6	a.	Derive the torsion expression $\frac{T}{I_{22}}=\frac{q_s}{R}=\frac{C.\theta}{\ell}$ with usual notations.	6	L3	CO3
	b.	A simply supported beam of span 6m has a cross section as shown Fig.Q6(b). It carries a udl of 5kN/m throughout. Calculate the bending stresses and shearing stresses for maximum values of being moment and shear force respectively. Draw neat diagrams of bending stress and shear stress distribution across the cross section.  Fig.Q6(b)	14	L3	CO3

Module – 4

Q.7	a.	Derive the moment curvature equation or differential equation for beam deflection in the form $EI\frac{d^2y}{dx^2}=M$ with usual notation.	8	L3	CO4
	b.	Determine the Euler's crippling load for a hollow cylindrical cast iron column 6m long with 150mm external diameter and 20mm thick with both ends hinged. Compare this load with the load obtained by Rankine's formula. Use the constants f_c = 550MPa, $\alpha=\frac{1}{1600}$, E = 80GPa.	12	L3	CO4

		OR			
Q.8	**a.**	Derive the Euler's crippling load for a column with both ends hinged.	**6**	**L3**	**CO4**
	b.	A beam of uniform section is 10m long. It is simply supported at its ends. It carries loads of 100kN and 80kN at distances of 2m and 6m respectively from the left end. Calculate the deflections under each load and slope at left support. Take $E = 2 \times 10^5$ N/mm^2 and $I = 8.5 \times 10^7$mm^4.	**14**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define : i) Principal planes ii) Principal stresses.	**4**	**L3**	**CO4**
	b.	A circular bar of 25mm diameter is subjected to an axial force of 20kN as shown in Fig.Q9(b). Determine the normal and tangential stresses on an inclined plane AB shown.  Fig.Q9(b)	**6**	**L3**	**CO5**
	c.	A thin cylinder of 250mm internal diameter with 4mm metal thickness and length 750mm is storing a fluid under a pressure fo 3N/mm^2. Calculate the hoop or circumferential stress and longitudinal stress developed in the wall of the cylinder. If Young's modulus for the material is 210GPa and Poisson's ratio is 0.286, calculate change in diameter, length and volume of cylinder.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive Lame's equations for hoop and radial stresses for thick cylinder subjected to internal and external fluid pressure.	**8**	**L3**	**CO5**
	b.	The state of stress at a point in strained material is as shown in Fig.Q10(b). Determine : i) Principal stresses and their planes ii) Maximum shear stress and its planes. Sketch the planes you have determined.  Fig.Q10(b) Also determine the normal and tangential stresses acting on the inclined plane AB shown.	**12**	**L3**	**CO5**

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