CBCS SCHEME

USN

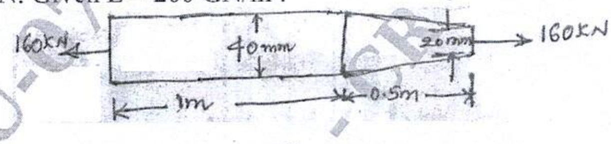
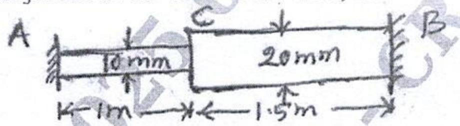
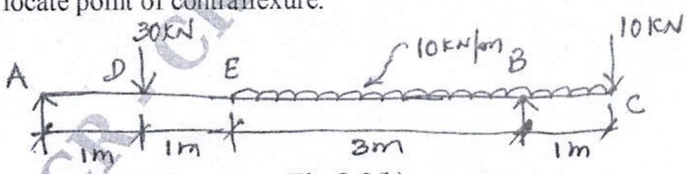
BCV301

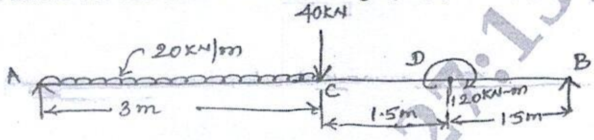
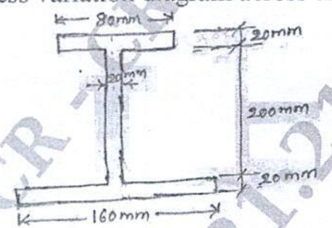
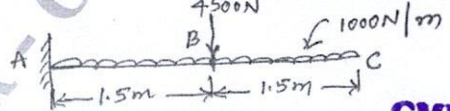
Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

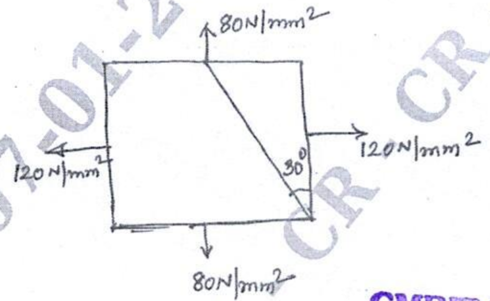
Strength of Materials

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.	Sketch a typical stress-strain curve for a ductile material and explain briefly the salient features of the curve.	6	L2	CO1
	b.	Define: i) Strain ii) Poisson's ratio.	4	L1	CO1
	c.	A 1.5 m long steel bar is having uniform diameter of 40 mm for a length of 1 m. In the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Fig.Q.1(c). Determine the elongation of this bar when subjected to an axial tensile load of 160 kN. Given E = 200 GN/m^2.  Fig.Q.1(c)	10	L3	CO1
		OR			
Q.2	a.	What are the elastic constants and explain them briefly?	6	L2	CO1
	b.	Explain St Venant's principle.	4	L2	CO1
	c.	The steel rod shown in Fig.Q.2(c) is in two parts. It has a diameter of 10 mm for a length of 1 m and 20 mm for the remaining length of 1.5 m. If it is constrained between two parts A and B and is stress free at 20°C. Find the stress in the material, when it is subjected to 70°C. E = 200 GPa, $\alpha = 12 \times 10^{-6}$/°C.  Fig.Q.2(c)	10	L3	CO1
		Module – 2			
Q.3	a.	For a cantilever beam subjected to a udl of intensity w/unit length throughout, plot SFD and BMD.	6	L3	CO2
	b.	For a simply supported overhanging beam as shown in Fig.Q.3(b), draw SFD and BMD and locate point of contraflexure.  Fig.Q.3(b)	14	L3	CO2

		OR			
Q.4	a.	For a simply supported beam subjected to udl of w/unit length throughout. Plot SFD and BMD.	6	L3	CO2
	b.	Draw SFD and BMD for the beam shown in Fig.Q.4(b).  Fig.Q.4(b)	14	L3	CO2
		Module – 3			
Q.5	a.	Derive the relation between bending stress and radius of curvature $\frac{\sigma}{y} = \frac{E}{R}$.	6	L3	CO3
	b.	Define: i) Neutral axis ii) Section modulus	4	L2	CO3
	c.	A hollow propeller shaft of a steam ship is to transmit 3750 KW at 240 rpm. If the internal diameter is 0.8 times the external diameter and if the maximum shear stress developed is to be limited to 160 N/mm^2, determine the size of the shaft.	10	L3	CO4
		OR			
Q.6	a.	Derive the torsion equation with usual notations.	8	L3	CO4
	b.	The unsymmetrical I-section shown in Fig.Q.6(b) is subjected to a shear force of 40 KN. Draw the shear stress variation diagram across the depth.  Fig.Q.6(b)	12	L3	CO3
		Module – 4			
Q.7	a.	Derive differential equation for beam deflection with usual notations.	8	L3	CO4
	b.	Determine the critical load for a hollow cast iron rectangular column of external dimensions 200 mm × 150 mm with the thickness of the metal being 25 mm. The height of the column is 6 m and both ends are fixed. Use Euler's formula and compare the value with that obtained by using Rankine's formula taking $\sigma_c = 500$ N/mm^2 and a = 1/1600, which of the above formula decides the safe crippling load?	12	L3	CO4
		OR			
Q.8	a.	Derive an expression for Euler's crippling load for both ends hinged columns with usual notations.	8	L3	CO4
	b.	Compute the mid-span and maximum deflection for the beam shown in Fig.Q.8(b). Given E = 210 GN/m^2 and moment of inertia = 36000 × 10^{-9} m^4.  Fig.Q.8(b)	12	L3	CO4

		Module – 5			
Q.9	**a.**	With a neat sketch, explain the two-dimensional stress system.	**8**	**L2**	**CO5**
	b.	A cylindrical shell is 3 m long and is having 1 m internal diameter and 15 mm thickness. Calculate the maximum intensity of shear stress induced and also the changes in the dimensions of the shell, if it is subjected to an internal fluid pressure of 1.5 N/mm^2.	**12**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive Lame's equation for radial and hoop stress for thick cylinder subjected to internal and external fluid pressure.	**10**	**L3**	**CO5**
	b.	The direct stresses acting at a point in a strained material are shown in Fig.Q.10(b). Find the normal, tangential and resultant stresses on plane 30° to the plane of major principal stress. Find the obliquity of the resultant stress also.  Fig.Q.10(b)	**10**	**L3**	**CO5**

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