CBCS SCHEME

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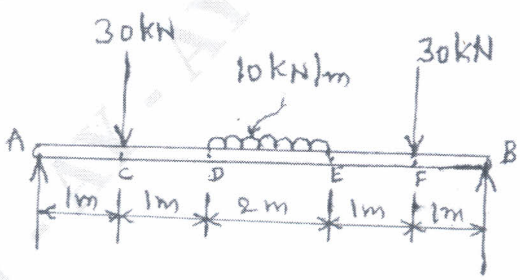
BCV301

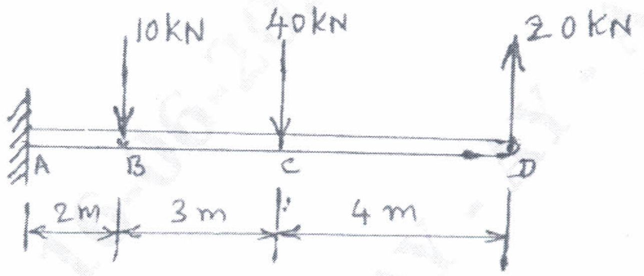
Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Strength of Materials

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.**	Define the following : i) Stress ii) Poisson's Ratio iii) Volumetric strain iv) Bulk Modulus	**06**	**L1**	**CO1**
	b.	Derive the relation between modulus of rigidity and Young's modulus of elasticity.	**06**	**L3**	**CO1**
	c.	Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 25 mm and of length 1.2 m, if the longitudinal stream in the bar during a tensile test is four times the lateral strain. Also find the change in volume when the bar is subjected to a hydrostatic pressure of 120 N/mm^2 . Take $E = 1.2 \times 10^5$ MPa.	**08**	**L3**	**CO1**
		OR			
Q.2	**a.**	Derive an expression for the deformation of a rectangular tapering bar of uniform thickness subjected to an uniaxial load 'P'.	**06**	**L3**	**CO1**
	b.	Draw stress – strain diagram for structural steel subjected to axial ensile force and explain the salient points.	**06**	**L2**	**CO1**
	c.	A concrete column with square section with side 250 mm is reinforced with Four steel bars of 15 mm diameter (each). Determine the stresses induced in concrete and steel bars, when the column is subjected to a load of 300 KN. Take E_{steel} = 200 GPa and $E_{concrete}$ = 14 GPa.	**08**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Define i) Shear Force ii) Bending Moment iii) Point of contraflexture	**06**	**L1**	**CO2**
	b.	Derive the relation between rate of loading, shear force and bending moment.	**06**	**L3**	**CO2**
	c.	Draw the shear force diagram and bending moment diagram for a simply supported beam subjected to the loads as shown in fig. Q.3 (c)  Fig. Q.3 (c)	**08**	**L4**	**CO2**

OR

Q.4	a.	With help of neat sketches, explain different types of beams and different types of loadings.	06	L2	CO2
	b.	Draw shear force and bending moment diagrams for a cantilever beam subjected to uniformly distributed load of intensity WKN/m on its entire length.	06	L3	CO2
	c.	Draw the shear force and bending moment diagrams for a cantilever subjected to Forces as shown in fig. Q.4 (c)  Fig. Q.4 (c)	08	L4	CO2

Module – 3

Q.5	a.	Define i) neutral axis ii) Section Modules iii) Moment of resistance.	06	L1	CO3
	b.	Derive the simple bending equation in the form $\frac{M}{I}=\frac{f}{y}=\frac{E}{R}$ with usual notations.	06	L3	CO3
	c.	A beam is simply supported and carries a uniformly distributed load of 40 kN/m over the entre span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm^2 and moment of inertia of the section is $7\times10^8\ mm^4$, find the span of the beam.	08	L3	CO3

OR

Q.6	a.	List the assumptions made in the theory of pure torsion.	06	L1	CO3
	b.	With usual notations derive the torsion equation $\frac{T}{J}=\frac{\tau}{R}=\frac{G\theta}{L}$	06	L3	CO3
	c.	A solid shaft rotating at 500 rpm transmits 30 kw. Maximum torque is 20% more than the mean torque. Material of shaft has the allowable shear stress 65 MP_a and modules of rigidity 81 GP_a. Angle of twist in the shaft should not exceed 1° in 1 meter length. Determine the diameter of shaft.	08	L3	CO3

Module – 4

Q.7	a.	Define i) slope ii) deflection iii) Elastic curve	06	L1	CO4
	b.	Derive the deflection equation $EI\frac{d^2y}{dx^2}=M$	06	L3	CO4
	c.	Derive expressions for maximum slope and deflection in a simply supported beam subjected to point load 'w' at mid point.	08	L3	CO4

		OR			
Q.8	**a.**	Define i) slenderness ratio ii) long column iii) short column	**06**	**L1**	**CO4**
	b.	Using Euler's theory, derive an equation for the crippling load of a long column pinned at both ends.	**06**	**L3**	**CO4**
	c.	A hallow circular column is used to carry an automobile of weight 20 KN. Length of the column is 3 meters. Material of column has an yield stress of 330 MPa. Outer diameter of the column is 100 mm and thickness of wall is 5 mm. one end of the column is fixed and other end is free. Taking E = 200GPa , determine : i) Factor of safety ii) ii) Ratio of yield stress to crippling stress.	**08**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define i) Principal stresses ii) Principal planes	**06**	**L1**	**CO5**
	b.	An uniform bar is subjected to axial tensile stress of 100 N/mm^2. Determine i) Stress acting on a plane which is at an angle of 60° with reference to 100 N/mm^2 stress plane ii) Magnitudes of maximum and minimum stresses induced and position of their planes iii) Magnitude of normal stress on the plane of maximum shear stress.	**06**	**L3**	**CO5**
	c.	A point in a machine member is subjected to principal stresses of magnitudes 30 MPa in tension and 100 MPa in compression. Determine i) Stresses acting on an element whose normal to one of its faces is oriented at an angle of 120° with reference to x – axis ii) Maximum and minimum shear stresses and their orientations. iii) Normal stresses acting on maximum and minimum shear stress planes.	**08**	**L3**	**CO5**
		OR			
Q.10	**a.**	Define : i) Thin cylinder ii) Thick cylinder iii) Hoop stress	**06**	**L1**	**CO5**
	b.	Derive Lame's equation for the redial and hoop stresses for thick cylinder subjected to internal and external fluid pressure.	**06**	**L3**	**CO5**
	c.	A thick walled cylindrical pressure vessel has inner radius of 150 mm and outer radius of 185 mm. Draw a sketch showing the radial pressure and hoop stress distribution in the section of the cylinder wall, when an internal pressure of 10 MPa is applied.	**08**	**L3**	**CO5**

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