CBCS SCHEME

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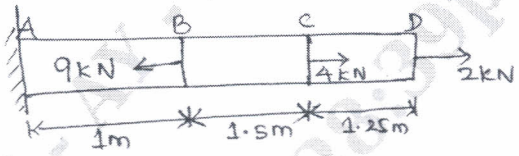
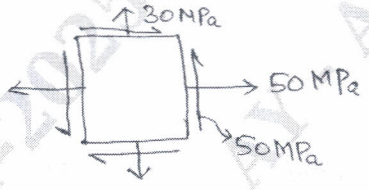
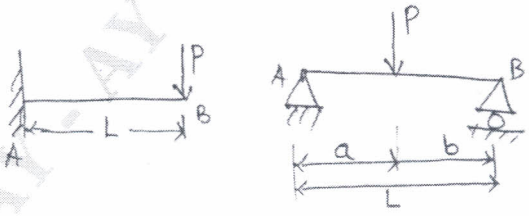
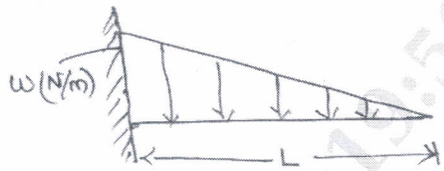
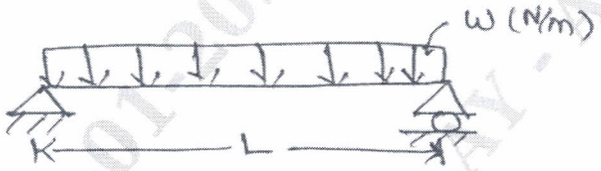
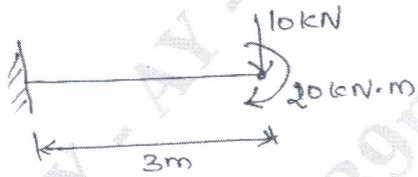
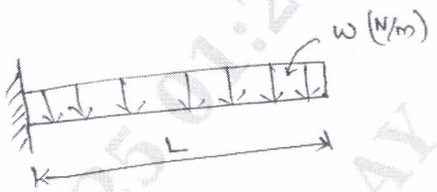
BAE304

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mechanics 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.	Calculate the body forces in order to achieve static equilibrium. $\sigma_{xx} = 12x^2y^2z$, $\sigma_{yy} = -9x^3y^2$, $\sigma_{zz} = 4y^2z^3$, $\tau_{xy} = 4y^3$, $\tau_{yz} = 16x^3yz$, $\tau_{xz} = -12xy^2z^2$	10	L3	CO1
	b.	Given displacement field, $u = 3x^4 + 2x^2y^2 + x + y + z^3 + 3$ $v = 3xy + y^3 + y^2z + z^2 + 1$ $w = x^2 + xy + yz + xz + y^2 + z^2 + 2$ Compute the associated strains.	5	L3	CO1
	c.	Explain the stress strain curve for brittle and ductile materials with neat sketch.	5	L2	CO1
		OR			
Q.2	a.	A steel rod of cross sectional area of 50 mm^2 is subjected to the loading as shown in Fig. Q2 (a). Determine the displacement of its end A and D. Take E = 200 GPa.  Fig.Q2 (a)	10	L3	CO1
	b.	Determine the principal stresses, the maximum in plane shear stress and average normal stress for a element as shown in Fig. Q2 (b). Draw Mohr Circle.  Fig. Q2 (b)	10	L3	CO1
		Module – 2			
Q.3	a.	Draw free body diagram of roller support, pinned support and fixed support are used in different beams as shown in Fig. Q3 (a) and find reaction forces.  Fig. Q3 (a)	10	L3	CO2

	b.	Draw shear force and bending moment diagram of the beam shown in Fig. Q3 (b).  Fig. Q3 (b)	10	L3	CO2
		OR			
Q.4	a.	Derive the bending flexure formula of a beam subjected to pure bending.	10	L2	CO2
	b.	Draw shear force and bending moment diagram of the beam shown in Fig. Q4 (b).  Fig. Q4 (b)	10	L3	CO2
		Module – 3			
Q.5	a.	Determine the slope and deflection at the free end of the Cantilever beam. Take E = 200 GPa and $I = 65 \times 10^6$ mm^4.  Fig. Q5 (a)	10	L3	CO2
	b.	Determine the slope and deflection of the Cantilever beam subjected to a loading as shown in Fig. Q5 (b).  Fig. Q5 (b)	10	L3	CO2
		OR			
Q.6	a.	A hollow pipe has an inner diameter of 80 mm and an outer diameter of 100 mm subjected to a torque of 40 N.m. Determine the shear stress developed in the material at the inner and outer walls.	10	L3	CO2
	b.	A solid shaft of 80 mm diameter is transmitting 100 kW power at 200 rpm. Calculate the maximum shear stress induced in the shaft and the angle of twist in degrees for a length of 6 m. Take torsional rigidity, GJ = 8×10^4 N/mm^2.	10	L3	CO2
		Module – 4			
Q.7		Write short notes on : **a.** Saint-Venant's principle **b.** Strain energy **c.** Reciprocity theorem **d.** Principle of minimum total potential energy.	20	L2	CO2

		OR			
Q.8	**a.**	Calculate the strain energy stored in simply supported beam of length L = 4 m, E = 200 GPa, and Moment of inertia $I = 8 \times 10^{-6}\ m^4$ subjected to a uniformly distributed load W = 2 KN/m.	**10**	**L3**	**CO2**
	b.	Explain the principle of virtual work and apply it to determine the reaction force in a Cantilever beam with a point load at the free end.	**10**	**L3**	**CO2**
		Module – 5			
Q.9	**a.**	Describe the different types of fractures in materials. Discuss the characteristics and mechanisms of each type.	**10**	**L2**	**CO3**
	b.	Explain the phenomenon of creep in materials. Describe the three stages of creep with examples.	**10**	**L2**	**CO3**
		OR			
Q.10	**a.**	Discuss fatigue and types of fatigue loading with examples. Explain the mechanism of fatigue failure in metals.	**10**	**L2**	**CO3**
	b.	Describe the S-N diagram in fatigue and interpretation of fatigue life.	**10**	**L2**	**CO3**

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