CBCS SCHEME

USN | | | | | | | | | | |

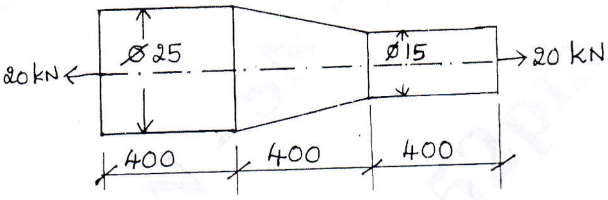
BAE304

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

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.	Derive equilibrium equations for three dimensional state of stress.	10	L2	CO1
	b.	Consider the displacement field $U = [y^2 i + 3yzj + (4 + 6x^2)k]10^{-2}$ where i, j, k are direction vectors. Determine strain components at the point (1, 0, 2).	10	L3	CO1
		OR			
Q.2	a.	Derive an expression for elongation in an uniformly tapering circular bar.	10	L2	CO1
	b.	Find the total elongation and the maximum stress in the material of the bar shown in Fig Q2(b) under an axial load of 20kN. $E = 200 GN/m^2$.  Fig Q2(b)	10	L3	CO1
		Module – 2			
Q.3	a.	Derive the relationship between load intensity, shear force and bending moment. Explain shear force and bending moment diagrams.	10	L2	CO2
	b.	A simply supported beam of 6m length is subjected to loads 2kN, 5kN and 4kN at distances 1.5m, 3m and 4.5m from the left support. Draw shears force and bending moment diagrams.	10	L3	CO2
		OR			
Q.4	a.	Derive moment curvature equation for a beam of flexural rigidity EI subjected to moment M.	10	L2	CO3
	b.	A cast iron test beams 25mm × 25mm cross-section and 1m long, supported at its ends fail when a central load of 800N is applied on it. What intensity of uniformly distributed load will break a cantilever of the same material 50mm wide, 100mm deep and 2m long?	10	L4	CO3
		Module – 3			
Q.5	a.	Derive the differential equation for deflection of a beam.	10	L2	CO3

	b.	Find deflection at free end of the cantilever beam shown in Fig Q5(b). Find its numerical value if $L = 3m$, $a = 2m$, $W_1 = 20kN$, $W_2 = 30kN$, $E = 2 \times 10^5 N/mm^2$, $I = 2 \times 10^8 mm^4$.	10	L4	CO3

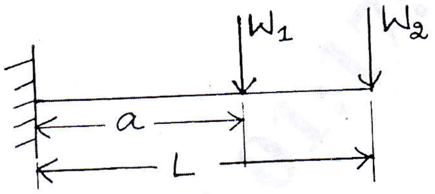


Fig Q5(b)

		OR			
Q.6	a.	Derive torsion equation for a shaft of length L, radius R subjected to torque T.	10	L2	CO3
	b.	A hollow circular shaft of 6m length and inner and outer diameters of 75mm and 100mm is subjected to a torque of 10kN-m. If G = 80 GPa, determine the maximum shear stress produced and the total angle of the twist.	10	L4	CO3
		Module – 4			
Q.7	a.	Explain the principle of complementary virtual work.	10	L3	CO4
	b.	Calculate the support reactions in a simply supported beam as shown in Fig Q7(b). Regard the beam as a rigid body.	10	L4	CO4

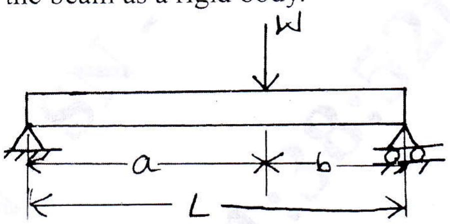


Fig Q7(b)

		OR			
Q.8	a.	State and prove Maxwell's Reciprocal theorem.	10	L3	CO4
	b.	A simply supported beam of span L carries a point load at mid-span. Determine strain energy stored in the beam and defection at its mid-span.	10	L4	CO4
		Module – 5			
Q.9	a.	Define Fracture. With neat sketches, explain different types of fracture.	10	L2	CO5
	b.	Define Creep. With the help of creep curve, explain the three stages of creep.	10	L2	CO5
		OR			
Q.10	a.	Define Fatigue. Explain various types of fatigue loading with examples.	10	L2	CO5
	b.	Write a note on S-N diagrams.	10	L1	CO5

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