Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Third Semester

Chemical Engineering

UCHT24302 / CH3302 - MECHANICS OF SOLIDS

Regulations – 2024 & 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	Define rigid bodies.	L1	1	2
2.	Explain thermal stresses.	L2	1	2
3.	Classify the types of support.	L2	2	2
4.	Define the term point of contraflexure.	L1	2	2
5.	Explain the double integration method.	L2	3	2
6.	A simply supported beam with a 2 m span carries a point load of 20 kN at its midpoint. Determine the maximum slope and deflection of the beam. Take flexural rigidity as 500 $\times 10^9$ N-mm^2.	L2	3	2
7.	List the assumptions made in the theory of simple bending.	L1	4	2
8.	Define the term equivalent section used in a flitched beam.	L2	4	2
9.	List the assumptions made while finding out the shear stress of a circular shaft subjected to torsion.	L1	5	2
10.	Define Euler's theory of long columns.	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Three bars made of copper, zinc, and aluminium are of equal length and have cross-sectional areas of 500 mm², 750 mm², and 1000 mm², respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportion of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3 x 10^5 N/mm², for zinc = 1.0 x 10^5 N/mm² and aluminium = 0.8 × 10^5 N/mm².	L3	1	16
		Or			
	b	A gun metal rod 20 mm in diameter, screwed at the ends, passes through a steel tube 25 mm and 30 mm in internal and external diameters, respectively. The nuts on the rod are screwed tightly home on the ends of the tube. Identify the intensity of stress in each metal when the common temperature rises by 200°F. Take. Coefficient of expansion for steel = 6 x 10^{-6}/°C Coefficient of expansion for gun metal = 10 × 10^{-6}/°C Modulus of elasticity for steel = 200 GPa Modulus of elasticity for gun metal = 100 GPa.	L3	1	16

12.	a	A simply supported beam of length 10 m carries a uniformly distributed load and two-point loads as shown in Fig. 12.a. Determine the maximum bending moment and also illustrate the S.F. and B.M. diagram for the beam.	L3	2	16

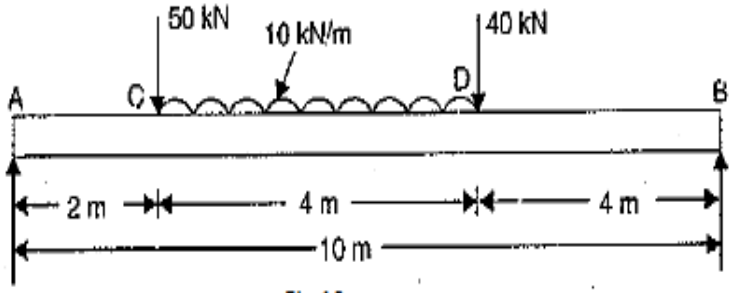

Fig.12.a

Or

	b	A simply supported beam of length 6 m carries point loads of 3 kN and 6 kN at a distance of 2 m and 4 m from the left end. Construct the shear force and bending moment diagram for the beam.	L3	2	16
13.	a	A beam of length 6 m is simply supported at both ends and carries two point loads of 48 kN and 40 kN at 1 m and 3 m from the left support, respectively. Using Macaulay's method, determine: (i) The deflection under each load, (ii) The maximum deflection, and (iii) The position of the maximum deflection. Take E = 2 x 10^5 N/mm^2 and I = 85 x 10^6 mm^4.	L3	3	16

Or

	b	A cantilever of length 2 m carries 20 kN at the free end and another load of 20 kN at its centre. If E = 10^5 N/mm^2 and I = 10^8 mm^4, apply the moment area method to find the slope and deflection at the free end.	L3	3	16
14.	a	Determine the following relation, $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ Where M = Bending moment, I = Moment of Inertia σ = Bending stress, y = Distance from N.A. E = Young's modulus, and R = Radius of curvature.	L3	4	16

Or

	b	A wooden beam 100 mm wide, 250 mm deep, and 3 m long carries a uniformly distributed load of 40 kN / m. Determine the maximum shear stress and sketch the variation of shear stress along the depth of the beam.	L3	4	16

15.	a	A hollow shaft of diameter ratio $\frac{3}{8}$ (internal diameter to outer diameter) is to transmit 375 kW power at 100 rpm. The maximum torque is 20% greater than the mean. The shear stress is not to exceed 60 N/mm², and the twist in a 4 m length should not exceed 2°. Calculate the external and internal diameters to satisfy these conditions. Assume modulus of rigidity (C) = 0.85 x 10^5 N/mm².	L3	5	8
		Or			
	b	A close-coiled helical spring of 10 cm mean diameter is made up of 1 cm diameter, with 20 turns. The spring carries an axial load of 200 N. Determine the shearing stress. Taking the value of modulus of rigidity = 8.4 x 10^4 N/mm^2, determine the deflection when carrying this load. Also, calculate the stiffness of the spring and the frequency of free vibration for a mass hanging from it.	L3	5	16