Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

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

Fourth Semester

Mechanical Engineering

UMETL24401 - MECHANICS OF MATERIALS

Regulations - 2024

Duration : 3 Hrs *Maximum : 100 Marks*

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

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Classify the types of stress.	L2	1	2
2.	List the applications of principal stresses and principal planes.	L1	1	2
3.	Classify the beams.	L1	2	2
4.	Explain the theory of simple bending.	L2	2	2
5.	List the assumptions made in determining the shear stress of a circular shaft subjected to torsion.	L2	3	2
6.	A close-coiled helical spring carries a load of 150 N. If the mean coil diameter is eight times the wire diameter, determine the mean coil diameter and wire diameter. Take maximum shear stress as 100 MPa.	L1	3	2
7.	Differentiate between Macaulay's method and the double integration method.	L1	4	2
8.	Define Maxwell's reciprocal theorem.	L2	4	2
9.	Differentiate between thin cylinders and thick cylinders.	L1	5	2
10.	Define the maximum shear theory.	L1	5	2

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

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	A reinforced short concrete column of size 250 mm x 250 mm is reinforced with 8 steel bars. The total area of steel bars is 2500 mm². The column carries a load of 390 kN. If the modulus of elasticity for steel is 15 times that of concrete, determine the stresses in concrete and steel.	L3	1	16
		Or			
	b	A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter, rigidly fixed at both ends. If there is no longitudinal stress at 10°C, calculate the stresses developed when temperature is raised to 200°C. Take $E_S = 2.1 \times 10^5$ N/mm² & $E_C = 1 \times 10^5$ N/mm².The linear thermal expansion for steel and copper is 11×10^{-6}/°C and 18×10^{-6}/°C respectively.	L3	1	16

12.	a	A simply supported beam of length 10 m carries the uniformly distributed load and two-point loads as shown in Fig. 12. a. Determine the maximum bending moment and also draw the S.F. and B.M. diagram for the beam.	L4	2	16

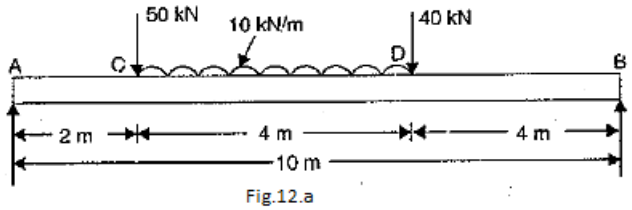

Fig.12.a

Or

	b	A simply supported beam carries a uniformly distributed load of 40 kN/m over the entire span. The cross-section is rectangular with a depth of 500 mm. If the maximum stress is 120 N/mm² and the moment of inertia is 7×10^8 mm⁴, determine the span of the beam.	L4	2	16
13.	a	A hollow shaft has an external diameter equal to twice its internal diameter. It is subjected to a torque of 4×10^6 N-mm and a bending moment of 3×10^6 N-mm. Determine the required external diameter if the maximum allowable shear stress is 80 N/mm².	L3	3	16

Or

	b	A close-coiled helical spring of mean diameter 20 cm is made of a 3 cm diameter wire and has 16 turns. A weight of 3 kN is dropped onto the spring. Determine the height from which the weight should fall so that the spring is compressed by 18 cm. Take $G = 8 \times 10^4$ N/mm².	L3	3	16
14.	a	A cantilever length of 2 m carries 20 kN at the free end and another load of 20 kN at its center. If $E = 10^5$ N/mm² and $I = 10^8$ mm⁴ for cantilever. Construct the slope and deflection of the cantilever at the free end using the moment area method.	L3	4	16

Or

	b	A simply supported beam of span L carries a point load W at mid-span. Determine the strain energy stored by the beam and hence calculate the central deflection.	L3	4	16
15.	a	A cylindrical vessel with closed ends is made of steel plates 4 mm thick. The length and internal diameter are 100 cm and 30 cm respectively. Determine the longitudinal and hoop stresses due to an internal pressure of 2 N/mm². Also calculate the increase in length, diameter, and volume. Take $E = 2 \times 10^5$ N/mm² and $\mu = 0.3$.	L3	5	16

Or

	b	Determine the diameter of a bolt subjected to an axial pull of 9 kN and a transverse shear force of 4.5 kN using: (i) maximum principal stress theory and (ii) maximum principal strain theory. Given: elastic limit = 225 N/mm², factor of safety = 3, and Poisson's ratio $\mu = 0.3$.	L3	5	16