Total number of printed pages: **D/4th semester/DME 405**

2023

STRENGTH OF MATERIALS

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	Define and explain the terms: longitudinal strain, lateral strain and Poisson's ratio.	6
	b)	Define Poisson's ratio. What is its maximum value?	2
	c)	Define the terms modulus of rigidity and bulk modulus.	4
	d)	What is a statically indeterminate structure?	2
	e)	Explain the difference between 'primary strain' and 'secondary strain'.	4
	f)	Classify the types of beam.	2
2.	a)	A hollow cylinder 2 m long has an outside and inside diameters of 50 mm and 30 mm respectively. Find the stress and deformation of the cylinder, when it is carrying an axial tensile load of 25 kN. Take E = 100 GPa.	7
	b)	A hollow steel tube 3.5 m long has external diameter of 120 mm. In order to determine the internal diameter, the tube was subjected to a tensile load of 400 kN and extension was measured to be 2 mm. If the modulus of elasticity for the tube material is 200 GPa, determine the internal diameter of the tube.	7
	c)	A steel rod 1m long and 20 mm × 20 mm in cross-section is subjected to a tensile force of 40 kN. Determine the elongation of the rod, if the modulus of elasticity for the rod material is 200 GPa.	6
3.	a)	A steel bar 2 m long, 40 mm wide and 20 mm thick is subjected to an axial pull of 160 kN in the direction of its length. Find the changes in length, width and thickness of the bar. Take E = 200 GPa and Poisson's ratio = 0.3.	7
	b)	An alloy bar has bulk modulus as 150 GPa and Poisson's ratio as 0.3. Find its modulus of rigidity.	7
	c)	If the values of modulus of elasticity and Poisson's ratio for an alloy body is 150 GPa and 0.25 respectively, determine the value of bulk modulus for the alloy.	6

4.	a)	The stresses at point of a machine component are 80 MPa (tensile) and 30 MPa (compression). Find the intensities of normal, shear and resultant stresses by analytical method on a plane inclined at an angle of 25° with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.	10
	b)	The stresses at a point in a component are 150 MPa and 50 MPa both tensile. Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 50° with tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress. BY USING MOHR'S CIRCLE	10
5.	a)	Explain briefly the relationship between loading, shear force and bending moment at a section.	6
	b)	A cantilever beam 1.5 m long carries point loads of 1 kN, 2 kN and 3 kN at 0.5 m, 1.0 m and 1.5 m from the fixed end respectively. Draw the shear force and bending moment diagrams for the beam.	7
	c)	List the assumptions made in the theory of torsion?	4
	d)	What is meant by stiffness? Write the formula for stiffness of a close coiled helical spring subjected to axial load.	3
6.	a)	A hollow circular shaft of external and internal diameter of 80 mm and 50 mm is required to transmit torque from one end to the other. What is the safe torque it can transmit, if the allowable shear stress is 45 MPa?	5
	b)	A circular shaft of 60 mm diameter is running at 150 r.p.m. If the shear stress is not to exceed 50 MPa, find the power which can be transmitted by the shaft.	5
	c)	What are springs? Distinguish clearly between bending springs and torsion springs.	4
	d)	A close-coiled helical spring is required to carry a load of 150 N. If the mean coil diameter is to be 8 times that of the wire, calculate these diameters. Take maximum shear stress as 100 MPa.	6