R22 Regulation *Subject code:4E4AB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech IV Semester Regular/Supplementary Examinations, April 2025

STRENGTH OF MATERIALS – II

(Civil Engineering)

Maximum Marks: 60 **Date:01.05.2025** **Duration: 3 hours**

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

PART-A

	All the following questions carry equal marks 10X1M=10 Marks	Marks	CO	Bloom Tx
1.a)	Define torsional rigidity.	1M	1	BL1
b)	Differentiate between open-coiled and close-coiled helical springs in terms of their application.	1M	1	BL2
c)	Define slenderness ratio	1M	2	BL1
d	Differentiate between short and long columns based on failure mode.	1M	2	BL2
e)	Define the kernel of a section.	1M	3	BL1
f)	State the condition for stability of a retaining wall.	1M	3	BL1
)	List any two assumptions made in Lame's theory for thick cylinders.	1M	4	BL1
h)	Differentiate between thin and thick cylinders based on wall thickness and stress distribution.	1M	4	BL2
i)	Define the term shear centre.	1M	5	BL1
J)	Differentiate between symmetrical and unsymmetrical sections with respect to shear centre location.	1M	5	BL2

Part-B

	Answer All the following questions. (3X10M=50Marks)	Marks	CO	Bloom Tx
2	A shaft is subjected to combined bending moment of 3 kNm and torsional moment of 4 kNm. Analyze the shaft using the maximum shear stress theory and maximum principal stress theory. Determine the diameter required for the shaft if the allowable stress is 60 MPa.	10M	1	BL3
	OR			
3	Two helical springs of different wire diameters and number of turns are connected in series and then in parallel. Analyze how the deflection and load sharing vary in each case. Provide expressions and draw comparative diagrams of spring deflection for both connections.	10M	1	BL3
d	A column of 2.5 m length is subjected to an axial compressive load with a small eccentricity of 10 mm. Use the Secant Formula to determine the maximum stress developed in the column. Assume slenderness ratio and necessary values.	10M	2	BL3
	OR			

5	Two empirical formulas — Straight Line Formula and Prof. Perry's Formula — are proposed to estimate the strength of a long column in design. Evaluate the assumptions, accuracy, and applicability of both formulas. Recommend the more suitable one for designing a steel tubular column in a transmission tower and justify your choice.	10M	2	BL5
6	A rectangular chimney section is subjected to a vertical load of 400 kN and a horizontal wind moment of 80 kN.m. The section is 2 m × 0.5 m. Determine the maximum and minimum stresses developed at the base due to the combined loading. Check whether the stress distribution remains within the kernel of the section.	10M	3	BL4
	OR			
7	A semi-circular beam of radius 3 m is simply supported at three equally spaced points and carries a uniformly distributed load of 10 kN/m. Analyze and compute the support reactions and maximum bending moment. Comment on how the curvature affects internal forces compared to a straight beam.	10M	3	BL6
8	A thin cylindrical shell has an internal diameter of 600 mm, thickness of 10 mm, and is subjected to an internal pressure of 2 MPa. Calculate the hoop stress and longitudinal stress. Also compute the change in diameter and then in volume. (Assume $E = 200$ GPa, $\nu = 0.3$)	10M	4	BL3
	OR			
9	A thick cylinder has an internal diameter of 100 mm and external diameter of 200 mm. It is subjected to an internal pressure of 40 MPa. Apply Lamé's theory to determine the radial and hoop stresses at the inner, outer, and mid-thickness. Sketch the stress distribution curves across the wall thickness.	10M	4	BL3
10	A T-section beam has the following dimensions: flange = 120 mm × 20 mm, web = 100 mm × 20 mm. It is subjected to a bending moment of 3 kN.m, acting in a plane inclined at 30° to the vertical. Determine the moment of inertia about the principal axes. Find the stresses due to oblique bending at the top and bottom fibres.	10M	5	BL3
	OR			
11	A beam of I-section is placed such that the web is vertical. The beam is subjected to a transverse load causing unsymmetrical bending. Analyze the deflection behavior of the beam. Compare it to a case where the beam is loaded symmetrically about the vertical axis.	10M	3	BL3