UPES
End Semester Examination, May 2024

Programme Name: B. Tech Mechatronics, Mechanical, and ADE **Semester: IV**
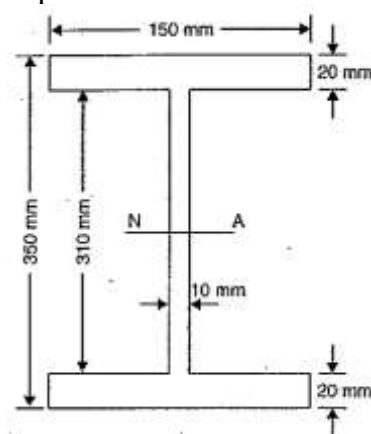**Course Name: Strength of materials** **Time: 03 hrs**
Course Code: MECH 2018 **Max. Marks: 100**
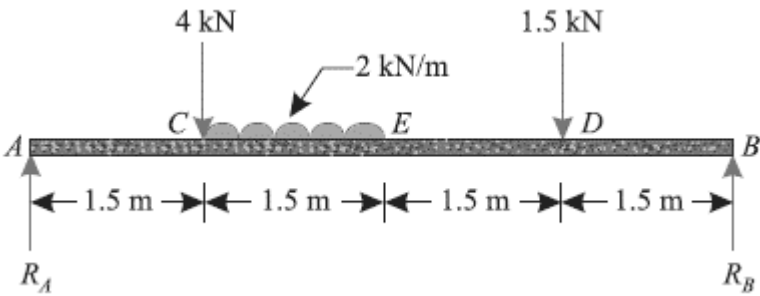**Instructions: Attempt all the questions as directed. Assume suitable data if missing.**

SECTION A

S. No.	Statement	Marks	CO
Q 1	Differentiate between thin cylindrical, and thick cylindrical pressure vessels.	**4**	**CO1**
Q 2	A thin tyre of steel is to be mounted on to a rigid wheel of 1.2 m diameter. Determine the internal diameter of the tyre if the hoop stress is limited to 120 MPa. Take E=210 GPa.	**4**	**CO2**
Q 3	Prove that the toughness is the area under the stress-strain diagram up to the failure point.	**4**	**CO1**
Q 4	Derive the relationship between bending moment and shear force in a beam.	**4**	**CO1**
Q 5	Discuss the analysis of shaft in series and parallel, subjected to pure torsional moments.	**4**	**CO1**

SECTION B

Q 6	At a point in a strained material, the principal stresses are 100 N/mm^2 (Tensile) and 40 N/mm^2 (Compressive). Determine the direction and magnitude in a plane inclined at 60^0 to the axis of major principal stress. Calculate the maximum intensity of shear stress in the material at the point.	**10**	**CO2**
Q 7	An- I section beam 350 mm x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section.	**10**	**CO2**

Q 8	A cylindrical shell is 3 m long; 1 m in diameter and the thickness of metal is 10 mm. It is subjected to an internal pressure of 150 N/cm^2. Calculate the change in dimensions of the shell and the maximum intensity of shear stress induced. Given E= 200 GPa and Poisson's ratio =0.3.	10	CO4
Q 9	The maximum allowable shear stress in a hollow shaft of external diameter equal to twice that of internal diameter, is 80 N/mm^2. Determine the diameter of the shaft if it is subjected to a torque of 4 x 10^6 N-mm and a bending moment of 3 x 10^6 N-mm. OR Two shafts of the same material and same lengths are subjected to the same torque. If the first shaft is of a solid circular section and the second shaft is of hollow circular section whose internal diameter is 2/3 of the outside diameter. Compare the weights of the shafts.	10	CO3
	SECTION-C		
Q 10	Develop the theory of simple bending clearly stating the assumptions. Derive an expression for the following bending equation with usual notations. $$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$ OR A simply supported beam of T-section cross section of size 150 mm wide and 250 mm deep and, 30 mm thick carries a uniformly distributed load of w kN/m over entire span of 4 m. A concentrated load 1 kN is acting at 1.2 m from the left support. If the maximum bending stress in the beam is not to exceed 40 N/mm^2 then find the load w.	20	CO3

Q 11	A beam is loaded as shown in figure below. Compute,
	    a. Deflection at point E and D.
	    b. Slop at end A and B
	
		20	CO4