MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
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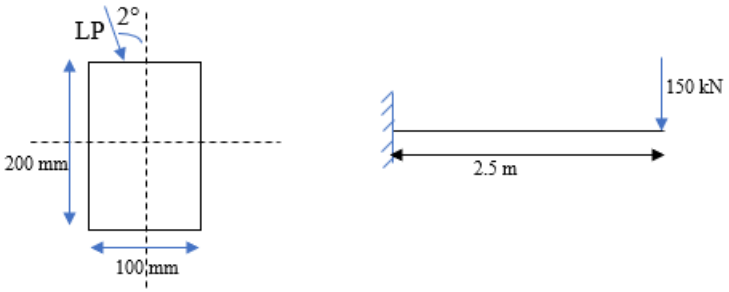
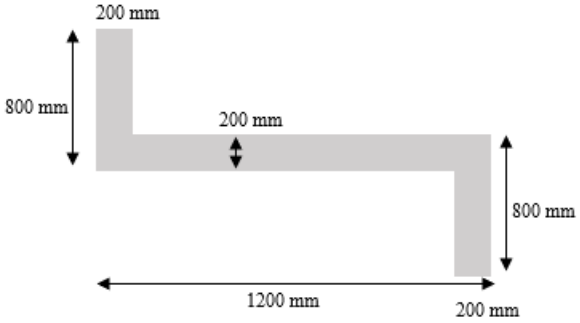
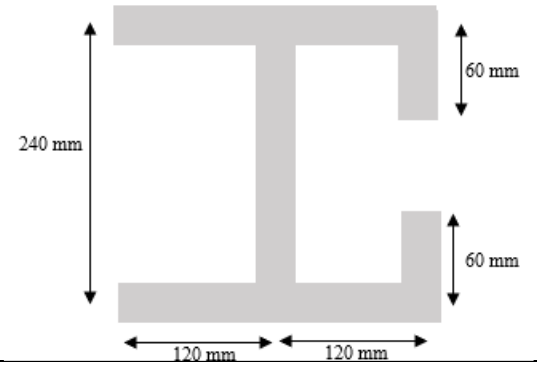
SECOND SEMESTER M.TECH (CIVIL ENGINEERING)
END SEMESTER EXAMINATION, APRIL-MAY 2024
Open Elective - ADVANCED STRENGTH OF MATERIALS (CIE 5301)
(– 05 - 2024)

TIME: 3 HRS. **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. Any missing data may be suitably assumed.

Q.No	Question	Marks	CO	BL
1A.	A solid circular shaft is transmitting power of 100 kW at a speed of 75 rpm. If the shear stress is not to exceed 50 MPa. Determine the diameter of solid shaft. If this is replaced by a hollow circular shaft of diameter ratio 0.7. Evaluate the diameter. Estimate is the size of the side if the shaft is replaced by equilateral triangle solid shaft.	**5**	**1**	**5**
1B	Deduce the expression for shear stress and angle of twist for a thin walled non-circular section	**5**	**1**	**4**
2A	A cantilever beam of span 2.5 m caries a point load of 150 kN at the free end the loading plane makes an angle of 2° with the vertical principal axis as shown in the figure. Estimate the resultant stresses at the four corners of the cross section. 	**5**	**2**	**4**
2B	For the above problem Q2A evaluate i). Position of Neutral axis ii). Magnitude and direction of maximum deflection Consider E as $2x10^5$ N/mm^2	**5**	**2**	**4**
3A	Evaluate the principal moment of inertia for the plane figure about a pair of mutually perpendicular axis passing through centroid. 	**5**	**2**	**4**

3B	Evaluate the shear center for the section shown in the figure with thickness 't'. (All dimensions are center line dimensions).  	**5**	**3**	**4**
4A	Illustrate the terms in the Winkler-Bach formula as applicable to beams curved in the plane of loading and list the assumptions.	**5**	**4**	**4**
4B	A crank hook has a circular section at its principal horizontal diameter and supports a load of 15 kN. The diameter at the principle section is 75 mm and inner radius of curvature is 50 mm. Evaluate the resultant stresses at the extreme fibers of the critical section.	**5**	**4**	**4**
5A	A cantilevered beam, curved in plan in the form of a quadrant of a circle carries a uniformly distributed load over its entire span. Analyze the beam and illustrate the variations of SF, BM, and TM.	**5**	**4**	**4**
5B	An infinite steel beam of width one unit and depth 150 mm is resting on elastic foundation with subgrade modulus of 15 N/mm^2. It is subjected to a concentrated load of 20 kN at a point along its length. Evaluate the maximum deflection and maximum bending moment of the beam. Assume E=200 kN/mm^2.	**3**	**5**	**4**
5C	Illustrate the effects of beams on elastic foundation with examples	**2**	**5**	**4**