BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B. ARCH **SEMESTER : III**
BRANCH: ARCHITECTURE **SESSION : MO/2025**

SUBJECT: AR204 STRUCTURAL MECHANICS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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			CO	BL
Q.1	The state of plane stress at a point on a body is represented on the element shown in Fig. 1. Represent this stress state in terms of the maximum in-plane shear stress and associated average normal stress. Also find out the planes of the maximum shear stress.	[5]	1	3

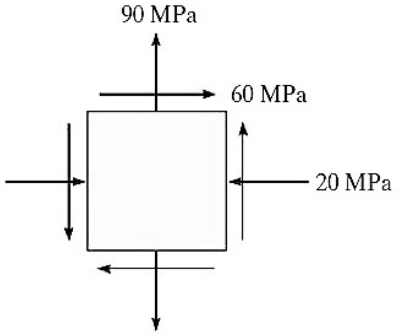

Fig. 1.

Q.2(a)	A state of stress is given as $\sigma_x = \sigma_y = -40$ MPa, $\tau_{xy} = 0$ MPa. Draw the Mohr's circle for the state of stress along with suitable justifications.	[2]	1	2
Q.2(b)	For the state of stress given as $\sigma_x = \sigma_y = 0$ MPa, $\tau_{xy} = 40$ MPa, draw the Mohr's circle and find out the principal stresses from it.	[3]	1	2
Q.3(a)	State the assumptions made while deriving the bending equation of a beam.	[2]	2	2
Q.3(b)	A timber beam of rectangular section is to support a load of 5 kN/m uniformly distributed load over a span of 4 m. If the depth of the section is to be twice the breadth and the stress in the timber is not to exceed 7 MPa, find the dimensions of the cross section.	[3]	2, 3	3
Q.4	A simply supported beam of 5 m span carries a uniformly distributed load of 10 kN/m and a point load of 10 kN at 2 m from the left support. Determine the magnitude and location of highest bending moment. Also suggest suitable dimensions of the rectangular cross-section if the allowable stress is limited to 8 MPa. Take depth as twice the width for cross-section.	[5]	2, 3	3
Q.5(a)	With respect to deflection of beams, explain the terms elastic curve and slope. What do you understand by the term stiffness of a beam and how does it impact the design of machine/structural components?	[2]	2, 3	2
Q.5(b)	For a simply supported and cantilever beam, show with a neat sketch the slope and deflection at any point. In each case, illustrate the points of zero deflection, maximum deflection, zero slope and maximum slope.	[3]	2, 3	2

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