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

CLASS: BTECH **SEMESTER : III/ADD**
BRANCH: ME/PIE **SESSION : MO/2025**

SUBJECT: ME24205 STRENGTH OF MATERIALS

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**

			CO	BL
Q.1(a)	Illustrate a non-zero state of stress in which the magnitudes of the maximum and minimum shear stresses are equal and are identical to the magnitudes of the principal stresses, i.e., $\|\tau_{max}\| = \|\tau_{min}\| = \|\sigma_1\| = \|\sigma_2\|$.	[2]	1	2
Q.1(b)	Two wooden joists $50\ mm \times 100\ mm$ are glued together along the joint AB as shown in Fig. Q.1(b). Determine the normal stress and shearing stress in the glue if $P = 200$ kN.	[3]	2	3

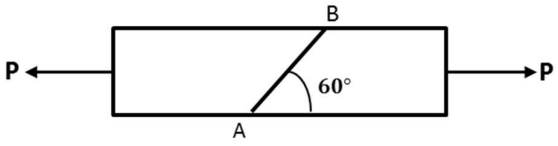

Fig.Q.1(b)

Q.2	If an element is subjected to the state of stress as shown in Fig. Q.2, find the principal stresses and their orientation with x-axis. Also, determine the stress components on the plane whose normal are at $45°$ and $135°$ with the x-axis.	[5]	3	4

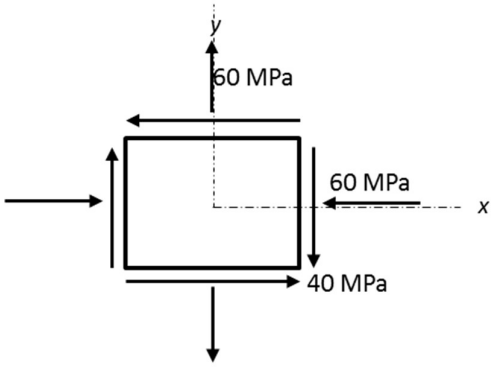

Fig. Q.2

Q.3	The strain components at a given point are $\epsilon_x = -800 \times 10^{-6}$, $\epsilon_y = 200 \times 10^{-6}$, and $\gamma_{xy} = -800 \times 10^{-6}$. If *E*=200 GPa and $\nu = 0.3$, find the stress components on the face whose normal at $+20°$ from the x-axis.	[5]	2	3
Q.4	Write shear and bending moment equations for the beam shown in Fig. Q.4. Also, draw shear force and bending moment diagram, specifying values at salient points and maximum bending moment.	[5]	3	4

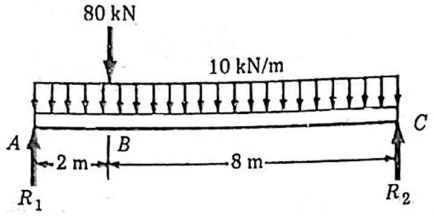

Fig. Q.4

Q.5(a)	Derive the flexure formula for a beam subjected to pure bending.	[3]	1	2
Q.5(b)	A high-strength steel band saw, 20 mm wide by 0.8 mm thick, runs over pulleys 600 mm in diameter. What maximum flexural stress is developed? Assume *E*= 200 GPa.	[2]	2,4	3

:::::22/09/2025 :::::E