

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

CLASS: B. ARCH
BRANCH: ARCHITECTURE

SEMESTER: III
SESSION: MO/2022

SUBJECT: AR204 STRUCTURAL MECHANICS

TIME: 2 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 25.
 2. Candidates attempt for all 25 marks.
 3. Before attempting the question paper, be sure that you have got the correct question paper.
 4. The missing data, if any, may be assumed suitably.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|--|-----|------|------|
| | | CO | BL |
| Q1 (a) Define and explain plane stress state at a point of the body. | [2] | 1 | 1, 2 |
| Q1 (b) A plane-stress condition exists at a point in a loaded structure. The stresses have the magnitudes and directions shown on the stress element of Figure 1. Calculate the stresses acting on the planes obtained by rotating the axes clockwise through an angle of 15°. Also, determine principle and maximum shear stresses. | [3] | 1, 2 | 3 |

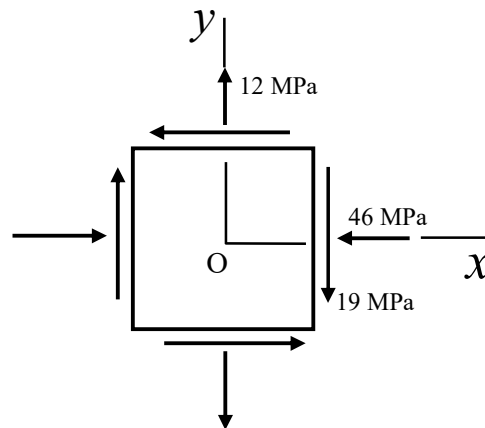


Figure 1

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|--|-----|---|------|
| Q2 (a) Define and explain plane strain state at a point of the body. | [2] | 1 | 1, 2 |
| Q2 (b) An element of material in plane strain undergoes the following strains: | [3] | 1 | 3 |

$$\epsilon_x = 340 \times 10^{-6}; \epsilon_y = 110 \times 10^{-6}; \gamma_{xy} = 180 \times 10^{-6}$$

Determine the following quantities:

- (a) the strains for an element oriented at an angle $\theta = 30^\circ$, (b) the principal strains, and (c) the maximum shear strains.
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|---|-----|---|---|
| Q3 (a) Describe briefly about 45° and 60° strain rosette. | [2] | 1 | 1 |
|---|-----|---|---|

- Q3 (b) During a test of an airplane wing, the strain gage readings from a 45° rosette (Figure 2) are as follows: gage A, 520×10^{-6} ; gage B, 360×10^{-6} ; and gage C, -80×10^{-6} . Determine the principal strains and maximum shear strains. [3] 1, 2 3

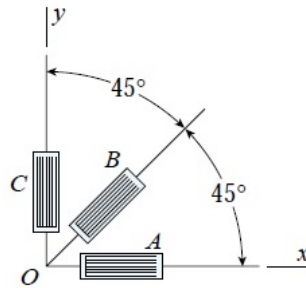


Figure 2

- Q4 (a) Explain pure bending of beams with a suitable example. [2] 1, 2, 3 2
- Q4 (b) What are the assumptions followed to derive the equations for pure bending of beams? [3] 1, 2, 3 1
- Q5 (a) Show that the bending stress in any fibre of the beam is proportional to the distance of that fibre from the neutral layer of the beam. [2] 1, 2, 3 3
- Q5 (b) What is section modulus of a beam? Explain with an example. [3] 1, 2, 3 1, 2

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