CLASS: B.TECH                                                                  SEMESTER : V
BRANCH: MECHANICAL                                                             SESSION : MO/2023

**SUBJECT: ME355 ADVANCED SOLID 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 stress at a point is characterised by the components                 [5]   1   3
$\sigma_x = 12.31$, $\sigma_y = 8.96$, $\sigma_z = 4.34$,  $\tau_{xy} = 4.20$, $\tau_{yz} = 5.27$, $\tau_{zx} = 0.84$.

Determine the values of the principal stresses and their directions.

Q.2   The displacement field in suitable units for a body is given by                   [5]   1   3

$$\vec{u} = (x^2 + y)\hat{\imath} + (3 + z)\hat{\jmath} + (x^2 + 2y)\hat{k}$$

Determine the principal strains at (3, -1, 2) and the direction of minimum principal strain.

Q.3   Express all boundary conditions for each of the problems illustrated in the Figure 1   [3+2]   1   2
below.
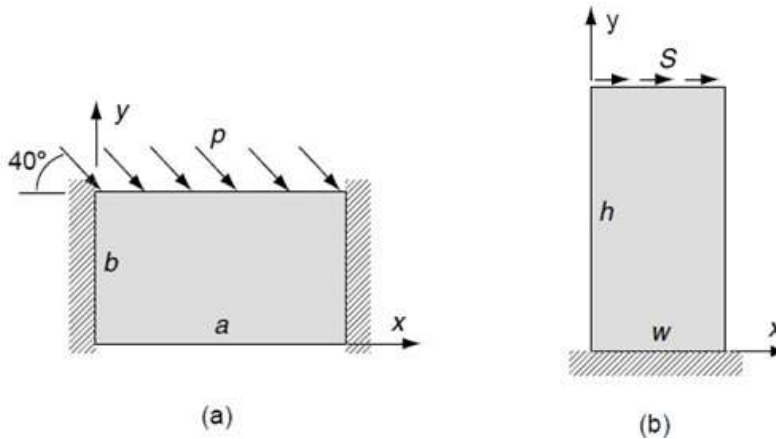


Figure 1

Q.4   A beam-column AB is subjected to an axial load *P* and a moment $M_b$ at support B as   [5]   2   6
shown in Figure 2. Derive the expression of deflection curve of the beam column.
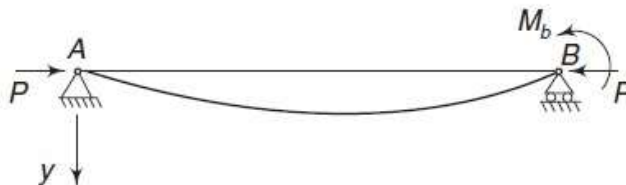


Figure 2

Q.5   Consider a pin-ended column subjected to an axial compressive load P. Assume that   [5]   2   3
the buckled shape of the column is given by
$$y = a \sin\frac{\pi x}{L}$$
where $a$ is an unknown parameter. Using the energy method, determine the critical
load.

:::::27/09/2023 M:::::