Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

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I SEMESTER M.TECH. (Structures.) END SEMESTER EXAMINATIONS
JANUARY 2024
ADVANCED MECHANICS OF SOLIDS [CIE 5126]

Date of Exam: Time of Exam: Max. Marks: **50**

Instructions to Candidates:

- Answer all the questions
- Any missing data may be suitably assumed

Q. No.	Questions	Marks	CO	BL
1A.	The state of stress at a point is given below, $[s] = \begin{bmatrix} 4.42 & 1.35 & 3.51 \\ 1.35 & 3.83 & 9 \\ 3.51 & 9 & 3.21 \end{bmatrix}$ MPa Assess the hydrostatic and deviatoric stresses along with the invariants.	**5**	**1**	**5**
1B.	A strain field is given as, $[e] = \begin{bmatrix} 3 & 8 & 4 \\ 8 & 2 & 6 \\ 4 & 6 & 1 \end{bmatrix} \times 10^{-6}$ Evaluate the principal strains and the direction cosines corresponding to major principal strain.	**5**	**2**	**5**
2A.	Analyze a cantilever beam for bending stresses using the Airy's stress function. The beam is of length 'L', unit width and depth '2H' subjected to a concentrated force 'P' at the free end.	**5**	**2**	**4**
2B.	Illustrate the method to obtain equilibrium equations in Polar co-ordinate system corresponding to 'radial direction only' for a general 2D circular element of unit thickness.	**5**	**3**	**4**
3A.	Illustrate the method to obtain the strain displacement relations in polar coordinate system corresponding to circumferential direction only.	**5**	**3**	**4**
3B.	A hollow cylinder is subjected to uniform pressures 'σ_i' and 'σ_o' on inner and outer surfaces respectively. The inner diameter of the cylinder is 'a' and outer diameter is 'b'. Evaluate the stresses by using a suitable Airy's stress function.	**5**	**3**	**5**
4A.	With usual notations, illustrate Navier's solution technique for obtaining the general expression for deflection (w(x,y)) of a simply supported rectangular plate. This plate has a dimension a×b with thickness 't' and is subjected to a line load of intensity q_o kN/m at a distance of 's' from the left hand support.	**5**	**4**	**4**
4B.	Illustrate the method to obtain the equilibrium equations corresponding to transverse direction ($\Sigma F_z = 0$) for a thin rectangular plate of size '$d_x \times d_y \times t$' subjected to a transverse load q (x,y).	**5**	**4**	**4**
5A.	With the usual notations using bending theory, illustrate the method to obtain equilibrium equations for shells corresponding to the longitudinal axis ($\Sigma F_x = 0$).	**5**	**5**	**4**
5B.	Classify the shells based on curvature, geometrical developability and form.	**3**	**5**	**4**
5C.	Illustrate the boundary conditions corresponding to the simply supported edge of a thin rectangular plate.	**2**	**4**	**4**