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MTECH
(SEM II) THEORY EXAMINATION 2021-22
ADVANCED MECHANICS OF SOLIDS

Time: 3 Hours

Total Marks: 70

Note: Attempt all Sections. If require any missing data; then choose suitably.

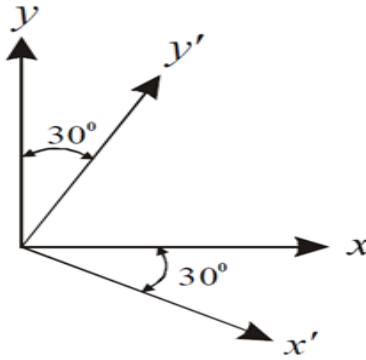
SECTION A

1. Attempt all questions in brief. 2x7 = 14

a.	Discuss scalar matrix
b.	What is body force?
c.	Justify that value of Poisson's ratio lies between -1 to 0.5.
d.	Differentiate between isotropic and anisotropic materials
e.	Write constitutive equations?
f.	Explain principle of minimum potential energy.
g.	Explain principle of virtual work

SECTION B

2. Attempt any three of the following: 7x3 = 21

a.	Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$
b.	For the given state of stress, determine the principal stresses and their directions $[\tau_{ij}] = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$
c.	Find the strain components associated with a set of axes $x'y'z'$ inclined at an angle of 30° clockwise to the $x y z$ set as shown in the figure. Also find the principal strains and the direction of the axes on which they act. <div style="text-align: center;">  <p>Figure</p> </div>
d.	Explain fundamentals of Plastic hardening and softening.
e.	Deduce Beltrami-Michell compatibility equations.



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SECTION C

3. Attempt any *one* part of the following: 7x1 = 7

a.	Find the components of metric tensor and the conjugate tensor in cylindrical coordinates.
b.	Find the equation of the sphere through the points (0, 0, 0), (0, 1, -1), (-1, 2, 0) and (1, 2, 3). Locate its centre and find the radius.

4. Attempt any *one* part of the following: 7x1 = 7

a.	A cylindrical boiler, 180 cm in diameter, is made of plates 1.8 cm thick is subjected to an internal pressure 1400 kPa. Determine the maximum shearing stress in the state at point P and the plane on which it acts.
b.	The state of stress characterized by τ_{ij} is given below. Resolve the given state into a hydrostatic state and a pure shear state. Determine the normal and shearing stresses on an octahedral plane.
$[\tau_{ij}] = \begin{bmatrix} 10 & 4 & 6 \\ 4 & 2 & 8 \\ 6 & 8 & 6 \end{bmatrix}$	

5. Attempt any *one* part of the following: 7x1 = 7

a.	The strain components at a point are given by $\epsilon_x = 0.01, \epsilon_y = -0.02, \epsilon_z = 0.03, \gamma_{xy} = 0.015, \gamma_{yz} = 0.02, \gamma_{xz} = -0.01$ Determine the normal and shearing strains on the octahedral plane.
b.	Prove that an element subjected to deviator strain undergoes pure deformation without a change in volume

6. Attempt any *one* part of the following: 7x1 = 7

a.	What is isotropic Hooke's law? Explain with suitable example.
b.	Assuming the necessary stress-strain rate relations, deduce Navier-Stokes' equations.

7. Attempt any *one* part of the following: 7x1 = 7

a.	Write short on the first form of Hamilton's principle for a conservative system of particles.
b.	What are displacement boundary conditions for surface loading conditions explain in brief.