Name: **Enrolment No:**	

UPES

End Semester Examination, Dec. 2023

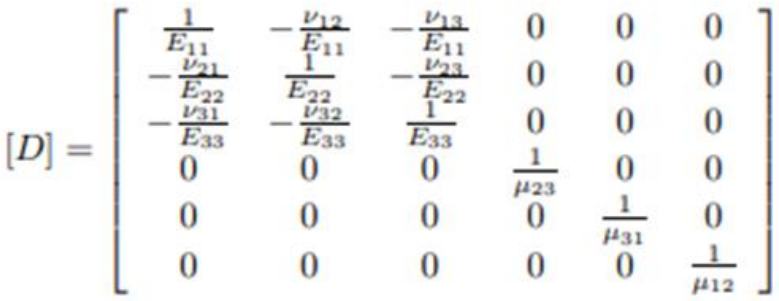
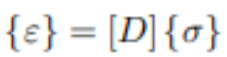
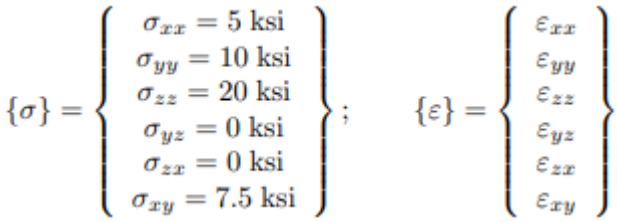
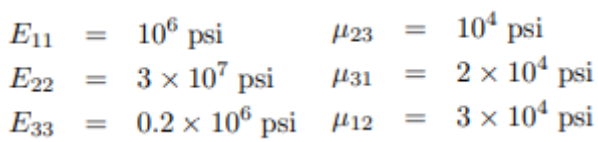
Program: B.Tech. (APE-UP) **Semester: VII**
Course: Geomechanics **Time: 03 hrs.**
Course Code: PEAU 4025 **Max. Marks: 100**
Nos. of page(s): 03
Instructions: All questions are compulsory
****Note: Graph Sheet is required for few Question**

SECTION A

S. No.		Marks	CO
Q 1	Enumerate the general assumptions for analysis of stresses around a wellbore.	**4**	**CO1**
Q 2	Describe E. M. Anderson's faulting theory with suitable stress relations and neat sketch.	**4**	**CO1**
Q 3	Define the following: (a) Geomechanical Earth Model (GEM) (b) Stress and Strain (c) 2-D Mohr's Circle (d) Model calibration	**4**	**CO1**
Q 4	(a) If the Poisson's ratio is given as 0.3 and the Young's modulus is given to 7 X 10^{10}. What will be the value for shear modulus? (b) The state of stress at a point under plane stress condition is σx = 40 MPa, σy = 100 MPa and τxy = 40 MPa. Determine the radius of the Mohr's circle representing the given state of stress in MPa is	**2+2**	**CO3**
Q 5	Describe the correlation between well bore fracture and collapse pressure with suitable formulations.	**4**	**CO2**

SECTION B

Q 6	Explain the following with suitable formulation: (a) Correlation between linear stress and strain components in cartesian and in-situ coordinate system. (b) Correlation between linear stress and strain components in cartesian and cylindrical coordinate system. OR Write detailed notes on the following with suitable examples? (a) 3-D Geomechanical Earth Model (b) 4-D Geomechanical Earth Model	**5+5**	**CO1**
Q 7	Discuss any two-pore pressure prediction method with associated formulations	**10**	**CO2**

Q 8	A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find: (i) The direction and magnitude of each of the principal stress and (ii) Magnitude of the greatest shear stress	**6+4**	**CO2**
Q 9	Describe the following sand production prediction methods: (a) Wellsite Engineering Method (b) Stress-strain model	**10**	**CO3**
	SECTION-C		
Q 10	Given that for a general orthotropic elastic material there are 12 unique coefficients such that:  The constitutive equation for this form would then be:  where the stress has the following values  Suppose that the 12 material coefficients have the following values: 	**20**	**CO4**

	$\nu_{12} = 0.2$ $\nu_{13} = 0.25$ $\nu_{21} = 0.33$ $\nu_{23} = 0.43$ $\nu_{31} = 0.05$ $\nu_{32} = 0.06$ Calculate the infinitesimal strain tensor.		
Q 11	(a) Derive the formula using Mohr's Coulomb criteria to determine the following: (i) Shear stress (ii) Normal Stress (iii) Relation between triaxial stress (iv) Compressive Stress and Tensile Stress (b) The following data is given for a vertical well drilled. σv = 10 MPa $\sigma H = \sigma h$ = 9 MPa P0 = 5 MPa μ = 0.3 Determine the following (a) Fracture pressure for non-deviated well (b) Fracture pressure at the deviation Υ = 40º and ϕ = 165º OR The stress in a granitic rock mass has been measured by the hydraulic fracturing technique. Two tests were conducted in a vertical borehole: one test at a depth of 500 m, and the other test at a depth of 1000 m. The results were as follows: Depth (m) / Breakdown pressure, P_B (MPa) / Shut-in pressure, P_S (MPa) 500 / 14.00 / 8.00 1000 / 24.50 / 16.00 Given that the tensile strength, σ_t, of the rock is 10 MPa, (a) Estimate and list the values of σ_1, σ_2 and σ_3 at the two depths. State all the assumptions you have to make in order to produce these estimates. (b) State whether the two sets of results are consistent with each other. Justify your reasons for the statement.	**10+10**	**CO3**