Name:

Enrolment No:

UPES

End Semester Examination, Dec. 2024

Course: Geomechanics **Semester: VII**

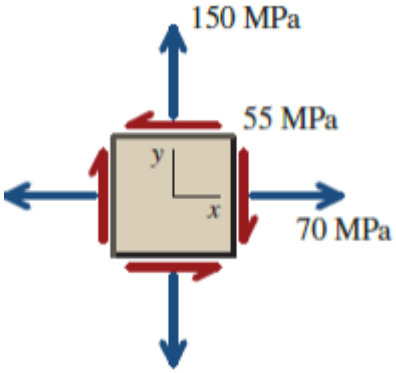
Programme: B.Tech. (APE-UP) **Time: 3 hrs.**

Course Code: PEAU4025 **Max. Marks: 100**

Instructions: All questions are compulsory

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the application of drill stem test (DST) in petroleum operation	**4**	**CO1**
Q 2	Describe the importance of failure criterion in well bore stability analysis.	**4**	**CO2**
Q 3	Describe in detail about E. M. Anderson's theory of faulting with suitable sketch.	**4**	**CO2**
Q 4	Describe the correlation between well bore fracture and collapse pressure with suitable formulations.	**4**	**CO2**
Q 5	Define the following: (a) Geomechanical Earth Model (GEM) (b) Stress and Strain (c) 2-D Mohr's Circle (d) Model calibration	**4**	**CO1**
	SECTION B **(4Qx10M=40Marks)**		
Q 6	Execute the following with suitable formulation: (a) Correlation between linear stress components in cartesian and in-situ coordinate system. (b) Correlation between linear stress 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.	**10**	**CO3**
Q 7	Illustrate any two-pore pressure prediction method with associated formulations.	**10**	**CO2**
Q 8	Describe the conditions for tensile failure during hydraulic fracturing.	**10**	**CO3**
Q 9	For the structural member, Determine: (a) The principal stresses and the maximum in-plane shear stress acting	**10**	**CO4**

	at the point. (b) Show these stresses in an appropriate sketch.  		
	SECTION-C **(2Qx20M=40Marks)**		
Q 10	(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. $\sigma v = 10$ MPa $\sigma H = \sigma h = 9$ MPa $P0 = 5$ MPa $\mu = 0.3$ Determine the following (a) Fracture pressure for non-deviated well (b) Fracture pressure at the deviation $\Upsilon = 40^o$ and $\phi = 165^o$ **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.	**20**	**CO3**

<table>
<tr><td></td><td>Justify your reasons for the statement.</td><td></td><td></td></tr>
<tr><td>Q 11</td><td>A cylindrical core of diameter 54 mm and height of 150 mm was taken for unconfined compressive strength test. The test results are tabulated below. Draw stress strain graph and determine the compressive strength, Elastic modulus and Poisson’s ratio of the sample.
<table>
<tr><th>Load(kN)</th><th>Axial Displacement(mm)</th><th>Lateral displacement(mm)</th></tr>
<tr><td>227.1</td><td>0.26</td><td>0.014</td></tr>
<tr><td>293.5</td><td>0.3</td><td>0.053</td></tr>
<tr><td>376.7</td><td>0.34</td><td>0.014</td></tr>
<tr><td>391.4</td><td>0.35</td><td>0.029</td></tr>
<tr><td>415.5</td><td>0.38</td><td>0.048</td></tr>
<tr><td>414</td><td>0.42</td><td>0.054</td></tr>
</table></td><td>20</td><td>CO4</td></tr>
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