Name:

Enrolment No:

UPES
End Semester Examination, Dec. 2024

Course: Reservoir Geomechanics **Semester: III**
Programme: M. Sc. (Petroleum Geoscience) **Time: 3 hrs.**
Course Code: PEGS 8021 **Max. Marks: 100**
Instructions: All questions are compulsory

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the application of geomechanics in mature oil and gas fields	**4**	**CO1**
Q 2	Express the following GEM data sources and its uses (a) Pressure while drilling (PWD) (b) Lost circulation	**4**	**CO2**
Q 3	(A) A circular solid piece of rock is tested in a compression-testing rig to examine its stress/strain behavior. The sample is 6 inches in diameter and 12 inches in length, with the compression load cell imposing a constant load of 10000 lbf equally at both top and bottom of the rock sample. Assuming a measured reduction in length of 0.02 inches. The compressive stress in the rock in pound foot per square inch is (i.) 353.7 (ii.) 250.9 (iii.) 265.5 (iv.) 365.9	**4**	**CO3**
Q 4	Explain the Lost circulation scenarios in detail.	**4**	**CO1**
Q 5	Define the following: (a) Effective Stress (b) Deviatoric Stress.	**4**	**CO2**

SECTION B
(4Qx10M=40Marks)

Q 6	Derive the formula to determine principal stresses and its orientation in two dimensions. **OR** The matrix below defines a given stress state. Determine the principal stresses.	**10**	**CO2**

<table>
<tr><td></td><td>$$[\sigma] = \begin{bmatrix} 16 & 3 & 3 \\ 3 & 12 & 6 \\ 3 & 6 & 12 \end{bmatrix}$$</td><td></td><td></td></tr>
<tr><td>Q 7</td><td>Examine the correlation suggested by E. M. Anderson’s Faulting Theory to determine the types of the faults.</td><td>10</td><td>CO3</td></tr>
<tr><td>Q 8</td><td>It has been determined that a point in a load-carrying member is subjected to the following stress condition:
$\sigma x = 400$ MPa $\sigma y = -300$ MPa $\tau xy = 200$ MPa (CW)
Perform the following:
(a) Find maximum and minimum principal stress and maximum shear stress
(b) Draw the complete Mohr’s circle, labeling critical points</td><td>10</td><td>CO3</td></tr>
<tr><td>Q 9</td><td>Illustrate the following with suitable examples?
(i) Model calibration by
(ii) Optimizing Model Performances
(iii) Expert Knowledge</td><td>10</td><td>CO1</td></tr>
<tr><td colspan="4">SECTION-C
(2Qx20M=40Marks)</td></tr>
<tr><td>Q 10</td><td>Describe the following sand production prediction methods:
(a) Wellsite Engineering Method
(b) Stress-strain model
OR
Laboratory test data show that confined compressive and tensile strengths for a rock are 105 MPa and 12 MPa., respectively. Find measurements indicates a joint persistence of 0.75. Further laboratory testing shows the joint cohesion and friction angle are 0.09 MPa and 26°, respectively. Using the Terzaghi jointed rock mass model, estimate the cohesion and angle of internal friction for intact rock tested in the laboratory, then determine the mass values of friction angle, cohesion, unconfined compressive strength, and tensile strength.</td><td>20</td><td>CO4</td></tr>
<tr><td>Q 11</td><td>The triaxial testing data of the rock samples are illustrated in the table below.
<table>
<tr><td>$(\sigma_1 + \sigma_3)/2$</td><td>1561.5</td><td>1245</td><td>974</td><td>735</td><td>312</td><td>156.5</td></tr>
<tr><td>$(\sigma_1 - \sigma_3)/2$</td><td>1054.5</td><td>807</td><td>674</td><td>573</td><td>288</td><td>156.5</td></tr>
</table>
Determine the following
(i) Plot the Mohr circles for the data.
(ii) Draw a failure line on the top of the circles.
(iii) Develop equations for the failure model.</td><td>20</td><td>CO3</td></tr>
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