Name:

Enrolment No:

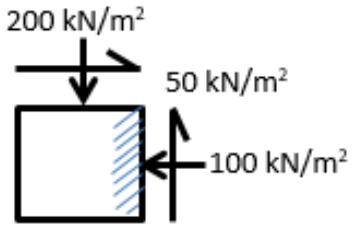
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

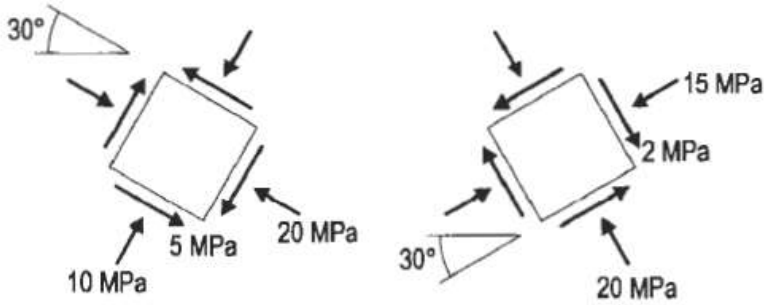
Programme: B. TECH (Applied Petroleum Engineering-Up Stream) **Semester: V**
Course: Geomechanics **Time: 03 hrs.**
Course Code: PEAU 3003 **Max. Marks: 100**

Instructions: All questions are compulsory

SECTION A

S. No.		Marks	CO
Q 1	Describe E. M. Anderson's faulting theory in brief with neat sketch?	**4**	**CO1**
Q 2	A cylindrical rock sample was collected and tested using a compression-testing rig to examine its stress/strain behavior. The length of the sample was 108 mm with L/D ratio 2.0. The sample was fractured at the load of 65 kN applied by the loading cell. The axial and lateral deformation in the sample was observed 0.34 mm and 0.014 mm respectively. Determine the compressive stress as well as Poisson's ratio of the rock samples.	**2+2**	**CO2**
Q 3	Differentiate between the following with suitable examples. (i.) 1-D and 4-D Geomechanical Earth Model (ii.) Model Calibration and Model Validation	**2+2**	**CO3**
Q 4	Describe the following pore pressure prediction method in brief and write suitable formulation. (i.) Effective stress method (ii.) d-Exponent method	**2+2**	**CO3**
Q 5	Discuss about Geertsma's nucleus of strain model with suitable formulations?	**4**	**CO4**
	SECTION B		
Q 6	Derive the formula to determine principal strains and its orientation in two dimensions.	**10**	**CO1**
Q 7	The matrix below defines a given stress state. Determine the principal stresses. $[\sigma] = \begin{bmatrix} 16 & 3 & 3 \\ 3 & 12 & 6 \\ 3 & 6 & 12 \end{bmatrix}$	**10**	**CO1**

Q 8	A plane stress condition exists at a point on the surface of a loaded rock, where the stresses have the magnitudes and directions as given below (where in this case, minus implies a tension and plus a compression): σ_x = - 45.5054 MPa, σ_y = 11.72109 MPa, τ_{xy} = - 18.61584 MPa Determine the principal stresses acting on the element and their orientation. OR Draw the Mohr's circle and determine the principal stresses and orientations of principal plane for the state of plane stress shown in the figure.  	**10** **10**	**CO2**
Q 9	A vertical well was drilled in the Gulf of Mexico and the following in situ pressure and rock properties data were collected. σ_v = 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 $\Upsilon = 40^o$ and $\phi = 165^o$	**4+6**	**CO3**
	SECTION-C		
Q 10	(a) For an oil field in the south of Texas, USA, where a vertical well is drilled to a maximum depth of 10,000 ft, the average specific gravity and pore pressure gradient are given as 2.3 and 0.38 psi/ft, respectively. Assume the Biot's constant and Poisson's ratio as 1 and 0.28, respectively. Calculate the following for the above data for the surrounding rock formation at the bottom of the vertical well. (i) Overburden Stress (ii) Horizontal In-Situ Stress (iii) Normal Stress (iv) Shear Stress (b) 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	**2.5+2.5 +2.5+2. 5** **2+2+4+ 2**	**CO2**

	OR Add the following 2-D rock stress states, and find the principal stresses and directions of the resultant stress state.  	**20**	
Q 11	Write a detailed notes on the following terms of the hydraulic fracturing: (i) Fracture initiation and formation breakdown and associated mathematical formula (ii) Fracture size and shape and associated mathematical formula	**10+10**	**CO4**