Name: Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2023

Programme Name: B.Tech., APE GAS **Semester** : IV
Course Name : Reservoir Engineering-I **Time** : 03 hrs
Course Code : PEAU 2010 **Max. Marks :** 100
Nos. of page(s) : 2

Instructions: 1. Assume any data missing.
2. Maintain a minimum of three decimal accuracy.

SNo	SECTION A (5*4=20M)	Marks	CO
Q 1	Define permeability and list various types of permeabilities based on the fluids phases.	4	CO1
Q 2	Define saturation and mention its significance.	4	CO2
Q 3	Define cricondentherm and retrograde condensation.	4	CO3
Q 4	Define Darcy's law.	4	CO4
Q 5	List various methods available to estimate a reserve	4	CO5
	SECTION B (4*10=40M)		
Q 6	A hydrocarbon reservoir is characterized by five distinct formation segments that are connected in parallel. Each segment has the same formation thickness. The length and permeability of each section of the five bed reservoir are given as : Length (ft): 150, 200, 300, 500, 200 Permeability (md): 80, 50, 30, 20, 10 Calculate the average permeability of the reservoir by assuming it to be a Linear flow system.	10	CO1
Q 7	Explain with a neat diagram the constant-composition expansion test to characterize the reservoir fluids.	10	CO3
Q 8	Demonstrate on various flow regimes that describe the fluid flow behavior and reservoir pressure distribution in a porous reservoir.	10	CO4
Q9	A gas field extending over an area of 160 acres with an initial reservoir pressure, of 3250 psia, porosity of 22% and an average initial water saturation of 23% has been producing from a net productive thickness of 40 ft till the reservoir reached the gas saturation of 34% after water invasion. The gas formation volume factor is 0.00533 ft^3/SCF 0.00667, ft^3/SCF and 0.03623 ft^3/SCF at initial, 2500 psia and 500 psia reservoir pressures respectively. Calculate Initial gas in place i. Gas in place after volumetric depletion to 2500 psia ii. Gas in place after volumetric depletion to 500 psia iii. Gas in place after water invasion at 3250 psia	10	CO5
	SECTION-C (2*20=40M)		
Q10	i. Derive an expression for radial flow rate Q of compressible gas with a viscosity of μ_g, flowing to a well bore of radius r_w under steady-state condition through a cylindrical geometry formation of permeability κ_g . ii. A core is 3 in. long and 2 cm in diameter. When the core is maintained at an upstream pressure was 29.4 psia and downstream pressure was 14.7 psia, a flow rate of 10	20	CO4

	cm^3/sec of air (μ = 0.018 cp) was recorded at downstream pressure. Calculate the permeability of the core in darcys.		
Q11	From the following equations for change in oil volume given by NB_{oi}- (N-N_P) B_o, change in free gas volume given by Nm B_{oi} $(1-\frac{B_g}{B_{gi}})$ $-$ N $R_{soi}B_g + N_pR_pB_g + NR_{so}B_g - N_pR_{so}B_g$ change in water & rock volumes given by $-W_e + B_wW_p - NB_{oi}(1+m)\frac{(C_wSw_i + C_f)}{1-SW_i}$ (ΔP) deduce for the following General Material Balance equation. $$\frac{\mathrm{N}(B_t - B_{ti})}{N_p[B_t + B_g(R_p - R_{soi})]} + \frac{\frac{NmB_{io}}{B_{gi}}(B_g - B_{gi})}{N_p[B_t + B_g(R_p - R_{soi})]} + \frac{NB_{oi}(1+m)\left(\frac{C_wSw_i + C_f}{1-SW_i}\right)\Delta\mathrm{P}}{N_p[B_t + B_g(R_p - R_{soi})]} + \frac{W_e - B_wW_p}{N_p[B_t + B_g(R_p - R_{soi})]} = 1$$	**20**	**CO6**