Name:
Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, Dec 2023

Programme Name: M.Tech., PE | **Semester :** I
Course Name : Reservoir Engineering | **Time :** 03 hrs
Course Code : PEAU 7002 | **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 a reservoir.	4	CO1
Q 2	Define Permeability and comment on the various types of permeabilities.	4	CO2
Q 3	Calculate the API gravity of water at 60^oF and 14.6 psi.	4	CO3
Q 4	Define Darcy's law.	4	CO4
Q 5	List various methods used to determine the hydrocarbon reserves.	4	CO5
	SECTION B (4*10=40M)		
Q 6	Explain with a neat diagram the saturation method for estimating the pore volume and hence the porosity of a rock sample.	10	CO1
Q 7	Explain with a neat diagram the multi-component phase diagram of petroleum 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	An oil field extended over 26700 acres with an average payzone thickness of 49 ft. The average porosity and connate water saturation of the payzone are respectively 8% and 45%. The formation volume factor of oil at the initial reservoir pressure of 2980 psi and an abandonment pressure of 300 psi were respectively calculated to be 1.68 RB/STB and 1.15 RB/STB. The residual oil saturation after the water invasion was 0.2 and the gas saturation at the abandonment pressure was 0.34. Then calculate the a. Initial oil in place. b. Oil in place after water invasion at initial pressure. c. Oil in place after volumetric depletion to abandonment pressure.	10	CO5
	SECTION-C (2*20=40M)		
Q10	a. Classify various types of reservoirs and show them on multi-component P-T diagram. b. A PVT cell initially contain oil at its bubble point of 180^0F & 2000 psi and the Hg was at 280 CC. 18.8 CC Hg was removed from the cell and the pressure dropped to 1600 psi. The Hg was then injected at constant pressure & temperature and 0.129 SCF of gas was removed leaving 263.5 CC of oil. Some more quantity was removed from the cell until the pressure was reduced to 14.7 psi & 60^0F. At that condition 0.388 SCF of gas is removed and 205.9 CC of oil remained in the cell. Then determine i. B_o and *GOR* at bubble point condition. ii. B_o, B_t and *GOR* at 1600 psi and 180^0F.	20	CO3

Q11	Derive the following General Material Balance equation $$\frac{\mathrm{N}(B_t - B_{ti})}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} + \frac{\frac{NmB_{io}}{B_{gi}}\left(B_g - B_{gi}\right)}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} + \frac{NB_{oi}(1+m)\left(\frac{C_w Sw_i + C_f}{1 - SW_i}\right)\Delta\mathrm{P}}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} + \frac{W_e - B_w W_p}{N_p\left[B_t + B_g\left(R_p - R_{soi}\right)\right]} = 1$$ **or** A gas field extended over 160 acres with an average payzone thickness of 40 ft. The average porosity and connate water saturation of the payzone are respectively 22% and 23%. The formation volume factor of gas at the initial reservoir pressure of 3250 psi was calculated to be 0.00533 CF/SCF. The formation volume factor of gas at 2500 psi and 500 psi were respectively 0.00667 CF/SCF and 0.03623 CF/SCF. The residual gas saturation after the water invasion was 0.34. Then calculate the a. Initial gas in the reservoir. b. Gas in place after volumetric depletion to 2500psia. c. Gas in place after volumetric depletion to 500psia. d. Gas in place after water invasion at 3250psia. e. Gas in place after water invasion at 2500psia. f. Gas in place after water invasion at 500psia. g. Gas reserve by volumetric depletion to 500psia. h. Gas reserve by full water drive.	**20**	**CO2**