Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech Mid Semester Exam 2023-24

Semester: ~~6th~~ 4th

Subject Code: (203120255)

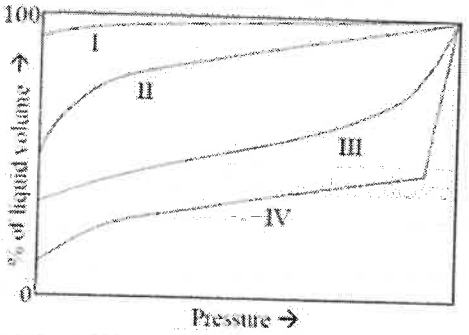
Subject Name: (Elements of Reservoir Engineering)

Date: (31/01/2024)

Time: (1hr: 30min)

Total Marks: 40

Sr. No.		Marks
Q.1	(A) One-line Questions	
	1. Define the wettability in short?	05
	2. Write down the formula of the calculation of the Dykstra Parson Permeability Variation Coefficient?	
	3. Draw the capillary height or pressure versus saturation graph for the low gravity oil-water, high gravity oil-water and gas-water system?	
	4. Which type of the oil reservoir reports GOR is 2000-3200 SCF/STB on production?	
	5. A real gas is produced from a gas reservoir at a constant temperature of 300 °C. The compressibility factor (Z) is observed to change with pressure (P) at a rate of $\left(\frac{dZ}{dP}\right) = Z^2$. What is the difference in the compressibility of the real gas from the ideal gas at a given pressure (P) and temperature (T).	
	(B) Compulsory Question	05
	1. Let the capillary pressure for drainage process is given by P_d and the capillary pressure for imbibition for the same process is given by P_i, and if $P_d - P_i = A$, then:	
	(A). Value of A will be either zero or negative for all the saturation	
	(B). Value of A will be first positive and then negative for increasing saturation of wetting phase	
	(C). Value of A will be either zero or positive for all the saturation	
	(D). Value of A does not depend on saturation at all	
	2. Which of the following statement is **FALSE** with reference to fluid properties?	
	(A). The value of gas FVF increases with decrease in pressure below bubble point	
	(B). The two-phase FVF decreases with decrease in pressure below bubble point	
	(C). The two-phase FVF increases with decrease in pressure above bubble point	
	(D). Gas solubility decreases with decrease in pressure below bubble point pressure	

	3. Free gas saturation for the undersaturated reservoir is:	
	(A) 0 (B) 1 - S_{wi}	
	(C) 1 (D) 1 – S_{wi} - S_{oi}	
	4. The liquid shrinkage curves for different types of crude oil are shown in the following figure. Which curve represents the Black Oil? 	
	(A) I B. II C. III D. IV	
	5. In a Retrograde Gas-Condensate Reservoir at an initial pressure above dew point pressure, what will be the change in the composition of liquid and gases as the pressure is reduced assuming isothermal conditions:	
	A. Fraction of liquid increases as the pressure decreases	
	B. Fraction of gases increases as the pressure decreases	
	C. Fraction of liquid increases up to a certain pressure and then decreases	
	D. Fraction of gases increases up to a certain pressure and then decreases	
Q.2	Attempt any four (Short Questions)	12
	(1) Two cells Boyles law porosity-meter is used to calculate the porosity (in %) of the cylindrical core using Helium Porosimeter. Sample dimensions = Length and Diameter are 7 cm and 2 cm respectively. Volume of cell 1 and 2: V_1 = 20 cc and V_2 = 50 cc. Core is placed at V_2. Pressure of cell: P_1/P_2 = 2.8.	
	(2) A core plug has a radius of $1.25*10^{-2}$ m and a length of $5*10^{-2}$ m. It is completely saturated with brine having density of 1150 kg/m^3. Dry core plug weighted $5.1*10^{-3}$ kg and $10.4*10^{-3}$ kg when it was saturated with brine. Calculate the effective porosity of core plug (in%).	
	(3) A cylindrical core having a radius $2.5*10^{-2}$ m and length of 0.42 m, was flooded with brine at a steady rate of $1*10^{-6}$ m^3/sec, the differential pressure across the core was 10 bar and the viscosity is 0.001 Pascal*sec. Calculate the absolute permeability of the core (in mD). Assume: 1 bar = 10^5 Pascal and 1 Darcy = 10^{-12} m^2.	

	(4) Explain the Constant Composition Expansion (CCE) Test in detail?	
	(5) Derive the formula for Gas Formation Volume Factor (B_g) and also explain Gas Solubility (R_s)?	
Q.3	Attempt any two	08
	(1) An oil reservoir exists at its bubble-point pressure of 3000 psia and temperature of 160°F. The following additional data are also available: Reservoir area = 125 acres, Average thickness = 48 ft, Connate water saturation = 0.26, Effective porosity = 18.5% and Oil FVF = 1.35 bbl/STB. Calculate the initial oil in place (MMbbl).	
	(2) Explain the Pressure-Temperature Diagram for a multi-component system in detail?	
	(3) Given the gas mixture whose composition is shown in table:	

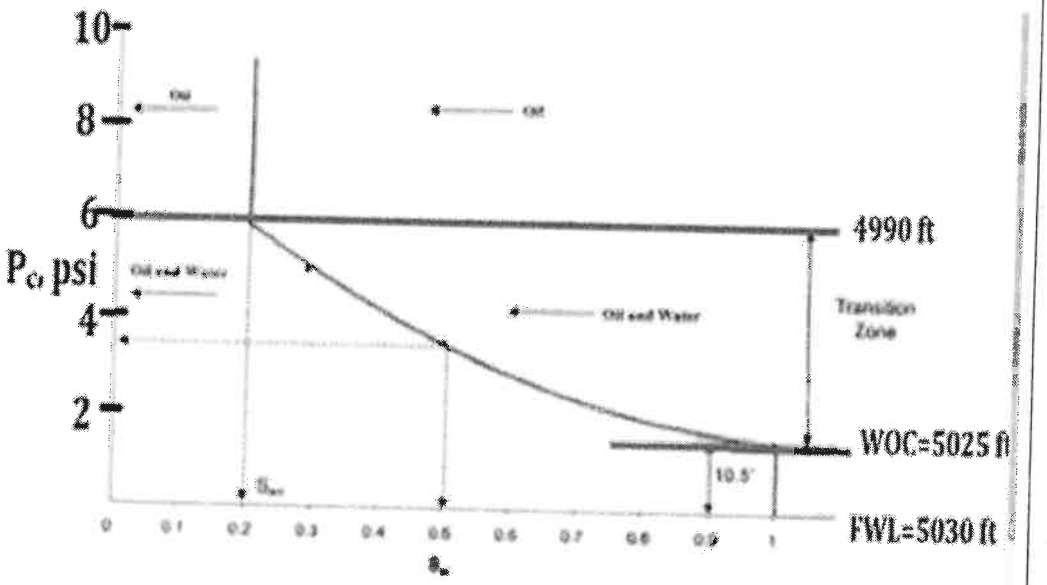
Component	Mole fraction
C1	80%
C2	12%
C4	4%
H_2S	5%

Gas deviation factor is 0.84. Universal gas constant 10.732 psia.ft^3/lb-mole-°R. Calculate the density of this gas mixture (in lb/ft^3) at 1200 psia and 150 °F temperature and also calculate the ratio of Gas FVF to Gas deviation factor (in bbl/scf).

Q.4	(A) The permeability of a 160-acre light gas formation drained by a single well is 15 mD. The well was heavily acidized to a permeability of 200 mD and a radius of 30 ft, and then completed. During well completion, a 2.4 ft-thick damaged radius developed in the vicinity of wellbore. The permeability of this damaged segment is 4 mD. The wellbore radius is 0.50 ft. Calculate the average permeability (in mD) of this drainage area?	05
	(B) During the core analysis, the following data are measured at laboratory and reservoir conditions.	05

Property	Laboratory condition	Reservoir condition
IFT (dyne/cm)	35	25
Porosity (%)	30	25
Permeability (mD)	100	80
Pore radius (µm)	22	18

The capillary pressure at the laboratory condition is 50 psi. The calculated capillary pressure using the Leverett J-function at the reservoir condition is _____ psi. (Rounded off to two decimal places).

	OR	
	(B)The following capillary pressure -saturation data is plotted for an oil reservoir. Additional data are given as: water density = 64.1 lb/ft^3, Interfacial tension = 50 dynes/cm, Capillary pressure at WOC = 1.5 psi. Based on the information, calculate the density of oil (in lb/ft^3) and API Gravity of oil. 	05