Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022

Course: Reservoir Engineering II

Program: B.Tech APE GAS

Course Code: PEAU 4014P

Semester: VI

Time : 03 hrs.

Max. Marks: 100

Instructions:

All Questions are Compulsory.

Use the attached graphs for any data.

SECTION A (5Qx4M=20Marks)

S. No.		Marks	СО			
Q 1	Classify and describe the flow regimes that influence the rate of water influx into the reservoir?	4	CO1			
Q 2	List out the limitation of material balance equation (MBE) in estimating the hydrocarbon in place?	4	CO4			
Q 3	List out different models in analyzing decline in production and explain about hyperbolic decline model?	4	CO3			
Q 4	What is an infinite aquifer?	4	CO2			
Q 5	What is two-dimensional displacement in enhancing the oil recovery?	4	CO2			
	SECTION B					
(4Qx10M= 40 Marks)						
Q 1	Discuss different type of decline curve analysis and explain the applicability of each curve type?	10	CO1			
Q 2	Calculate water influx and residual gas saturation in water drive reservoirs. Given: Bulk reservoir volume, Initial = 415.3 MM cu ft. Average Porosity = 0.172 Average Connate water = 0.25 Initial Pressure = 3200 psia. $B_{gi} = 0.005262$ cu ft/SCF, 14.7 psia and 60°F Final Pressure = 2925 psia. $B_{gf} = 0.005700$ cu ft/SCF, 14.7 psia and 60°F. Cumulative water Production = 15,200 bbl (surface) $B_{w} = 1.03$ bbl/surface bbl. $G_{p} = 935.4$ MM SCF at 14.7 psia and 60°F. Bulk volume invaded by water at 2925 psia = 13.04 MM Cu.ft	10	CO2			

Net productive thickness=45 ft				
		20	CO4	
· ·				
radius ft	2600			
	Reservoir	Aquifer	20	CO2
b) Calculate the cumulative water influx that result from a pressure drop of 200 psi at the oil-water contact with an encroachment angle of 80°. The reservoir-aquifer system is characterized by the following properties: (10 Marks)				
a) List out various methods for estimating the water influx volume into an oil reservoir and investigate the importance each method? (10 Marks)				
		·ks)		
is reached?	SECTION C			
one-month period, identify a suitable decline model, determine model parameters, and project production rate until a marginal rate of 25 stb/day				CO3
1				
b) The gas filed is property by pressure stabilizes at 22% and the gas for cu.ft/SCF. Calculate	at 1350 psi. If the residurmation volume factor at the unit recovery an	al gas saturation is 1350 psi is 0.02145 d recovery factor?		
$W_p = 32000 \text{ STB}$				
$N_p = 1.25 \text{ MM STB}$ $\Delta \bar{n}$ at 3600 psig = 1400 psi				
$c_f = 5.0 * 10^{-6} \text{ psi}^{-1}$ $p_i = 5000 \text{ psig}$			10	CO4
Given data: $B_{ti} = 1.35469 \text{ bbl/STB}$ B_{t} at 3600 psig = 1.37500 bbl/STB Connate water = 0.20 $C_{w} = 3.6 * 10^{-6} \text{ psi}^{-1}$ B_{w} at 3600 psig = 1.04 bbl/STB				
*	l in place in a volumet	·		
	reservoir. Given data: Bti = 1.35469 bbl/STB Bt at 3600 psig = 1.37500 Connate water = 0.20 Cw = 3.6 * 10 ⁻⁶ psi ⁻¹ Bw at 3600 psig = 1.04 bbl/ cf = 5.0 * 10 ⁻⁶ psi ⁻¹ pi = 5000 psig Np = 1.25 MM STB \[\Dar{p} \) at 3600 psig = 1400 psi Wp = 32000 STB We = 0. b) The gas filed is p pressure stabilizes 22% and the gas for cu.ft/SCF. Calculate (Assume the require) Given that a well has declify parameters, and project profis reached? a) List out various merinto an oil reservoir method? b) Calculate the cumulation drop of 200 psi at the angle of 80°. The result of the following proper the followi	reservoir. Given data: $B_{ii} = 1.35469 \text{ bbl/STB}$ B_r at 3600 psig = 1.37500 bbl/STB Connate water = 0.20 $C_w = 3.6 * 10^{-6} \text{ psi}^{-1}$ B_w at 3600 psig = 1.04 bbl/STB $c_f = 5.0 * 10^{-6} \text{ psi}^{-1}$ $p_i = 5000 \text{ psig}$ $N_p = 1.25 \text{ MM STB}$ $\Delta \bar{p}$ at 3600 psig = 1400 psi $W_p = 32000 \text{ STB}$ $W_e = 0$. b) The gas filed is produced under a water of pressure stabilizes at 1350 psi. If the residut 22% and the gas formation volume factor at cu.ft/SCF. Calculate the unit recovery an (Assume the required data). Given that a well has declined from 100 stb/day to one-month period, identify a suitable decline mode parameters, and project production rate until a margin is reached? SECTION-C (2Qx20M=40 Mar) a) List out various methods for estimating the winto an oil reservoir and investigate the impormethod? b) Calculate the cumulative water influx that redrop of 200 psi at the oil-water contact with angle of 80°. The reservoir-aquifer system is the following properties: Reservoir radius, ft 2600 porosity 0.18 c_f , psi ⁻¹ 4 × 10 ⁻⁶ c_w , psi ⁻¹ 5 × 10 ⁻⁶ h , ft 20 a) Given the following data for the oil field Area=24,670acres	reservoir. (5 Marks) Given data: $B_{ii} = 1.35469 \text{ bbl/STB}$ $B_{r} \text{ at } 3600 \text{ psig} = 1.37500 \text{ bbl/STB}$ Connate water = 0.20 $C_{w} = 3.6 * 10^{-6} \text{ psi}^{-1}$ $B_{w} \text{ at } 3600 \text{ psig} = 1.04 \text{ bbl/STB}$ $c_{r} = 5.0 * 10^{-6} \text{ psi}^{-1}$ $B_{w} \text{ at } 3600 \text{ psig} = 1.04 \text{ bbl/STB}$ $c_{r} = 5.0 * 10^{-6} \text{ psi}^{-1}$ $p_{r} = 5000 \text{ psig}$ $N_{p} = 1.25 \text{ MM STB}$ $\Delta \bar{p} \text{ at } 3600 \text{ psig} = 1400 \text{ psi}$ $W_{e} = 0.$ b) The gas filed is produced under a water drive such that the pressure stabilizes at 1350 psi. If the residual gas saturation is 22% and the gas formation volume factor at 1350 psi is 0.02145 cu.ft/SCF. Calculate the unit recovery and recovery factor? (Assume the required data). (5 Marks) Given that a well has declined from 100 stb/day to 96 stb/day during a one-month period, identify a suitable decline model, determine model parameters, and project production rate until a marginal rate of 25 stb/day is reached? SECTION-C (2Qx20M=40 Marks) a) List out various methods for estimating the water influx volume into an oil reservoir and investigate the importance each method? (10 Marks) b) Calculate the cumulative water influx that result from a pressure drop of 200 psi at the oil-water contact with an encroachment angle of 80°. The reservoir-aquifer system is characterized by the following properties: (10 Marks) Reservoir Aquifer radius, ft 2600 10000 porosity 0.18 0.12 c_{t} , psi ⁻¹ 4 × 10 ⁻⁶ 3 × 10 ⁻⁶ c_{w} , psi ⁻¹ 5 × 10 ⁻⁶ 4 × 10 ⁻⁶ h , ft 20 25	reservoir. (5 Marks) Given data: Bn = 1.35469 bbl/STB Bn at 3600 psig = 1.37500 bbl/STB Connate water = 0.20 Cw = 3.6 * 10^6 psi^1 Bw at 3600 psig = 1.04 bbl/STB cr = 5.0 * 10^6 psi^1 pn = 5000 psig Np = 1.25 MM STB Ap at 3600 psig = 1400 psi Wp = 32000 STB We = 0. b) The gas filed is produced under a water drive such that the pressure stabilizes at 1350 psi. If the residual gas saturation is 22% and the gas formation volume factor at 1350 psi is 0.02145 cu.ft/SCF. Calculate the unit recovery and recovery factor? (Assume the required data). (5 Marks) Given that a well has declined from 100 stb/day to 96 stb/day during a one-month period, identify a suitable decline model, determine model parameters, and project production rate until a marginal rate of 25 stb/day is reached? SECTION-C (2Qx20M=40 Marks) a) List out various methods for estimating the water influx volume into an oil reservoir and investigate the importance each method? (10 Marks) b) Calculate the cumulative water influx that result from a pressure drop of 200 psi at the oil-water contact with an encroachment angle of 80°. The reservoir-aquifer system is characterized by the following properties: (10 Marks) Reservoir Aquifer radius, ft 2600 10000 porosity 0.18 0.12 ct, psi-1 4 × 10-6 3 × 10-6 cw, psi-1 5 × 10-6 4 × 10-6 h, ft 20 25 a) Given the following data for the oil field Area=24,670acres (10 Marks)

Porosity=6% Average Swi=34%

Initial reservoir pressure, pi=2765 psia

Abandonment pressure, pa=245 psia

Bo at pi=1.67 bbl/STB

Bo at pa=1.12 bbl/STB

Sg at pa=31%

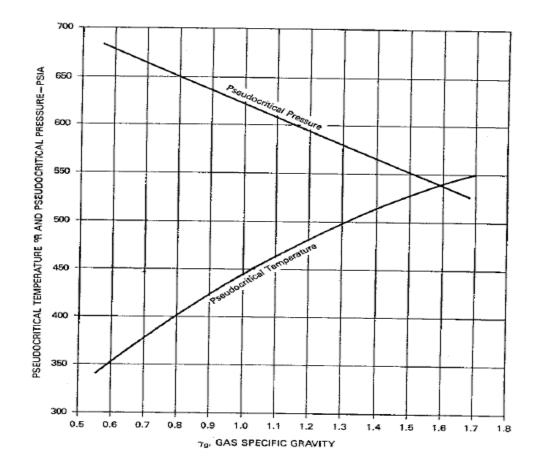
Sor after water invasion=23%

Calculate:

- 1. Initial oil in place
- 2. Oil in place after volumetric depletion to abandonment pressure
- 3. Oil in place after water invasion at initial pressure
- 4. Oil reserve and Recovery Factor by volumetric depletion to abandonment pressure
- 5. Oil reserve and Recovery factor by full water drive
 - b) Derive an expression for production 'q' bbl at time't' from well initially producing 'qi' bbl of oil by exponential decline analysis.

(10 Marks)

Graph 1: Pseudocritical Properties of Natural Gas



Graph 2: Compressibility factors of natural gases

