Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU

School of Engineering

Mid - Term Examinations - November 2024

Semester: 5th | **Date**: 06-11-2024

Course Code: PET3006 | **Time**: 09:30 to11:00am

Course Name: Advanced Petroleum Reservoir Engineering | **Max Marks**: 50

Program: B. Tech | **Weightage**: 25%

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2 marks. 5QX2M=10M

1	State the classification of the aquifer based on pressure maintenance. Draw a neat diagram explaining the variation of various drives on a pressure vs time plot.	**2 Marks**	**L1**	**CO1**
2	List the basic difference between improved oil recovery (IOR) and enhanced oil recovery (EOR).	**2 Marks**	**L1**	**CO1**
3	Reproduce the name of model that can be used to estimate the water influx into a gas or oil reservoir which is based on the basic definition of compressibility. Write the equation of the model.	**2 Marks**	**L1**	**CO1**
4	List the three stages of oil production from reservoirs in terms of recovery with a neat diagram	**2 Marks**	**L1**	**CO2**
5	Reproduce the range of fractional flow curve and identify the reason of its starting range	**2 Marks**	**L1**	**CO2**

Part B

Answer ALL Questions. Each question carries 10 marks. 4QX10M=40M

6	Aquifers play a crucial role in petroleum systems by impacting hydrocarbon migration, accumulation, and recovery. Discuss the classification of Aquifers and its subpart in detail.	**10 Marks**	**L3**	**CO1**

or

7 The pressure history of a water drive oil reservoir is given in the table. The aquifer is under a steady state flowing condition with an estimate of influx constant of 130bbl/day/psi. Given the initial reservoir pressure is 3500psi, solve for the cumulative water influx after 100,200 days using steady state model. **10 Marks** **L3** **CO1**

t(days)	**P (psi)**
0	------
100	3450
200	3410

8 Using Fetkovich method, calculate the water influx as a function of time for the following reservoir/aquifer boundary pressure data: **10 Marks** **L5** **CO1**
k= 200md, pi=2740 psi, viscosity of water= 0.55 cp, c_t= 7x10^{-6} psi^{-1}, h=100 ft, encroachment angle=140. reservoir radius =9200 ft, aquifer radius=46000 ft. Porosity=0.25.
The boundary pressure history is as follows:

Time (days)	**P_r (psi)**
0	2740
365	2500
730	2290
1095	2109
1460	1949

Or

9 **10 Marks** **L3** **CO1**
A reservoir- aquifer model system has the following boundary pressure history:

Time (days)	Boundary Pressure (psi)
0	3000
30	2956
60	2917
90	2877
120	2844

Given the following data: h = 200 ft ; φ= 10%; μ_w= 0.395 cp; C_f = 5 X 10^{-6} psi^{-1};

C_w = 3 X 10^{-6} psi^{-1} ; F_k = 0.04, T=140 ºF; r_a = infinite; r_e = 2000 ft. k= 80md

Appy the knowledge of unsteady state bottom water drive model to solve for the cumulative water influx. Use the chart below:

Assume data appropriately, if missing.

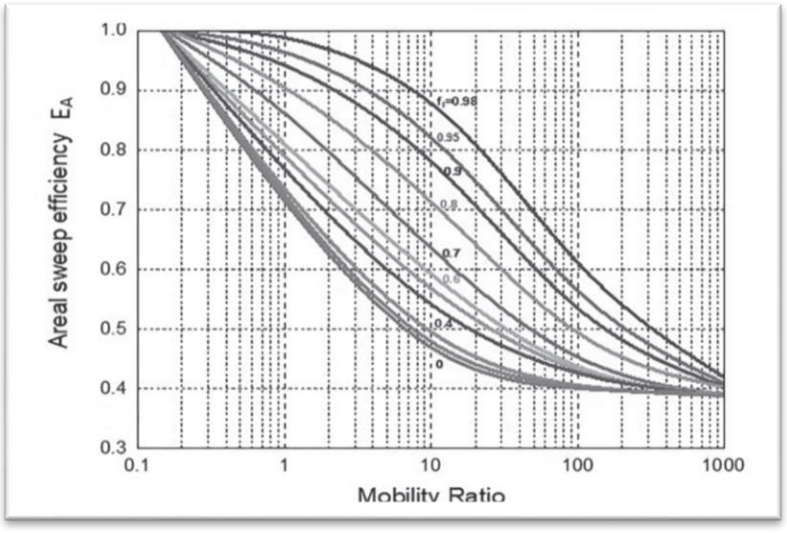
Dimensionless time	Fluid influx
12	7.104
24	11.996
36	34.360
48	43.520

10 For waterflood recoveries from a five-spot well pattern, the following data are given **5+5 Marks L3 CO2**

Well spacing	= 50 acres	$\mu_o = 7$ cp
Pay thickness	= 20 ft.	$\mu_w = 0.8$ cp
Porosity	= 25%	$k_{ro} = 0.75$
S_{oi}	= 70%	$k_{rw} = 0.25$
S_{or}	= 30%	$B_o = 1.25$

If the injection rate is 200 reservoir barrels per day, solve for the oil recovery at

(a) At fw =0.3.
(b) At fw =0.5.



or

11 fractional flow equation is integral to modeling, optimizing, and managing fluid displacement processes in reservoirs, and its insights are fundamental to improving hydrocarbon recovery and designing efficient reservoir management strategies. Discuss the effect of **5+5 Marks L3 CO2**

a) water viscosity,
b) direction of the flow, i.e., updip or downdip injection

on the Fractional flow curve with appropriate diagram.

12	An oil field is currently producing through natural energy drive. Recent analysis of production data shows a gradual decline in production. Production team has decided to start the secondary recovery techniques for which water flooding has been selected. Field is a sandstone field with crude oil having API of 41°. One of the first steps is to select the reservoir for waterflooding. Various factors must be considered while making the selection of reservoir for waterflooding. Discuss all the essential characteristics of reservoirs we should take care while selecting the reservoir for waterflooding. Draw a flood pattern for 5 spots (regular and inverted) arrangement.	**10 Marks**	**L3**	**CO2**
	or			
13	Buckley and Leverett (1942) developed a well-established theory, called the frontal displacement theory. This classic theory consists of two equations: 1) Fractional flow equation or formula 2) Frontal advance equation or formula. Briefly discuss about your understanding of Frontal advance equation. State its applicability, assumptions and equation relating the movement and position of front with saturation on a time scale. Using this equation, give insights, draw and compare the derivative of fractional flow of water with saturation.	**10 Marks**	**L3**	**CO2**