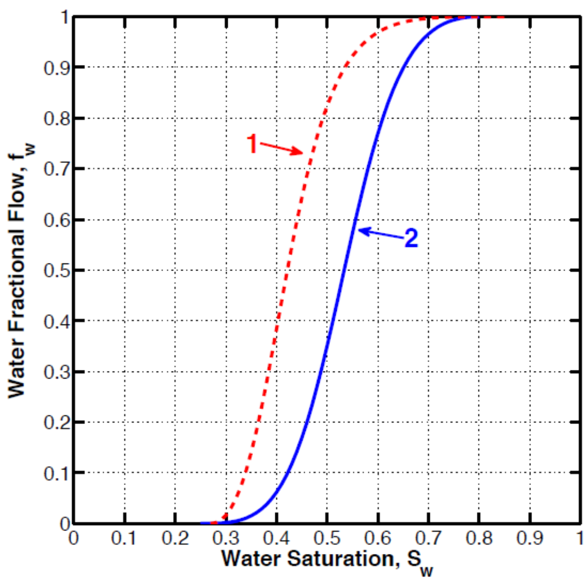
Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Reservoir Engineering-II — **Semester: VI**
Program: B.Tech-APEUP — **Time 03 hrs.**
Course Code: PTEG 332 — **Max. Marks: 100**

Instructions: All questions are compulsory. There is no overall choice. However, internal choice has been provided in some questions. You have to attempt only one of the alternatives in all such questions.

SECTION A

S. No.		Marks	CO
Q 1	The following figure presents a plot of water fractional flow as function of water saturation for two different reservoir fluids. Indicate with reasons which case has the most favourable mobility ratio, and explain why you are choosing this case. 	4	CO4
Q 2	Explain peripheral injection pattern, its advantages and disadvantages.	4	CO3
Q 3	Water flooding is to be performed in an oil reservoir having initial water saturation 0.2 and initial gas saturation 0.15 at the start of water flood. Calculate the displacement efficiency if the average water saturation at the end of water flood is reported to be 0.7 while maintaining the gas saturation constant 0.15.	4	CO3
Q 4	An under saturated oil reservoir having initial average porosity of 18% and rock	4	CO3

compressibility cf = 10 × 10^{-6} was on production. The reservoir pressure has declined form initial pressure of 5000 psi to 4000 psi. Calculate the porosity at 4,500 psi.

Q 5	The degree of vertical permeability variation influence the vertical sweep efficiency. Explain this statement for a layered reservoir, which has been taken up for water injection.	**4**	**CO3**

SECTION B

Q 6	A retrograde gas condensate reservoir having initial reservoir pressure of 6000 psi and Dew point pressure 4500 psi was on production. During production when flowing bottom hole pressure came down to 4000 psi, the production engineer observed that the rate of gas production had declined drastically. Find out the reason of production decline and explain in detail the phenomenon happening inside the reservoir and its possible remedy.	**10**	**CO1**
Q 7	Explain the Tracy's method by deriving a mathematical equation for predicting the oil and gas production from a saturated reservoir.	**10**	**CO2**
Q 8	Explain Schilthuis' Steady State Model for determining the rate of water influx. Determine cumulative water influx that results from a pressure drop of 200 psi at oil water contact with an encroachment angle of 50°. The reservoir-aquifer system is characterized by the following properties: (see table below)	**10**	**CO2**

Parameters	Reservoir	Aquifer
Radius, ft	6000	20,000
Porosity	0.18	0.15
c_f, psi^{-1}	4×10^{-6}	3×10^{-6}
c_w, psi^{-1}	5×10^{-6}	4×10^{-6}
h, ft	25	20

Q 9 — **10** — **CO3**

What do you understand about overall recovery efficiency? Define areal sweep efficiency, elaborate in details about various factors on which it depends.

OR

A solution gas-drive reservoir that is under consideration for a water flood project. The volumetric calculations of the field indicate that the areal extent of the field is 1612.6 acres. The field is characterized by the following properties:

Thickness h = 25 ft
Porosity ϕ = 15%
Initial water saturation S_{wi} = 20%
Initial pressure pi = 2377 psi

Results from the MBE in terms of cumulative oil production Np as a function of reservoir pressure p are given below

Pressure, psi	Bo, bbl/STB	Rs, scf/STB	Bg, bbl/scf	Np MMSTB
2377	1.706	921	-	-
2250	1.678	872	0.00139	1.10

	1950	1.555	761	0.00162	1.76	
	1650	1.501	657	0.00194	2.64	
	1350	1.448	561	0.00240	3.3	

Assume that the water flood will commence when the reservoir pressure decline to 1650 psi and trapped gas saturation is 12.6%, find the pressure that is required to dissolve the trapped gas.

SECTION-C

Q10	A new onshore oil and gas field is discovered after drilling of exploratory well which has produced oil gas during testing. Geophysical data indicated it a very large field. Now operator wants to bring the field on commercial production. Kindly explain in details following: a. Activities that are involved to bring the field on production. b. Actions that required for maximizing or economic recovery from the reservoir during different stages of production.	**20**	**CO5 CO6**
Q11	a. Drive fractional flow equation showing each step of your derivation for water flooding operation. b. A saturated oil reservoir is under consideration to be waterflooded immediately after drilling and completion. Core analysis tests indicate that the initial and residual oil saturations are 70 and 35%, respectively. Calculate the displacement efficiency when the oil saturation is reduced to 65, 55, and 35%. **OR** The following table presents the reservoir properties and operational parameters of an oil reservoir that is at a pressure near to bubble point pressure. The reservoir is taken up for water flood to displace oil.	**20**	**CO4**

Reservoir and fluid properties		
1	Area of reservoir (ft^2)	505
2	Total Length of reservoir (ft)	1000
3	Porosity, ϕ	0.15
4	Initial water saturation	0.30
5	Oil formation volume factor RB/STB	1.15
6	Total Injection rate (ft^3/day)	30
7	The water saturation at the displacement front is Swf	0.5141
8	df_w/dS_w	3.7426

a. Calculate the location of the displacement front after 100 days from the beginning of injection using the Buckley-Leverett solution of the frontal advance equation.
b. Calculate the time to water breakthrough at the total length of the reservoir.
c. If average water saturation at the time of water breakthrough, is 0.5672, calculate the displacement efficiency at this time.
d. Determine cumulative water injected at breakthrough.