Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

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

Course: Principle of Reservoir Engineering **Semester: 3rd**
Program: B.Tech – GSE/GIE **Time 03 hrs.**
Course Code: PTEG 334 **Max. Marks: 100**

Instructions: Attempt all the questions.

SECTION A

S. No.	Statement of questions	Marks	CO
Q 1	How much tank oil exists in the following oil field? Area of field= 640acres, Average sand thickness=20ft, Average porosity=20%, Connate water saturation, Sw=30% and formation volume factor for oil, Bo = 1.20	**4**	**CO1**
Q 2	Illustrate low shrinkage oil reservoir and volatile crude oil reservoir with the help of phase diagram.	**4**	**CO1**
Q 3	Calculate the porosity of a sandstone sample when the following information is available from the core analysis. Bulk Volume of sample = 8.1 cc Weight of dried crushed sample= 17.3 gm Sand grain density = 2.67 gm/cc	**4**	**CO1**
Q 4	Determination of density of pure water. A connate water is known to be relatively pure and exists in the reservoir at 5000 psia and 200 °F. If it is assumed that the water is saturated with natural gas, what is the density of the water at formation volume factor of water is 1.0301 bbl/bbl and density of water at wellbore is 62.34 lb/cu ft.	**4**	**CO2**
Q 5	Calculate the specific gravity and the API gravity of a crude oil system with a measured density of 53 lb/ft^3 at standard conditions.	**4**	**CO3**
	SECTION B		
Q 6	Explain the following a. Klinkenberg Effect. b. Drainage and imbibition process.	**10**	**CO1**
Q 7	Derive an expression for the steady state linear flow of incompressible fluid. Assume that only single fluid phase is flowing under isothermal condition. OR A. An incompressible fluid flows in a linear porous media with following properties. Calculate flow rate in bbl/day. P1 = 2000 psi P2 = 1990 psi L = 2000 ft h = 20 ft width = 300 ft φ= 15% μ_o = 2 cp k = 100 md	**10**	**CO4**

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Q 8</td><td>A gas reservoir has the following gas composition, the initial reservoir pressure and temperature are 3000 psi and 180 ^{0}F respectively. Determine apparent molecular weight (MWa), specific gravity, Gas formation volume factor, bbl/scf, pseudo-critical pressure, and pseudocritical temperature of the gas.

<table>
<tr><th>Components</th><th>Mole fraction</th><th>Tci, $^\circ$R</th><th>Pci, psi</th></tr>
<tr><td>C_1</td><td>0.8612</td><td>343</td><td>673</td></tr>
<tr><td>C_2</td><td>0.0591</td><td>550</td><td>708</td></tr>
<tr><td>C_3</td><td>0.0358</td><td>666</td><td>617</td></tr>
<tr><td>C_4</td><td>0.0172</td><td>766</td><td>550</td></tr>
<tr><td>C_5</td><td>0.0050</td><td>846</td><td>490</td></tr>
<tr><td>CO_2</td><td>0.0010</td><td>548</td><td>1070</td></tr>
<tr><td>N_2</td><td>0.0207</td><td>227</td><td>492</td></tr>
</table></td><td>10</td><td>CO4</td></tr>
<tr><td>Q 9</td><td>Explain the different types of reserve estimation methods in detail.

OR
With the help of material balance equation, derive an expression of initial oil in place for the solution gas drive reservoir.</td><td>10</td><td>CO3</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 10</td><td>Explain the following different types of reservoirs and their characteristics with the help of their phase diagram
a. Black Oil Reservoir
b. Retrograde Gas Reservoir
c. Wet Gas Reservoir
d. Dry Gas Reservoir</td><td>20</td><td>CO3</td></tr>
<tr><td>Q 11</td><td>What is the equivalent permeability of four beds in series, having equal formation thickness under the following condition
(i) For liner system and
(ii) For radial system if the radius of the penetrating well bore is 6 inch?
Assume bed 1 adjacent to the well bore.
<table>
<tr><th>Bed</th><th>Pay thickness, ft</th><th>Permeability, md</th></tr>
<tr><td>1</td><td>300</td><td>25</td></tr>
<tr><td>2</td><td>300</td><td>50</td></tr>
<tr><td>3</td><td>600</td><td>100</td></tr>
<tr><td>4</td><td>1000</td><td>200</td></tr>
</table>
OR
A volumetric gas reservoir has the following production history.
The following data is also available:
φ = 13%
Swi = 0.52</td><td>20</td><td>CO2</td></tr>
</table>

A = 1060 acres
h = 54 ft.
T = 164°F

Calculate the gas initially in place from the MBE.

Time t (years)	Reservoir pressure (psia)	Z Factor	Cumulative production Gp (MMMscf)
0	1798	0.869	0
0.5	1680	0.870	0.96
1	1540	0.880	2.12
1.5	1428	0.890	3.21
2	1335	0.900	3.92