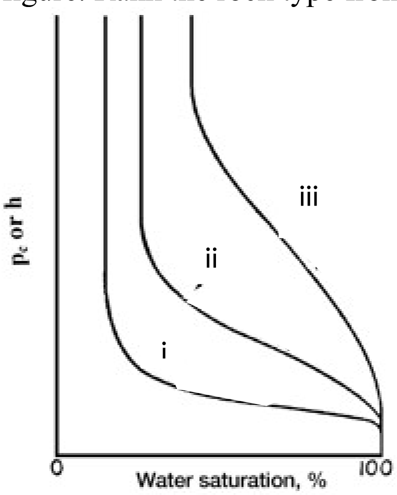
Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Reservoir Engineering I **Semester:** V
Program: BT-APEU
Time: 03 hrs. **Max. Marks: 100**

Instructions:

SECTION A

S. No.		Marks	CO
1	"When a wetting and a non wetting phase flow together in a reservoir rock, each phase follows separate and distinct paths." Defend this statement with the help of a graph.	4	CO1
2	The reservoir fluid has an oil formation volume factor of 1.552 bbl/STB at the initial reservoir pressure 5000 psia and 1.620 bbl/STB at the bubble point pressure of 3000 psia. If the reservoir produced 900000 STB of oil when the pressure dropped at 3000 psia, calculate the initial oil in place.	4	CO5
3	Elaborate the different categories of reserve. Explain in details about proven reservoir.	4	CO5
4	The capillary pressure curves for three different reservoir rock are in the following figure. Rank the rock type from higher to lower permeability 	4	CO2
5	The phase diagram of an oil reservoir is characterized by the quality lines which are closer to the bubble point curve. Identify the type of reservoir and define its properties. How will the phase behavior change with decrease in pressure?	4	CO3

SECTION B

<table>
<tr><td>Q 6</td><td>A volumetric gas reservoir has the following production history.
The following data is also available:
φ = 13%
Swi = 0.52
A = 1060 acres
h = 54 ft.
T = 164°F
Calculate the gas initially in place volumetrically and from the MBE.

<table>
<tr><td>Time t (years)</td><td>Reservoir pressure (psia)</td><td>Z Factor</td><td>Cumulative production Gp (MMMscf)</td></tr>
<tr><td>0</td><td>1798</td><td>0.869</td><td>0</td></tr>
<tr><td>0.5</td><td>1680</td><td>0.870</td><td>0.96</td></tr>
<tr><td>1</td><td>1540</td><td>0.880</td><td>2.12</td></tr>
<tr><td>1.5</td><td>1428</td><td>0.890</td><td>3.21</td></tr>
<tr><td>2</td><td>1335</td><td>0.900</td><td>3.92</td></tr>
</table></td><td>10</td><td>CO5</td></tr>
<tr><td>Q 7</td><td>Write short notes on the following:
a. Surface tension and interfacial tension
b. Cricondentherm pressure and cricondenbar temperature
c. Water saturation profile
d. Types of fluids in the reservoir.
e. Role of reservoir engineer</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 8</td><td>“The decline-curve analysis technique is based on the assumption that past production trends and their controlling factors will continue in the future and, therefore, can be extrapolated and described by a mathematical expression.”
Elaborate the conditions which must be considered in production decline curve analysis. Also illustrate the types of rate decline behavior.</td><td>10</td><td>CO5</td></tr>
<tr><td>Q 9</td><td>State the primary natural drive indices encountered in a typical petroleum reservoir with their expected range of percentage recovery.</td><td>10</td><td>CO6</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 10</td><td>PVT analysis data is presented below for an oil sample of a newly discovered oil field having reservoir temperature 120^0 F. Calculate z factor from experimental data at each pressure where gas was liberated by using gas equation.

<table>
<tr><td>Sl No</td><td>Pressure Psi</td><td>oil +gas volume cc</td><td>oil volume cc</td><td>Gas Volume at STP, cc</td></tr>
<tr><td>1</td><td>3000</td><td>78.331</td><td>1.4758</td><td>1179.258</td></tr>
<tr><td>2</td><td>2500</td><td>75.540</td><td>1.4232</td><td>1147.377</td></tr>
<tr><td>3</td><td>2000</td><td>71.499</td><td>1.3471</td><td>875.3058</td></tr>
<tr><td>4</td><td>1500</td><td>69.387</td><td>1.3073</td><td>957.3795</td></tr>
<tr><td>5</td><td>1000</td><td>67.430</td><td>1.2704</td><td>913.6537</td></tr>
<tr><td>6</td><td>500</td><td>65.559</td><td>1.2352</td><td>882.1962</td></tr>
</table>Also calculate z factor by using gas formation volume factor and compare the value of z factor calculated by two different methods</td><td>20</td><td>CO3</td></tr>
</table>

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Q 11	A. Starting from Darcy's law in cylindrical geometry, derive an expression for the steady state inflow of slightly compressible fluid into a vertical well. Assume that only single fluid phase is flowing under isothermal condition. B. Assuming steady-state radial flow and incompressible fluid, calculate the oil flow rate under the following conditions: pe = 2500 psi pwf = 2000 psi re = 745 ft rw = 0.3 ft μo = 2 cp Bo = 1.4 bbl/STB h = 30 ft k = 60 md OR A. Starting from Darcy's law in cylindrical geometry derive an expression for the steady state inflow of incompressible fluid into a vertical well. Assume that only single fluid phase is flowing under isothermal condition. B. An incompressible fluid flows in a linear porous media with the following properties. L = 2500 ft h = 30 ft width = 500 ft k = 50 md phi = 17% viscosity= 2 cp inlet pressure = 2100 psi Q = 4 bbl/day density = 45 lb/ft3 Calculate the pressure at 0.25ft, 500ft, 1000ft and 2000ft. Identify the zone where the pressure drop is maximum.	**20**	CO4