Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

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

Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Describe briefly the drive mechanisms associated with producing an under saturated oil reservoir, without a supporting aquifer down to a pressure well below bubble point pressure (from initial reservoir pressure).	4	CO2
Q 2	A volumetric solution-gas-drive reservoir has an initial water saturation of 20%. The initial oil formation volume factor is reported at 1.5 bbl/STB. When 10% of the initial oil was produced, the value of B_o decreased to 1.38 bbl/STB. Calculate the oil saturation and gas saturation.	4	CO1
Q 3	Calculate the reduction in the pore volume of a reservoir due to a pressure drop of 12 psi. The reservoir original pore volume is one million barrels with an estimated formation compressibility of 10×10^{-6} psi^{-1}	4	CO2
Q 4	Calculate the water influx rate e_w in an active water drive reservoir whose pressure is stabilized at 3000 psi. Given: initial reservoir pressure = 3500 psi dN_p/dt = 32,000 STB/day B_o = 1.4 bbl/STB GOR = 900 scf/STB R_s = 700 scf/STB B_g = 0.00082 bbl/scf $dW_p/dt = 0$ B_w = 1.0 bbl/STB	4	CO2
Q 5	What is condensate blockage and its effect during production from gas condensate reservoir.	4	CO1

SECTION B

Q 1	The following data are available on a volumetric under saturated-oil reservoir:	10	CO4

<table>
<tr><td></td><td>p_i = 4000 psi p_b = 3000 psi   N = 100 MMSTB
$c_f = 5 \times 10^{-6}$ psi−1 $c_o = 15 \times 10^{-6}$ psi^{-1} cw = 3×10^{-6} psi^{-1}
S_{wi} = 30% B_{oi} = 1.40 bbl/STB
Estimate cumulative oil production when the reservoir pressure drops to 3200 psi. The oil formation volume factor at 3200 psi is 1.414 bbl/STB.</td><td></td><td></td></tr>
<tr><td>Q 2</td><td>What are Instantaneous GOR, Solution GOR and Cumulative GOR (R_p)? Using mathematical expression, indicate how is cumulative gas produced G_p related to the instantaneous GOR and cumulative oil production?</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 3</td><td>An oil reservoir is being considered for further development by initiating a water flooding project. The oil–water relative permeability data indicate that the residual oil saturation is 35%. It is projected that the initial gas saturation at the start of the flood is approximately 10%.
Calculate the anticipated reduction in residual oil saturation, ΔS_{or}, due to the presence of the initial gas at the start of the flood. Also calculate percentage reduction of residual oil saturation (figures for S_{gi} vs S_{gt} and S_{gt} vs S_{or} are enclosed).</td><td>10</td><td>CO5</td></tr>
<tr><td>Q 4</td><td>What are the various types of well arrangements that are used in fluid injection projects? Also mention the important factors that must be considered while making the selection of injection pattern.
Or
What is the effect of trapped gas on water flood recovery? Present the different theories describing the phenomenon of improving the overall oil recovery when initial gas exist at the start of water flood.</td><td>10</td><td>CO4</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q1</td><td>What are the different phases in the life cycle of field development? Describe in brief various activities involved in development and planning phase.</td><td>20</td><td>CO6</td></tr>
<tr><td>Q2</td><td>Drive fractional flow equation and describe its significance. Illustrate the effect of change in viscosities, injection rate and dip angle on fractional flow.
Or
Perform the fractional flow calculations for the two values of oil viscosity: = 0.5 and 10 cp and for different saturations as tabulated below. The values of relative permeability for each saturation are also given in the table. Plot the fractional flow curve for a linear reservoir system with the following properties:
Dip angle = 0, Absolute permeability = 50 md
B_o = 1.20 bbl/STB, B_w = 1.05 bbl/STB
ρ_o = 45 lb/ft3, ρ_w = 64.0 lb/ft3
μ_w = 0.5 cp Cross-sectional area A = 25,000 ft^2
<table>
<tr><td>Saturations S_w</td><td>K_{ro}</td><td>K_{rw}</td></tr>
<tr><td>0.24</td><td>0.95</td><td>0.00</td></tr>
<tr><td>0.40</td><td>0.74</td><td>0.04</td></tr>
<tr><td>0.50</td><td>0.45</td><td>0.09</td></tr>
<tr><td>0.60</td><td>0.19</td><td>0.17</td></tr>
<tr><td>0.70</td><td>0.06</td><td>0.28</td></tr>
<tr><td>0.78</td><td>0.00</td><td>0.41</td></tr>
</table></td><td>20</td><td>CO3</td></tr>
</table>

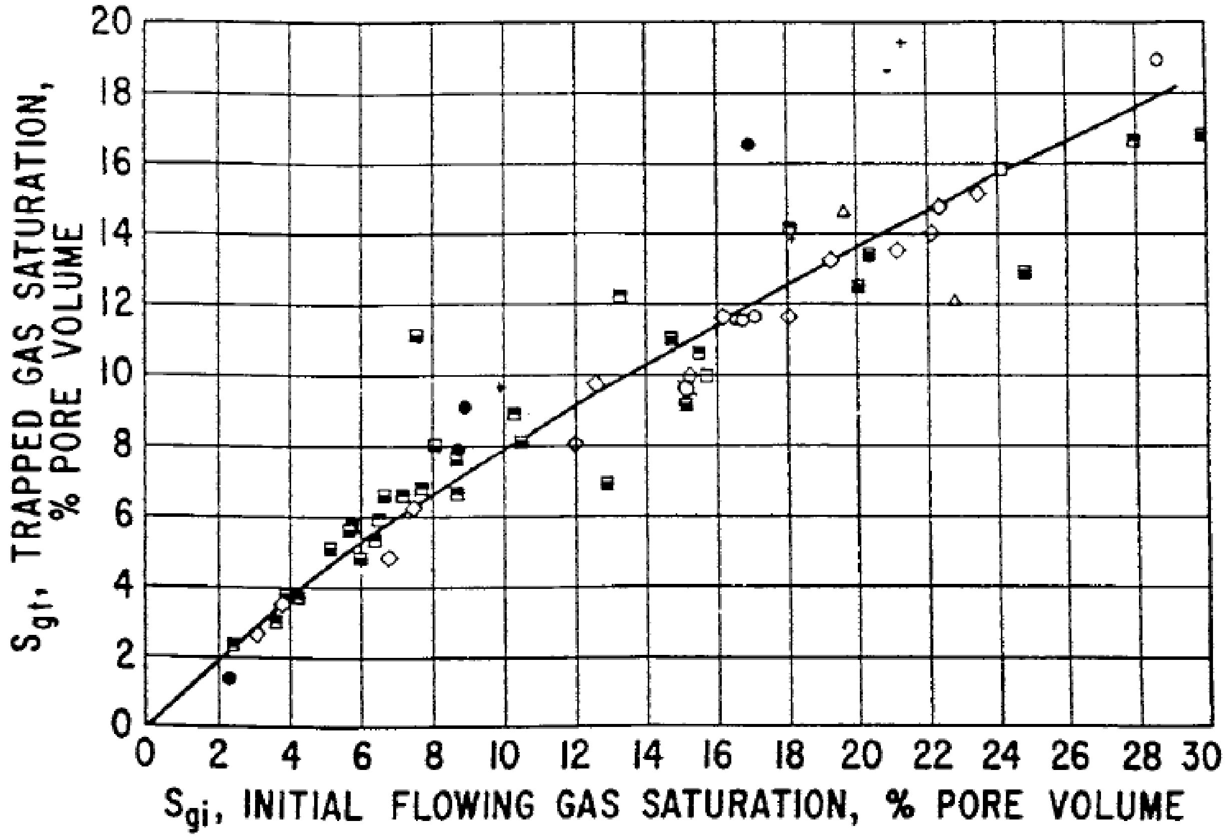

Figure-1: *Relation between S_{gi} and S_{gt}.*

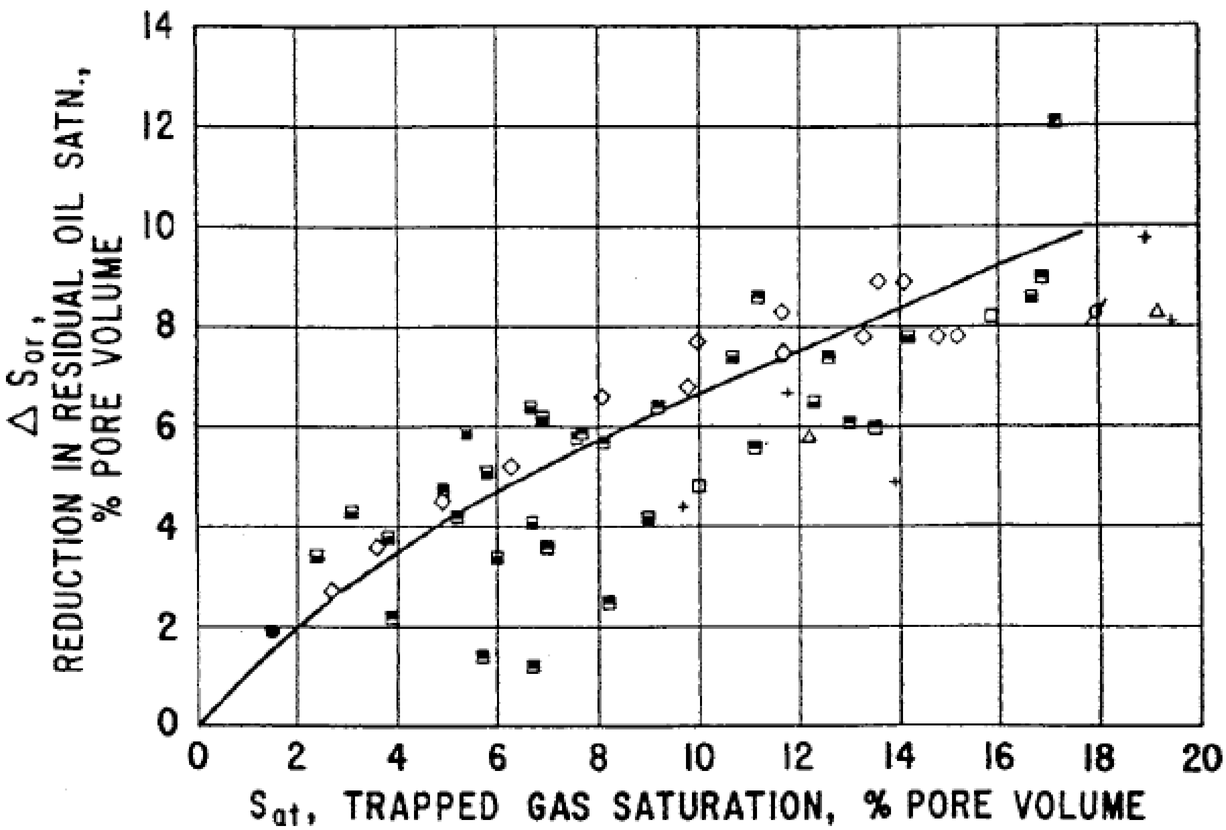

Figure-2: *Effect of S_{gt} on water flood recovery.*