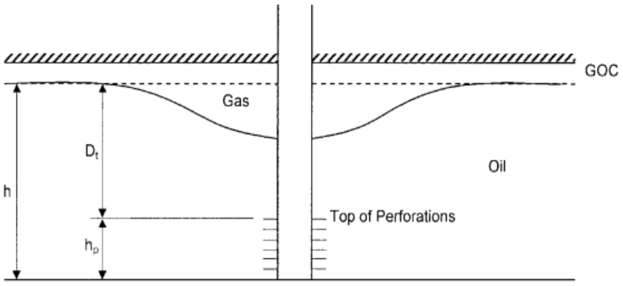
Name:
Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Programme Name: B.Tech., APE Gas
Course Name : Reservoir Engineering - II
Course Code : PEAU 4104P
Nos. of page(s) : 2
Semester : VI
Time : 03 hrs
Max. Marks : 100

Instructions: 1. Assume any data missing.
2. Attach any graphs and/or data sheets (if any) used to the answer sheets for evaluation

<table>
<tr><th>SNo</th><th>SECTION A (6*5=30M)</th><th>Marks</th><th>CO</th></tr>
<tr><td>Q 1</td><td>Identify the various expansion terms in the MBE and their sources.</td><td>5</td><td>CO1</td></tr>
<tr><td>Q 2</td><td>Define the total formation volume factor and mention its significance</td><td>5</td><td>CO2</td></tr>
<tr><td>Q 3</td><td>Define economic limit production rate and list the variables included in its estimation?</td><td>5</td><td>CO3</td></tr>
<tr><td>Q 4</td><td>List various types of decline curves used to analyze production rates</td><td>5</td><td>CO3</td></tr>
<tr><td>Q 5</td><td>Define coning and mobility ratio. Mention the significance of mobility ratio in coning.</td><td>5</td><td>CO3</td></tr>
<tr><td>Q 6</td><td>Define diffusive flow and mention the conditions at which it would occur.</td><td>5</td><td>CO4</td></tr>
<tr><th colspan="4">SECTION B (5*10=50M)</th></tr>
<tr><td>Q 7</td><td>Determine the drive indices for the following reservoir data with negligible gas saturation:
$N = 16.890*10^6$ stb; $W_e = 1.773*10^6$ bbl; $N_p = 1559001$ stb; $G_p = 9.866*10^8$ scf; $R_{soi} = 650$ scf/stb; $B_{ti} = 1.325$ rb/stb.
The reservoir fluid data gathered at depletion pressure of 2264 psia is:
$B_o = 1.308$ rb/stb; $B_g = 0.0048$ cf/scf; $R_s = 612$ scf/stb.</td><td>10</td><td>CO1</td></tr>
<tr><td>Q 8</td><td>A gas well producing from the Devonian formation in Ward County, Texas, is tested periodically and the following data is collected:
<table>
<tr><td>P_R (psi)</td><td>5608</td><td>4910</td><td>4537</td><td>4055</td><td>3631</td></tr>
<tr><td>Z</td><td>1.0045</td><td>0.9705</td><td>0.9525</td><td>0.9300</td><td>0.9102</td></tr>
<tr><td>Gp (MCF)</td><td>144,941</td><td>2,282,721</td><td>5,338,601</td><td>9,989,696</td><td>13,443,654</td></tr>
</table>
Calculate the original gas-in-place.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 9</td><td>A well producing from a particularly tight reservoir produces 6292 bbls during its first month of production. By the end of its twenty-seventh month of production, the rate has dropped to 730 bbls/month, and cumulative production is 55,900 bbls. Calculate for n and the percentage decline per month.</td><td>10</td><td>CO3</td></tr>
<tr><td>Q10</td><td>Derive an expression for maximum possible oil flow rate through a well, which penetrates a depth ‘D_t’ into a oil zone of thickness ‘h’ during gas coning

</td><td>10</td><td>CO3</td></tr>
<tr><td>Q11</td><td>Derive an expression describing fractional flow of water in displacement of oil by water,</td><td>10</td><td>CO4</td></tr>
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<tr><td></td><td>in one dimension tilted reservoir block with uniform cross sectional area</td><td></td><td></td></tr>
<tr><td colspan="4">SECTION-C (1*20=20M)</td></tr>
<tr><td>Q12</td><td>A water-drive reservoir is of such size and shape that water encroachment to the first line of producers can be treated as linear flow. The water drive is sufficiently active that the fluid flow is steady state. The withdrawal rate from the reservoir averages 2830 RB/day. The reservoir data is as follows:
Average formation dip = 15.5^0; Reservoir porosity = 21.5%; Average width of reservoir = 8000ft; Reservoir thickness = 30ft; Average cross-sectional area = 240000 ft^2; Permeability = 108md; Connate water saturation = 16%; Reservoir oil specific gravity = 1.01; Oil viscosity = 1.51cP; Reservoir water specific gravity = 1.05; Water viscosity = 0.83cP; the average distance from the original WOC to the first line of producers is 350ft.
a. Calculate the fractional flow values for this reservoir corresponding to the saturations listed in table below.
<table>
<tr><td>S_w</td><td>0.79</td><td>0.75</td><td>0.65</td><td>0.55</td><td>0.45</td><td>0.35</td><td>0.25</td><td>0.16</td></tr>
<tr><td>k_{rw}</td><td>0.63</td><td>0.54</td><td>0.37</td><td>0.23</td><td>0.13</td><td>0.06</td><td>0.02</td><td>0.00 <i>(Critical)</i></td></tr>
<tr><td>k_{ro}</td><td>0.00 <i>(Critical)</i></td><td>0.02</td><td>0.09</td><td>0.23</td><td>0.44</td><td>0.73</td><td>0.94</td><td>0.98</td></tr>
</table>
b. Calculate the position of the water-front at a saturation of 0.7XX after 2 years, <i>where XX is the last two digits of your roll number.</i></td><td>20</td><td>CO4</td></tr>
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