UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2022

Programme Name: BTECH APE-UP
Semester : V
Course Name : RESERVOIR ENGINEERING I **Time : 03 hrs**
Course Code : PEAU 3002 **Max. Marks: 100**

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

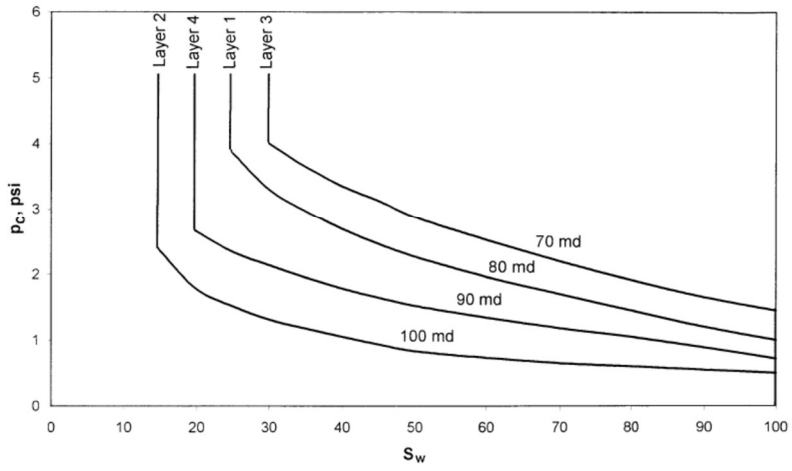
SECTION A

S. No.		Marks	CO
1	Reservoir begins to fill up with oil is termed as a) Drainage b) Imbibition c) Both (a) and (b) d) None of the above Please justify your answer.	**4**	**CO2**
2	Sw irreducible is reached when a) Kro is 100% and Krw is 0% b) Kro is 80% and Krw is 20% c) Kro is 50% and Krw is 50% d) None of the above Please justify your answer.	**4**	**CO2**
3	Describe the process of saturation and desaturation of a core from water wet reservoir.	**4**	**CO1**
4	The isothermal compressibility coefficient is essentially the controlling factor in identifying the type of the reservoir fluid. Discuss the classification of the reservoir fluids on the basis of isothermal compressibility coefficient.	**4**	**CO2**
5	Graphically represent the variation of oil formation volume factor with decline in pressure.	**4**	**CO1**
	SECTION B		
6	Derive Darcy's law and describe the assumptions. Starting from Darcy's law in a radial porous system, derive an expression for the steady state inflow of incompressible fluid. Assume that only single fluid phase is flowing under isothermal condition. OR The following data are available on a well in the Red River Field: pe = 2506 psi pwf = 1800 re = 745ft rw = 0.25 ft Bo = 1.25 bbl/STB μ_O = 2.5cp co = 25x 10^{-6} Psi^{-1} k = 0.12 Darcy h = 25 ft. Assuming a slightly compressible fluid, calculate the oil flow rate. Compare the result with that of incompressible fluid.	**(5+5)= 10**	**CO3**
7	The initial reservoir pressure of an Undersaturated reservoir is 1000 psi. The bubble point pressure is 900 Psi. The current reservoir pressure is 800 Psi at which the gas cap and aquifer are both active. a) Discuss and elaborate about the pressure profile of the reservoir.	**10**	**CO5**

<table>
<tr><td></td><td>b) Also suggest few ways to improve the recovery of the field.</td><td></td><td></td></tr>
<tr><td>8</td><td>Describe the equation to determine the effect of rock and fluid expansion when the pressure declines in an undersaturated reservoir. Assume the tank model of the reservoir system.</td><td>10</td><td>CO4</td></tr>
<tr><td>9</td><td>The Nameless Field is an undersaturated-oil reservoir. The crude oil system and rock type indicates that the reservoir is highly compressible. The available reservoir and production data are given below:
Swi = 0.25 φ = 20% Area = 1,000 acres h = 70 ft T = 150°F
Bubble-point pressure = 3500 psia
Calculate the cumulative oil production at 3900 psi. The PVT data show that the oil formation volume factor is equal to 1.938 bbl/STB at 3900 psia.
The rock and fluid expansion is negligible.
<table>
<tr><td></td><td>Original condition</td><td>Current condition</td></tr>
<tr><td>Pressure (Psi)</td><td>5000</td><td>4500</td></tr>
<tr><td>Bo, bbl/STB</td><td>1.905</td><td>1.920</td></tr>
<tr><td>Rs, scf/STB</td><td>700</td><td>700</td></tr>
<tr><td>NP, MSTB</td><td>0</td><td>610.9</td></tr>
</table></td><td>10</td><td>CO5</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>10</td><td>Treating the reservoir pore as an idealized container derive the volumetric balance expressions to account for all volumetric changes which occurs during the natural productive life of the reservoir. Also include the secondary recovery mechanisms.

OR

A combination-drive reservoir contains 40 MMSTB of oil initially in place. The ratio of the original gas-cap volume to the original oil volume, i.e., m, is estimated as 0.15. The initial reservoir pressure is 3500psia at 120°F. The reservoir produced 4.4 MMSTB of oil, 2100 MMscf of 0.84 specific gravity gas, and 150,000 STB of water by the time the reservoir pressure dropped to 2600 psi. The following PVT is available:
<table>
<tr><td></td><td>3500 psi</td><td>2600 psi</td></tr>
<tr><td>Bo, bbl/STB</td><td>1.58</td><td>1.48</td></tr>
<tr><td>Rs, scf/STB</td><td>1040</td><td>850</td></tr>
<tr><td>Bg, bbl/scf</td><td>0.00080</td><td>0.00092</td></tr>
<tr><td>Bt, bbl/STB</td><td>1.58</td><td>1.655</td></tr>
<tr><td>Bw, bbl/STB</td><td>1.000</td><td>1.000</td></tr>
</table>
The following data are also available:
Swi = 0.20; cw = 1.5×10^{-6} psi^{-1}; cf = 1×10^{-6} psi^{-1}
Calculate:
a. Cumulative water influx
b. Net water influx
c. Primary driving indexes at 2900 psi.</td><td>20</td><td>CO4</td></tr>
</table>

11	A four-layer oil reservoir is characterized by a set of reservoir capillary pressure-saturation curves as shown in figure. The following additional data are also available. WOC = 5060 ft Water density = 65.2 lb/ft3 Oil density = 55.2 lb/ft3 Calculate and plot water saturation versus depth for this reservoir. Layer | Depth, ft 1 | 5000-5010 2 | 5010-5020 3 | 5020-5035 4 | 5035-5060  	**20**	**CO2**