

القسم / هندسة نفط
الزمن / 3 ساعات
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كلية الهندسة – جامعة مصراتة

الامتحان النهائي لمقرر / تحليل الضغوط العابرة (425)

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(Open book exam)

Problem 1

(20 marks)

An oil well was producing oil, gas and water from a saturated reservoir as follows ; 1100 STB/d , 1800 m scf/d and 4200 STB/d respectively from a circular drainage area of 23 acres. The well was producing for 20.5 hours prior to shut-in for build-up test. The reservoir rock and fluid properties are :

$$\begin{array}{lll} R_s = 537 \text{ scf/STB} & \mu_o = 0.49 \text{ cp} & \mu_g = 0.01778 \text{ cp} \\ \mu_w = 0.231 \text{ cp} & \beta_o = 1.34 \text{ bbl/STB} & \beta_g = 1.424 \text{ bbl/m scf} \\ \beta_w = 1.057 \text{ bbl/STB} & C_o = 2.04 \times 10^{-4} \text{ psi}^{-1} & C_g = 5.33 \times 10^{-4} \text{ psi}^{-1} \\ C_w = 9.79 \times 10^{-6} \text{ psi}^{-1} & C_f = 3.09 \times 10^{-6} \text{ psi}^{-1} & S_w = 0.57 \\ S_g = 0.1 & \phi = 0.165 & h = 114 \text{ ft} \\ r_w = 0.411 \text{ ft} & \gamma_g = 0.80 & T = 250^\circ \text{ F} \end{array}$$

The pressure test data are:

$\Delta t, \text{ hrs}$	$P_{ws}, \text{ psia}$
0.0	1658
0.2	1750
0.3	1800
0.5	1875
0.75	1900
1.0	1912
2.0	1945
3.0	1963
5.0	1985
7.0	2000
10.0	2015
12.0	2020

Determine the following by using Horner method:

- 1). The total mobility " λ_t ".
- 2). Effective permeabilities; K_o , K_w and K_g .
- 3). Additional pressure drop due to damage.
- 4). Average drainage area pressure " P_{avg} " using MBH method.
- 5). Radius of investigation at shut-in time of 7 hours.

Problem 2

(20 marks)

A two- rate flow test was run by stabilizing the flow rate at 500 STB/day for 184.7 hrs then reducing the flow rate to 250 STB/day. The flowing bottom-hole pressure at time of rate change " P_{wf1} " was 3490 psia:

Other pertinent data are :

$$\begin{array}{lll} \mu_o = 0.805 \text{ cp} & h = 69 \text{ ft} & C_t = 10 \times 10^{-5} \text{ psi}^{-1} \\ r_w = 0.198 \text{ ft} & \beta_o = 1.137 \text{ bbl/STB} & \phi = 0.039 \\ p_i = 4412 \text{ psia} & \rho_o = 52.7 \text{ lb/ft}^3 & A_a = 0.0218 \text{ ft}^2 \end{array}$$

The pressure data during the second rate are shown in the table below:

Time, Δt <u>hrs</u>	P_{wf} <u>psia</u>
0.45	3654
0.93	3750
1.34	3795
1.94	3830
2.79	3853
5.78	3870
12.00	3890
17.30	3900

Determine :

- 1). The formation permeability .
- 2). The skin factor.
- 3). The pressure drops across the skin at rates q_1 and q_2 respectively.
- 4). The time needed to end the wellbore storage effect.

Problem 3

(20 marks)

A). Confirm that the drainage area of problem 1 is approximately 23 acres.

B). The following data were recorded from two pressure buildup tests :

$P_{avg1} = 3900$ psi , $P_{avg2} = 3000$ psi and average daily oil production " q_{avg} " in 6 months was 250 STB/day. The other pertinent data are:

$\beta_o = 1.292$ bbl/STB $C_1 = 9.52 \times 10^{-5}$ psi⁻¹ $\phi = 0.215$ $h = 12.5$ ft
Estimate the reservoir area in acres.

Good Luck

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