

كلية الهندسة
القسم : هندسة النفط
الزمن : 3 ساعات
أستاذ المادة : أحمد مصطفى بادي
(open Book Exam)

جامعة مصراتة
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الامتحان النهائي لمقرر : تحليل الضغوط العابرة (425)
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أسم الطالب :

Problem 1

A). From this equation ;

$$p_{wf} = p_i - \frac{162.6 Q_o B_o \mu_i}{kh} \left[\log \left(\frac{kt}{\phi \mu c_l r_w^2} \right) - 3.23 + 0.87s \right]$$

derivative the following equation :

$$s = 1.151 \left[\frac{p_i - p_{wf}}{|m|} - \log t - \log \left(\frac{k}{\phi \mu c_l r_w^2} \right) + 3.23 \right]$$

(5 marks)

B). A drawdown test was conducted on a new oil well in a large reservoir . At the time of the test , the well was the only well that had been developed in the reservoir. The flow rate during the test was stabilized at 500 STB/day. Analysis of the data indicated that the wellbore storage does not affect the pressure measurements. The rock and fluid properties are as follows :

$$\begin{aligned} P_i &= 4000 \text{ psia} & h &= 20 \text{ ft} & \phi &= 0.25 \\ \beta_o &= 1.2 \text{ bbl/STB} & \mu_o &= 1.5 \text{ cp} & C_t &= 30 \times 10^{-6} \text{ psi} \\ r_w &= 0.333 \text{ ft} \end{aligned}$$

The measurements of the bottom-hole pressure with the time are tabulated below:

Time, Δt (hrs.)	Flowing bottom hole pressure P_{wf} psia
2	3503
5	3469
10	3443
20	3417
50	3383
75	3368
100	3350
150	3306
200	3282
300	3250

Estimate:

(15 marks)

1. Permeability of the formation
2. Additional pressure drop due to damage around the wellbore.
3. Drainage radius of the well, " r_e " .
4. Shape factor , " C_A " .
5. Prove that $P_i = 4000$ psi.

Problem 2

A). How do you calculate the well drainage area from buildup test evaluated by either Horner or MDH methods.

(5 marks)

B). A single-phase and single-rate pressure buildup test was conducted on an oil well situated in a center of closed square. The well was produced for an

effective time of 180 days at a constant flow rate of 500 STB/day. The pressure recorded during the test is listed below :

$\Delta t, \text{ hrs.}$	$P_{ws} \text{ psia}$
0.668	4045
0.833	4104
1.0	4155
2.0	4271
3.0	4306
4.0	4324
5.0	4340
7.0	4363
10.0	4387
20.0	4432

The bottom hole pressure at shut-in time was 3561 psi , and the well drainage area is 12 acres. The formation and fluid properties of the reservoir are ,:

$$\begin{aligned} \mu_o &= 0.80 \text{ cp} & h &= 49 \text{ ft} & C_t &= 17.0 \times 10^{-6} \text{ psi}^{-1} \\ r_w &= 0.333 \text{ ft} & \beta_o &= 1.136 \text{ bbl/STB} & \phi &= 0.23 \end{aligned}$$

By using MDH method , estimate :

(15 marks)

- 1). Oil effective permeability
- 2). Additional pressure drop due to damage around the wellbore.
- 3). Average drainage area pressure " P " using Dietz method.
- 4). What type of flow when the well was shut in?
- 5). The effective wellbore radius r_{we} .

Problem 3

A).A drawdown test was run on an oil well, The flowing bottom-hole pressure and oil flow rate versus the time listed below:

$t, \text{ hrs.}$	$q_o, \text{ STB/d}$	$P_{wf}, \text{ psi}$	$t, \text{ hrs.}$	$q_o, \text{ STB/d}$	$P_{wf}, \text{ psi}$
1	249	4329.5	6	244	4312.9
2	248	4322.3	7	243	4312.0
3	247	4318.4	8	242	4311.3
4	246	4315.9	9	241	4310.9
5	245	4314.2	10	240	4310.5

The rock and fluid properties are:

$$\begin{aligned} P_i &= 4521.6 \text{ psi} & h &= 13 \text{ ft} & \phi &= 3.88 \% & r_w &= 0.25 \text{ ft} \\ \beta_o &= 1.30 \text{ bbl/STB} & \mu_o &= 1.73 \text{ cp} & C_t &= 8.44 \times 10^{-6} \text{ psi}^{-1} \end{aligned}$$

Calculate formation permeability and skin factor.

(15 marks)

B). The following characteristics are given for a gas well

$$\begin{aligned} \text{well depth} &= 11000 \text{ ft} & r_w &= 0.39 \text{ ft} & \mu_g &= 0.01925 \text{ cp} \\ C_{ws} &= 0.000333 \text{ psi}^{-1} & h &= 12 \text{ ft} & k &= 8 \text{ md.} \end{aligned}$$

Assume there is no bottom hole packer. Calculate the time required for wellbore storage effects to become negligible.

(5 marks)

Good Luck