فصل الربيع 2016/2015 كلية الهندسة – جامعة مصراتة القسم / هندسة نفط
الامتحان النهائي لمقرر/ سريان الموائع في الأوساط المسامية(423) الزمن/ 3 ساعات
التاريخ 2016/05/24 م أستاذ المادة /أ. أحمد مصطفى بادي
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(Open Book Exam)

Problem 1 *(20 marks)*

A). *An oil well is developed on the center of a squared-drilling pattern. The well is producing at a constant flow rate of 247 STB/day under a semisteady-state conditions. The reservoir has the following properties:*

$\Phi = 20\%$, $r_w = 0.25\ ft$, $h = 15\ ft$, $k = 60\ md$
$\mu_o = 1.5\ cp$, $\beta_o = 1.4\ bbl/STB$, $c_t = 15\times10^{-6}\ psi^{-1}$, $S = 5$

The bottom hole flowing pressure is presented by the following straight line equation: $P_{wf} = 2500 - 1.033\,t$, *where;* p_{wf} *is in psi and t ,time, in hours.*

1). *What is the slope of the semisteady state flow based on the given equation*
2). *Estimate the well drainage area in acres.*
3). *The initial reservoir pressure .*
4). *Additional pressure drop due to skin.*

B). *Assume that the previous well had damaged out so that the permeability decreased to 15 md, and the damage extended to 10 ft from the wellbore. What would be the additional pressure drop due to the damage ?*

Problem 2 *(15 marks)*

A). *An oil well is located in the center of 640 acres circular drainage area and is producing under pseudosteady state flow conditions. The rock and fluid properties are :*

$q_o = 606\ STB/day$, $\mu_o = 0.306\ cp$, $r_w = 0.25\ ft$, $k = 17.5\ md$
$\beta_o = 1.593\ bbl/STB$, $h = 103\ ft$, $\Phi = 12\%$, $T = 275\ ^oF$
$C_t = 18\times10^{-6}\ psi^{-1}$, $P_i = 4250\ psi$, $s = (+12)$

Calculate :

a). *additional pressure drop around the wellbore due to skin.*
b). *flowing bottom-hole pressure when* P_{avg} *is 4100 psi.*
c). *pressure decline rate " dp/dt "*
d). *flow rate* q_o *which would be obtained for a drawdown* $(P_{avg} - P_{wf})$ *of 500 psi if an acid job were performed , changing the skin factor ' S ' from (+12) to (-2).*

B). *unsteady state flow equation used in the case of dimensionless pressure method when* $t_D > 100$ *is :*

$$P_{wf} = P_i - (141.2\ q_o \mu_o \beta_o / k h) \times P_D ,$$

from this equation derivative the following transient straight line equation :

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

Problem 3 *(15 marks)*

A). *The equation of unsteady state flow for compressible fluids is:*

$$P_i^2 - P_{wf}^2 = 1637 \frac{q_g T Z \mu_g}{k h} \left[\log \frac{k t}{\Phi \mu_g C_t r_w^2} - 3.23 + 0.87 s'\right]$$

From this expression derivative this equation :

$$P_{wf} = P_i - \frac{162.6 \times 10^3 \, q_g \mu_g \beta_g}{k h} \left[\log \frac{k t}{\Phi \mu_g C_t r_w^2} - 3.23 + 0.87 s'\right]$$

B). *A gas well has the following rock and fluid parameters:*

$k = 65$ md	$h = 15$ft	$q_g = 38313$ mscf/d
$p_e = 4400$ psia	$T = 600°$ R	$r_e = 1000$ ft
$r_w = 0.25$ ft	$\mu_{gi} = 0.0267$ cp	$\gamma_g = 0.759$
$T_{sc} = 520°$ R	$P_{sc} = 14.7$ psia.	$z_i = 0.862$
$\Phi = 15\ \%$	$S = +5$	$D = 0.0$

Determine flowing bottom-hole pressure assuming steady-state flow conditions.

Good Luck

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