فصل الربيع 2015/2014 كلية الهندسة – جامعة مصراتة القسم / هندسة نفط
الامتحان النهائي لمقرر/ سريان الموائع في الأوساط المسامية(423) الزمن/ 3 ساعات
التاريخ / 2015/07/27 م أستاذ المادة /أ. أحمد مصطفى بادي

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(Open book exam)

Problem *(20 marks)*

A). *Estimate the flow efficiency using the following data:*

$\beta_o = 1.226$ bbl/STB $\quad \mu_o = 3.75$ cp $\quad k = 19.1$ md
$h = 67$ ft $\quad r_w = 0.3$ ft $\quad p_{wf} = 2309$ psi
$P_{avg} = 3137$ psi $\quad q_o = 105$ STB/d $\quad s = 8.2$

B). *An oil well drilled in a field with uniform 40-acre square drilling pattern has produced for 10 days with a constant pressure decline of 48 psi/day. The gas-oil ratio has been constant during the production. The well was damaged out due to build-up test analysis and skin factor estimated to be 2.43. The flowing bottom-hole pressure is 1123 psi. The rock and fluid data are as follows :*

$\phi = 0.1$ $\quad h = 40$ ft $\quad \mu_o = 2.0$ cp
$C_t = 10 \times 10^{-6}$ psi^{-1} $\quad r_w = 4.0$ in. $\quad \beta_o = 1.31$ bbl/STB
$k = 82.5$ md

Estimate:

a). *drainage well radius.* ***b).*** *oil flow rate.*
c). *average reservoir pressure.* ***d).*** *pressure drop due to well damage.*
e). *At what type of flow regime is this well producing?*

Problem 2 *(20 marks)*

A). *The Ei-solution to the diffusivity equation is given by the following formula:*

$$p(r,t) = p_i + \left[\frac{70.6QB\mu}{kh}\right] \mathrm{Ei}\left[\frac{-948\phi\mu c_t r^2}{kt}\right]$$

Prove that the above equation can be expressed by this formula:

$$p_D = -\frac{1}{2}\mathrm{Ei}\left(-\frac{r_D^2}{4t_D}\right)$$

B). *Using the following fluid and rock properties of a producing well :*

$P_i = 5651$ psia $\quad P_{wf} = 3500$ psia $\quad k = 8.2$ md $\quad h = 53$ ft
$\phi = 19\ \%$ $\quad \mu_o = 1.7$ cp $\quad r_w = 0.328$ ft $\quad \beta_o = 1.1$ bbl/STB
$C_t = 1.29 \times 10^{-5}$ psi^{-1} .

to develop a relationship between production rate and time assuming unsteady state flow condition .

C). *An oil well has initial pressure of 3500 psia and producing at a constant flow rate of 300 STB/day under unsteady state flow conditions.The rock and fluid characteristics are:*

$k = 120$ md $\quad \beta_o = 1.2$ bbl/ STB $\quad \mu_o = 2$ cp
$s = 3$ $\quad h = 20$ ft $\quad \phi = 0.25$
$r_w = 0.328$ ft $\quad C_t = 20 \times 10^{-6}$ psi^{-1}

Calculate : ***a).*** *pressure after 20 hrs at 100 ft away from the wellbore.*
b). *flowing bottom-hole pressure after 20 hours.*
c). *flowing bottom-hole pressure after 50 hours using P_D-method.*

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Problem 3 (20 marks)

A). *Gas flow rate has recorded against apparent skin factor as follows:*

q_g mmscf/day	S'
5	7
10	11
20	19

Calculate

1). the true skin factor" S", and

2). turbulent factor"D".

3). Apparent skin factor" S' " if q_g =15 mmscf/d

B). *A gas well is producing at a constant rate of 8 mm scf/day under steady state flow conditions. The following data is available:*

$K = 50$ md $\quad h = 15$ ft $\quad \varphi = 0.20 \quad P_i = 2000$ psia

$T = 140\ ^{o}f \quad r_w = o.333$ ft

$r_e = 1000$ ft

The gas properties are tabulated below :

P,psia	μ_g, cp	z
400	0.01286	0.937
800	0.01390	0.883
1200	0.01530	0.832
1600	0.01680	0.794
2000	0.01840	0.770

1). *Plot $\psi(P)$ versus pressure, and find the value of $\psi(p)$ at P =1000 psia*

2). *Calculate the flowing bottom-hole pressure using:*

a). *pseudopressure method.*

b). *squared- pressure method .*

Good Luck

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