INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date_____FN/AN

Time: 3Hrs. Full Marks: 60

Department of Mining Engineering; No. of students 75.

End Autumn Semester Examination 2015-16.

Subject No. MI40039; Subject Name: Oil and Gas Well Testing & Enhanced Oil Recovery

4th Year B.Tech.(H) in Mining Engineering

Instructions:

I. *Answer ALL questions.*
II. *Semi-log (5 cycles) graph papers should be provided.*
III. *Any missing data may be assumed and stated.*

1. A drawdown test in which the rate decreased continuously throughout the test was run in a well with the following characteristics: $\phi = 0.18$, $\mu = 1.2$ cp, $c_t = 16 \times 10^{-6}$ psi^{-1}, $r_w = 0.3$ ft, $h = 80$ ft, $B_o = 1.12$ RB/STB, $\rho = 55$ lb/cu ft, and liquid gas interface was present in the well. The test data are given in the Table below:
From the data obtained, estimate the formation permeability and skin factor.

t (hours)	P_{wf} (psi)	q (STB/D)	t (hours)	P_{wf} (psi)	q (STB/D)	t (hours)	P_{wf} (psi)	q (STB/D)
0	5000	200	1.02	4804	129	10.9	4800	113
0.114	4927	145	1.22	4801	128	13.0	4801	112
0.136	4917	143	1.46	4799	127	15.6	4801	110
0.164	4905	142	1.75	4798	126	18.8	4802	109
0.197	4893	141	2.11	4797	124	22.5	4803	108
0.236	4881	140	2.53	4797	122	27.0	4803	107
0.283	4868	138	3.03	4797	121	32.4	4804	105
0.340	4856	137	3.64	4797	121	38.9	4805	104
0.408	4844	136	4.37	4798	119	46.7	4806	103
0.490	4833	135	5.24	4798	118	56.1	4807	102
0.587	4823	133	6.29	4798	117	67.3	4807	100
0.705	4815	132	7.54	4799	116	80.7	4808	99
0.846	4809	131	9.05	4799	114	96.9	4809	98

10+10 = 20

2. Estimate the formation permeability and skin factor from the following data available from a gas well pressure build-up test. T = 199°F; h = 34ft; $\mu_i = 0.023$ cp; $S_w = 0.33$(water is immobile); $c_{gi} = 0.000315$ psi^{-1}; $\varphi = 0.22$; $z_i = 0.87$; and $r_w = 0.3$ft. The well produced 6,068 Mcf/D before the test. A plot of p_{ws} vs. $\log(t_p + \Delta t)/\Delta t$ gave a middle-time line with a slope of 66psi/cycle. Analysis of the build-up curve showed that static drainage-area pressure, p, was 3,171 psia. Pressure on the middle-time line at Δt =1hour, $p_{1\,hr}$, was 2,745 psia; flowing pressure, at shut-in, p_{wf}, was 2,486 psia.

3. i) Explain the principle of superposition and derive the mathematical expression for the pressure drop in a well where more than three wells are producing in an infinite acting reservoir.
ii) With ternary phase diagram explain the conditions necessary for a dry gas miscible drive and for a condensing gas drive process. 5+5=10

4. i) Discuss the In-situ Combustion process used in EOR in detail with a neat diagram, the advantages and the disadvantages associated with it.
ii) Using Nelson-McNiel technique derive the equation for air requirements in In-situ Combustion process.
iii) What should be the air requirement for a five spot pattern using the above technique per acre of pattern?
4+4+2 = 10

5. i) Discuss the screening guidelines with respect to rock and fluid properties for a successful surfactant flooding.
ii) Calculate the pressure gradient required to move a residual oil droplet out of a pore in typical water-wet consolidated sandstone. The data available are: $r_1 = 9 \times 10^{-4}$cm, $r_2 = 4 \times 10^{-3}$cm., $\delta_{ow} = 30$dynes/cm., droplet length = 4×10^{-2}cm. 5+5 = 10

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