Name:

Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

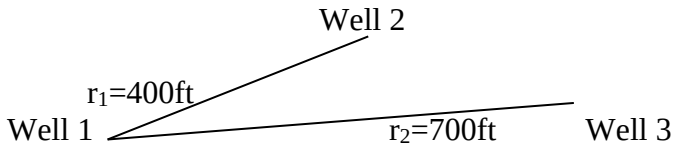
Course: Formation Evaluation and Well Testing **Semester: VI**
Program: B.Tech (Applied Petroleum Engg) + GAS Stream **Time: 03 hrs.**
Course Code: PEAU 3016 **Max. Marks: 100**

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: All questions are compulsory. Assume if any data missing.

S. No.	**Question**	**CO**
Q 1	What are the basic differences between Gamma ray log and Density log?	**CO1**
Q 2	Define Skin effect in induction log.	**CO1**
Q 3	What is the difference between flushed zone and invaded zone?	**CO2**
Q 4	An exploratory well was drilled in Nigeria Delta and the discovery was made from a sandstone reservoir. Based on well test and core data analysis the following petro physical properties were obtained: Saturation exponent: 2, Formation water resistivity: 0.1ohm-m, Formation true resistivity: 25ohm-m, Porosity: 25% Find the saturation of the formation using Archie's equation.	**CO1**
Q 5	Estimate the oil permeability and skin factor from the following Reservoir data and drawdown test data: h=130 ft rw = 0.25 ft Qo= 348 STB/day Bo=1.14 bbl/STB μo = 3.93 cp Ct = 8.74×10^{-6} psi^{-1} ϕ= 20% Pi = 1,154 psi m= -22psi/cycle P1hr = 954 psi	**CO3**
Q 6	A new oil well with an infinite acting boundary produced 500 STB/D for 4 days, it then was shut in for a pressure buildup test, during which the following data were recorded.	**CO4**

Time after shut-in, Δt (hours)	Pws (psig)
0	1,150
2	1,794
4	1,823
8	1,850
16	1,876
24	1,890
48	1,910

	If the wellbore radius, r_w is 0.3 ft; net sand thickness, h is 22 ft; formation volume factor, Bo is 1.3 RB/STB; porosity, ϕ is 0.2; total compressibility, Ct is 20 $x10^{-6}$ psi^{-1} and oil viscosity, μo is 1.0 cp, then, estimate Formation Permeability, k.	
SECTION B **1. Each question will carry 10 marks** **2. Instruction: All questions are compulsory. Assume if any data missing.**		
Q 7	Briefly explain Ramey's Type curves and What are the different gas well tests? Explain the isochronal tests for gas wells.	**CO3**
Q 8	State the working principle of neutron log. Why it called porosity log?	**CO2**
Q 9	Narrate the utility of Gamma-Gamma ray log over Gamma ray log with proper example.	**CO3**
Q 10	"In one formation Rmf is greater than Rw and in other Rw is greater than Rmf"- explain the resistivity responses with appropriate explanation.	**CO4**
Q 11	A flowing well is completed in a reservoir that has the following properties: p_i = 2500 psia B = 1.32 bbl/STB μ = 0.44 cp k= 25 md h= 43 ft C_t = 18 $x10^{-6}$ psi^{-1} ϕ = 0.16 What will be the pressure drop in a shut-in well 500 ft from the flowing well when the flowing well has been shut in for 1 day following a flow period of 5 days at 300 STB/D. **OR** Assume that the three wells as shown in figure below are producing under a transient Flow condition for 15 hours.  The following additional data is available: Qo1= 100 STB/day Pi= 4500 psi h=20 ft r_w = 0.25 ft Qo2=160 STB/day Bo = 1.20 bbl/STB Φ= 15 % μ_o= 2.0 cp Qo3=200 STB/day C_t = 20$x10^{-6}$ psi^{-1} k= 40 md r_1 = 400ft r_2 = 700ft $S_{well\ 1}$ = 0 If the three wells are producing at constant flow rate calculate the sand face flowing pressure at well 1.	**CO3**
SECTION C **1. Each Question carries 20 Marks.** **2. Instruction: All questions are compulsory. Assume if any data missing.**		
Q 12	A single-phase and single-rate pressure buildup test was conducted on an oil well. The data of Table 1 were recorded. The following well/reservoir parameters are	**CO4**

given: Bo = 1.224 rb/stb, h = 55 ft, ϕ = 0.06, rw = 0.21 ft, Co = 1.5 x 10^{-6}, and μo = 0.65 cP, psc = 14.65 psia, T = 2000F, re = 1520ft, and $p0$ = 53.51bm/ft^3.
Assume the well is draining from the center of a square. Well depth = 4500 ft, qf = final production rate at shut-in time = 250 stb/day, and cumulative production at shut-in time = 141,979 stb. Determine the following:

1. At what shut-in time At does after flow cease and boundary effect appear?
2. Formation permeability, k
3. Skin factor, s
4. Additional pressure drop near the wellbore, $(\Delta p)skin$
5. Effective wellbore radius, rwa
6. Flow efficiency FE using p^*
7. Damage ratio DR using p*
8. Productivity index, PI
9. Radius of investigation by the shut-in transient at the start and end of the MTR
10. End of wellbore storage distortion.

Table -1

Pressure Buildup Test Data - Single-Phase Test (tp = 13,629.99 h)

Time, Δt (hr)	p_{ws} (psig)
0.00	3519
0.15	3680
0.20	3723
0.30	3800
0.40	3866
0.50	3920
1.00	4103
2.00	4250
4.00	4320
6.00	4340
7.00	4344
8.00	4350
12.00	4364
16.00	4373
20.00	4379
24.00	4384
30.00	4393
40.00	4398
50.00	4402
60.00	4405
72.00	4407

OR

(a) A well producing only oil and dissolved gas has produced 12,173 STB. The well has not been stimulated, nor is there any reason to believe that there is a significant amount of formation damage. A pressure buildup test is run with the primary objective of estimating static drainage-area pressure. During buildup, there is a rising liquid level in the wellbore. Well and reservoir data are: $\Phi = 0.14$; $\mu = 0.55$ cp; $C_t = 16 \times 10^{-6}$ psi^{-1}; $B = 1.126$ RB/STB; $r_W = 0.5$ ft; $A_{wb} = 0.0218$ sq ft; $r_e = 1{,}320$ ft (well centered in cylindrical drainage area); $\rho = 54.8$ lbm/cu ft; $q = 988$ STB/D; and $h = 7$ ft. Data recorded during the buildup test are given in the following Table. Estimate the average reservoir pressure.

Δt, hrs	P_{ws}, psia	Δt, hrs	P_{ws}, psia	Δt, hrs	P_{ws}, psia	Δt, hrs	P_{ws}, psia
0	709	4.92	3772	14.8	4133	34.5	4306
1.97	3169	5.91	3873	19.7	4198	39.4	4327
2.95	3508	7.88	3963	24.6	4245	44.4	4343
3.94	3672	9.86	4026	29.6	4279	49.3	4356
						59.1	4375

(b) A constant-rate pressure drawdown test was run in a well with the following characteristics:

$q = 250$ STB/D (constant); $\Phi = 0.039$; $\mu = 0.8$cp; $C_t = 17 \times 10^{-6}$ psi^{-1}; $r_w = 0.198$ ft; $h = 69$ ft; $B_o = 1.136$ RB/STB; $A_{wb} = 0.0218$ sq ft; $\rho = 53$ lb/cu ft; and liquid/gas interface throughout the drawdown test. From the test data in the following table, estimate formation permeability, k.

t, hrs	P_{wf}, psia	t, hrs	P_{wf}, psia	t, hrs	P_{wf}, psia	t, hrs	P_{wf}, psia
0	4412	8.32	3593	43.0	3537	185	3490
0.12	3812	9.99	3586	51.5	3532	222	3481
1.94	3699	14.4	3573	61.8	3526	266	3472
2.79	3653	17.3	3567	74.2	3521	319	3460
4.01	3636	20.7	3561	89.1	3515	383	3446
4.82	3616	24.9	3555	107	3509	460	3429
5.78	3607	29.8	3549	128	3503		
6.94	3600	35.8	3544	154	3497		