Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

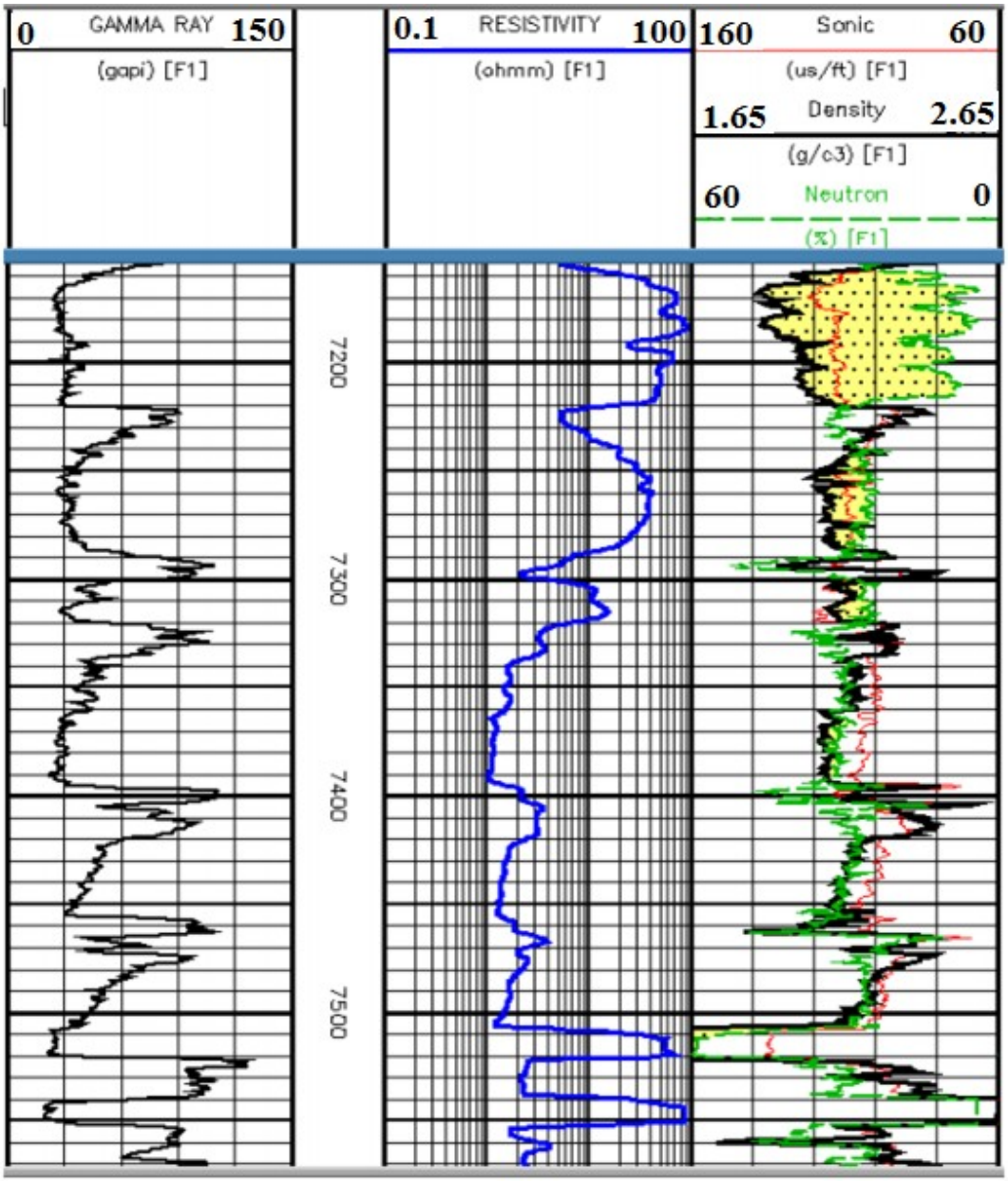
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: WELL LOGGING AND WELL TESTING
Semester: VI
Program: BTECH APE GAS **Time 03 hrs.**
Course Code: PTEG327 **Max. Marks: 100**

Instructions: All questions are compulsory. There is no overall choice. However, internal choice has been provided. You have to attempt only one of the alternatives in all such questions.

SECTION A

S. No.		Marks	CO
1	Explain the actual and ideal Pressure Build Up test with diagram.	**4**	**CO5**
2	Write down the expressions of dimensionless time, distance and pressure for diffusivity equation.	**4**	**CO4**
3	Discuss the uses of formation density log.	**4**	**CO1**
4	Ennumerate the important information obtained from PD curves.	**4**	**CO5**
5	Evaluate the porosity of sandstone formation, if the interval transit times of the formation, matrix and fluid are 70 µs, 55 µs and 190 µs respectively.	**4**	**CO2**
	SECTION B		
6	Develop a mathematical relationship between sand face and surface flow rate for Infinite acting reservoir with wellbore storage with respect for dimensionless time and dimensionless pressure.	**10**	**CO4**
7	Derive the Diffusivity Equation. OR Discuss the solution of the diffusivity equation for the following conditions a) Bounded Cylindrical Reservoir b) Infinite cylindrical reservoir with line source c) Pseudo steady state solution	**10**	**CO4**
8	From the given well log data identify lithology. Evaluate shale volume, porosity, water saturation and hydrocarbon saturation at a depth 7200 ft. (Given Resistivity of formation water is 0.1 ohm m) [Attach the interpreted well logs along with the	**10**	**CO3**

	answer sheet]  		
9	Graphically illustrate the relation between the pressure and rates for the following tests. a) Flow after flow test b) Isochronal test c) Modified isochronal test	**10**	**CO5**

SECTION-C

10	Following completion, a well is produced for a short time and then shut in for a buildup test. The production history and reservoir and fluid properties are given below. a) Calculate pseudo producing time. b) Calculate the drawdown by Superposition Principle. c) Calculate the drawdown by Horner's Approximation and justify its application. d) Compare the above results. P_i = 2500Psi B=1.32 RB/STB μ=0.44cp k=25md h=43ft C_t =18x10^{-6} psi-1 Ø=0.16 Production time(hours) / Total production (STB) 25 / 52 12 / 0 26 / 46 72 / 68 OR A well and reservoir have the following characteristics: The flowing well is producing only oil; it is producing at the constant rate of 200 STB/D. Data describing the well performance are μ = 0.62 cp, *k* = 16 mD Ct = 1.0 x 10-5 psi-l Pi = 3,200 psia, J = 0.5r STB/psi-D B0 = 1.475 RB/STB, h = 158 ft ϕ = 0.23 Calculate the distance of shut-in well from the flowing well when shut-in was performed for a period of 2 days following a flow period of 8 days.	**20**	**CO4**
11	A new oil well produced 500 STB/D for 3days; it then was shut in for a pressure buildup test, during which the data in following were recorded. For this well, net sand thickness, h, is 22ft; formation volume factor, Bo, is 1.3 RB/STB; porosity is	**20**	**CO5**

	0.2; total compressibility, total compressibility is 20x 10-6 Psi^{-1}; oil viscosity is 1.0cp; and well bore radius is 0.3ft. From these data, estimate formation permeability, initial reservoir pressure and skin factor.		

Time after Shut in (hours)	P_{WS} (Psi)
0	1150
2	1794
4	1823
8	1850
16	1876
24	1890
48	1910

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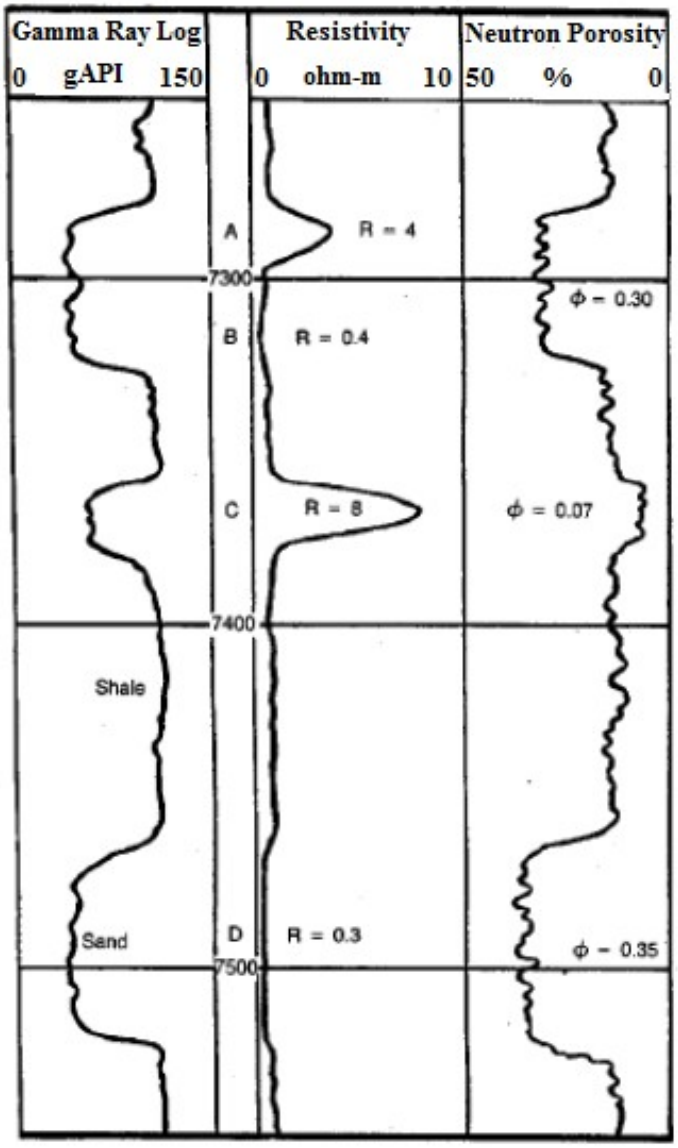
SECTION A

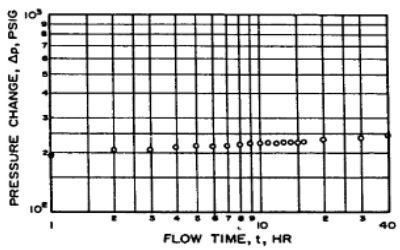
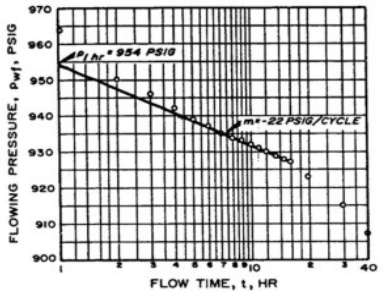
S. No.		Marks	CO
1	Discuss the conditions under which Horner's Approximation is applicable.	**4**	**CO4**
2	Write down the expressions of dimensionless time, distance and pressure for diffusivity equation.	**4**	**CO4**
3	Explain the following processes a) Neutron emission b) Neutron scattering c) Neutron Emission	**4**	**CO1**
4	Discuss the uses of SP log.	**4**	**CO1**
5	Evaluate the porosity of sandstone formation, if the interval transit times of the formation, matrix and fluid are 95 µs, 35 µs and 170 µs respectively.	**4**	**C02**

SECTION B

6	"According to superposition principle, the total flow rate at any point in the reservoir is the sum of flow rates at that point caused by flow in each of the wells in the reservoir." Justify this statement mathematically.	**10**	**CO4**
7	Derive the solution for the Diffusivity Equation for infinite acting reservoir with line	**10**	**CO4**

	source well for overbalanced well. OR A pressure build-up test analysis for a well with q = 83 STB/D, B = 1.12 RB/STB, μ = 3.15 cp, h = 12 ft, r_w = 0.265 ft, and $p_{avg} - p_{wf}$ = 265 psia gave k = 155 mD and s = 2.2. Find the pressure drop across the skin, the flow efficiency, the damage ratio, the damage factor, and the apparent wellbore radius.		
8	Wireline logging was performed on April 2018 in Well No 15/9-FC in XYZ oil field to identify new hydrocarbon bearing zones. The Gamma ray log was recorded to identify the lithology, resistivity log was acquired to identify the fluid type in the reservoir zone and to determine the porosity neutron log was acquired which is sensitive to the hydrogen index of the formation.	**10 (3+3+3 +1)**	**CO3**

	 a. Identify the reservoir and non-reservoir zones. b. Classify the reservoirs as hydrocarbon bearing or water bearing. c. Classify hydrocarbon bearing zones as oil bearing and gas bearing. d. Identify an OWC (Oil Water Contact) in the given logs.		
9	A flowing well is completed in a reservoir that has the following properties. μ = 0.44 cp, k = 25 mD Ct = 18 x 10-6 psi-l Pi = 2500 psia, B0 = 1.4 RB/STB, h = 43 ft ϕ = 0.16	**10**	**CO4**

	Calculate the pressure drop be 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.		
	SECTION-C		
10	Estimate oil permeability and skin factor from the draw down data of given figures: log-log and semi-log plots. reservoir data are:- $h = 130$ ft $\phi = 0.20$ $r_w = 0.25$ ft, $p_i = 1154$ psia $q_o = 348$ STB/D $m = -22$ psi/cycle $B = 1.14$ RB/STB $\mu = 3.93$ cp $p_{1hr} = 954$ psi $C_t = 8.74 \times 10^{-6}$ psi^{-1}   OR Graphically illustrate and explain the relation be… for the following tests. d) Flow after flow test e) Isochronal test f) Modified isochronal test g) Horner's plot for hydraulically fractures h) Horner's plot for well off centered in the	**20**	**CO5**
11	For the following simulated well-test data deter…	**20**	**CO5**

Δt (hours)	p_{ws} (psi)
0	1,094.897
0.0332947	1,122.317
0.1551056	1,217.656
0.3332977	1,344.633
0.5332947	1,471.678
0.7333069	1,584.464
0.9848022	1,708.728
1.233307	1,814.685
1.533295	1,924.317
1.871201	2,027.047
2.233307	2,117.398
2.633301	2,198.191
2.818207	2,229.975
3.433304	2,315.763
3.830093	2,358.232
4.911301	2,439.504
6.066498	2,491.655
7.300705	2,525.854
8.619293	2,548.988
10.02831	2,565.269
11.53360	2,577.269
13.14200	2,586.563
14.86050	2,594.116
16.69659	2,600.520
18.65829	2,606.144
20.75430	2,611.217
22.99380	2,615.861
25.38651	2,620.230
27.94310	2,624.321
30.67450	2,628.196

	$k = 48$ mD $\quad s = +10$ $\phi = 0.20$ $\quad t_p = 150$ hrs $r_w = 0.25$ ft, $\quad p_i = 1154$ psia $q = 500$ STB/D $\quad h = 17$ ft		