UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Program/course: M.TECH PE   Semester –   II
Subject: Formation Evaluation & Well Logging   Max. Marks   : 100
Code   : PEAU 7005   Duration   : 3 Hrs
No. of page/s: 03

Notes: Attempt all the questions from Section A & B.
       Attempt any one questions from Section C

Section A [5X4=20 Marks]

1- Define the formation evaluation and illustrate the borehole environment. **[5]**

2- Relate any five application of drilling fluid. [5]

3- Classify the tools use for formation evaluation. [5]

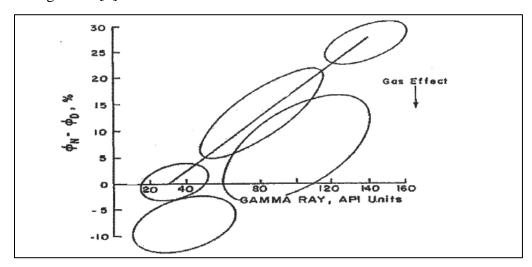4- Create the resistivity profile of invasion and application well log analysis. [5]

Section B [12X5=60 Marks]

5- Differentiate Any Three: [4X3=12]

      a- Formation water & Mud filtrate.

      b- Thermal Neutron & Epithermal Neutron.

      c- Gamma Ray log & Gamma Gamma Ray log.

      d- MWD & LWD

6- In Cambay basin, a well is producing from tarapur formations of 10-ft thickness and well drainage is 20 acre. Density log shows porosity 30 %. Resistivity logs show Rt equals to 5 Ω m and Rxo equal to 2 Ω m. Formation water resistivity is 0.5 Ω m and mud filtrate resistivity is 1.5 Ω m at formation temperature.

      a- Calculate the movable oil.   **[6]**

      b- Estimate the type of the used drilling fluid in this well. If in a lower sandstone section of the same porosity (Rw and Rmf are the same), resistivity logs showed Rt equal to 0.8 Ω m and Rxo equals to 10 Ω m. Determine water saturation of this section and do you think this is oil zone?. [6]

7- a- Please choose the correct answer for fill in the blanks: [6X1=6]
      i-   Gamma ray log is use to evaluate ………………..
      ii-   Laterolog log is affected by…………content in drilling mud.

iii- Neutron and Density porosity Equations………..

iv- Presence of formation fluids best detected by………….tool.

v- Caliper log help to measure ………….

vi- Moveable H.C. & Producible Hydrocarbon Index Equations…..

b-Calculate the SSP for a clean, predominantly NaCl water bearing sand drilled with a fresh water base mud (also predominantly NaCl). The formation temperature is 200^0F and Rmf, Rw measure respectively at 68^0F temperature are 0.31 and 0.054 ohm-m respectively. [6]

8- a- Below figure shows a cross plot of $(\Theta_N-\Theta_D)$ vs. gamma ray for a specific log interval, as it can be seen on the figure, five different zones were observed and each zone is shown by an ellipse. Assume that the detected zones are: 1- shelly gas bearing formation 2- clean gas bearing formation 3- shelly liquid bearing formation 4- shale 5- clean liquid bearing formation. Show each zone on the corresponding ellipse in below figure.   [6]

b- Describe the sonic tool in terms of working principle and applications. **[6]**

9- In thick sandstone, formation has porosity 20%. If Rw is equal to 0.09 Ωm, Rmf is equal to 0.07 Ωm, and the residual hydrocarbon saturation in the flushed zone is 40%; what will be the value of Rxo and Rt in the water and hydrocarbon zones, if water saturation in the hydrocarbon zone is equal to 30%. **[12]**

Section C [1X20=20 Marks]

10- (a) An interval transit time of 90 µsec/ft was measured in a sandstone reservoir. The acoustic velocity of the matrix was 18000 ft/sec. What is the interval transit time of the matrix? Assume a fluid transit time of 189 µsec/ft. Calculate the porosity in the sandstone reservoir using Wyllie's time average equation. [10]

b- Describe three methods for determination of shale volume in shelly sand reservoir. Calculate minimum shaliness from Grlog =40 , Grmin =20 , Grmax =100 ,Phin = 30% , PhiNsh = 45% . PhiD =25% , PhiDsh = 20% ,PSP = -60mv and SSP = - 80 mv? [10]

11- Classify the logging tools with name; use to evaluate Lithology, Porosity, Saturation, and Resistivity. Describe the working principle and applications of SP logging tool. [20]

………………………………………………………………………………………………

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Section A [5X4=20 Marks]

1. Define the mud cake and transit time. [5]

2. Differentiate Flushed zone and Virgin Zone. [5]

3. Relate the significance of football effect. What does it indicate? [5]

4. Define the porosity, permeability and movable Hydrocarbon Index. [5]

Section B [12X5=60 Marks]

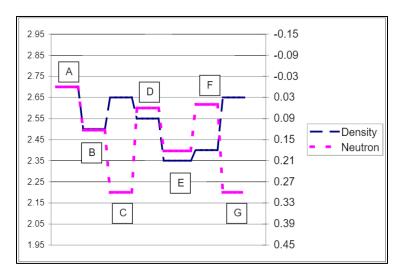5. **(a)** Using the following parameters calculate **SW & Sh**. **[6]**

DPHI	0.23
NPHI	0.24
VSH	0.03
RW	0.08
RT	34

(b). Use the following facts and find out **Rw**.   **[6]**

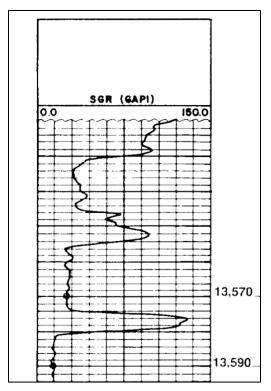| Porosity	Rt
19.0	4.2
15.0	6.7
12.0	10.4
17.0	5.2
13.0	8.9

6. Describe three methods for determination of shale volume . Calculate minimum shaliness from Grlog =40 , Grmin =20 , Grmax =100 ,$Phin^{00}$ = 30% , Phinsh = 45% . Phid =25% , Phidsh = 20% ,PSP = -60mv and SSP = - 80 mv? [12]

7. Differentiate **Any Three [4X3=12]**

    a. Membrane potential & Liquid junction potential
    b. Gamma Ray log & Spectrometry log

    c.   Conventional core and Side wall core

    d.   Mud log and LWD

8. Write a short note on **Any Three [4X3=12]**

    a. Sonic porosity tool

    b. Density Porosity tool

    c. Caliper log

    d. Induction tool

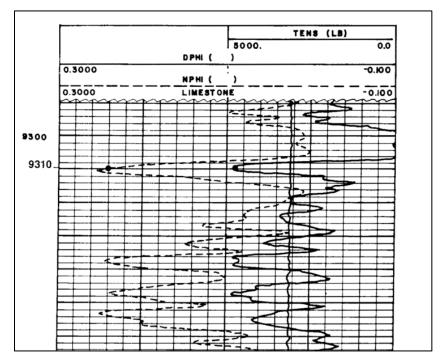9. Explain interpret the combination of Density and Neutron log responses from zone A to G. [12]

Section C [1X20=20 Marks]

10. Calculate the gamma ray index and volume of shale for the above formation at a depth of 13570 ft. Given that is the formation is consolidate. Discuss the working principle and application of LL9. [20 marks]

11. Calculate the true porosity at the depth of 9310ft. Where is the anomalous zone for formation water content/hydrocarbon content/gas content from the given throughout the log data. Develop the Archie's equations. [20]

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