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Federal University of Technology
School of Engineering and Engineering Technology
Department of Petroleum Engineering

2019/2020 Rain Semester Examination PET 304-Reservoir Engineering I

Instructions: Answer any six questions

Time: 3 hours

- 1(a)(i) Define the term 'Porosity'. (ii) Explain five factor that influences the porosity of a formation
 (b) Differentiate between the following: (i) Absolute porosity and Effective porosity (ii) Reservoir pore volume and Hydrocarbon pore volume (iii) Reservoir barrel and Stock tank barrel
 (c) Calculate the Average Porosity of a layered reservoir strata from the 2D seismic data tabulated below:

LAYER	THICKNESS (feet)	POROSITY (%)	AREA (acre)
A	10	25	2000
B	5	20	1500
C	20	15	1000
D	10	20	500

- 2 (a). List and briefly explain the three types of permeability.
 (b). A well in the Addax field was producing with a flow Rate of 9000b/d under a pressure differential of 300psi. The well and Reservoir Data from the field are given in the Table below. Calculate the permeability to oil?

s/n	parameters	value
1	Wellbore radius (inches)	12
2	Drainage radius (ft)	500
3	Oil viscosity (cp)	0.5
4	Reservoir temp. (°F)	140
5	Oil form. vol. factor (rb/stb)	1.2
6	Pay thickness (ft)	30

- 3(a). Use sketch where necessary and briefly explain the following Terms as applied to Reservoir Engineering. (i) Net Overburden Pressure, (ii) Over burden effects on porosity, and (iii) compressibility of porous Rock.
 (b). State the generalized capillary equation and define the Terms.

- 4(a). Briefly explain the different types and classes of compressibility.
 (b). State the Darcy's Equation of permeability and explains the parameters. (c) List five Assumptions made when darcy's equation of permeability is used.

- 5 (a) An oil-water system has the following data: $\theta = 25^\circ$, $\rho_w = 1.0 \text{ gm/cm}^3$, $\rho_o = 0.68 \text{ gm/cm}^3$, $r = 10^{-4} \text{ cm}$, $\sigma_{ow} = 28 \text{ dynes/cm}$. Calculate (i) the capillary pressure (ii) the capillary rise

(b) Show that
$$P_c = \frac{2\sigma_{ow} \cos\theta}{r}$$

- 6 (a) glass capillary tube is placed in a large open vessel containing water and the following data are available:

$\theta = 23^\circ$, $\rho_w = 1.2 \text{ gm/cm}^3$, d (diameter of tube) = 0.2 cm , $g = 980 \text{ cm/s}^2$

Calculate (i) the surface tension between air and water (ii) the total upward force which holds the liquid up (iii) the downward force of mass

- (b) Write short notes on the following: (i) Wettability (ii) surface and interfacial tension (iii) Capillary Hysteresis

- 7 (a) What is electrical resistivity of a fluid saturated rock?

(b) List the nonconductive materials in a multi fluid saturated medium

(c) Explain the effects of wettability in measurement of electrical properties of fluid saturated sandstone reservoirs

(d) Determine the porosity for a sandstone using Archie's and Humble equation. The formation water's resistivity was 0.67 ohm-meters. The formation rock 100% saturated with this water was 45.05 ohm-meters. Which of the two equations will give the most reasonable answer?

- 8 (a) state the J- Function equation, define the parameters and their units.

(b) Discuss the factors affecting fluid saturations evaluation in a porous medium

(c) list methods of determining fluid saturation

(d) differentiate between the interfacial tension and surface tension, Give 2 examples in each where each of these boundary tensions occur