BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: CHEM ENGG./CEP&P **SESSION : MO/18**

SUBJECT: CL7023 INTRODUCTION TO PETROLEUM RESERVIOR ENGG.

TIME: 3 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What are absolute porosity and effective porosity? Discuss how their properties are determining. Define the term "Permeability" of reservoir rock. [6]

Q.1(b) A gas flows through a core sample of 1-inch diameter and 1- inch length. The upstream pressure is 190 mm Hg gauge, the discharge pressure is 1 atmosphere and the flow rate are 6.2 cc/sec at that pressure. Calculate the permeability of the sample. Given, viscosity of gas=0.018cp. [6]

Q.2(a) Oil and gas are flowing simultaneously downward through a reservoir which is inclined at some angle to the horizontal. Starting from Darcy's law show that fraction of gas flowing [6]

$$F_g = \frac{1 + \frac{K_o}{\mu_o}\frac{A}{q_t}[\Delta\rho\, sin\alpha - \frac{\delta P_c}{\delta L}]}{[1 + \frac{K_0}{K_g}\frac{\mu_g}{\mu_o}]}$$

Given, q = $\frac{KA}{\mu}[\frac{\delta P}{\delta L} + \rho sin\alpha]$ where the term has usual significance.

Q.2(b) Starting from the equation [6]

$$q = \frac{2\pi Kh\Delta P}{\mu ln\frac{r_e}{r_w}}$$

show that the field relative permeability is given by
$\frac{K_g}{K_o}$=(R-R_s)$\frac{\mu_g B_g}{\mu_o B_o}$

where the term has usual significance.

Q.3(a) What is retrograde condensation? With a net Pressure- Temperature diagram show the region of retrograde condensation. Define to the following terms: (i) Critical Point. (ii) Cricondenbar. (iii) Cricondentherm. [6]

Q.3(b) With net Sketches discuss the different types of well arrangements used in fluid injection operation. [6]

Q.4(a) Discuss in brief the methods used for the maintenance of pressure of a reservoir. [6]

Q.4(b) Explain Klinkenberg Effect in reservoir engineering. [6]

Q.5(a) Discuss in brief the Churn/Cable-tool drilling method. How larger formation samples are collected in this method. [6]

Q.5(b) What is dissolving power of acid, X? A carbonate reservoir rock is to be treated with 15% HCl. Calculated the dissolving power of the acid, X [6]
Given, molecular weight of $CaCO_3$= 100.09(pure).
Molecular weight of 100% HCl=36.47.

Q.6(a) Discuss in brief the following methods of improving oil recovery [6]
(i) Carbonated water flooding.
(ii) Alternative gas-water injection
(iii) Thermal oil recovery

Q.6(b) Show that for close gas reservoir the pressure-production history is given by [6]
$\frac{P}{Z} = \frac{P_i}{Z_i} - V_g(\frac{0.00504T_i}{G})$
where P_i,T_i = Initial pressure and temperature
P= Pressure at any time

PTO

Q.7(a) Discuss in brief the method of stimulation of well by acidizing with special mention of [6]

(i) Method of acidizing
(ii) Acid type and additives
(iii) Acid system used

Q.7(b) Determine the area extent of the reservoir with the following data: [6]

H=10ft, φ=0.1, S_{wi} = 0.35, Temp=175^{o}F
Original pressure=3000psia
$V_g = 4x10^8$ SCF of gas the reservoir pressure is 2000 psia.
Given P_i = 3000psia, Z_i = 0.88
At P=2000psia, Z=0.89

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