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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**SUMMER END TERM Examinations, August 2024**

**Semester**: Summer Term

**Course Code**: PET2004

**Course Name**: Fundamentals of Petroleum Reservoir Engineering

**Program**: B.Tech. (Petroleum)

**Date**: 05/Aug/2024

**Time**: 09:30 AM – 12:30 PM

**Max Marks**: 100

**Weightage**: 50%

**Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Do not write any matter on the question paper other than roll number.*

**Part A [Memory Recall Questions]**

**Answer any three Questions. Each question carries ten marks. (3Qx 10M= 30M)**

1. Draw a neat phase diagram for an oil reservoir. Label all its components and define the same.

(C.O.No.2) [Knowledge]

2. Define permeability. Briefly write its classification. What is the Unit and Alphabetical notation used for Permeability? (C.O.No.2) [Knowledge]

3. State Darcy’s law and discuss its assumptions. (C.O.No.3) [Knowledge]

4. Draw the relative permeability curve for oil water system and explain the same.

(C.O.No.3) [Knowledge]

**Part B [Thought Provoking Questions]**

**Answer any two Questions. Question carries fifteen marks. (2Qx15M=30M)**

5. Read the following statements and comment.

a. A rock can have high porosity but may not be suitable as a reservoir rock.

b. Darcy’s law is ideally possible but practically impossible.

c. While fluid rise through a capillary the movement will stop after a certain height.

d. Contact angle is way to measure wetting behavior of a fluid

e. As the reservoir pressure declines below the bubble-point pressure, gas evolves from the oil phase and however this gas will not flow until a certain limit is crossed.

(C.O.No.3) [Comprehension]

6. Interpret the concept of Transition Zone, Free Water Line (FWL), Oil-Water Contact (OWC) with the help of Restored Capillary Pressure Technique. Draw relevant diagram.

(C.O.No.3) [Comprehension]

7. Summarize the concept of Capillary Pressure “Pc”, Surface Tension (σ), Contact Angle (θ) and Capillary Height “h” for an Oil water system using a mathematical derivation. Do draw appropriate diagram. (C.O.No.1) [Comprehension]

**Part C [Problem Solving Questions]**

**Answer any two Questions. Question carries twenty marks. (2Qx20M=40M)**

8. Solve the following:

a. A brine is used to measure the absolute permeability of a core plug. The rock sample is 4 cm long and 3 cm2 in cross section. The brine has a viscosity of 1.0 cp and is flowing a constant rate of 0.5 cm3/sec under a 2.0 atm pressure differential. Calculate the absolute permeability.

b. Rework the above example assuming that an oil of 2.0 cp is used to measure the permeability. Under the same differential pressure, the flow rate is 0.25 cm3/sec.

(C.O.No.3) [Application]

9. An oil reservoir exists at its bubble-point pressure of 3,000 psia and temperature of 160°F. The oil has an API gravity of 42° and gas-oil ratio of 600 scf/STB. The specific gravity of the solution gas is 0.65. The following additional data are also available:

Reservoir area= 640 acres; Average thickness=10 ft; Connate water saturation= 0.25

Effective porosity= 15%; Calculate the initial oil in place in bbl.

(C.O.No.4) [Application]

10. Calculate the pressure difference, i.e., capillary pressure, and capillary rise in an oil-water system from the following data:

θ=30° Density of water= 1 gm/cm3; Density of oil= 0.75 gm/cm3

Radius of capillary= 0.0001 cm; Oil-Water interfacial tension= 0.25 Dyne/cm

Also, if a a core sample with length 10 cm, breadth of 4cm and width 4 cm. Weight of the sample is 282.4 gm in its dry form. The core is then saturated with 100% with brine of density 1.1 gm/cc. The brine saturated core weight is 300 gm. Find the Porosity of the sample.

(C.O.No.4) [Application]