Roll No												

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

MAKEUP EXAMINATION – JAN 2023

Date: 23-JAN-2023
Time: 01:00 PM to 04:00 PM
Max Marks: 100
Weightage: 50%

Course Code: PET 225
Course Name: Advanced Reservoir Engineering and Management
Program : B.Tech

Instructions:

(i) Read the all questions carefully and answer accordingly.
(ii) Question paper consists of three parts: Part A, Part B and Part C
(iii) Attempting all questions is mandatory. Some questions contains multiple parts.
(iv) *Use normal graph paper for Part C question, and tie the plotted graph paper inside the answer sheet.*

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries FOUR marks. (5Q x 4M = 20M)

1. List the different primary reservoir driving mechanisms. Detail briefly as the presence of which among these mechanisms makes the reservoir as good prospects and weaker prospects for water flooding? (C.O. No. 2) [Knowledge]

2. What is the primary reason behind influx of water into the hydrocarbon reservoir. Detail all the conditions leading to the water influx through diagrammatic approach? (C.O. No. 1) [Knowledge]

3. Define the instantaneous GOR of a depletion drive reservoir. Express it mathematically in terms of fluid and rock properties with proper nomenclature. (C.O. No. 3) [Knowledge]

4. What is an Absolute Open Flow (AOF) Potential in an inflow performance relationship of a well? Mark AOF in the IPR curve. Can we measure the AOF in real conditions? (C.O. No. 3) [Knowledge]

5. What is water and gas coning, explain briefly through a proper illustration? List the forces affecting the fluid flow distribution around the wellbores and their effect on coning? (C.O. No. 4) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries TWENTY marks. (2Q x 20M = 40M)

6. Briefy give your insights about the following given terms:

i. Specific Productivity Index (C.O.No.3) [Comprehension]

ii. Critical Production Rate

iii. Stable and Unstable Cone

iv. Residual oil and Connate water saturation

7. **A.** In order to develop an approach to calculate the increase in average water saturation in the swept area. Buckley and Leverett (1942) developed a well-established theory called the frontal displacement theory. Give your understanding about the fractional flow of water in an oil reservoir? Highlight its significance on waterflooding by illustrating through the relative permeability curve and fractional flow curve (for an oil reservoir). (C.O. No 2) [Comprehension]

B. Overall recovery efficiency of hydrocarbons is determined considering the displacement in all possible directions. Provide your understanding of the overall recovery efficiency in terms of different efficiency factors, and detail the major factors affecting them. Also give brief details about displacement efficiency of waterflooding? (C.O. No 2) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries TWENTY marks. (2Q x 20M = 40M)

8. **A.** Using the relative permeability curve (Fig. 2) given below, plot the fractional flow curve on a graph paper for a dipping reservoir system under the waterflooding. The water injection rate in waterflooding is 1000 bbl/day. The oil viscosity is considered constant at 1 cP. Calculate the fractional flow curve for the reservoir dip angles of 10^o and 20^o, assuming

(a) updip displacement

(b) downdip displacement. (C.O. No. 2) [Application]

Viscosity of water (μ_w) = 0.5 cP
Density of water, ρ_w = 64 lb/ft^3
Water formation volume factor B_w = 1.05 bbl/STB
Cross sectional Area A= 25,000 ft ^{2}

Absolute Permeability = 50 mD
Oil formation volume factor B_O = 1.2 bbl/STB
Density of oil (ρ_o) = 45 lb/ft^3

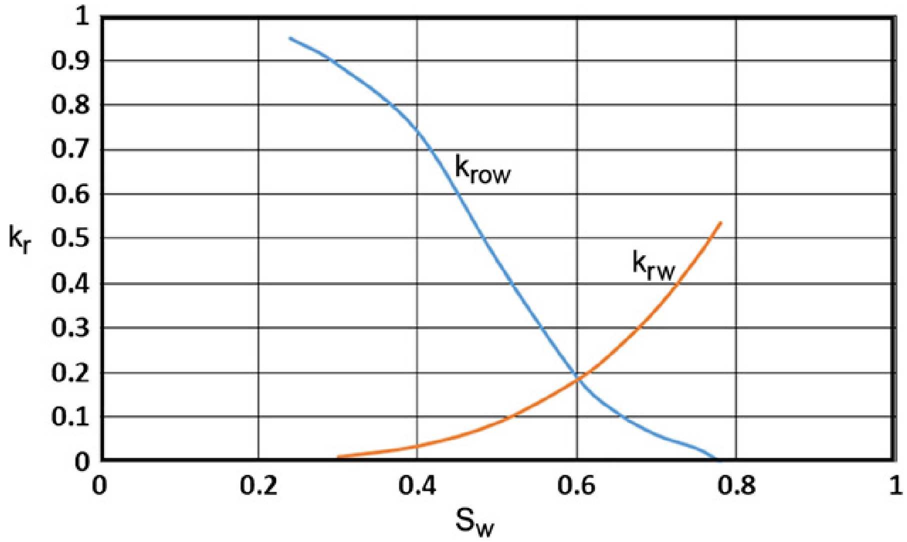

Fig 2. Relative permeability data

B. Explain the variation in the relative permeability curves of oil and water with respect to water saturation in the **Fig. 2** given above? Provide the values of the residual oil saturations and connate water saturations in Fig. 2? (C.O. No. 2) [Application]

9. A vertical well is drilled in an oil reservoir that is overlaid by a gas cap and underlaid by a vertical well is drilled in an oil reservoir overlaid by a gas cap. The related well and reservoir data are given as follows:

oil density, ρ_o = 47.5 lb/ft^3

water density = 63.76 lb/ft^3

gas density, ρ_g = 5.1 lb/ft^3

oil viscosity, μo = 0.73 cp

oil formation volume factor, Bo = 1.1 bbl/STB

oil column thickness, h = 65 ft

well perforated interval, hp = 15 ft

depth from GOC to top of perforations, Dt = 25 ft

wellbore radius, r_w = 0.25 ft

drainage radius, r_e = 660 ft

Oil effective permeability, Ko= 93.5 md

Horizontal and vertical permeability .i.e. Kh= 110 md, Kv= 110 md

Oil relative permeability, Kro= 0.85

Using the above data determine the maximum permissible oil rate that can be imposed to avoid cones breakthrough .i.e water and gas coning? (C.O. No. 4) [Application]

B. Is coning phenomena avoidable in oil and gas production and if it is avoidable, should it be avoided during oilfield life? Give your brief insights on this statement? (C.O. No. 4) [Application]