PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM EXAMINATION AUGUST -2024

Semester: Semester IV- DCET

Course Code: PET2004

Course Name: Fundamentals of Petroleum Reservoir Engineering

Program & Sem: B.Tech. & IV Sem (DCET-4PET-1)

Date: 12/08/2024

Time:9.30AM -12.30PM

Max Marks: 100

Weightage: 50%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number

Part A [Memory Recall Questions]

Answer any five the Questions. All question carries four marks   (5Qx 4M= 20M)

1. Outline the difference between Primary, Secondary and Tertiary drive mechanisms.

(CO4)   [Knowledge]

2. Define Fluid Potential. Write its equation and mention various sign convention used while calculating Fluid Potential.   (CO3)   [Knowledge]

3. Define "1 Darcy". What is the significance of negative sign in Darcy's law for linear flow? Why negative sign is not required for Radial Darcy's law.   (CO2)   [Knowledge]

4. Why N_2 or Helium Gases are used in permeability measurement of a core sample in laboratory? Find the dimension of Permeability.   (CO2)   [Knowledge]

5. Define: Cricondentherm, Cricondenbar, Critical Point and Quality lines.   (CO2)   [Knowledge]

6. Define Wetting Phase and Non-Wetting Phase. How contact angle helps in measurement of wetting and non-wetting phase.   (CO1)   [Knowledge]

7. Answer the following:

(i) A reservoir has Pore to Grain volume ratio 1:3. Then the porosity of the rock sample is _____%.

(ii) 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. The Porosity of the sample is _____%.   (CO1)   [Knowledge]

Part B [Thought Provoking Questions]

Answer any four the Questions. Each question carries ten marks. **(4Qx10M=40M)**

8. Explain the concept of Steady state, Un-steady state and Psudosteady state with a suitable diagram and mathematical equations. (CO3) [Comprehension]

9. Derive the equation for Linear, compressible and steady state flow of fluid through porous media.

(CO3) [Comprehension]

10. Derive the Darcy's equation for an incompressible, steady state equation for (a) Linear and (b) Radial flow. (CO4) [Comprehension]

11. Derive the equation for Linear, slightly compressible and steady state flow of fluid through porous (CO4) [Comprehension]

12. Explain Klinkenberg effect on permeability measurement with relevant diagram.

(CO2) [Comprehension]

13. 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. (CO2) [Comprehension]
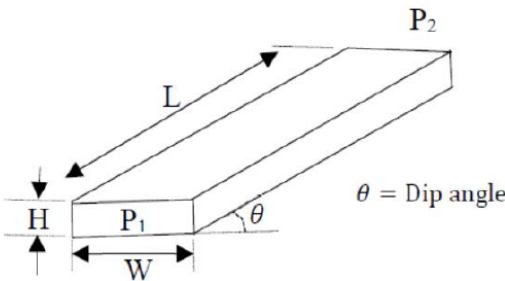

Part C [Problem Solving Questions]

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

14. An incompressible fluid flows in a linear porous media with the following properties:

L = 2000 ft.; h = 20′; width = 300′; k = 100 md; Porosity= 15%; μ = 2 cP; P1 = 2000 psi, P2 = 1990 Psi. Assume that the porous media with the properties as given above is tilted with a dip angle of 5° as shown in Figure. The incompressible fluid has a density of 42 lb/cf, then estimate

a. Flow rate in bbl/day

b. Apparent fluid velocity in ft/day

c. Actual fluid velocity in ft/day

(CO4) [Application]

15. An oil well in the Nameless Field is producing at a stabilized rate of 600 STB/day at a stabilized bottom-hole flowing pressure of 1800 psi. Analysis of the pressure buildup test data indicates that the pay zone is characterized by a permeability of 120 md and a uniform thickness of 25 ft. The well drains an area of approximately 40 acres. The following additional data is available:
r_w= 0.25ft A= 40acres; Bo= 1.25 bbl/STB μ_o= 2.5 cP
Calculate the pressure profile (distribution) and list the pressure drop across 1 ft intervals from r_w to 1.25 ft, 4 to 5 ft, 19 to 20 ft, 99 to 100 ft, and 744 to 745 ft. (Use graph to draw pressure profile)
(CO3) [Application]

16. An incompressible fluid (density = 40 lb/ft3) flows at a steady state through a linear porous media with the following properties: The absolute value of the difference between the actual fluid velocity (ft/day) at $\theta = 0°$ and $\theta = 10°$ is _____ (rounded off to three decimal places).

Length (L) = 1500 ft	Permeability = 150 mD
Height (H) = 15 ft	Viscosity = 1.5 cP
Width (W) = 30 ft	Inlet pressure (P_1) = 1600 psi
Porosity = 18%	Outlet pressure (P_2) = 1590 psi

θ = Dip angle

(CO3) [Application]