Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2022-23 Examination

Semester: 4 **Date: 24/03/2023**

Subject Code: 203120255 **Time: 2.00pm to 4.30pm**

Subject Name: Elements of Reservoir Engineering **Total Marks:60**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (Fill in the blanks, one word answer, MCQ-not more than Five in case of MCQ) (All are compulsory) (Each of one mark) **(15)**

1. Define Bubble Point pressure?
2. Explain variation of Oil formation volume factor (B_O) with pressure in short with a graph?
3. Write down the formula of Oil compressibility below bubble point pressure?
4. What do you mean by Effective Porosity?
5. What do you mean by Residual Oil saturation?
6. In which drive mechanism gas-oil ratio increases continuously in up-structure wells.
7. Write down the pressure equation of the Ei-Function Solution.
8. Material Balance Equation (MBE) is _____ dimensional equation.
9. Low API gravity oil reservoir with an oil-water contact will have a _____ transition zone than a high API gravity oil reservoir
10. A well that only partially penetrates the pay zone could result in _____ flow.
11. When the pressure in the reservoir is declining linearly, i.e., at a constant declining rate is called _____.
12. Which oil reservoirs are having gas-oil ratios between 2,000-3,200 scf/STB?

(A) Ordinary black oil (B) Low-shrinkage crude oil

(C) High-shrinkage (volatile) crude oil (D) Near-critical crude oil

13. What is the effect on the additional pressure loss if skin value increases from 2 to 4 and effective permeability reduces from 50 mD to 25 mD assuming other parameters remaining are the same.

(A) reduces to half (B) gets doubled

(C) increases four times (D) remains same

14. An increased well inflow rate (Q) can be achieved by:

(A) decreasing the factor (k*h) (B) increasing skin factor

(C) decreasing r_e/r_w (D) increasing viscosity

15. Where capillary pressure is zero?

(A) Free water level (FWL) (B) Water-Oil contact (WOC)

(C) Gas-Oil contact (GOC) (D) Gas-Water contact (GWC)

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Explain the Differential liberation (Vaporization) test in detail with a diagram?

B) Length and diameter of core plug are 2 cm and 2.52 cm respectively. Oil viscosity is 1.82 cp. Inlet pressure and outlet pressure is 2 atm and 1 atm respectively. Flow rate is 0.275 cm^3/sec. Calculate the permeability of the core sample in mD?

C) Explain High-shrinkage (volatile) crude oil with P-T diagram and liquid shrinkage curve.

D) A core sample is analyzed in the laboratory which yielded the following parameters: Porosity = 0.22, Permeability = 80 mD. Observed capillary pressure is 6.5 psi at Sw = 50%. Assume interfacial tension is 45 dynes/cm and angle of contact is 45°. Calculate the Leverett J-Function for a core sample at a saturation of 50% up to three digits.

Q.3 A) An oil well produced at a constant rate of 320 STB/day. Total production during constant rate was reported to be 0.245 MMSTB. After this period well experienced a constant decline of 18% per year and was abandoned when reached an economic limit of 85 STB/day. Calculate the total time (in years) for which the well had produced? (1 year = 365 days). **(07)**

B) An oil well is producing at a constant flow rate of 300 STB/day under unsteady state flow conditions. The reservoir has the following rock and fluid properties: Bo = 1.25 bbl/STB, μo = 1.5 cp, $c_t = 12*10^{-6}$ psi^{-1}, ko = 60 md, h = 15 ft, p_i = 4000 psi, ϕ = 15%, r_w = 0.25 ft. Calculate the bottom-hole flowing pressure after 10 hours of production. **(08)**

OR

B) Derive the flow rate equation for Linear Flow of Compressible Fluids (Gases)? **(08)**

Q.4 A) Calculate average oil and connate water saturation (in %) from following measurements: **(07)**

Sample	Thickness, ft	Porosity, %	Oil saturation, %
1	1.2	10	75
2	1.4	12	77
3	1.6	14	71
4	1.8	15	68
5	2.0	13	74
6	2.2	16	72

OR

A) An oil well is producing at a constant oil flow rate of 1250 STB/day under a semisteady-state flow regime. Well testing data indicate that the pressure is declining at a constant rate of 5.64 psi/hr. Following additional data are available: h = 35 ft, ϕ = 18%, Bo = 1.43 bbl/STB, ct = $14*10^{-6}$ psi^{-1}. Calculate the well drainage area in Acres? **(07)**

B) Explain the Pressure-Temperature diagram for a multicomponent system in details? **(08)**