| Roll No. | | | | | | | | | | | | |
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**PRESIDENCY UNIVERSITY**
**BENGALURU**

## School of Engineering

## Mid - Term Examinations - November 2024

**Semester**: V | **Date**:6-11-2024

**Course Code**: PET2019 | **Time**: 02:00pm – 03:30pm

**Course Name**: Oil and Gas Well Test Analysis | **Max Marks**: 50

**Program:** B.Tech. (Petroleum Engineering) | **Weightage**: 25%

**Instructions:**

*(i) Read all questions carefully and answer accordingly.*

*(ii) Do not write anything on the question paper other than roll number.*

### Part A

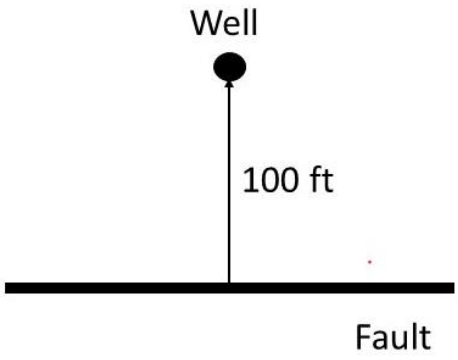
**Answer ALL the Questions. Each question carries 2 marks. 5Qx2M =10M**

| | | | | |
|---|---|---|---|---|
| 1 | Write down Horner's Equation. Also state any two assumptions for Horner's Equation | 2 Marks | L1 | CO1 |
| 2 | Define radius of investigation. Write down formula to calculate it. | 2 Marks | L1 | CO1 |
| 3 | Define unsteady state with respect to petroleum reservoir. | 2 Marks | L1 | CO1 |
| 4 | Discuss the information we get from pressure build-up test. | 2 Marks | L1 | CO2 |
| 5 | List the steps of ideal pressure build-up test with diagram. | 2 Marks | L1 | CO2 |

### Part B

**Answer ALL the Questions. Each question carries 10marks. 4Qx10=10M**

| | | | | |
|---|---|---|---|---|
| **6** | The illustration (as shown in the figure) depicts a fault situated 100 feet away from a production well. | **10Marks** | **L2** | **CO1** |



Under non-steady-state flow conditions, the well is producing oil at a consistent rate of 200 barrels per day. Below are the details regarding the well and reservoir data:

$\mu$ = 2 cp; k = 60 md; $P_i$ = 5000 psi; $c_t$ = 25 x $10^{-6}$ $psi^{-1}$; $r_w$ = 0.3 ft; B = 1.1 bbl/STB; h = 25 ft; $\varphi$ = 17%; S = 0; Ei (-0.54) = -0.525

Estimate the bottom hole flowing pressure after 10 hours.

**or**

**7** The figure illustrates the rate history of a well that has been producing under transient flow conditions for 15 hours. Given the following data: pi = 5000 psi; h = 20'; B = 1.1 bbl/STB; $\varphi$= 15%; $\mu$= 2.5 cp; $r_w$ = 0.3ft; $c_t$ = 20 X $10^{-6}$ $psi^{-1}$; s = 0; k = 40 md. Estimate the sand face pressure after 15 hours. **10Marks** **L2** **CO1**

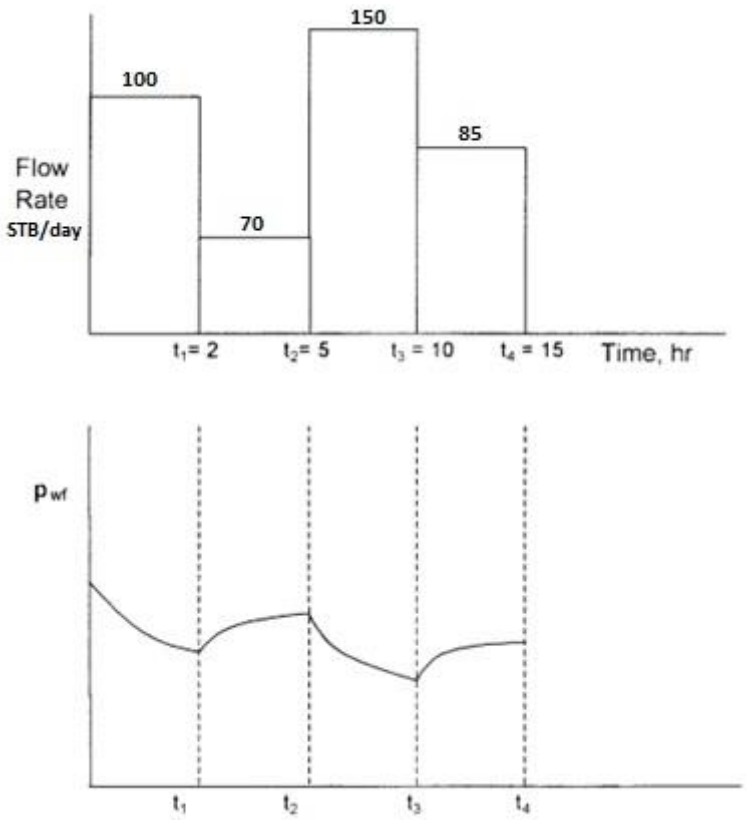



Figure: Production and pressure history of a well

| | | | | |
|---|---|---|---|---|
| **8** | Overall, the diffusivity equation is significant for its role in understanding and managing reservoir behavior, optimizing production strategies, and enhancing the efficiency of oil and gas extraction processes. Derive the diffusivity equation for slightly compressible fluid in a reservoir for transient flow. | **10Marks** | **L2** | **CO1** |

**or**

| | | | | |
|---|---|---|---|---|
| **9** | Assume that the three wells as shown in Figure are producing under a transient flow condition for 15 hours. The following additional data are available: | **10Marks** | **L2** | **CO1** |

| | |
|---|---|
| $q_1$ = 100 STB/day | h = 20’ |
| $q_2$ = 160 STB/day | Φ = 15% |
| $q_3$ =200 STB/day | k = 40md |
| Pi = 4500 psi | $r_w$ = 0.25’ |
| B = 1.20 bbl/STB | μ = 2 |
| $c_t$ = 20 X $10^{-6}$ | r1 = 400’ |
| $S_1$ = -0.5 | r2 = 700’ |

If the three wells are producing at a constant flow rate, estimate the sand face flowing pressure at Well 1.

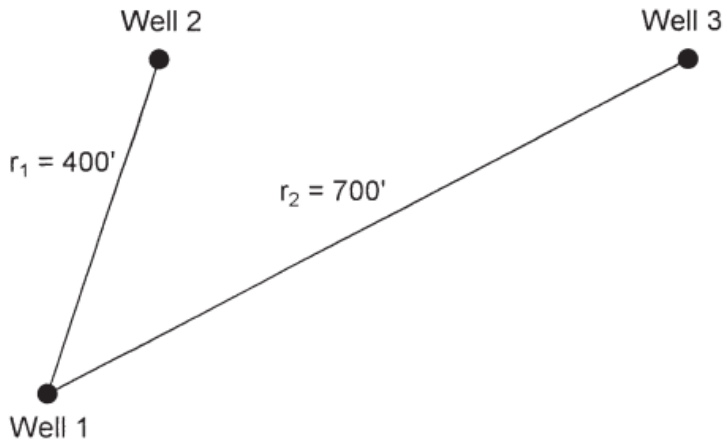



Figure: Well layout

| | | | | |
|---|---|---|---|---|
| **10** | Explain the concept of wellbore storage and elaborate how it influences early-time pressure behavior during well testing. | **10Marks** | **L2** | **CO2** |

**or**

| | | | | |
|---|---|---|---|---|
| **11** | The skin factor is a vital parameter in reservoir engineering that measures the impact of near-wellbore conditions on well productivity. In reservoir engineering, that quantifies near-wellbore effects on well productivity. Elaborate on the skin factor concept and provide its formula. Also, discuss the possibility of skin factor values being positive, negative, or zero and elucidate their significance. | **10Marks** | **L2** | **CO2** |

| | | | | |
|---|---|---|---|---|
| **12** | Upon completion of the drilling process, a recently established oil well exhibited a daily production rate of 400 barrels for a continuous period of 2.5 days. Subsequent to this production phase, the well underwent a temporary shutdown to conduct a pressure build-up test, during which the data presented in the table were gathered: | **10Marks** | **L3** | **CO2** |

**Table: Pressure Build-up Data**

| **Shut-in Time [i.e., Δt (hours)]** | **Shut-in Pressure [i.e., $P_{ws}$ (psi)]** |
|---|---|
| 0 | 1,150 |
| 2 | 1,795 |
| 4 | 1,823 |
| 8 | 1,850 |
| 16 | 1,876 |
| 24 | 1,890 |
| 48 | 1,910 |

Information regarding the additional well and reservoir data are as follows:

$\mu$ = 2 cp; $c_t$ = 19.5 x $10^{-6}$ $psi^{-1}$; $r_w$ = 0.29 ft; B = 1.25 rb/STB; h = 20 ft; $\varphi$ = 0.20

Compute (a) the slope of Horner's Plot; (b) formation permeability (k)

**[Provide Semi-Log Paper for this question]**

**or**

**13** A recently drilled oil well yielded a daily output of 400 barrels for a duration of 2.5 days. Subsequently, the well was temporarily closed for a pressure build-up test, during which the data presented in the table below were documented: **Marks** **L3** **CO2**

**Table: Pressure Build-up Data**

| **Shut-in Time [i.e., Δt (hours)]** | **Shut-in Pressure [(i.e., $P_{ws}$ (psi)]** |
|---|---|
| 0 | 1,165 |
| 2 | 1,801 |
| 4 | 1,838 |
| 8 | 1,865 |
| 16 | 1,891 |
| 24 | 1,905 |
| 48 | 1,925 |

The details concerning the other well and reservoir data are outlined below:

$\mu$ = 2 cp; $c_t$ = 19.5 x $10^{-6}$ $psi^{-1}$; $r_w$ = 0.29 ft; B = 1.25 rb/STB; h = 20 ft; $\varphi$ = 0.20

Determine (a) the slope of Horner's Plot; (b) formation permeability (k)

**[Provide Semi-Log Paper for this question]**