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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

Summer term End term EXAMINATION - August 2024

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| **Semester : Summer Term** | **Date : 05-08-2024** |
| **Course Code : PET2019** | **Time :1:00pm-4:00pm** |
| **Course Name : Oil and Gas Well Test Analysis** | **Max Marks : 100** |
| **Program: B.Tech. in Petroleum Engineering** | **Weightage : 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | Write down the diffusivity equation. Also write down its assumptions. | (CO 1) | [Knowledge] |
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| 2 | Describe wellbore storage effect. | (CO 2) | [Knowledge] |
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| 3 | Define radius of investigation. | (CO 1) | [Knowledge] |
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| 4 | Define skin factor. | (CO 1) | [Knowledge] |
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| 5 | Describe two-rate test. | (CO 3) | [Knowledge] |
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| 6 | Describe the significance of exponent "n" in back pressure equation. | (CO 4) | [Knowledge] |
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| 7 | Describe the significance of exponent "C" in back pressure equation. | (CO 4) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | As a reservoir engineer, discuss the insights and comments regarding the pressure drawdown plot for various reservoirs, highlighting the distinct characteristics and regions shown on the graph (Region 1, 2, 3, C1, C2, S1, S2, S3, P, Q, and R). Explain how these plots provide crucial information about reservoir behavior, aiding operators in optimizing production strategies, improving recovery efficiency, and planning future reservoir management. | (CO 2) | [Comprehension] |
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| 9 | As a petroleum engineer, you've noticed two distinct flow rates in the figure, which are crucial for conducting precise pressure build-up tests. Establish the mathematical adjustment you would recommend to the ideal pressure build-up test formula for these varying flow rates. | (CO 3) | [Comprehension] |
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| 10 | Pressure Build-Up Test is a fundamental method in well testing that provides essential insights into reservoir properties and well performance. Discuss Pressure Build-up Test and its significance in well test analysis. | (CO 1) | [Comprehension] |
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| 11 | You have been tasked with conducting a gas well test analysis for a formation with ULTRA LOW permeability as a petroleum engineer. Determine which test should be performed and give a thorough explanation of the procedures needed to assess the back pressure equation. | (CO 1) | [Comprehension] |
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| 12 | As a petroleum engineer, you have been assigned to perform a gas well test analysis for a formation with HIGH permeability. Identify the appropriate test to conduct and provide a detailed explanation of the steps involved in evaluating the back pressure equation. | (CO 4) | [Comprehension] |
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| 13 | A gas well test analysis need to be performed for a formation with LOW permeability. Specify which test should be performed and give a thorough explanation of the procedures involved in assessing the back pressure equation. | (CO 4) | [Comprehension] |
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| 14 | A conventional three-point deliverability test, specifically a flow-after-flow test, was conducted on a gas well, as illustrated in the accompanying graph. The slope of the linear segment is calculated to be 1.2495, the performance coefficient is 0.017006, and the average reservoir pressure is recorded at 1975 psi. Estimate the absolute open flow (AOF). | (CO 4) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 14 | A new oil well produced 400 stb/day for 2.5 days; then it was shut-in for a pressure build-up test, during which the following data in the table were recorded:  Table: Pressure Build-up Data   |  |  | | --- | --- | | Shut-in Time (i.e., Δt (hours)) | Shut-in Pressure (i.e., Pws (psi) | | 0 | 1,150 | | 2 | 1,795 | | 4 | 1,823 | | 8 | 1,850 | | 16 | 1,876 | | 24 | 1,890 | | 48 | 1,910 |   The other well and reservoir data were  µ = 2 cp; ct = 19.5 x 10-6 psi-1; rw = 0.29 ft; B = 1.25 rb/STB; h = 20 ft; φ = 0.20  Compute (a) the slope of Horner’s Plot;  (b) formation permeability (k),  (c) initial reservoir pressure (Pi) and  (d) skin factor (s).  (*Provide Semi-Log Graph paper for this Question*) | (CO 2) | [Application] |
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| 15 | Figure shows the rate history of a well that is producing under transient flow condition for 15 hours. Given the following data: pi = 5000 psi; h = 20’; B = 1.1 bbl/STB; φ= 15%; µ= 2.5 cp; rw = 0.3ft; ct = 20 X 10-6 psi-1; s = 0; k = 40 md. Calculate the sand face pressure after 15 hours.    Figure: Production and pressure history of a well | (CO 1) | [Application] |
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| 16 | The following data are recorded for pressure drawdown in the table given below along with the reservoir data. Reservoir data: h = 130 ft; rw = 0.25; q = 348 STB/day; B = 1.14 bbl/day; µ = 3.93 cp; Ct = 8.74 X 10-6; φ = 20%; Pi = 1154;  Assume that wellbore storage effects are not significant, calculate:   1. Permeability 2. Skin Factor 3. Pressure drops due to skin.  |  |  |  |  | | --- | --- | --- | --- | | **Time**  **(hr)** | **Pwf**  **(psi)** | **Time**  **(hr)** | **Pwf**  **(psi)** | | 2 | 950 | 11 | 931 | | 3 | 947 | 12 | 930 | | 4 | 942 | 13 | 929 | | 5 | 939 | 15 | 928 | | 6 | 937 | 16 | 927 | | 7 | 936 | 20 | 923 | | 8 | 934 | 30 | 915 | | 10 | 932 | 40 | 907 |   (*Provide Semi-Log Graph paper for this Question*) | (CO 3) | [Application] |
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