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PRESIDENCY UNIVERSITY BENGALURU

 SCHOOL OF ENGINEERING

 MAKE UP EXAMINATION – JULY 2024

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| **Semester: VI** | **Date:03-07-2024** |
| **Course Code : PET 225** | **Time:9:30AM -12:30 PM** |
| **Course Name: Advanced Reservoir Engineering and Management** | **Max Marks: 100** |
| **Program: B.Tech. (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 | Define water influx. | (CO1) | [Knowledge] |
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| 2 | What are the various primary drive mechanisms which controls the oil recovery from the reservoirs? | (CO1) | [Knowledge] |
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| 3 | which model can be used to estimate the water influx into a gas or oil reservoir is based on the basic definition of compressibility? Write the equation of the model | (CO1) | [Knowledge] |
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| 4 | State Schilthuis Steady State Model assumptions and equations. | (CO1) | [Knowledge] |
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| 5 | State the basic difference between improved oil recovery (IOR) and enhanced oil recovery (EOR). | (CO2) | [Knowledge] |
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| 6 | Restate the assumptions that are used to derive the frontal advancement equation. | (CO2) | [Knowledge] |
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| 7 | Define AOF. State the condition to achieve AOF | (CO3) | [Knowledge] |
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| **PART B** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** |
| 8 | Recovery of crude oil from the reservoirs is the main concern of a reservoir engineer. For this a reservoir engineer uses many tools to estimate the efficiency of the process. One of the major tools is to quantify the recovery efficiency. You have been assigned to quantify the recovery efficiency. Briefly discuss about the recovery efficiency. Express the equation for cumulative oil production in terms of recovery efficiency. Draw and discuss in detail about areal and vertical sweep efficiency**.** | (CO2) | [Comprehension] |
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| 9 | The water influx model that can be used to estimate the water influx rate into an oil reservoir is based on the compressibility concept. Identify the model and predict the cumulative water influx that results from a pressure drop where initial reservoir pressure is 3000 psi and current pressure is 2840 psi at the oil-water contact with an encroachment angle of 70°. The reservoir-aquifer system is characterized by the following properties:

|  |  |  |
| --- | --- | --- |
|  | Reservoir | Aquifer |
| Radius, ft | 6000 | 20,000 |
| Porosity | 0.18 | 0.12 |
| Cf (1/psi) | 4E-06 | 3E-06 |
| Cw (1/psi) | 5E-06 | 4E-06 |
| h, ft | 25 | 20 |

 | (CO1) | [Comprehension] |
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| 10 | In the dynamic landscape of the oil and gas industry, the accuracy of reservoir performance predictions influences not only the economic success of extraction projects but also their broader impact on environmental sustainability, safety, and the responsible stewardship of finite natural resources. Describe the different phases of predicting the reservoir performance. Explain each phase in brief. | (CO3) | [Comprehension] |
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| 11 | Water influx rate can be equivalently expressed in terms of material balance equation. Using the same concept to compute the water influx rate (ew) in a reservoir whose pressure is stabilized at 2500 psi. Given: initial reservoir pressure= 3500 psi; dNp/dt= 32,000 STB/day; Bo= 1.4 bbl/STB, GOR= 900 scf/STB, Rs= 700 scf/STB, Bg= 0.00082 bbl/scf, Bw= 1.0 bbl/STB.Also, predict the Schlithuis water influx constant. | (CO1) | [Comprehension] |
|  |
| 12 | Prediction of future reservoir performance is essential to determine the economic potential of anoilfield. The material balance equation is often used to provide the estimates of the initial oil in place,size of gas cap and water influx. But to use the material balance equation for performance prediction,it is essential to determine the instantaneous gas-oil ratio (GOR). Thus, understanding ofinstantaneous GOR is highly important. Keeping this in mind, provide your understanding of theGOR curve (given below) of a given hypothetical depletion drive reservoir shown below, where well flowingpressure is plotted against time or cumulative oil. Provide your understanding for the following points1,2,3,4,5 of the curve. | (CO3) | [Comprehension] |
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| 13 | The importance of designing a waterflooding project lies in its ability to optimize oil recovery, sustain reservoir productivity, and ensure the economic and environmental sustainability of oil fields, especially those in their later stages of production. For designing, selection of pattern flooding is done first. Discuss all the factors while selecting the flood patterns. Draw a flood pattern for 7 spots (regular and inverted) arrangement. | (CO2) | [Comprehension] |
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| 14 | Delicate comprehension of oil saturation dynamics within a reservoir contribute to the formulation of reservoir management strategies, and the optimization of oil saturation impact the overall cumulative oil production, economic viability of hydrocarbon recovery projects. State the equation of oil saturation in terms of cumulative oil production and initial water saturation. Explain each and every term. A volumetric solution gas drive reservoir has an initial water saturation of 20%. The initial oil formation volume factor is reported at 1.5 bbl/STB. When 10% of the initial oil was produced, the value of Bo decreased to 1.38. Calculate the oil saturation and gas saturation | (CO3) | [Comprehension] |
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| **PART C** |
|  **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |
| 15 | A reservoir- aquifer model system with an encroachment angle of 60º has the following boundary pressure history:

|  |  |
| --- | --- |
| Time (month) | Boundary Pressure (psi) |
| 0 | 2610 |
| 6 | 2600 |
| 12 | 2580 |
| 18 | 2552 |
| 24 | 2515 |

Given the following data: h = 100 ft ; φ= 15%; µw= 0.7 cp; Cf = 5 X 10-6 psi-1; Cw = 4 X 10-6 psi-1 ; k = 100 md. T=140 ºF; ra = infinite; re = 2000 ft. Appy the knowledge of VEH method (edge water drive) to compute the cumulative water influx. Assume data appropriately, if missing. Use the chart below:

|  |  |
| --- | --- |
| Dimensionless time | Fluid influx |
| 30 | 16.742 |
| 60 | 28.691 |
| 90 | 39.625 |
| 120 | 49.968 |

 | (CO1) | [Application] |
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| 16 | The following PVT data characterizes a solution gas drive reservoirPredict the cumulative oil and gas production for 4150 psi. Viscosity of oil= 1.7cp and gas =0.023cp. USE Tracy method for oil reservoir prediction**.** | (CO3) | [Application] |
|  |
| 17 | Buckley and Leverett (1942) developed a well-established theory, called the frontal displacement theory. This classic theory consists of two equations:1. Fractional flow equation or formula
2. Frontal advance equation or formula.
3. Briefly discuss about your understanding of Frontal advance equation. State its applicability, assumptions and equation relating the movement and position of front with saturation on a time scale. Using this equation, give insights, draw and compare the derivative of fractional flow of water with saturation**.**
 | (CO2) | [Application] |
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