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PRESIDENCY UNIVERSITY BENGALURU

 SCHOOL OF ENGINEERING

 SUMMER SMESTER END TERM EXAMINATION - August 2024

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| **Semester: Summer Term** | **Date: 08.08.2024** |
| **Course Code: PET225** | **Time: 1.00PM -4.00PM** |
| **Course Name: Advanced Reservoir Engineering and Management** | **Max Marks: 100** |
| **Program: B. Tech.**  | **Weightage: 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *The question paper consists of 3 parts.*
3. *Scientific and non-programmable calculators are permitted.*
4. *Do not write any information on the question paper besides Roll Number.*
5. *Use Graph Paper wherever needed. Write the Question No. on the graph paper with a pen.*

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| **PART A** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** |
| 1 | State the classification of the aquifer based on pressure maintenance. | (CO 1) | [Knowledge] |
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| 2 | List the three stages of oil production from reservoirs in terms of recovery with a neat diagram. | (CO 1) | [Knowledge] |
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| 3 | State the basic principle of Pot aquifer model | (CO 1) | [Knowledge] |
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| 4 | State the classification of the aquifer based on pressure maintenance. Draw a neat diagram explaining the variation of various drives on a pressure vs time plot. | (CO 1) | [Knowledge] |
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| 5 | Define productivity index. | (CO 3) | [Knowledge] |
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| 6 | Define Time Value of Money and & NPV. | (CO 4) | [Knowledge] |
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| 7 | Define IPR and state its use. | (CO 3) | [Knowledge] |
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| **PART B** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** |
| 8 | An in-depth understanding and precise identification of the dominant drive mechanisms within a reservoir not only influence production rates and ultimate recovery but also shape the strategic decisions made by operators in maximizing resource extraction efficiency and optimizing field development plans. List all the six drive mechanisms present in natural recovery and briefly explain about them | (CO1) | Comprehension |
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| 9 | 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 **points 1**,2,3,4,5 of the curve. | (CO 3) | Comprehension |
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| 10 | The compressibility notion serves as the foundation for the water influx model, which may be used to calculate the water inflow rate into an oil reservoir. Identify the model and predict the cumulative water influx. Initial reservoir Pressure = 4000, Current pressure =2900 at oil-water contact fractional encroachment angle=70º. other properties are as follows

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| --- | --- | --- |
|  | Reservoir | Aquifer |
| Radius, ft | 8000 | 30,000 |
| Porosity | 0.20 | 0.15 |
| Cf (1/psi) | 4E-06 | 3E-06 |
| Cw (1/psi) | 5E-06 | 4E-06 |
| h, ft | 30 | 25 |

 | (CO1) | Comprehension |
|  |
| 11 | Water influx rate can be equivalently expressed in terms of material balance equation. Using the same concept to determine the water influx rate (ew) in a reservoir whose pressure is stabilized at 3000 psi. Given: initial reservoir pressure= 3500 psi; dNp/dt= 32,000 STB/day; Bo= 51.4 bbl/STB, GOR= 900 scf/STB, Rs= 700 scf/STB, Bg= 0.00082 bbl/scf, dWp/dt= 0, Bw= 1.0 bbl/STB. | (CO1) | Comprehension |
|  |
| 12 | 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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| 13 | 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 |
|  |  |  |  |
| 14 | Reservoir management is a critical aspect of the oil and gas industry, and its importance extends across various facets of exploration, production, and environmental stewardship. Define and explain your understanding of reservoir management, briefly describe its objective and explain the reservoir management team composition with a neat diagram. | (CO4) | Comprehension |
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| **PART C** |
|  **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |
| 15 | Define Instantaneous GOR & cumulative GOR. Discuss its importance and significance. State the equation of Instantaneous GOR.If a well is oil and gas havig Rs= 840 scf/STB, Kro=0.65 ,Krg=0.5 , viscosity of oil=1.7 cp, viscosity of gas= 0.023 cp ,Bo= 1.4 bbl/STB, Bg=7.4 x 10-6 bbl/scf. calculate the Instantaneous GOR. | (CO3) | [Application] |
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| 16 | Predicting oil reservoir performance is a multifaceted task with far-reaching implications for economic, environmental, and operational aspects of oil and gas extraction. It is a cornerstone of responsible reservoir management and plays a central role in the long-term success and sustainability of the oil and gas industry. In view of that, explain the steps of TRACY method of estimating the oil reservoir performance. explain the steps in brief. | (CO3) | [Application] |
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| 17 | 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.Identify the best suited VEH method (edge water drive/ bottom 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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