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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 10 – 01- 2025  **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** B. Tech. in Petroleum Engineering |
| **Course Code:** PET3006 | **Course Name:** Advanced Petroleum Reservoir Engineering |
| **Semester**: V | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **10** | **10** | **40** | **40** | **NA** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

|  |
| --- |
| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** |
| **1** | With a neat sketch, Recall the behavior of productivity index and drawdown with time in transient and pseudo steady state conditions. | **2 Marks** | **L1** | **CO3** |
| **2** | Define AOF. State the condition to achieve AOF | **2 Marks** | **L1** | **CO3** |
| **3** | Recall the equation of cumulative gas production in terms of avg. GOR. | **2 Marks** | **L1** | **CO3** |
| **4** | Define cumulative GOR (Rp) and its unit. | **2 Marks** | **L1** | **CO3** |
| **5** | State the variables which affects the productivity index. Draw its combined behavior against bubble point with a neat diagram. | **2 Marks** | **L1** | **CO3** |
| **6** | List the key elements of setting goals. | **2 Marks** | **L1** | **CO4** |
| **7** | State the key steps in data acquisition and analysis. | **2 Marks** | **L1** | **CO4** |
| **8** | List at least 4 methods used in oil & gas industry for economic evaluation  | **2 Marks** | **L1** | **CO4** |
| **9** | Explain IRR. | **2 Marks** | **L1** | **CO4** |
| **10** | Define NPV. | **2 Marks** | **L1** | **CO4** |

 **Part B**

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| **Answer the Questions. Total Marks 80** |
| **11.** |  | 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.Apply the knowledge of VEH method (edge water drive) to solve 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 |

 | **10****Marks** | **L3** | **CO1** |
| **or** |
| **12.** |  | The water influx model that can be used to estimate the water influx rate into an oil reservoir is based on the compressibility concept. Infer the model and solve for 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. The reservoir has two water influx entry point with an encroachment angle of 70° and 50° respectively.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 |

 | **10 Marks** | **L3** | **CO1** |
|  |  |  |  |  |  |
| **13.** |  | Use the relative permeability data as shown, to solve for the fractional flow curve for a linear reservoir system with the following properties:Perform the calculation for the oil viscosity of 5 and 10 cp. | **10 Marks** | **L3** | **CO2** |
| **or** |
| **14.** |  | The linear system is under consideration for a waterflooding project with a water-injection rate of 1,000 bbl/day. The oil viscosity is considered constant at 1.0 cp. Solve for the fractional flow curve for the reservoir dip angle of 30˚, assuming updip displacement. Absolute Permeability =50md. | **10 Marks** | **L3** | **CO2** |

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| **15.** |  | The following PVT data characterizes a solution gas drive reservoirSolve for 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**.** | **15****Marks** | **L3** | **CO3** |
| **Or** |
| **16.** |  | Relating reservoir performance with time is fundamental for a comprehensive understanding of reservoir behavior. It guides decision-making processes related to reservoir production optimization throughout the life of the reservoir. For a filed you have been asked to relate the reservoir performance with Time. Demonstrate the steps in detail. | **15 Marks** | **L3** | **CO3** |

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| **17.** |  | Vogel's method for estimating the Inflow Performance Curve is important for its simplicity, data-driven approach, and its role in decision-making related to well design, reservoir management, and economic evaluations in the field of reservoir engineering. A well is producing from a saturated reservoir with an average reservoir pressure of 2500 psig. Stabilized production test data indicates that the stabilized rate and wellbore pressure are 350 STB/day and 2000 psig, respectively. Use Vogel equation to Calculate the following:1. Solve for the oil flow rate at Pwf = 1850 psig.
2. Solve for the oil flow rate assuming constant J

Construct the IPR by using the Vogel method and the constant productivity index approach. | **15****Marks** | **L3** | **CO3** |
| **Or** |
| **18.** |  | The productivity index is a critical tool in the evaluation and optimization of oil well performance. It informs reservoir management decisions, helps in well design and completion strategies, supports production forecasting, and contributes to economic assessments, making it an indispensable parameter in the field of reservoir engineering. Discuss the equation, significance of productivity index for oil well performance evaluation, its applicability regime. Express it as a equation of straight line and explain how will you compare the productivity index for various well having variable thickness. | **15****Marks** | **L3** | **CO3** |

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| **19.** |  | Reservoir management is essential for maximizing hydrocarbon recovery, ensuring economic viability, and maintaining environmental and safety standards in the oil and gas industry. It requires a multidisciplinary approach, incorporating geology, engineering, economics, and environmental science to achieve optimal results throughout the life of a reservoir. Explain the concept of reservoir management. With a neat diagram explain the reservoir life process in connection with reservoir management. | **15****Marks** | **L2** | **CO4** |
| **Or** |
| **20.** |  | 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. | **15****Marks** | **L2** | **CO4** |

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| **21.** |  | Discuss the importance of “Developing Plan” in a reservoir management process. Discuss its step in detail with a flowchart. | **15****Marks** | **L2** | **CO4** |
| **Or** |
| **22.** |  | Discuss the importance of “Economic optimization and implementation of economic plan” in decision making process in oil & gas Industry. | **15****Marks** | **L2** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***