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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 09 / 01/2025 **Time:** 01:00 pm – 04:00 pm |

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| --- | --- | --- |
| **School:** School of Engineering | **Program:** B. Tech. (Petroleum Engineering) | |
| **Course Code:** PET2009 | **Course Name:** Thermodynamics of Reservoir Fluids | |
| **Semester**: III | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **0** | **50** | **50** | **NA** | **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** | Define Gibbs phase rule with expression. | **2 Marks** | **L1** | **CO2** |
| **2** | State the concept of phase equilibrium | **2 Marks** | **L1** | **CO2** |
| **3** | State the solution gas oil ratio. | **2 Marks** | **L1** | **CO2** |
| **4** | State the degree of freedom at triple point of water. | **2 Marks** | **L1** | **CO2** |
| **5** | Define Bubble point. | **2 Marks** | **L1** | **CO2** |
| **6** | List the inorganic and organic compounds contained in reservoir natural gas. | **2 Marks** | **L1** | **CO3** |
| **7** | Define phase. | **2 Marks** | **L1** | **CO3** |
| **8** | Recall Total Volume Formation Factor. | **2 Marks** | **L1** | **CO3** |
| **9** | Define Gas Formation Volume Factor. | **2 Marks** | **L1** | **CO3** |
| **10** | State two application of PT diagram. | **2 Marks** | **L1** | **CO3** |

**Part B**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Answer the Questions. Total Marks 80** | | | | | |
| **11.** |  | Classify the different types of crude oil based on the P-T diagrams. Draw the P-T diagram of each crude oil types and briefly explain their characteristics. | **20**  **Marks** | **L2** | **CO2** |
| **or** | | | | | |
| **12.** |  | The Pressure-Temperature diagram is a fundamental tool in the exploration, production, and processing of reservoir fluids. It provides valuable insights into the behavior of fluids under different conditions, guiding engineering decisions and ensuring the safe and efficient operation of oil and gas facilities. A pressure-temperature (P-T) diagram representing a multi-component mixture, as seen in natural gas or intricate hydrocarbon systems, is more complicated compared to a straight forward P-T diagram for a single-component fluid. Explain the P-T diagram for a multicomponent mixture with a clear illustration. | **20 Marks** | **L2** | **CO2** |
|  |  |  |  |  |  |
| **13.** |  | Explain the procedure of flash expansion method with a neat diagram. Also, explain the procedure to determine the Bubble point pressure from flash expansion method in detail. | **20 Marks** | **L2** | **CO2** |
| **or** | | | | | |  | **or** |
| **14.** |  | Explain the procedure of Differential method with a neat diagram. Also, explain the procedure to determine Rs, Bo and Bg from differential expansion method in detail. | **20 Marks** | **L2** | **CO2** |

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| **15.** |  | Explain the origin of Real gas equation. State the assumptions made while driving the ideal gas equation and explain the reason that why ideal gas equation cannot be applied in a Petroleum reservoir. Explain the factor which is used to convert ideal gas to real gas equation and its procedure to find it. | **20**  **Marks** | **L2** | **CO3** |
| **or** | | | | | |  | **or** |
| **16.** |  | Explain the complexities of PVT Analysis with a pictorial diagram in detail and explain Rs, Bo and Bg. | **20**  **Marks** | **L2** | **CO3** |

|  |  |  |  |  |  |
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| **17.** |  | Explain the concept of Vapour liquid Equilibria in detail. State the different methods to compute the Vapour liquid Equilibria. explain Raoult’s law in detail.  SLove for the vapor pressure of a solution at 25℃ containing 78.0 grams of glucose (MM = 180.16 g/mol) in 500 grams of water. The vapor pressure of pure water at this temperature is 23.8 mm Hg. Solve for XH2O | **20**  **Marks** | **L3** | **CO3** |
| **or** | | | | | |
| **18.** |  | A gas reservoir has the following gas composition: the initial reservoir pressure and temperature are 3000psia and 180ºF, respectively   |  |  |  |  | | --- | --- | --- | --- | | **Component** | **Yi** | **Tci(ºR)** | **Pci** | | CO2 | 0.02 | 547.91 | 1071 | | N2 | 0.01 | 227.49 | 493.1 | | C1 | 0.85 | 343.33 | 666.4 | | C2 | 0.04 | 549.92 | 706.5 | | C3 | 0.03 | 666.06 | 616.4 | | i-C4 | 0.03 | 734.46 | 527.9 | | n-C4 | 0.02 | 765.62 | 550.6 |   Solve for the gas compressibility Factor under initial reservoir conditions using following chart. | **20**  **Marks** | **L3** | **CO3** |

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