**Name:**

**Enrolment No:**

**UPES**

**End Semester Examination, December 2024**

**Course: Fundamentals of Reservoir Engineering** **Semester: III**

**Program: B.Tech Applied Petroleum Engineering** **Time : 03 hrs.**

**Course Code: PEAU 2022** **Max. Marks: 100**

**Instructions:**

1) **All questions are mandatory.**
2) **Under section B, Q 9 has Internal Choice.**
3) **Assume any data if required.**

**SECTION A**
**(5Qx4M=20Marks)**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Recognize various factors that have a major role in understanding the hydrocarbon reservoir? Also, the parameters that are effected by reservoir fluid properties. | **4M** | **CO2** |
| Q 2 | Define the terms a) Compressibility Factor, b) Formation Gas Oil Ratio, c) Production Gas Oil Ratio and d) Oil Formation Volume Factor. | **4M** | **CO1** |
| Q 3 | A reservoir has a total pore volume of 1,000,000 cubic meters and a porosity of 20%. Calculate the reservoir's bulk volume and the solid matrix's occupied volume? | **4M** | **CO3** |
| Q 4 | Explain what reservoir depletion means and the impact it has on phase behavior and fluid distribution. | **4M** | **CO3** |
| Q 5 | Consider a reservoir being produced by a solution gas drive mechanism. The pressure has declined significantly. What steps could be taken to improve recovery? | **4M** | **CO2** |
| **SECTION B**<br>**(4Qx10M= 40 Marks)** | | | |
| Q 6 | Outline the material balance equation for a gas reservoir and discuss its primary assumptions. | **10M** | **CO2** |
| Q 7 | "When a wetting and a non-wetting phase flow together in a reservoir rock, each phase follows separate and distinct paths." Justify how the presence of one phase effects the fluid flow in porous and permeable media with the help of a graph. | **10M** | **CO3** |
| Q 8 | A reservoir has the following properties:<br>• Original oil in place (OOIP) = 1,500,000 stock tank barrels (STB)<br>• Initial pressure = 4,000 psi<br>• Bubble point pressure = 2,500 psi<br>• Current reservoir pressure = 2,800 psi | **10M** | **CO4** |

| | | | |
|---|---|---|---|
| | • Oil formation volume factor at initial pressure, Boi=1.25 RB/STB<br>• Current oil formation volume factor, Bo=1.30 RB/STB<br>• Oil produced so far = 300,000 STB<br>• Initial gas solubility, Rsi=600 scf/STB<br>• Current gas solubility, Rs=400 scf/STB<br>• Solution gas-oil ratio = 400 scf/STB<br>Assume negligible water production and calculate the following:<br>1. The current oil in place.<br>2. Cumulative gas produced. | | |
| Q 9 | Create a detailed flowchart illustrating the decision-making process for selecting an appropriate reservoir drive mechanism during the development phase of an oilfield. Include reservoir pressure, fluid properties, and economic considerations in your flowchart. | **10M** | **CO3** |
| | **(OR)** | | |
| Q 9 | (i) List and briefly describe the main drive mechanisms in oil reservoirs.<br>(ii) Explain why understanding these mechanisms is crucial for optimizing oil extraction processes. | **5M + 5M** | **CO3** |
| | **SECTION-C (2Qx20M=40 Marks)** | | |
| Q 10 | a) Compare and contrast the phase diagrams of a single-component hydrocarbon system and a multi-component hydrocarbon system. Highlight the key differences in terms of phase boundaries, critical points, and phase behavior complexities.<br>b) Illustrate different techniques used for hydrocarbon reservoir fluid sampling, and how they vary based on the type of reservoir and fluid composition. | **10M + 10M** | **CO3** |
| Q 11 | The following data are given for the Bell Gas Field:<br>Area = 160 acres.<br>Net productive thickness = 40 ft .<br>Initial reservoir pressure = 3250 psia.<br>Porosity = 22%<br>Connate water = 23%<br>Initial gas FVF = 0.00533 ft3/SCF<br>Gas FVF at 2500 psia = 0.00667 ft3/SCF<br>Gas FVF at 500 psia = 0.03623 ft3/SCF<br>Sgr after water invasion = 34%<br>Find the following:<br>1) Initial gas in place<br>2) Gas in place after volumetric depletion to 2500 psia<br>3) Gas in place after volumetric depletion to 500 psia<br>4) Gas in place after water invasion at 3250 psia<br>5) Gas in place after water invasion at 2500 psia<br>6) Gas in place after water invasion at 500 psia<br>7) Gas reserve by volumetric depletion to 500 psia<br>8) Gas reserve by full water drive; i.e. at 3250 psia | **20M** | **CO4** |

| | | | |
|---|---|---|---|
| | 9) Gas reserve by partial water drive; i.e. at 2500 psia | | |