**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**Online End Semester Examination, December 2020**

Course: Reservoir Engineering                                 **Semester: V**
**Program: B. Tech. GSE**                                     **Time 03 hrs.**
**Course Code: PEAU 4008**                                    **Max. Marks: 100**

**SECTION A**

1. **Each MCQ will carry 2 Marks**
2. **Instruction: Select the correct option**

Q1. 1.Which two factors influence the gas formation volume factor?                    CO1

   a. Permeability and saturation
   b. Permeability and pressure
   c. Pressure and temperature
   d. None of the above

2. Gravity drainage can be very effective drive in all the following conditions existing except

   a. Low formation dip angle
   b. High effective value permeability
   c. Low oil viscosity
   d. Low residual oil saturation

3. In material balance drive indices, SDI refers to

   a. Source drive index
   b. Gravity (segregation) drive index
   c. Solution drive Index
   d. Get cap (segregation) drive index

Q2.

4. A reservoir fluid has formation volume factor 1.2 at Reservoir pressure above bubble point pressure. With decline in pressure of reservoir towards bubble point, the formation volume factor of oil will

   a. Decrease till 1
   b. Increase
   c. Decrease till 0
   d. Remains same

5. _____is the temperature at which a gas becomes a liquid

   a. Bubble point
   b. Dew Point
   c. Boiling point

d. None of the above

6. _____is the property of a fluid to adhere to a solid surface

   a. Wettability
   b. Absorption
   c. Adsorption
   d. None of the above

7. The porosity of the cubic packing is:
   a. 47%
   b. 26%
   c. 35%
   d. 78%

# Q3.

8. Porosity that results from the alteration of rock matrix by compaction, cementation and solution is called _____
   a. Primary porosity
   b. Secondary porosity
   c. Dual porosity
   d. Absolute porosity

9. The property of rocks that measures the storage capacity that is capable of holding Fluids is known as _____
   a. Grain volume
   b. Bulk volume
   c. Porosity
   d. Permeability

10. _____is the saturation above which the fluid will flow

   a. Effective saturation
   b. Critical saturation
   c. Residual saturation
   d. Flowing saturation

Q4.

11. The percentage of interconnected pore space with respect to bulk volume is called _____

   a. Effective porosity
   b. Interconnected porosity
   c. Absolute porosity
   d. Bulk porosity

12. The law which quantifies the rate of flow of fluids through porous media via the concept of permeability is

   a. Darcy's law
   b. Newton's law
   c. Navier Stokes law
   d. None of the above

Q5.

13. An effect that causes a change in permeability values while determining permeability with gases at different pressures is known as ___

   a. Darcy's effect
   b. Friction effect
   c. Klinkenberg effect
   d. Real gas effect

# Q6.

14. Volumetric under saturated reservoir with a small gas cap is most likely to be driven by _____

   a. Gas cap drive
   b. Expansion drive
   c. Water drive
   d. Solution gas drive

15. Which of these is not a flow regime

   a. Steady state
   b. Semi steady state
   c. Quasi steady state
   d. None of the above

| SECTION B | | |
|---|---|---|
| **1. Each question will carry 10 marks** | | |
| **2. Instruction: Write short / brief notes** | | |
| | | |
| Q 1 | a) Calculate the instantaneous gas oil ratio produced from an oil reservoir having gas cap. Fluid and Reservoir properties are as follows.<br>$R_s$ , gas solubility, scf/STB =200<br>$k_{rg}$ , relative permeability to gas=0.1<br>$k_{ro}$ ,relative permeability to oil =0.4<br>$B_o$ , oil formation volume factor, bbl/STB=1.25<br>$B_g$ , gas formation volume factor, bbl/scf=0.002<br>$\mu_o$ , oil viscosity, cP =1.5<br>$\mu_g$ ,gas viscosity, cP = 0.01<br><br>b) Calculate the two phase formation factor (Rb/STB) of reservoir at 4000 psia and temperature of 180 degree F?<br>Data Given:<br>Oil Formation Volume Factor =1.2 Rb/STB<br>Solution GOR at 2500 psi =1500 SCF/ STB<br>Initial Solution GOR = 750 SCF/STB<br>Gas Formation Volume Factor = 0.0025 Rb/SCF | **CO2** |

| Q 2 | Explain the following<br>   a.     Klinkenberg Effect.<br>   b.     Drainage and imbibition process. | **CO3** |
|---|---|---|
| Q 3 | a)  A brine is used to measure the absolute permeability of a core plug. The rock sample is 4 cm long and 3 $cm^2$ in cross section. The brine has a $\mu$= 1 cp and is flowing at a constant rate of 0.5 $cm^3$/sec under a 2 atm pressure differential. Calculate permeability in mD.<br><br>b)  A linear porous media is flowing a 0.72 SG gas at $120°$ F. The upstream and downstream pressure are 2100 psi and 1849.73 psi respectively. The cross section area is 4500 ft2 . The total length is 2500 ft with an absolute permeability of 60mD. Calculate the gas flow rate in scf/day. | **CO4** |
| Q 4 | With the help of neat sketch explain three methods of decline curve analysis | **CO5** |
| Q 5 | Explain the different types of reserve estimation methods in detail.<br><div align="center">OR</div>Explain different types of reservoir drive mechanism with diagram. | **CO6** |

<div align="center"><b>Section C</b></div>

1. **Each Question carries 20 Marks.**
2. **Instruction: Write complete solution**

| Q 1 | Explain the following types of reservoir and their characteristics with the help of their phase diagram | |
|---|---|---|
| | a. Black Oil Reservoir<br>b. Retrograde Gas Reservoir<br>c. Wet Gas Reservoir<br>d. Dry Gas Reservoir | **CO6** |

OR

A combination drive reservoir contains 10 MMSTB of oil initially in place. The ratio of the original gas cap volume to the original oil volume is 0.25. The initial reservoir pressure is 3000 psia at 150° F. The reservoir produced 1 MMSTB of oil, 1100 MMscf of 0.8 specific gravity gas, and 50000 STB of water by the time the reservoir pressure dropped to 2800 psi. The following PVT is available:-

| | 3000 psi | 2800 psi |
|---|---|---|
| $B_o$ , bbl/STB | 1.58 | 1.48 |
| $R_s$ , scf/STB | 1040 | 850 |
| $B_g$ ,bbl/scf | 0.00080 | 0.00092 |
| $B_t$ , bbl/STB | 1.58 | 1.655 |
| $B_w$ , bbl/STB | 1.000 | 1.000 |

The following data are also available:-

initial water saturation=0.20     Compressibility of water=$1.5 \times 10^6$ psi$^{-1}$     compressibility of rock= $1 \times 10^{-6}$ psi$^{-1}$

Calculate:-

a. Cumulative water influx, bbl.
b. Net water influx, bbl.
c. Primary driving indices at 2800 psi