Name: **Enrolment No:**	

UPES

End Semester Examination, May 2023

Course: Reservoir Engineering-II | **Semester: VI**
Program: B. Tech. APE UP | **Time : 03 hrs.**
Course Code: PEAU 3038 | **Max. Marks: 100**
Nos. of page(s) : 4

Instructions: All question are compulsory.

a. Answers must carry the supporting material such as equations and diagrams
b. Abbreviations used in the questions are standard and have their usual meaning
c. Make appropriate assumptions where data is not supplied

SECTION A
(5Qx4M=20Marks)

S. No.	Statement of question	Marks	CO
Q 1	Define the reservoir pressure monitoring. Explain Issues/essentialities of pressure gradient analysis.	**4**	**CO1**
Q 2	Illustrate the coning and mobility ratio. Mention the significance of mobility ratio in coning.	**4**	**CO1**
Q 3	List out the limitation and advantages of Volumetric Analysis in estimating the hydrocarbon in place.	**4**	**CO2**
Q 4	Illustrate the following Physical property correlations with suitable equation : (a) Apparent molecular weight (b) Specific gravity (c) Gas formation volume factor (d) Compressibility factor	**4**	**CO2**
Q 5	List out the assumptions for rate equations. Explain WOR & GOR equations in detail.	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

S. No.	Statement of question	Marks	CO
Q 6	(a) Discuss rock compressibility and calculate the porosity at 4500 psi. for the given following data: $c_f = 10 \times 10^{-6}$ original pressure = 5000 psi original porosity = 18% current pressure = 4500 psi.	**10 (5+5)**	**CO2**

	(b) Cumulative oil production for our example reservoir was 14.73×10^6 STB at the time when reservoir pressure was 900 psig. At the same time, cumulative production of solution gas was 4.05×10^9 SCF. Calculate the reservoir volume occupied by released gas. **Data:** $N = 90.46 \times 10^6$ [STB] Rsi at 1225 psig = 230 [SCF/STB] Rs at 900 psig = 169 [SCF/STB] Bg at 900 psig = 0.002905 [RB/SCF]		
Q 7	(a) Discuss well spacing. Illustrate the different rules of well spacing. Explain different types of well pattern with suitable figures. (b) Explain pressure maintenance. Discuss advantage of pressure maintenance. Explain the factors important in WI pressure maintenance.	**10 (5+5)**	**CO3**
Q 8	Explain Reservoir-aquifer systems based on flow geometry. Discuss water influx in water drive reservoirs Write down the factors that influences oil recovery by water drive mechanism. **OR** Calculate the cumulative water influx that results from a pressure drop of 200 psi at the oil-water contact with an encroachment angle of 80°.The reservoir-aquifer system is characterized by the following properties: | **Reservoir** | **Aquifer** Radius , ft | 2600 | 10,000 Porosity, fraction | 0.18 | 0.12 C_f,psi^{-1} | 4 10^{-4} | 3x10^{-3} C_w,psi^{-1} | 5x10^{-6} | 4x10^{-6} h , ft | 20 | 25	**10**	**CO4**
Q 9	(a) Describe the criteria of simulator selection. Write down the two names of commercial simulators for reservoir modeling & simulation of oil & gas field. (b) Describe the development of oil & gas fields with case study of Indian scenario. **OR** (a) Discuss different modeling methods in oil & gas fields. Write down the names of modeling software for static and dynamic modeling. (b) Explain OGFD. Illustrate the development strategy of oil & gas fields.	**10 (5+5)**	**CO6**

SECTION-C (2Qx20M=40 Marks)			
Q 10	(a) Discuss continuity Equation. Write down the assumptions, limitations and advantages of using MBE. (b) **Given the following data for the gas field** Area = 160 acres Net productive thickness = 40 ft Initial reservoir pressure = 3250 psia Porosity = 22% Connate water = 23% Initial gas FVF = 0.00533 ft3/SCF Gas FVF at 2500 psia = 0.00667 ft3/SCF Gas FVF at 500 psia = 0.03623 ft3/SCF Sgr after water invasion = 34% **Calculate:** 1. Initial gas in place 2. Gas in place after volumetric depletion to 2500 psia 3. Gas in place after volumetric depletion to 500 psia 4. Gas in place after water invasion at 3250 psia 5. Gas in place after water invasion at 2500 psia 6. Gas in place after water invasion at 500 psia 7. Gas reserve by volumetric depletion to 500 psia 8. Gas reserve by full water drive; i.e. at 3250 psia 9. Gas reserve by partial water drive; i.e. at 2500 psia	**20 (10+10)**	**CO2**
Q 11	(a) A vertical well is drilled in an oil reservoir that is overlaid by a gas cap and underlain by bottom water shows an simultaneous gas and water coning. Calculate the maximum permissible oil rate that can imposed to avoid cones breakthrough, i.e., water and gas coning. The following data are available: oil density, $\rho_o = 47.5$ lb/ft^3 water density, $\rho_w = 63.76$ lb/ft^3 gas density, $\rho_g = 5.1$ lb/ft^3 oil viscosity, $\mu_o = 0.73$ cp oil formation volume factor, $B_o = 1.1$ bbl/STB oil column thickness, h = 65 ft depth from GOC to top of perforations, $D_t = 25$ ft well perforated interval, $h_p = 15$ ft wellbore radius, $r_w = 0.25$ ft drainage radius, $r_e = 660$ ft oil effective permeability, $k_o = 93.5$ md horizontal and vertical permeability, i.e., kh, kv = 110 md oil relative permeability, $k_{ro} = 0.85$	**20 (10+10)**	**CO5**

(b) The pressure history of a water-drive oil reservoir is given below:

t, days	p, psi
0	3500 (pi)
100	3450
200	3410
300	3380
400	3340

The aquifer is under a steady-state flowing condition with an estimated water influx constant of 130 bbl/day/psi.
Calculate the cumulative water influx after 100, 200, 300, and 400 days using the steady-state model.

OR

(a) A sour natural gas has a specific gravity of 0.7. The compositional analysis of the gas shows that it contains:
5 %CO_2 and 10 % H2S.
Calculate the density of the gas at 3500 psia and 160°F

(b) Calculate the water influx rate e_w in a reservoir whose pressure is stabilized at 3000 psi. Other related data is given as under:

Initial reservoir pressure = 3500 psi
dN_p/dt = 32,000 STB/day
B_o = 1.4 bbl/STB
GOR = 900 scf/STB
R_s = 700 scf/STB
B_g = 0.00082 bbl/scf
dW_p/dt = 0
B_w = 1.0 bbl/STB