Exam Date & Time: 30-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

B.Tech. Chemical Engineering
VI Semester End Semester Examination
May/June 2023

OIL AND GAS RESERVOIR ENGINEERING [CHE 4052]

Marks: 50 **Duration: 180 mins.**

Descriptive Questions

Answer all the questions. Section Duration: 180 mins

1) A gas well is producing gas with a specific gravity of 0.85 at a rate of 2.1 MMscf/day. The average reservoir pressure and temperature are 1,700 psi and 250 °F. "z" can be considered as 1.

A) Estimate: (4)

a. Apparent molecular weight of the gas.

b. Gas density at reservoir conditions.

B) Analyse the difference between flash and differential expansion along with neat sketch. (3)

C) Explain the role of the multistage separation in oil/gas production. (3)

2) Explain the classification of oil reservoirs based on phase diagram. (4)

A)

B) Explain surface recombination sampling procedure to collect the fluid samples along with neat sketch. (3)

C) The relative volumes of gas liberated at 2,800 psia will expand to give 6.9457 relative volumes of gas at standard conditions and the gas expansion factor (E) is 149.05. Knowing 'E', evaluate the z-factor of the liberated gas at 150 °F. (3)

3) The Big Butte field is a combination-drive reservoir. The current reservoir pressure is 2500 psia. Volume of bulk oil zone is 100,000 ac-ft and that of gas zone is 40,000 ac-ft. The reservoir production data and PVT information are given below:

A) Initial Conditions

Current Conditions

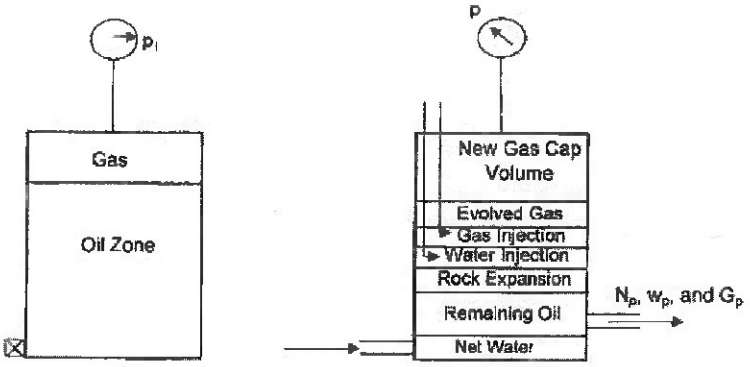
Pressure, psia	B_o, rb/stb	R_s, scf/stb	N_P, MMstb	G_P, MMMscf	B_g, rb/scf	B_w, rb/stb	W_e, MMrb	W_p, MMrb	C_f, C_w
5000	1.35	600	0	0	.0011	1	1.145	1.1287	0
2500	1.33	500	5	5.5	.0015	1	257	214	0

(4)

Determine the initial oil in place "N".

$$N = \frac{N_p[B_o + (R_p - R_s)B_g] - (W_e - W_pB_w) - G_{inj}B_{ginj} - W_{inj}B_{wi}}{(B_o - B_{oi}) + (R_{si} - R_s)B_g + mB_{oi}\left[\frac{B_g}{B_{gi}} - 1\right] + B_{oi}(1+m)\left[\frac{S_{wi}c_w + c_f}{1 - S_{wi}}\right]\Delta p}$$

B) Explain the following Tank-Model concept and list all the assumptions involved in the Material Balance Equation (MBE) along with the role of MBE. (3)



Tank-model concept.

C) Based on the geological evidence it is known that the areal extent of an oil reservoir is 740 acres, the thickness of the pay zone is 40 ft, the porosity is equal to 30%, and S_w (water saturation) is 25%, and there is no S_g (free gas saturation). Consider B_{oi} as 1.306 bbl/STB. (3)

Evaluate (a) Pore volume (b) initial oil in place in STB.

4) Outline various well integrity tests and explain any one well integrity test along with neat sketch. (3)

A)

B) Explain the importance of 'history matching' and 'prediction' related to reservoir engineering along with relevant graphs. (3)

C) Derive $p_e - p_{wf} = \frac{q\mu}{2\pi kh} \ln \frac{r_e}{r_w}$ using Darcy's law for radial steady state flow and sketch the pressure profile of the radial flow of oil into a well under steady state flow conditions for a damaged well. (4)

5) Explain (a) mobility ratio (b) capillary number along with their significance. (2)

A)

B) Explain the advantages of the EOR and explain steam flooding process along with schematic. (4)

C) Explain how pressure drawdown test is conducted along with idealized drawdown profiles. (4)

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