BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(End SEMESTER EXAMINATION SP2023)

CLASS: BTECH **SEMESTER: VII**
BRANCH: CHEMICAL ENGINEERING **SESSION: MO/2024**

SUBJECT: CL437 NATURAL GAS ENGINEERING

TIME: 03 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Write the physical properties of the natural gas	[2]	1	1
Q.1(b)	Calculate the value of universal gas constant (R) in psia-ft^3/(lbmol°R)	[3]	1	2
Q.1(c)	The compressibility factor Z of a natural gas is given by the following equation: Z=1-(P/100)+(P^2/5000), where P is the pressure in MPa. Calculate the isothermal compressibility (Cg) of natural gas at a pressure of 10 MPa.	[5]	1	3
Q.2(a)	Describe the various types of fluid flow geometries that can occur in a reservoir with neat diagrams.	[2]	2	2
Q.2(b)	Calculate the choke flow coefficient (C) using the following data: Fluid density = 62.4 lb/ft^3, Viscosity = 0.5 cp, Diameter of the nozzle = 2 inch, and Fluid Velocity = 0.538 ft/s. The choke flow coefficient varies with the Reynolds no. (Re) as C=0.5/[1+(Re×10^{-6})$^{0.6}$].	[3]	2	3
Q.2(c)	A 0.65 specific gravity natural gas flows from a 2-in pipe through a 1.5-in nozzle-type choke. The upstream pressure and temperature are 100 psia and 70°F, respectively. The downstream pressure is 80 psia (measured 2 ft from the nozzle). The gas specific heat ratio is 1.25. The nozzle flow coefficient is 1.2. (i) What is the expected daily flow rate? (ii) is icing a potential problem?	[5]	2	3
Q.3(a)	Briefly explain the gathering systems for natural gas production.	[2]	3	2
Q.3(b)	Describe the gas-oil separation process for removing gas from high-pressure oil well with a neat diagram.	[3]	3	2
Q.3(c)	Determine the number of stages required to compress the gas from 10 to 625 psig using a compression ratio of 3:1. Also, calculate the exit temperature for each stage if the gas enters each stage at 80°F.The specific heat ratio is 1.15.	[5]	3	3
Q.4(a)	What are the factors that enhance the corrosion during amine treatment of acid gases?	[2]	4	1
Q.4(b)	Describe retrograde condensation phenomena in detail with a neat phase diagram.	[3]	4	2
Q.4(c)	Describe amine reclaiming with a neat process flow diagram of an amine treating reclaimer.	[5]	4	3
Q.5(a)	What is a gas hydrate, and where does it form?	[2]	5	1
Q.5(b)	What are the main factors that influence the production of coal bed methane (CBM) from coal seams?	[3]	5	1
Q.5(c)	Explain the shale gas production in detail. What are the major differences between shale gas and conventional gas production?	[5]	5	3

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