Name:

**Enrolment No:** 



## UPES

## End Semester Examination, May 2024

**Course:** Natural Gas Conditioning and Processing **Program:** B.Tech. (APEG) **Course Code:** CHCE3047 Semester: VITime: 3 Hrs.Max. Marks : 100

## **Instructions:**

1. All questions are compulsory.

2. Assume any missing data, if any

	SECTION - A		
	(5Qx4M= 20 Marks)		
S. No.		Marks	CO
Q1	Enumerate the primary reasons for removal of water from natural gas.	4	C01
Q2	Mention the hydrate number of all the hydrate forming molecules.	4	C01
Q3	List all the chemical reactions that takes place in carbonate process.	4	C01
Q4	Elaborate on the process variables that must be considered for designing adsorption dehydration plant?	4	CO2
Q5	Discuss why membrane separation process is to be preferred over other NGL production processes?	4	CO2
	SECTION - B (4Qx10M= 40 Marks)		
Q6	<ul><li>a) Discuss dew point and dewpoint depression.</li><li>b) Detail the Hammerschmidt's equation and its importance.</li></ul>	5+5	CO2
Q7	<ul> <li>a) Classify the chemical reactions involved in sponge iron process and Alkanolamine process.</li> <li>b) Compare the different Claus process configuration with reference to H<sub>2</sub>S mole % in acid gas.</li> </ul>	10	CO2
Q8	Sketch and explain the internal refrigeration process used for NGL recovery.	10	CO3
Q9	Examine LO-CAT sulfur recovery process. Write the chemical reactions involved in the process.	10	СО3
	SECTION - C		
	(2Qx20M= 40 Marks)		
Q10	A glycol dehydrator plant is to be designed for handling 14 MMscfd of the sour gas ( $N_2 = 8.5\%$ , $H_2S = 5.4\%$ , $CO_2 = 0.5\%$ , $C_1 = 77.6\%$ , $C_2 = 5.8\%$ , $C_3$	20	CO4

	<ul> <li>= 1.9%, n-C<sub>4</sub> = 0.1%, i-C<sub>4</sub> = 0.1%, i-C<sub>5</sub> = 0.1%). The glycol circulation rate is 4 gal TEG/lb water, lean glycol concentration is 99 %, glycol specific gravity is 1.0, inlet gas pressure and temperature are 1000 psi and 120<sup>0</sup>F respectively, and the absorption tower uses bubble-cap trays. For an exit water content of 10 lb/MMscf gas, determines the followings:</li> <li>a) Specific gravity of natural gas</li> <li>b) Water content of inlet gas</li> <li>c) Dew point depression</li> <li>d) Water removal rate in lbm/hr</li> </ul>		
	a) Analyze the adsorption sweetening process with the help of a process flow diagram.		
Q11	b) Explore the following terms with reference to the designing of adsorption dehydration process.	10+10	CO4
	I. Water Loading		
	II. Zone Length		

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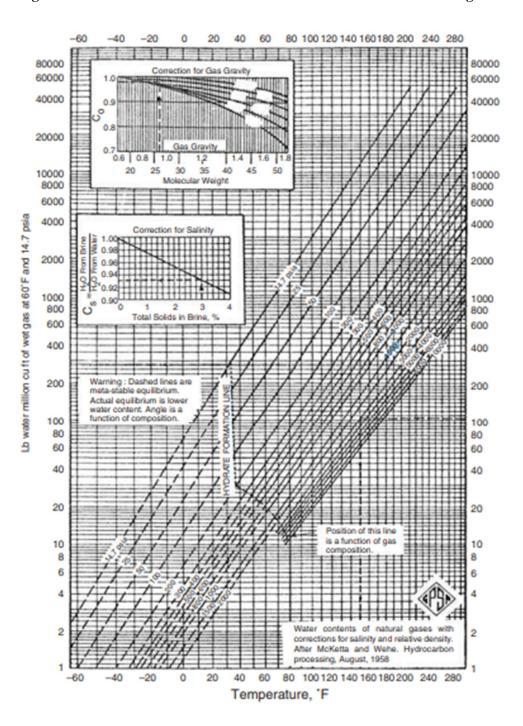


Figure 1: The Mcketta-Wehe correlation for water content of natural gases