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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program Name : B. Tech (APEU) | **Semester : V**
Course Name : Natural Gas Engineering | **Max. Marks : 100**
Course Code : PTEG 362 | **Duration : 3 Hrs**
No. of page/s : 5

Instructions:

- Attempt **all** questions from **Section-A** and **Section-B**
- The physical constants for natural gas constituents, compressibility factor chart, isothermal pressure correction to the molar heat capacity chart are enclosed with the paper

Section-A (Attempt all questions)			
1.	What is critical pressure and critical temperature? How the Kay's mixing rule is used to find the effective critical properties of natural gas ?	**[5]**	**CO1,CO2**
2.	What are the diluents and contaminants present in natural gas ?	**[5]**	**CO1**
3.	What is the state of a substance at critical point ?	**[5]**	**CO2**
4.	Define retrograde phenomenon and explain it with the help of phase diagram	**[5]**	**CO2**
5.	List the different selection criterion of flow measurement devices	**[5]**	**CO4**
6.	Explain the different compression processes with the help of PV diagram	**[5]**	**CO3**
7.	Write the function of oil and gas separators	**[5]**	**CO5**
8.	List the merits and demerits of horizontal separator	**[5]**	**CO5**
Section-B (Attempt all questions)			
9.	Draw the neat sectional view of horizontal, vertical and spherical separator/s and label their different parts	**[15]**	**CO5**
10.	What are the different attributes of flow measurement devices? Explain in details the % of full scale and % of reading accuracy with example	**[15]**	**CO4**

11.	Discuss the merits and demerits of different types of orifice meters and pressure tabs in details with the help of neat diagram	**[15]**	**CO4**
12.	A gas is being compressed from 100 psia and 150^0F to 2500 psia. Determine its compression parameters at the suction end. The gas has the following composition in mole fraction: C_1 = 0.9216, C_2 = 0.0488, C_3 = 0.0185, i-C_4 = 0.0039, n-C_4 = 0.0055, i-C_5 = 0.0017.	**[15]**	**CO1,CO3**

Table 1: Physical Constants for Natural Gas Constituents

Compound	Molecular Weight	Critical Pressure (psia)	Critical Temp. (°R)	Crit. Comp. Factor (Z_c)
CH_4	16.043	667.8	343.1	0.289
C_2H_6	30.070	707.8	549.8	0.285
C_3H_8	44.097	616.3	665.7	0.281
n-C_4H_{10}	58.124	550.7	765.4	0.274
i-C_4H_{10}	58.124	529.1	734.7	0.283
n-C_5H_{12}	72.151	488.6	845.4	0.262
i-C_5H_{12}	72.151	490.4	828.8	0.273
n-C_6H_{14}	86.178	436.9	913.4	0.264
n-C_7H_{16}	100.205	396.8	972.5	0.263
n-C_8H_{18}	114.232	360.6	1023.9	0.259
n-C_9H_{20}	128.259	332.0	1070.4	0.251
n-$C_{10}H_{22}$	142.286	304.0	1111.8	0.247
N_2	28.013	493.0	227.3	0.291
CO_2	44.010	1070.9	547.6	0.274
H_2S	34.076	1306.0	672.4	0.266
O_2	31.999	737.1	278.6	0.292
H_2	2.016	188.2	59.9	0.304
H_2O	18.015	3203.6	1165.1	0.230

Figure 1: Compressibility factor chart for Natural Gas as a function of reduced pressure and temperature

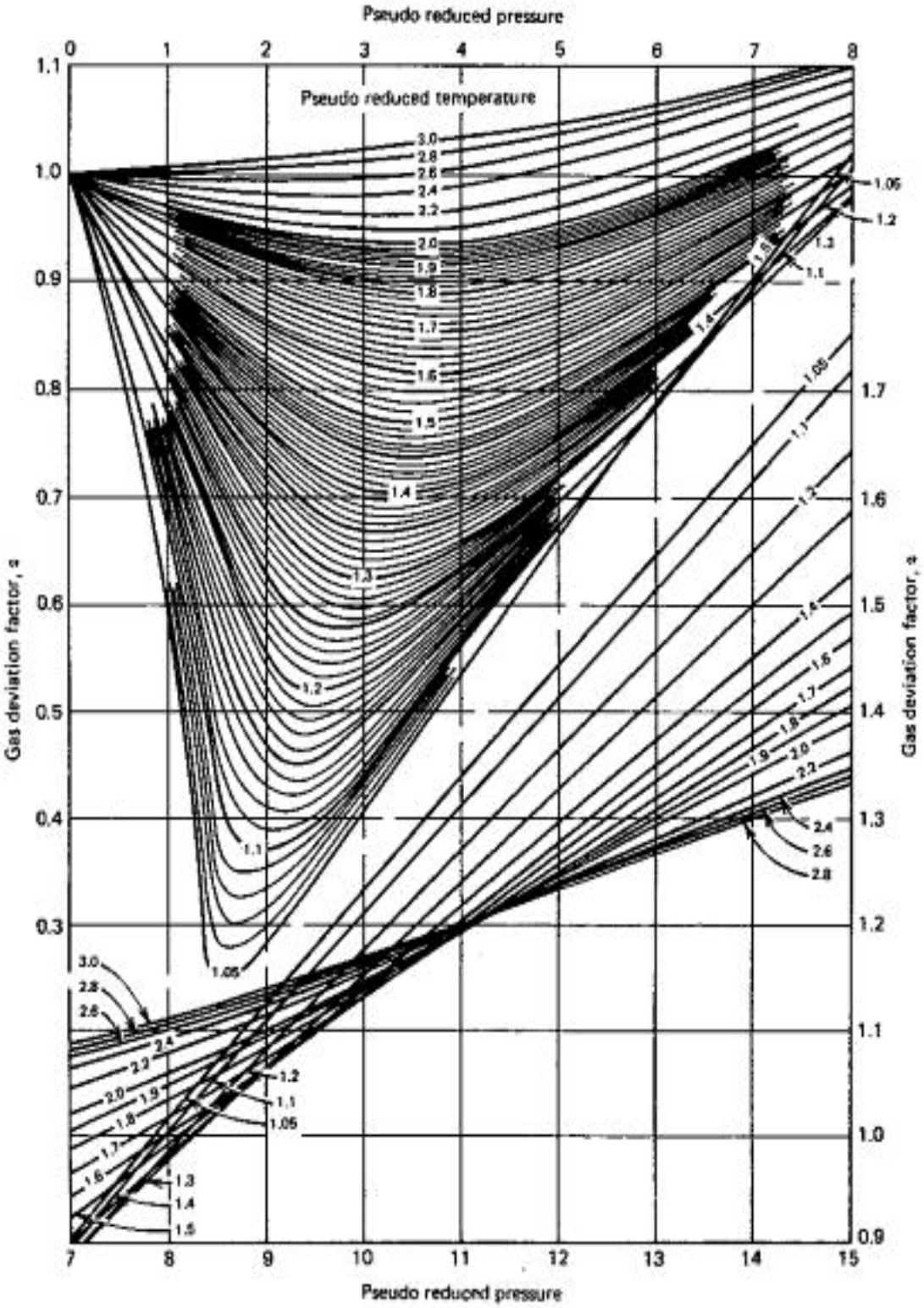

Figure 2: Isothermal pressure correction to the molar heat capacity of gases