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**UNIVERSITY OF PETROLEUM
AND ENERGY STUDIES**



End Semester Examination, April, 2017

Program/course: B.Tech (APE-GAS)
Subject: Natural gas Processes, Modeling & Simulation
Code : PTEG 432
No. of page/s: 02

Semester – : VIII
Max. Marks : 100
Duration : 3 Hrs

- Assume appropriate data if missing. The terms and units are mentioned in this paper have their own meanings with respect to the oil and gas industry.

SECTION-A

Answer all the questions carefully

[5×4=20]

1. Define “working gas” and “Cushion gas” of the underground natural gas storage.
2. List out all the possible leakages occur in the natural gas underground storage.
3. Define desiccant capacity and mention the equation describing this?
4. How do you estimate the dew-point depression of the natural gas?
5. The gas sales contract specifications, an amount of water content of 100 kg/10⁶ MMscfd at a pressure of 6.9 MPa. The inlet gas temperature is 40⁰C. Calculate the minimum lean TEG concentration required?

SECTION-B

Answer all the questions

[4×10=40]

6. Describe the acid gas removal of Iron -Sponge process with neat flowsheet and limitations?
7. In a flash vaporization unit a typical hydrocarbon mixture containing 25 mol% of *n*-butane, 45 mol% of *n*-hexane is to be separated in a simple flash vaporization process operated at 10 atm and 270⁰F. The equilibrium *k*- values at this composition are given in the table. Let *x_i* represent mole fraction of the component *i* in liquid phase and *y_i* represent mole fraction of the component *i* in vapor phase. Develop model equations for the given data.

Component	<i>z_i</i>	<i>y_i</i>
<i>n</i> -butane	0.25	2.13
<i>n</i> -pentane	0.45	1.10
<i>n</i> -hexane	0.30	0.59

8. A depleted gas reservoir is converted to natural gas storage. The reservoir data and conditions are given in Table below. Calculate the total gas volume in the reservoir and the total injected gas volume at P =6,000 psi. For convenience, *Z* is given as 1.07. Assume the temperature will be the same as the initial temperature. Plot the graph between *P* and *Z* factor and analyze the slope.

Variable	Quantity	Unit
A	200	Acre
h	50	feet
\emptyset	0.25	
S_w	0.25	
γ_g	0.6	
T_i	150	$^{\circ}\text{F}$
p_i	1000	psia
Z_i	0.91	

9. Calculate the gas loss, using graphical method for the given tabular data.

Year	Season	G_s , Bcf	p/Z , psia
Year i	Spring	13.5	365
	Fall	17.6	470
Year $i+1$	Spring	14.5	389
	Fall	17.5	465
Year $i+2$	Spring	15.1	395
	Fall	17.7	460

SECTION-C

Answer all questions.

[2×20=40]

10. Develop a model equation for the two-phase oil and gas storage vessel by assuming necessary assumptions with respect to heat and mass transfer operations.

11. Calculate the circulation rate of 98.7 wt%, lean TEG needed to dry 10^6 std m^3/d of gas at 7.0 MPa and 40°C in a six-tray absorber (1.5 theoretical. tray) to achieve an exit gas water content of 117 $\text{Kg}/10^6$ std m^3 . The inlet water content is 1100 $\text{Kg}/10^6$ std m^3 (saturated gas). Use appropriate charts for calculations.

(OR)

Calculate the diameter and height for an absorption column for the dehydration of wet natural gas under the following operation conditions.

- (i) Natural gas flow rate is 98 MMscfd
- (ii) Saturated with water at 1000 psig, 100°F gas
- (iii) Target gas water content is 7 lb/MMscfd
- (iv) Use TEG for dehydration (98.5 %) purity the balance is water
- (v) No stripping gas is used.