UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2023

Program Name :   **B.Tech APE Gas**   **Semester**   **: VII**
Course Name   :   **Pipeline Transportation of Oil and Gas**   **Time**   **: 3 hrs**
Course Code   :   **PEAU3135**   **Max. Marks: 100**
Nos. of page(s) :   **04**

Section A
(5x12=60 Marks)

S. No.		Marks	CO
Q 1	A natural gas mixture consists of the following components: | Component	Mole fraction y	Mi	Pci	Tci | |---|---|---|---|---| | C_1 | 0.780 | 16.04 | 667.00 | 343.34 | | C_2 | 0.005 | 30.07 | 707.80 | 550.07 | | C_3 | 0.002 | 44.10 | 615.00 | 665.93 | | N_2 | 0.013 | 28.01 | 492.80 | 227.52 | | CO_2 | 0.016 | 44.01 | 1070.00 | 547.73 | | H_2S | 0.184 | 34.08 | 1300.00 | 672.40 | Calculate the apparent molecular weight of the gas, gas gravity, and the compressibility factor of the gas at 90°F and 1200 psia.	**12**	**CO1**
Q 2	A gas pipeline, with an inside diameter of 476 mm, transports natural gas (specific gravity=0.6) and viscosity is 0.00012 poise at a flow rate of 7.5 Mm^3/day at an inlet temperature of 15°C. Assuming isothermal flow, calculate the velocity of gas at the inlet and outlet of the pipe and the Reynolds number if the inlet pressure is 7 MPa and the outlet pressure is 6 MPa. The base pressure and base temperature are 0.1 MPa and 15°C.	**12**	**CO2**
Q 3	a) Discuss the four stages of the drilling procedure. b) Illustrate with a neat sketch of separating the condensate from the raw natural gas.	**(06+06)**	**CO3**
Q 4	Compare reciprocating and centrifugal pumps and discuss pump head versus flow rate.	**12**	**CO4**
Q 5	a) Explain the consequences of corrosion and its chemistry. b) Summarize the factors that control the corrosion rate.	**12**	**CO5**
	## Section B ### (2x20=40 Marks)		
Q 6	a) A steel pipeline of 500 mm outside diameter, 10 mm wall thickness is used to transport heavy crude oil at a flow rate of 800 m^3/hr at 100°C. Using the Shell-MIT equation calculate the friction loss per kilometer of pipe assuming an internal pipe roughness of 0.05 mm and calculate the head loss in 3000 ft of this pipe. The heavy	**(10+10)**	**CO3 & CO4**

	crude oil has a specific gravity of 0.89 at 100ºC and a viscosity of 120 cSt at 100ºC. Hazen Willimas Factor C=140. b) Analyze the guiding points for finalizing the preliminary route for laying down the pipeline.		
Q 7	a) Describe pigging, the type of pigs, and the reasons for pigging operations in a pipeline. b) Explain the principle, working, and installation of a Galvanic sacrificial anode with a neat sketch.	**(10+10)**	**CO5**

COMPRESSIBILITY OF
NATURAL GASES
JAN. 1, 1941