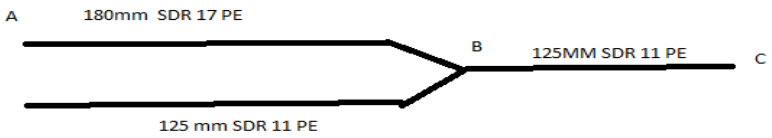
Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Term Examination – December 2023

Program: B.Tech APE (Gas) **Semester: V**
Course: Design of CGD Network **Time: 03 hrs.**
Code: CHGS 3029
Max Marks :100

SECTION A (4x5=20)

S. No.	Short Notes	Marks	CO
1	What are applications of Network Analysis to Gas systems?	**4**	**CO1**
2	Derive equation for equivalent length for pipeline in series	**4**	**CO3**
3	Write the Kirchhoff's first and second law equations using a loop diagram.	**4**	**CO2**
4	A natural gas mixture consisting of 92% methane, 5% ethane, and 3% propane & LPG: 78% Propane and 22% butane. Calculate a specific gravity of gas. Comment on your result.	**4**	**CO4**
5	 Calculate equivalent length of complete sections; LAB=300; LBC=230	**4**	**CO2**

SECTION B (10x4=40)

6	A series piping system consists of 12 mi of NPS 16, 0.375 in. wall thickness connected to 24 mi of NPS 14, 0.250 in. wall thickness and 8 miles of NPS 12, 0.250 in. wall thickness pipes. Calculate the inlet pressure required at the origin A of this pipeline system for a gas flow rate of 150 MMSCFD. Gas is delivered to terminus B at a delivery pressure of 500 psig. The gas gravity and viscosity are 0.6 and 0.000008 lb/ft-s, respectively. The gas temperature is assumed constant at 60°F. Use a compressibility factor of 0.90 and the General Flow equation with Darcy friction factor = 0.02. The base temperature and base pressure are 60°F and 14.7 psia, respectively.	**10**	**CO3**
7	With the help of network diagram describe principles graph theory for network analysis.	**10**	**CO2**
8	With the aid of diagram explain following terms of graph theory a) Nodes – Nodes Representations b) Nodes- Branches Representations	**10**	**CO1**

9	Examine various approaches to calculating the friction factor, considering its benefits and drawbacks.	**10**	**CO2**
	SECTION-C (20x2=40)		
10	Natural gas is supplied through a low-pressure distribution pipe 1200m in length. with an initial pressure of 50 mbar(gauge)at A and a final pressure of 30mbar at B. It's required to increase the flow rate by 30%, 50 % , 70 % , 90 % and 110% by reinforcing the existing pipe with parallel Pipe of the same diameter as the original pipe. What length of reinforcement pipe must be installed if the pressure drop is to remain unchanged? Plot a graph of capacity vs reinforcement and discuss your results.	**20**	**CO5**
11	A gas pipeline, NPS 16 with 0.250 in. wall thickness, 55 miles long, transports natural gas (specific gravity =0.6 and viscosity =0.000008 lb/ft-s) at a flow rate of 150 MMSCFD at an inlet temperature of 60 °F. Assuming isothermal flow, calculate the inlet pressure required if the required delivery pressure at the pipeline terminus is 900 psig. The base pressure and base temperature are 14.7 psig and 60°F, respectively. Use the Colebrook equation with pipe roughness of 0.0007 in. **Case A**—Consider no elevation changes along the pipeline length. **Case B**—Consider elevation changes as follows: inlet elevation of 150 ft and elevation at delivery point of 500 ft, with elevation at the midpoint of 300 ft. $$Q = 77.54\left(\frac{T_b}{P_b}\right)\left(\frac{P_1^2 - P_2^2}{GT_f LZf}\right)^{0.5} D^{2.5} \quad \text{(USCS units)}$$ $$s = 0.0375G\left(\frac{H_2 - H_1}{T_f Z}\right) \quad \text{(USCS units)}$$ $$Re = 0.0004778\left(\frac{P_b}{T_b}\right)\left(\frac{GQ}{\mu D}\right) \quad \text{(USCS units)}$$	**20**	**CO4**