Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Term Examination – December 2022

Program: B.Tech APE (Gas) **Semester: V**
Course: Pipeline Transportation of Oil & Gas **Time: 03 hrs.**
Code: CHGS 3002
Max Marks :100
Assume data if necessary

SECTION A (4x5=20)

S. No.	Short Notes	Marks	CO
1	Write short notes on 'sectionalizing Valve'.	**4**	**CO1**
2	What is Trenching in pipeline laying?	**4**	**CO4**
3	Explain the function of 'RTU' in SCADA.	**4**	**CO5**
4	Compare centrifugal & reciprocating pump.	**4**	**CO3**
5	Three liquids A, B, and C are blended together in the volumetric ratio of 20%, 20%, and 60% respectively. Determine the specific gravity of the blended liquid if the individual liquids have the following specific gravities at 70°F: ▪ Specific gravity of liquid A: 0.815 ▪ Specific gravity of liquid B: 0.850 ▪ Specific gravity of liquid C: 0.895.	**4**	**CO1**

SECTION B (10x4=40)

6	Define corrosion? Evaluate corrosion prevention methods in brief.	**10**	**CO5**
7	Describe pigging stations used in pipeline	**10**	**CO4**
8	Elaborate the term SCADA? Explain the instrumentation used in SCADA system.	**10**	**CO5**
9	A steel pipeline of 500 mm outside diameter, 10 mm wall thickness is used to transport heavy crude oil at a flow rate of 750 m3/hr at 100°C. Using the MIT equation determine the pressure drop per kilometer of pipe assuming an internal pipe roughness of 0.05 mm. The heavy crude oil has a specific gravity of 0.89 at 100°C and a viscosity of 120 cSt at 100°C.	**10**	**CO2**

SECTION-C (20x2=40)

10	A natural gas pipeline, 140 miles long from Dover to Leeds, is constructed of NPS 16, 0.250 in. wall thickness pipe, with an MOP of 1200 psig. The gas specific gravity and viscosity are 0.6 and 8×10^{-6} lb/ft-s, respectively. The pipe roughness can be assumed to be 700μin. and the base pressure and base temperature are 14.7 psia and 60°F, respectively. The gas flow rate is 175 MMSCFD at 80°F, and the delivery pressure required at Leeds is 800 psig. **a)** Calculate the pressure required at inlet to deliver the gas at Leeds? **b)** Can the gas be delivered at the calculated inlet pressure from Dover? If not, mention the reasons. **c)** Assuming if only one intermediate compressor is installed at mid-point of the pipeline at Kent, will it be able to deliver the gas at Leeds at delivery pressure. Mention reasons **d)** If not calculate the exact location of compressor. Also for this location, calculate the suction pressure and compression ratio at Kent. Assume Z= 0.85	**20**	**CO3**
	or		
	i) Describe pump performance curves in detail ii) The head and efficiency versus capacity data for a centrifugal pump with a 10 in. impeller is as shown below.	**10**	**CO3**

Q, gal/min	0	800	1600	2400	3000
H, ft	3185	3100	2900	2350	1800

	a) The pump is driven by a constant-speed electric motor at a speed of 3500 RPM**.** Determine the performance of this pump with an 12 in. impeller, using Affinity Laws. **(b)** If the pump drive were changed to a variable frequency drive (VFD) motor with a speed range of 3000 to 4000 RPM, calculate the new H-Q values for the maximum speed of 4000 RPM with the original 10 in. impeller.	**10** **10**	**CO3** **CO3**
11	Illustrate ‘Preliminary Route selection’ & ‘Detailed survey of route selection’ in detail.	**20**	**CO4**
	Equations are as follows i) **Centistokes to SSU** $Centistokes = 0.226(SSU) - \frac{195}{SSU}$ **ii) General Flow Equation**		

$$Q = 77.54\left(\frac{T_b}{P_b}\right)\left(\frac{P_1^2 - P_2^2}{GT_f LZf}\right)^{0.5} D^{2.5} \quad \text{(USCS units)}$$

iii) **Colebrook Equation**

$F=-4\ \mathrm{Log}_{10}[(e/3.7D)+1.255(F/R)]$

for turbulent flow R>4000

$R=92.24\ Q/(\nu\ D)$

MIT Equation

$Pm=0.2421(Q/F)^2(Sg/D^5)$