


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022			
Course: Advanced Thermodynamics Program: M.Tech (ChE) Course Code: CHPD 7003		Semester: 2 Time : 03 hrs. Max. Marks: 100	
Instructions: Open book examination			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Calculate the compressibility factor of a gas at 350 K and 10 bar when it obeys volume explicit virial equation of state truncated to two terms. Second virial coefficient of the gas is $-0.4 \text{ m}^3/\text{kmol}$.	4	CO1
Q2	Molar volume and volume expansivity of liquid are $0.075 \text{ m}^3/\text{kmol}$ and 0.001 K^{-1} respectively at 300 K and 1 bar. Calculate the entropy change when it is isothermally compressed to 30 bar.	4	CO2
Q3	Calculate the change of Gibbs free energy of mixing of ideal gases of 0.4 moles of CO, 0.2 moles of CO ₂ and 0.4 moles of N ₂ into ideal gas mixture at 30°C.	4	CO3
Q4	In the dehydrogenation of propane to propylene, initial moles of propane is 5 moles and the final product contained 3 moles of propylene. Calculate the molar composition of the product mixture.	4	CO4
Q5	For a pseudo component, the molal average boiling point is 720°R and K factor is 11.94. Calculate the specific gravity of the pseudo component.	4	CO5
SECTION B (4Qx10M= 40 Marks)			
Q 6	10 kg of dimethyl ether is kept in a cylinder of 3 liters at 30° C and it obeys Peng–Robinson-Stryjek-Vera (PRSV) equations of state. Calculate its pressure.	10	CO1
Q7	Using Lee/Kesler Generalized-correlations, calculate the residual enthalpy of ethylbenzene at 60°C and 5 bar.	10	CO2
Q8	Calculate the fugacity of cis-2-butene at 300 K and 10 bar using generalized correlation of fugacity coefficient.	10	CO3
Q9	Using Riazi and Daubert correlation, calculate T_c , P_c and V_c of a pseudo component whose chemical composition is unknown. Normal boiling point and specific gravity at 60°F of the pseudo component are 420 K and 0.78 respectively.	10	CO5

SECTION-C
(2Qx20M=40 Marks)

Q10	Calculate the residual Gibbs free energy of carbon disulfide vapors at 150°C and 4 bar when it obeys Peng-Robinson equation of state. (Or) When a binary mixture of methyl ethyl ketone and acetone of composition 30 mole% acetone obeys virial equation of state, estimate their fugacity at 300 K and 20 bar.	20	CO3
Q11	Calculate the maximum conversion of ethylene to ethylene oxide by vapor phase oxidation at 500 K and 15 bar for an initial oxygen to ethylene ratio of 5.	20	CO4