A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54901

B.E./B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Chemical Engineering

15UCH401- CHEMICAL ENGINEERING THERMODYNAMICS-I

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which is the following is an intensive property CO1- R

   (a) Internal Energy (b) Enthalpy (c) Density (d) Volume

2. Properties of substances like pressure, temperature and density, in thermo dynamic coordinates are CO1- R

   (a) path functions (b) point functions (c) cyclic functions (d)real functions

3. Value of R gas constant in KJ/ kg mole. K is CO2- R

   (a) 846 (b) 8314.4 (c) 0.846 (d) 8.314

4. For an ideal gas, Z has the value CO2- R

   (a) 0 (b) 2 (c) 1 (d) infinity

5. Carnot cycle efficiency is maximum when CO3- R

   (a) initial temperature is 0°K (b) final temperature is 0°K

   (c) difference between initial and final temperature is 0°K (d) final temperature is 0°C

6. The door of a running refrigerator inside a room was left open. Which of the following statements is correct? CO3- R

   (a) The room will be cooled to the temperature inside the refrigerator.

   (b) The room will be cooled very slightly.

   (c) The room will be gradually warmed up.

   (d) The temperature of the air in room will remain unaffected.

7. Which of the following plots is called Mollier diagram CO4- R

(a) H-S diagram (b) H-P diagram

(c) T-S diagram (d) None of these

8. The Gibbs-Duhem equation is given by CO4- R

(a) SdT + Vdp – Σ(n)*d(molal chemical potential)

(b) -SdT + Vdp – Σ(n)*d(molal chemical potential)

(c) SdT + Vdp – Σ(n)*d(molal chemical potential)

(d) -SdT – Vdp – Σ(n)*d(molal chemical potential)

9. Steam power plant is based on CO5- R

(a) Diesel Cycle (b) Brayton Cycle

(c) Rankine cycle (d) Atkinson Cycle

10. For same compression ratio and for same heat added CO5- R

(a) Otto cycle is more efficient than Diesel cycle

(b) Diesel cycle is more efficient than Otto cycle

(c) efficiency depends on other factors

(d) both Otto and Diesel cycles are equally efficient

PART – B (5 x 2= 10Marks)

11. Quote Zeroth law of Thermodynamics. CO1- R

12. What is compressibility factor? CO2- R

13. What are the assumptions made on heat engine? State Carnot theorem. CO3- R

14. State the importance of clausius clapeyron equation. CO4- R

15. If an aeroplane goes to higher altitudes maintaining the same speed, the Mach number will remain constant. Say true or false. CO5- R

PART – C (5 x 16= 80Marks)

16. (a) Write a detailed note on the reversible and irreversible processes. Also comment on the statement that "The path of an irreversible process cannot be determined" with the help of quasi-equilibrium process and rapid processes. CO1- App (16)

Or

	(b)	Properties of a closed systems change according to the relation p.v= 3.0 (p= bar, v= m^3)Calculate the work done when the pressure is increased from 1.5 to 7.5 bar.	CO1- App	(16)
17.	(a)	A vessel of volume 0.28m^3 contains 10 kg of air at 320 k. Determine the pressure exerted by the air using a) perfect gas equation b) Vander walls equation c) Generalized compressibility chart.(Take critical temperature of air as 132.8 k and critical pressure of air as 37.7 bar.	CO2- App	(16)
		Or		
	(b)	Describe the importance of PVT behavior of fluids and also describe the mathematical representation in detail.	CO2- Ana	(16)
18.	(a)	From basic principles and first law of thermodynamics, derive the steady flow energy balance for an open system? .	CO3- Ana	(16)
		Or		
	(b)	0.5m^3 of air at 5 bar pressure and 100^oC is in a closed system cylinder undergoes a reversible adiabatic expansion till the pressure falls to 1 bar. The gas is expanded at constant pressure till internal energy increases by 1000kJ.Calculate (i) the total work done (ii) heat transfer (iii) the index of expansion , if the above process are replaced by a single reversible polytropic process giving the same work between the same initial and final states.	CO3- Ana	(16)
19.	(a)	Identify different types of thermodynamic diagrams. Explain any one of them.	CO4-App	(16)
		Or		
	(b)	Evaluate the thermodynamic properties from an equation of state.	CO4 -App	(16)
20.	(a)	Explain the effect of Mach number on compressibility. Calculate the percentage deviation due to the assumption of incompressibility when Mach number is equal to 0.5 and specific heat ratio is 1.4.	CO5- U	(16)
		Or		

(b) Carbon dioxide at 1 bar and 300 K is is to be compressed (adiabatically) to a pressure of 10 bar in a single– stage compressor at a rate of 100 m^3 / h . Assuming that CO_2 behaves as an ideal gas, calculate the temperature of the gas after of the gas after compression and the work required. Take γ = 1.3. CO5- U (16)