22406

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. Attempt any FIVE of the following : **10**

a) Define 'Thermodynamics'.

b) List any two examples of 'Open System'.

c) State Zeroth law of Thermodynamics.

d) Define 'Specific heat'

e) State the relation between 'C_p' and 'C_v'

f) State 'Gibb's Phase Rule'.

g) Explain the term 'Entropy'.

Marks

2. Attempt any THREE of the following : **12**

a) Represent 'Adiabatic Process' on P–V and T–S diagram.

b) Differentiate between 'Work' and 'Heat'.

c) 0.1 m^3 of air at a pressure of 1.5 bar is expanded isothermally to 0.5 m^3. Calculate final pressure of gas and heat supplied during the process.

d) State, explain second, third law of thermodynamics along with their mathematical statements.

3. Attempt any THREE of the following : **12**

a) List different types of equilibrium for thermodynamic system ? Give example of each .

b) A certain gas occupies space of 0.3 m^3 at pressure 2 bar and temperature 77°C. It is heated at constant volume until pressure is 7 bar.

Calculate -

i) Change in Internal Energy

ii) Change in enthalpy

c) Explain in detail 'Clausius Inequality'.

d) Explain P-H Thermodynamic diagram.

4. Attempt any THREE of the following : **12**

a) Write 'Van der Wall's equation for real gas ? State the meaning of each term.

b) Assuming that air is a mixture of 21% Oxygen and 79% Nitrogen by volume. Calculate entropy of 1 Kilo mole of air relative to pure Oxygen and Nitrogen at same temperature and pressure.

c) Prove that Adiabatic mixing of two fluid is irreversible.

d) Write 'Van't Hoff' equation. State the effect of rise in temperature for exothermic reaction.

e) Derive relation between 'K_p' and 'K_c'

Marks

5. Attempt any TWO of the following : **12**

a) Explain 'Joule - Thomson porous plug experiment.

b) Explain T-V diagram for pure substance.

c) Calculate K_p for Ammonia synthesis at total pressure of 26 atm at 380°C, Reaction is

$$N_2 + 3H_2 \longleftrightarrow 2NH_3$$

Assume percentage of Ammonia is 20%.

6. Attempt any TWO of the following : **12**

a) Draw phase diagram for Carbon-di-Oxide system.

b) Explain the term

i) Degree of freedom

ii) Vander Waals constant

c) Derive the relation between thermodynamic equilibrium constant and conversion for second order reversible reaction

$$A + B \rightleftharpoons R + S$$