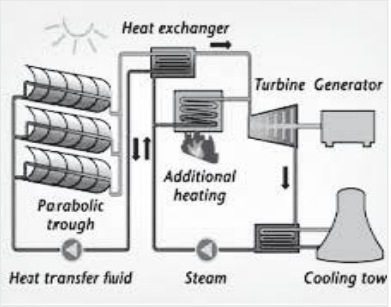

16CH204 CHEMICAL ENGINEERING THERMODYNAMICS-I

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
25	50	-	-	5	5

Course Description and Objectives:

This course deals with first, second and third laws of thermodynamics, volumetric properties, refrigeration and liquefaction processes. The objective of this course is to provide understanding in the theory and applications of classical thermodynamics, thermodynamic properties and equations of state.

Course Outcomes:

The student will be able to :

- apply fundamental concepts of thermodynamics to engineering applications.
- estimate thermodynamic properties of substances in gas and liquid states.
- determine thermodynamic efficiency of various energy related processes.

SKILLS:

- ✓ *Estimation of thermodynamic properties.*
- ✓ *Determination of heat engine and pump efficiency.*
- ✓ *Identification of reversible and irreversible processes.*
- ✓ *Selection of refrigeration process and refrigerant.*

UNIT- 1 **L-9, T-3**

BASIC CONCEPTS : The scope of thermodynamics, Dimensions and units, Measures of amount or size, Force, Temperature, Pressure, Work, Energy, Heat, Zeroth law.

UNIT - 2 **L-9, T-3**

FIRST LAW OF THERMODYNAMICS : Joule's experiment, Internal energy, Statement of first law, Energy balance for closed system, Thermodynamic state and state functions, Equilibrium, Phase rule, Reversible processes, Constant-v and constant-p processes, Enthalpy, Heat capacity.

UNIT - 3 **L-9, T-3**

VOLUMETRIC PROPERTIES OF PURE FLUIDS : PVT behaviour of pure substances, Virial equations of state, Ideal gas, Applications of the virial equations, Cubic equations of state.

UNIT - 4 **L-9, T-3**

THE SECOND LAW OF THERMODYNAMICS : Statements of the second law, Heat engines, Thermodynamic temperature scales, Entropy, Mathematical statement of the second law, Third law of thermodynamics (statement).

UNIT - 5 **L-9, T-3**

REFRIGERATION AND LIQUEFACTION : Carnot refrigerator, Vapor compression cycle, Choice of refrigerant, Absorption refrigeration, Liquefaction processes.

Production of Power from Heat: Steam power plant, Rankine cycle, Otto engine, Diesel engine.

TEXT BOOKS:

1. J.M.Smith, H.C,Vanness and M.M.Abbot, "Introduction to Chemical Engineering Thermodynamics", 6th edition, McGraw-Hill, 2005.
2. Y.V.C.Rao, "Chemical Engineering Thermodynamics", 1st edition, Universities Press, 2004.

REFERENCE BOOKS:

1. Dodge B.F., "Chemical Engineering Thermodynamics", 1st edition, McGraw-Hill, 1944.
2. Kyle B.G., "Chemical and Process Thermodynamics", 1st edition, Prentice Hall of India,1999.

ACTIVITIES:

- *Calibration of thermometer.*
- *Conversion of work into heat using Joule's experiment.*
- *Expansion of gas using Joule-Thomson effect.*