GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 4

Chemical Engineering

Subject Code 140502
Subject Name Chemical Engineering Thermodynamics-I

Sr.No	Course contents
1	**Introduction:** Conservation of energy and first law of thermodynamics, application to steady state flow process; enthalpy, internal energy, equilibrium state, phase rule, irreversible vs. reversible process, heat capacity and specific heat.
2	**Properties of pure substances:** PVT behavior of pure substances, ideal and non-ideal gases, equation of states, Virial, Van der Waals, Redlich kwong equation , RKS equation, PR equation, Berthelot equation etc., Calculation of constants in terms of Pc, Tc, Vc, condition to be satisfied by any equation of state, reduced forms of equations of state, principles of corresponding states.
3	**Heat effects:** Heat capacities of gases as a function of temperature, Heat capacities of gases, liquids and solids, Concept of Cpm, Heat of vaporization, Heat of fusion, Heat of sublimation, Heat of formation (ΔHf), Laws of thermo chemistry, Heat of combustion (ΔHc), Heat of reaction ΔHr from ΔHc, Heat of reaction (ΔHr) from ΔHf etc., thermo-neutrality of salt solution, Heat formation of ions and atoms, Heat of solution, Heat of solution of hydrate,
4	**Second Law of thermodynamics:** Second law of thermodynamics, Thermodynamic temperature scale, Ideal gas temperature scale, Concept of entropy, entropy change and irreversibility, Introduction to third law of thermodynamics.
5	**Thermodynamic properties of fluids:** Network of thermodynamic equations, mathematical relations among thermodynamic functions, Maxwell relations, Interrelations between H, S, G, E, Cp, Cv, etc. in terms of PVT relations (exhaustive treatment), Thermodynamic properties of single phase and two phase systems, Effect of temperature and pressure, on various properties and their evaluations, Types of thermodynamic diagrams, generalized correlations of thermodynamics properties of ideal gas mixtures.
6	**Residual properties:** Departure functions
7	**Thermodynamics of flow process:** Fundamental equations and relationships flow in pipes, maximum velocity in pipe flow, nozzles, Single and Multistage compressors and ejectors.

8	**Refrigeration and liquefaction:** Basic of Carnot refrigeration cycle, Air refrigeration cycle, Vapor compression cycle, Absorption refrigeration, Heat pump, liquefaction processes, Refrigeration through solar energy, Cascade refrigeration., Power cycles, Recent advancement in refrigeration and liquefaction cycle design.

Reference Books:

1 Smith J.M, Van Ness H.C., Abbott M. M, "Introduction to Chemical Engineering Thermodynamics", The McGraw Hill Companies, Inc., USA, 7th Ed., 2005

2 Narayanan K.V., "Chemical Engineering Thermodynamics",

3 Rao Y.V.C., "Introduction to Chemical Engineering Thermodynamics", Wiley Eastern. 1994

4 Karapetyants M. Kh., "Chemical Thermodynamics" Mir Publishers.

5 Elliot J. R. and Lira C.T, "Introductory Chemical Engineering Thermodynamics ", Prentice Hall, 1999

6 Kyle B.G., "Chemical and Process Thermodynamics"3rd Ed., Prentice Hall, 1999

7 Sandler S.I, "Chemical Engineering Thermodynamics", John Wiley and Sons, Inc., New York, 3rd Ed., 1999

8 Dodge B.F., `Chemical Engineering Thermodynamics', McGraw Hill.1960

9 Weber H.C. and Meissner J.P., "Thermodynamics for Chemical Engineers", Wiley Eastern