SUBJECT NO-ME22002, SUBJECT NAME- Thermodynamics

LTP- 3-1-0,CRD- 4

SYLLABUS :-

• Introduction: Fundamental Concepts: definitions of system and surrounding, concept of control volume, thermodynamic state, concepts of simple compressible substances, pure substance and phase, thermodynamic processes and thermodynamic equilibrium; Temperature and Zeroth law; Thermodynamic properties and use of tables of thermodynamic properties; Idea of a generalized chart and the law of corresponding states; Concept of ideal gases and their equations of state; Thermodynamic concept of energy; Modes of work and heat transfer.

• First Law of Thermodynamics: The first law referred to cyclic and non-cyclic processes, concept of internal energy of a system, conservation of energy for simple compressible closed systems; Definitions of enthalpy and specific heats; Conservation of energy for an open system or control volume, steady & transient processes.

• Second Law of Thermodynamics: The directional constraints on natural processes; Formal statements; Concept of reversibility; Carnot principle; Absolute thermodynamic temperature scale; Clausius Inequality, entropy, change in entropy in various thermodynamic processes, Tds relations, entropy balance for closed and open systems, Principle of increase-in-Entropy, entropy generation.

• Exergy: Concept of reversible work & irreversibility; Second law efficiency; Exergy change of a system: closed & open systems, exergy transfer by heat, work and mass, exergy destruction, exergy balance in closed & open systems.

• Thermodynamic Property Relations: Maxwell relations; Clausius-Clapeyron equation; Difference in heat capacities; Ratio of heat capacities; Joule-Thompson coefficient.

• Introduction to Properties of Mixtures and Phases: Amagat’s and Dalton’s model, Equation of state and properties of ideal gas mixtures, Change in entropy on mixing; introduction to real-gas mixtures; Gibbs phase rule; Air/Water Mixtures, Psychrometrics.

• Thermodynamics of Reactive Systems: First law analysis; Internal energy and enthalpy of reaction; Enthalpy of formation; Second law analysis; chemical equilibrium; equilibrium constant for ideal-gas mixtures and its variation with temperature.

• Air Standard Cycles: Carnot, Stirling, Ericsson, Otto, Diesel, and Dual cycles. Brayton cycle: intercooling, reheating and regeneration.

• Vapour Cycles: Carnot cycle; Simple Rankine cycle, Techniques for efficiency improvement, Reheat and Regenerative cycles with open & closed feed water heater; Ideal vapour compression refrigeration cycle.