

# AMPE06 ENGINEERING THERMODYNAMICS

## UNIT-1 BASIC CONCEPTS AND FIRST LAW

- 1.1 Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach.
- 1.2 Path and point functions.
- 1.3 Intensive and extensive, total and specific quantities.
- 1.4 System and their types.
- 1.5 Thermodynamic Equilibrium State, path and process.
- 1.6 Quasi-static, reversible and irreversible processes.
- 1.7 Heat and work transfer, definition and comparison, sign convention.
- 1.8 Displacement work and other modes of work .P-V diagram.
- 1.9 Zeroth law of thermodynamics- concept of temperature and thermal equilibrium- relationship between temperature scales- new temperature scales.
- 1.10 First law of thermodynamics- application to closed and open systems- steady and unsteady flow processes.

## UNIT-2 SECOND LAW AND AVAILABILITY ANALYSIS

- 2.8 Heat Reservoir, source and sink.
- 2.9 Heat Engine, Refrigerator, and Heat pump.
- 2.10 Statements of second law and its corollaries.
- 2.11 Carnot cycle Reversed Carnot cycle, Performance.
- 2.12 Clausius inequality.
- 2.13 Concept of entropy, T- s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy.
- 2.14 Applications of II Law.
- 2.15 High and low grade energy.
- 2.16 Available and non- available energy of a source and finite body.
- 2.17 Energy and irreversibility.
- 2.18 Expressions for the energy of a closed system and open systems.
- 2.19 Energy balance and entropy generation.
- 2.20 Irreversibility. I and II law Efficiency.

## UNIT-3 PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

- 3.1 Formation of steam and its thermodynamic properties, p-v, p-T, T- v, T-s, h- s diagrams. p-v-T surface.
- 3.2 Use of Steam Table and Mollier Chart.
- 3.3 Determination of dryness fraction.
- 3.4 Application of I and II law for pure substances.
- 3.5 Ideal and actual Rankine cycles, Cycle Improvement Methods
- 3.6 Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

## UNIT-4 IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS

- 4.1 Properties of Ideal gas
- 4.2 Ideal and real gas comparison
- 4.3 Equations of state for ideal and real gases-Reduced properties.
- 4.4 Compressibility factor
- 4.5 Principle of Corresponding states.
- 4.6 Generalised Compressibility Chart and its use.
- 4.7 Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes.
- 4.8 Simple Calculations.

### **UNIT-5 GAS MIXTURES AND PSYCHROMETRY**

- 5.1 Mole and Mass fraction,
- 5.2 Dalton's and Amagat's Law.
- 5.3 Properties of gas mixture
- 5.4 Molar mass, gas constant, density, and change in internal energy, enthalpy, entropy and Gibbs function.
- 5.5 Psychrometric properties, Psychrometric charts.
- 5.6 Property calculations of air vapour mixtures by using chart and expressions.
- 5.7 Psychrometric process- adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing.
- 5.8 Simple Applications

#### **Reference Books:**

1. Nag.P.K. "Engineering Thermodynamics", 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.