

APPLIED THERMODYNAMICS OF MATERIALS

Module I (12 hours)

Basic concepts and definition: Scope of Thermodynamics, Macroscopic and Microscopic approaches; Definition of Fixed mass (closed systems) and Control volume (open system), Properties (extensive and Intensive), State and its representation on a property diagram, Process and its representation, Cyclic process (or cycle) and its representation, Characteristics of properties (point and path function); Reversible and Irreversible processes; Thermal, mechanical and Chemical equilibrium.

Thermodynamic equilibrium, Zeroth Law of Thermodynamics and temperature, Measurement of temperature and calibration of thermometers, the ideal gas temperature scale, Measurement of pressure, Bourdon pressure gauge and manometers, gauge and absolute pressure.

Ideal gauges and their P-V-T relations, Gas mixtures

Energy Transfer: Work Transfer (definition and calculation), Different modes of work, Displacement

Work for various process, Heat Transfer; Modes of heat transfer, Basic laws in conduction, convection and radiation, combined modes of heat transfer with examples.

Module II (14 hours)

First Law of Thermodynamics:

i. Formal statement (using cyclic processes), First law for processes of fixed masses (closed systems) and introduction of internal energy as a thermodynamics property, Introduction of enthalpy as a thermodynamic property; Definition of specific heats and their use in calculation of internal energy and enthalpy with emphasis on ideal gases.

ii Application of First Law to control volumes; Nozzle, Diffuser, Compressor, Turbine, Throttling device, Heat Exchanger. (only steady flow need be considered)

Second Law of Thermodynamics: Kelvin- Planck and Clausius statements of Second Law, Reversible and irreversible engines and their efficiency, Entropy concepts and the principle of entropy increase.

Module III (10 hours)

Properties of pure substances:

P-V, P-T, T-S, H-S diagram for steam, different types of steam, Introduction to steam tables with respect to specific volume, pressure, temperature, enthalpy and entropy

Application of thermodynamics:

Air compressors, steam power plant, Refrigerators and Heat pump, I.C. Engines (Brief Description of different components of above mentioned systems and working principles with Schematic diagram only)

Text and Reference Books:

1. Engineering Thermodynamics by P.K.Nag, Publisher: TMH
2. Basic Engineering Thermodynamics by Rayner Joel, Pearson Education
3. Engineering Thermodynamics by Van Wylen and Sontang, John Wiley

4. Engineering Thermodynamics by M.Achuthan, Publisher: PHI
5. Applied Thermodynamics by Eastop and McConkey, Publisher: Pearson
6. Fundamental of Engineering Thermodynamics by E. Rathakrishnan, publisher. PHI
7. Engineering Thermodynamics by Russel and Adebiyi, publisher, Oxford
8. Steam Tables in SI Units by Ramalingam, Scitech.