Kulkarni, Tata McGraw Hill Pvt. Ltd., New-Delhi

BASIC THERMODYNAMICS
(Commonto ME/IP/AU/IM/MA)

Sub Code	: 10ME33	**IA Marks**	: 25
Hrs/week	: 04	**Exam Hours**	: 03
Total Lecture Hrs	: 52	**Exam Marks**	: 100

PART-A

UNIT - 1

Fndamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

06 Hours

UNIT - 2

Work and Heat: Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

06 Hours

UNIT - 3

First Law of Thermodynamics: Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as filmg and evacuation of vessels with and without heat transfer.

07 Hours

UNIT - 4

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynacmic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat

engine; schematic representation and efficiency. Devices converting work to heat in a theromodynamic cycle; reversed heat engine, schematic representation, coefficients of performace. Keivin - Planck statement of the Secnd law of Thermodynamics; PMM I and PMM II, Clasius statement of Second law of Thermodynamics,Equivalence of the two statements; Reversible and irrevesible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

07 Hours

PART-B
UNIT-5

Entropy: Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT-6

Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT-7

Thermodynamic relations: Maxwell relation, Causius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and partiuclar gas constans, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy. enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT-8

Ideal gas mixture : Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressiblity factor; compressibility chart

06 Hours

Data Handbooks :
1. **Thermodynomic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroiya, Birla Pub. Pvt. Ltd., Delhi, 2008

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TEXT BOOKS:

1. **Basic Engineering Thermodynomics,** A.Venkatesh, University Press, 2008

2. **Basic and Applied Thermodynamics,** P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. **Thermodynamcis,** An Engineering Approach, Yunus A.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002

2. **Engineering Thermodynamics,** J.B.Jones and G.A.Hawkins, John Wiley and Sons..

3. **Fundamentals of Classical Thermodynamics,** G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.

4. **An Introduction to Thermodynamcis,** Y.V.C.Rao, Wiley Eastern, 1993,

5. **B.K Venkanna, Swati B. Wadavadagi "Basic Thermodynomics,** PHI, New Delhi, 2010

MECHANICS OF MATERIALS

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PART-A

UNIT 1:

Simple Stress and Strain: Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2:

Stress in Composite Section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

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