Sub Code	
: 06 ME 33	
IA Marks	
: 25	
Hrs/week	
: 04	
Exam Hours	
: 03	
Total Lecture	**Hrs**

: 52

Exam Marks

: 100

PART-A

UNIT 1:

Fundamental Concepts & Definitions: Thermodynamics; definition and scope. Microscopic and Macroscopic approaches. Engineering Thermodynamics Definition, some practical applications of engineering thermodynamic. System (closed system) and Control Volume (open system); 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 processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium- Zeroth law of thermodynamics, Temperature; concepts, scales, measurement. Internal fixed points.

□□□□□□□□

7 Hours

UNIT 2:□□□□□□□□□□□□□□□□

Work & Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; at part of a system boundary, at 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, what heat is not.

6 Hours

UNIT 3:□□□□□□□□□□□□□□□□

First Law of Thermodynamics: Joule's experiments, 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 at constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer.

6 Hours

UNIT 4:□□□□□□□□□□□□□□□□

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin -Planck statement of the Second law of Thermodynamic; PMM I and PMM1I. Clasiu's statement .of Second law of Thermodynamic; Equivalence of the two statements; Reversible and irreversible processes; factors that make a process .irreversible, reversible heat engines, Carnot cycle, Carnot principles. Thermodynamic temperature scale.

7 Hours

PART – B

UNIT 5:□□□□□□□□□□□□□□□□

Entropy: Clasiu's inequality; statement, proof, application to a reversible cycle. Q_R/T as independent of the path. Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

7 Hours

UNIT 6:□□□□□□□□□□□□□□□□

Availability and Irreversibility: - Maximum Work, maximum useful work for a system and a control volume, availability of a system and a steadily flowing stream, irreversibility. Second law efficiency.

6 Hours

UNIT 7:□□□□□□□□□□□□□□□□

Pure substances: P-T and P-V diagrams, triple point and critical points. Sub- cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapour states of a pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness factor (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.

6 Hours

UNIT 8:□□□□□□□□□□□□□□□□

Real and ideal gases: Introduction; Vander Waal's Equation Van der Waal's constants in terms of critical properties, law of corresponding states, compressibility factor; compressibility)" chart. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes. Ideal gas mixture; Dalton's law of additive pressures, Amagat's law of additive volumes, evaluation of properties. Analysis of various processes.

7 Hours

Text Books:

1. **"Basic and Applied Thermodynamics"** by P .K. Nag, Tata McGraw Hill, 3rd Edi. 2002

2. **"Thermodynamics an engineering approach"**, by Yunus A. Cenegal and Michael A. Boles. Tata McGraw hill Pub. 2002

Reference Books:

1. **Engineering Thermodynamics**. By Rajput, Laxmi Publications pvt ltd., 3rd Edi. 2007.

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

3. **Thermo Dynamics** by S.C.Gupta, Pearson Edu. Pvt. Ltd., 1st Ed. 2005.

Scheme of Examination:

One Question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least 2 questions from part A and 2 questions from part B.