I Year II Semester	L	T	P	C
Code: 20ES2012	3	0	0	3

ENGINEERING THERMODYANAMICS

Course Objectives:

1. To impart the knowledge on the concepts of thermodynamics systems, laws, related fundamental definitions with respect to energy, heat and work interactions of the system and surroundings.
2. To learn the first law of thermodynamics, based on energy conservation principle, and applications of steady flow energy equation to the various mechanical components. To educate students about the limitation of first law and approach to second law, able to solve the problems heat engines and analyze the concepts of Carnot cycle, entropy.
3. To impart knowledge on air standard cycles which are useful to calculate the performance parameters of the systems related to IC engines.

Course Outcomes: At the end of the Course, Students will be able to

1. Understand the basic concepts of thermodynamic systems and heat and work interactions and energy concepts.
2. Apply the first law of thermodynamics to different thermodynamic systems, and solve steady flow energy equation to the various mechanical components.
3. Evaluate the heat engines and heat pumps, also to analyze the concepts of Carnot cycle, entropy, availability and irreversibility.
4. Determine the volumetric and gravimetric analysis.
5. Understand the concept of air standard cycles and calculate the efficiency and performance parameters of the systems that use these cycles.

UNIT - I

Introduction: Basic Concepts: System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle - Reversibility - Quasi - static Process, Irreversible Process, Causes of Irreversibility - Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics -Concept of Temperature - Principles of Thermometry -Reference Points - Const. Volume gas Thermometer -Scales of Temperature, Ideal Gas Scale.

UNIT II

Joule's Experiments - First law of Thermodynamics - Corollaries - PMM-I - First law applied to a non-flow process – Internal energy- a property of the system, specific heats. First law applied to a flow system - Steady Flow Energy Equation. Concept of enthalpy, throttling and free expansion processes.

UNIT - III

Limitations of the First Law - Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Clausius Inequality, Entropy, Principle of Entropy Increase- Energy Equation, Availability and Irreversibility.

UNIT - IV

Mixtures of perfect Gases - Mole Fraction, Mass friction Gravimetric and volumetric Analysis - Dalton's Law of partial pressure, Avogadro's Laws of additive volumes - Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect gases.

UNIT - V

Power Cycles: Otto, Diesel, Dual Combustion cycles - Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis - comparison of Cycles, Brayton cycle - Performance Evaluation.

Text Books:

1. Engineering Thermodynamics, PK Nag 4th Edn , TMH.
2. Thermodynamics (Asia Adaptation): An Engineering Approach by Yunus A. Cengel
3. Engineering Thermodynamics, R K Rajput.

References:

1. Engineering Thermodynamics - Jones & Dugan PHI
2. An Introduction to Thermodynamics - Y.V.C.Rao - Universities press.
3. Thermodynamics - J.P.Holman, McGrawHill
4. Basic Engineering Thermodynamics - A.Venkatesh - Universities press.
5. Engineering Thermodynamics - P.Chattopadhyay - Oxford Higher Edn Publ.