R-15

II YEAR I SEM

15AME09-THERMODYNAMICS

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Course Objectives

During the course the students will develop their skills and knowledge in the following areas:

- Thermodynamic systems: properties and processes
- Calculations of changes in a thermodynamic system
- Calculations of applied thermodynamic systems

UNIT- I

Basic Concepts: Macroscopic and Microscopic Approaches, Thermodynamic System, Surrounding, boundary, universe, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,.

Work & Heat Transfer: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

UNIT- II

First Law Of Thermodynamics: First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I. Limitations of first law, thermal reservoir, heat pump, heat engine.

Flow Systems: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

UNIT- III

Second Law Of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II, Kelvin Flank statement.

Entropy And Availability: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability, Gibbs & Helmholtz functions.

UNIT- IV

Pure Substances: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties, Rankine cycle.

THERMODYNAMIC RELATIONS: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius- Clapeyron equation.

UNIT-V

Properties Of Gases And Gas Mixtures: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases-Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles, P-V & T.S diagrams, Thermal Efficiency, mean effective pressure.

Note: Steam tables Mollier Diagrams Shall be supplied.

Text Books :

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi.
2. Engineering Thermodynamics by P.L.Dhar, Elsevier – 2008.
3. Advanced thermodynamics – by R.Yadav
4. Thermal Engineering – by R.K. Raj put

References :

1. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd.
2. Thermodynamics by Chattopadhyay, oxford
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH
4. Thermodynamics – J.P.Holman, McGrawHill
5. An introduction to Thermodynamics, YVC Rao, New Age
6. Engineering Thermodynamics – Jones & Dugan

Course Outcomes

After the course the students must be able to:

- describe the four basic laws of thermodynamics.
- explain basic thermodynamic concepts such as temperature, pressure, work and heat
- describe state properties such as internal energy, enthalpy and entropy.
- apply state functions for processes such as the steam expansion in a turbine
- define models for closed and open systems based on transport of heat, work and mass, and apply these on thermodynamic cycles. Apply thermodynamic models on ideal and real power cycles

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