Course Name Engineering Thermodynamics & Fluid Mechanics

Course Code ME(EE)201

Course Credit 3

Contact Hour 3L-1T

Prerequisite

Course Objective

The course objectives are:

Engineering Thermodynamics:

1. To teach the students the basic principles of classical thermodynamics and prepare them to apply basic conversion principles of mass and energy to closed and open systems.
2. To enable the students to understand second law of thermodynamics and apply it to various systems, note the significance of the results and to know about entropy and second law aspects of daily life.
3. To help the students understand various gas laws and equations of state and apply them to solve problems of estimating enthalpy, entropy, specific heat and internal energy.
4. To teach the students about properties of pure substances and to analyze the performance of thermodynamic air and vapour power cycles.

Fluid Mechanics:

The aim of this course is to introduce and explain basic fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc. Also to learn fluid properties and hydrostatic law – to understand the importance of flow measurement and its applications in Industries and to obtain the loss of flow in a flow system.

Course Outcome

On completion of the course students will be able to

Engineering Thermodynamics:

1. Understanding the concepts such as conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics.
2. Identify closed and open systems and analyze related problems.
3. Apply the concept of second law to design simple systems.
4. Analyze the performance of gas and vapor power cycles and identify methods to improve thermodynamic performance.
5. Demonstrate the importance of phase change diagrams of various pure substances

Fluid Mechanics:

1. Understanding the concepts of conservation of mass, conservation of energy, basic hydrostatics, laws of Fluid mechanics.
2. To find frictional losses in a pipe when there is a flow between two places
3. Find the dependent and independent parameters for a model of fluid flow.

CO Mapping with departmental POs

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1												
CO 2												
CO 3												
CO 4												
CO 5												

Course Content:

Module I: Basic Concepts of Thermodynamics **11L**

Introduction: Microscopic and Macroscopic viewpoints, Definition of Thermodynamic systems: closed, open and isolated systems Concept of Thermodynamics state; state postulate. Definition of properties: intensive, extensive & specific properties. Thermodynamic equilibrium Thermodynamic processes; quasi-static, reversible & irreversible processes; Thermodynamic cycles. Zeroth law of thermodynamics. Concept of empirical temperature.

Heat and Work: Definition & units of thermodynamic work. Examples of different forms of thermodynamic works; example of electricity flow as work. Work done during expansion of a compressible simple system, Definition of Heat; unit of Heat, Similarities & Dissimilarities between Heat & Work

Ideal Equation of State, processes; Real Gas: Definition of Ideal Gas; Ideal Gas Equations of State. Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes. Equations of State of Real Gases: Van der Waal's equation; Virial equation of state.

Properties of Pure Substances: p-v & P-T diagrams of pure substance like H_2O. Introduction to steam table with respect to steam generation process; definition of saturation, wet & superheated status. Definition of dryness fraction of steam, degree of superheat of steam.

Module II: 1st Law of Thermodynamics **7L**

Definition of Stored Energy & Internal Energy 1st Law of Thermodynamics for cyclic processes Non Flow Energy Equation. Flow Energy & Definition of Enthalpy. Conditions for Steady State Steady flow: Steady State Steady Flow Energy Equation

Module III: 2nd Law of Thermodynamics **9L**

Definition of Sink, Source Reservoir of Heat. Heat Engine, heat Pump & Refrigerator; Thermal efficiency of Heat Engines & co-efficient of performance of Refrigerators. Kelvin – Planck & Clausius statements of 2nd Law of Thermodynamics Absolute or Thermodynamic scale of temperature, Clausius Integral Entropy. Entropy change calculation for ideal gas processes. Carnot Cycle & Carnot efficiency. PMM-2; definition & its impossibility

Module IV: **9L**

Air standard Cycles for IC engines: Otto cycle; plot on P-V, T-S planes; Thermal efficiency Diesel cycle; plot on P-V, T-S planes; Thermal efficiency

Rankine cycle of steam: Chart of steam (Mollier's Chart). Simple Rankine cycle plot on P-V, T-S, h-s planes Rankine cycle efficiency with & without pump work (Problems are to solved for each module)

Module V: **12L**

Properties & Classification of Fluids: Ideal & Real fluids. Newton's law of viscosity; Newtonian and Non-Newtonian fluids. Compressible and Incompressible fluids

Fluid Statics: Pressure at a point

Measurement of Fluid Pressure Manometers: simple & differential U-tube, Inclined tube

Fluid Kinematics: Stream line. Laminar & turbulent flow external & internal flow Continuity equation

Dynamics of ideal fluids: Bernoulli's equation. Total head; Velocity head; Pressure head Application of Bernoulli's equation

Measurement of Flow rate : Basic principles, Venturimeter, Pilot tube, Orificemeter

(Problems are to be solved for each module)

Engineering Thermodynamics

Text Book

1. Engineering Thermodynamics - P K Nag, 4th edn, TMH.

Text Book

1. "Fundamentals of Thermodynamics" 6e by Sonntag & Van Wylin published by Wiley India.
2. Engineering Thermodynamics – Russel & Adeliyi (Indian edition), OUP
3. Engineering Thermodynamics – Onkar Singhh, New Age International Publishers Ltd.
4. Basic Engineering Thermodynamics – R Joel, 5th Ed., Pearson

Fluid Mechanics

Text Book

1. Fluid Mechanics and Hydraulic Machines - R K Bansal.

Text Book

1. Introduction to Fluid Mechanics and Fluid Machines - S.K.Som and G.Biswas. 2nd edn, TMH
2. Fluid Mechanics by A.K.Jain.