S14. Course Number: ME 634

Course Name: Thermodynamics of Energy Systems

Credits: 3-0-0-3

Prerequisites: Instructor's consent

Intended for: M. Tech / UG/MS/PhD

Distribution: Core for M. Tech Energy Engg. (Mechanical), elective for / UG/MS/PhD

Semester: Odd/Even

Preamble: The objective of this course is to acquaint the students with important topics in thermodynamics related with performance analysis of energy systems. Key focus of this course will be to develop physical understanding of the principles with emphasis on energy applications.

Course Outline: The objective of the course is to introduce the students to basic laws of thermodynamics and other energy conversion basic concepts such as entropy and availability. The course aims to provide the students an understanding of the fundamental concepts and techniques that are important in the design of various components of the energy systems.

Course Modules:

Module - 1:
Laws of Thermodynamics: The first law for open and closed system; steady & transient processes; work and heat transfer; second Law of Thermodynamics for open and closed systems; Local Thermodynamic Equilibrium (LTE) Model, entropy maximum and energy minimum principles. (10L)

Module - 2:
Entropy: Concept of reversibility and irreversibility; change in entropy in various thermodynamic processes, entropy balance for closed and open systems, mechanism of entropy generation, entropy generation minimization. (7L)

Module - 3:
Single and Multiphase systems: Maxwell relations; Clausius – Clapeyron equation; GibbsDuhem Relation, phase diagrams; phase transition; types of equilibrium and stability; multi-component and multi-phase systems, equations of state. (9L)

Module - 4:
Combustion and Thermochemistry: Stoichiometry of reactions, enthalpy of formation and reaction, adiabatic flame temperature, second law and availability analysis of chemical reactions (6L)

Module - 5:
Advanced Thermodynamics Cycles: Advanced vapor power cycles; advanced gas power cycles, combined cycle power cycles, Cogeneration. (6L)

Module - 6:
Exergy Analysis of energy systems and case studies (5L)

Text books:

1. A. Bejan, *Advance Engineering Thermodynamic*, Wiley, 2006.

2. M. J. Moran and H. N. Shapiro, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons

3. C. Borgnakke, G. Van Wylen and R. E. Sonntag, *Fundamentals of Thermodynamics*, Wiley India.

Other Faculty interested in teaching this course: Dr. Dhiraj Patil