BASIC THERMODYNAMICS

AIM: At the end of the course the students will be able to analyze and evaluate various thermodynamic cycles used for energy production - work and heat, within the natural limits of conversion.

Learning Objectives of the Course

1. Recall

1.1 Basic definitions and terminology

1.2 Special definitions from the thermodynamics point of view.

1.3 Why and how natural processes occur only in one direction unaided.

2. Comprehension

2.1 Explain concept of property and how it defines state.

2.2 How change of state results in a process?

2.3 Why processes are required to build cycles?

2.4 Differences between work producing and work consuming cycles.

2.5 What are the coordinates on which the cycles are represented and why?

2.6 How some of the work producing cycles work?

2.7 Why water and steam are special in thermodynamics?

2.8 Why air standard cycles are important?

2.9 Evaluate the performance of cycle in totality.

2.10 How to make energy flow in a direction opposite to the natural way and what penalties are to be paid?

2.11 How the concept of entropy forms the basis of explaining how well things are done?

2.12 How to gauge the quality of energy?

3. Application

3.1 Make calculations of heat requirements of thermal power plants and IC Engines.

3.2 Calculate the efficiencies and relate them to what occurs in an actual power plant.

3.3 Calculate properties of various working substances at various states.

3.4 Determine what changes of state will result in improving the performance.

3.5 Determine how much of useful energy can be produced from a given thermal source.

4. Analysis

4.1 Compare the performance of various cycles for energy production.

4.2 Explain the influence of temperature limits on performance of cycles.

4.3 Draw conclusions on the behavior of a various cycles operating between temperature limits.

4.4 How to improve the energy production from a given thermal source by increasing the number of processes and the limiting conditions thereof.

4.5 Assess the magnitude of cycle entropy change.

4.6 What practical situations cause deviations form ideality and how to combat them.

4.7 Why the temperature scale is still empirical?

4.8 Assess the other compelling mechanical engineering criteria that make thermodynamic possibilities a distant dream.

5. Synthesis

Nil

6. Evaluation

6.1. Assess which cycle to use for a given application and source of heat

6.2. Quantify the irreversibilites associated with each possibility and choose an optimal cycle.