Thermodynamics & Hydraulics

Training Program

Course Description:

Although various aspects of what is now known as thermodynamics have been of interest since antiquity, formal study began only in the early 19th century through consideration of the motive power of heat: the capacity of hot bodies to produce work. Today the scope is larger, dealing generally with energy and entropy, and with relationships among the properties of matter. Moreover, in the past 25 years engineering thermodynamics has undergone a revolution, both in terms of the presentation of fundamentals and in the manner that it is applied. In particular, the second law of thermodynamics has emerged as an effective tool for engineering analysis and design.

Important topics to be considered in this course are thermodynamics, thermal systems and thermal transformation systems. Thermodynamics involves fundamental relationships between heat, work, and the properties of a system. It is concerned with the transformation of one form of energy into another and the basic laws that control such transformation. Of particular importance is the transformation of thermal energy into mechanical energy, which is the first step in the conversion of the energy associated with fossil fuels into electrical energy. Thermal transformation systems are systems that transform thermal energy into mechanical energy. This includes steam power plants, steam engines, steam turbines, gas turbines, and internal combustion engines.

Who Should Attend?

- Mechanical Engineers
- Instrumentation and Control Engineers

- Electrical Engineers
- Project Engineers
- Maintenance Engineers
- Systems Planners and Managers

Course Objectives:

At the end of this workshop, you will gain valuable know-how related to engineering thermodynamics on:

- First & second laws of thermodynamics
- Ideal gas model
- The properties of pure substances
- The definition of enthalpy, internal energy, and entropy
- The definition of exergy
- The difference between the thermal efficiency and second law efficiency
- Several thermal systems
- How to improve the performance of thermal systems

Course Outline:

Day 1

Fundamentals

- Basic Concepts and Definitions
- The First Law of Thermodynamics
- Energy

- The Second Law of Thermodynamics
- Entropy
- Entropy Generation

Property Relations and Data

- Basic Relations for Pure Substances
- P-v-T Relations
- Enthalpy, Internal energy and Entropy Evaluating
- Ideal Gas Model

Day 2

Control Volume Applications

- Conservation of Mass
- Control Volume Energy Balance
- Control Volume Entropy Balance
- Control Volumes at Steady State

Combustion

- Reaction Equations
- Property Data for Reactive Systems •
- Reaction Equilibrium

Day 3

Energy Analysis

- Defining Energy
- Control Volume Energy Rate Balance

- Exegetic Efficiency

Day 4

Vapor and Gas Power Cycles

- Rankine and Brayton Cycles
- Otto, Diesel, and Dual Cycles
- Carnot, Ericsson, and Stirling Cycles
- Heat Pump and Refrigeration Cycles

Day 5

Design Optimization

- Guidelines for Improving Thermodynamic Effectiveness
- Procedure for Optimizing the Design of a Thermal System •
- Case Study