Thermodynamics I

Course code: 28161
Credits: 3
Course Type: Theoretical
Prerequisites: Differential Equations, Physics 2
Course Length: 51 hours

Course Outline:

1- Definitions:

History of science of thermodynamics and its applications, thermodynamic system, control mass and control volume, state and properties of a substance, process and cycle, zeroth law of thermodynamics and equality of temperatures, temperature scales, units and dimensions.

2- Properties of a Pure Substance

Vapor-liquid-solid-phase equilibrium in a pure substance, thermodynamic state, intensive and extensive properties, independent and dependent properties, quality, equations of state, ideal and real gas behavior, thermodynamic tables of properties.

3- Work and Heat

Work and heat as boundary phenomena, different work modes, work done at the boundary of a simple compressible system, quasi-equilibrium process, definition of heat, comparison of work and heat, units of work and heat.

4- Conservation of Energy or First Law of Thermodynamics,

Conservation of mass for a system, volumetric and mass flow rates, first law applied to a system in a cyclic process and change of state, internal energy, kinetic energy, potential energy, first law applied to a control volume process, steady state and steady flow process, uniform state and uniform flow process, enthalpy, throttling process and Joule Thompson coefficient, constant pressure and constant volume heat capacities.

5- **Second Law of Thermodynamics**

Heat engines and Refrigerators, thermal efficiency and coefficient of performance, second law of thermodynamics, Kelvin-Plank and Clausius statements, reversible process, Carnot cycle.

6- Entropy

7- The inequality of Clausius, entropy, change of entropy for reversible and irreversible process, lost work, principle of increase of entropy in a system and control volume, change of entropy for ideal gas.

7- Exergy Analysis

Reversible work, Irreversibility, definition of availability or exergy, exergy analysis for a system and control volume, second law efficiency.

References:

1- Borgnakke, C., and Sonntag, R.E., "Fundamentals of Thermodynamics", John Wiley &Sons, 8th Ed, 2013 Chap. 1-10.
2- Cengel, Y.A., and Boles, M.A., "Thermodynamics: An Engineering Approach", McGraw-Hill,8th Ed., 2014.
3- Reynolds, W.C., and Perkins, H.C. "Engineering Thermodynamics" McGraw-Hill, Chap.1-8.
4- Balzhiser , R.E., and Samuels, M.R., "Engineering Thermodynamics" Prentice Hall, Chap. 1-5.
5- Burghardt, M.D., and Harbach J.A., "Engineering Thermodynamics with Applications", Harper-Collins, 1993, Chap.1-9.
6- Faires, V.M., "Thermodynamics", Macmillan Pub Co, 6th Ed., 1978, Chap. 1-5,7.
7- Lay, J.E., "Thermodynamics", Merrill, C.E., Publishing, 1963, Chap. 11,13,15,16,17,19,20.
8- Zemansky, M.W., Abbott, M.M., Vanness, H.C., "Basic Engineering Thermodynamics", McGraw Hill, 2nd Ed., 1975, Chap. 9,10.
9- Jones, J.B., and Hawkins, G.A., " Engineering Thermodynamics" John Wiley and Sons, 1986.
10- Holman, J.P., " Thermodynamics" McGraw-Hill, 4th Ed., 1985.