Course Number: 28037

Course Name: Advanced Thermodynamics

Course Type: Theory	Type & Max Unit: Constant 3
Prerequisite: Thermodynamics 2	Corequisite: Nothing.
Level: Graduate	First Presentation: 2017-1
Group: Energy Conversion	Last Edition: 2017-1.

Objectives:

The main goal of this course is to present the fundamental of thermodynamics. Starting with thermostatics, the thermodynamics postulates and fundamental equations of thermodynamics will be explained. It covers maximum entropy and minimum energy principles, Legendre and Massieu transformations to derive thermodynamics potential, exergy analysis and second law efficiency, microscopic point of view and statistical thermodynamics, first and second laws from statistical point of view, classical and quantum distributions, models for real gas mixtures and solutions, phase equilibrium, chemical equilibrium, Ionization and plasma state.

Topics:

- **Introduction:** A review of thermodynamic laws, postulates, fundamental equations, Euler equation
- **Maximum entropy and minimum energy principles:** Legendre and Massieu transformations, thermodynamic potentials, extremum principle
- **Exergy analysis and entropy generation minimization:** Exergy analysis for system and control volume, second law efficiency
- **Molecular thermodynamics:** Classical and quantum distributions, Boltzmann, Fermi-Dirac and Bose–Einstein distributions, first and second laws from statistical point of view, application for monoatomioc gas
- **Generalization of thermodynamic relations, generalized charts equations of state**
- **Thermodynamics of mixture and solutions:** Real mixture models, ideal solution model
- **Thermodynamics of Multicomponent systems:** Binary phase equilibrium, chemical equilibrium, Ionization, plasma state

References:

1- Herbert B. Callen, Thermodynamics and an Introduction to Thermostatics, Fourth Ed.John Wiley and Sons, (Chaps. 1-6), 1987

2- A. Bejan, Advanced Engineering Thermodynamics, John Wiley, Third Ed. 2006

3- Norman M. Laurendeau, Statistical Thermodynamics, Cambridge University Press, 2005

4- Fundamentals of Thermodynamics, C. Borgnakke, R. E. Sonntag, Wiley, 8th. Ed., 2012

5- A. Bejan, Entropy Generation Minimization, 1st. Ed.CRC Press, 1995