Thermodynamics II

Course code: 28162
Credits: 3
Course Type: Theoretical
Prerequisites: Thermodynamics I
Corequisite: Thermodynamics Lab.
Course Length: 51 hours

Outlines:

1- Cycles:

Rankine Cycle, effect of pressure and temperature on the cycle performance. Rankine cycle with reheat, Rankine cycle with regeneration, Deviations between actual and ideal Rankine cycles. Vapor compression refrigeration cycles, Absorption cycle, Otto and Diesel cycles, Stirling cycle, Brayton cycle, Gas turbine cycle with regeneration, Multi-stage inter-cooling and reheat gas turbine cycle, Jet engine cycle.

2- Thermodynamic Relations

Maxwell's thermodynamic relations. Clapeyron equation, Thermodynamic relations for enthalpy, internal energy, entropy, Joule Thompson coefficient and Volume Expansivity. Equation of state, Generalized compressibility chart, Ideal and real gas equations of state, enthalpy and entropy deviation charts for Real gas.

3- Mixtures

Mixture of ideal gases, mixture of air-water vapor, dry and wet bulb temperature, humidity ratio, relative humidity, application of first law for mixture process, Psychometric properties, Psychometric chart, adiabatic saturation process, mixing process.

4- Fuels and Combustion

Fuels, combustion process, combustion products, enthalpy of formation, adiabatic flame temperature, enthalpy of combustion, lower and higher heating values

5- Flow through Nozzles and Blade Passages

Stagnation properties, momentum principle for control volume, resulting forces acting on the control surface, one dimensional compressible adiabatic reversible flow through nozzle, speed of sound, Mach number, normal shock, Fanno and Rayleigh lines, flow through blades, steam flow through nozzles, nozzle and diffuser coefficients, velocity triangle, axial and tangential forces, impulse and reaction stages and turbines.

Reference:

1- Sonntag, R.E, and Borgnakke, C., "Fundamentals of Thermodynamics" , John Wiley and Sons, 8th Ed., 2013, Chap. 9-15.
2- Reynolds, W.C. and Perkins, H.C., "Engineering Thermodynamics" ,1977, McGraw Hill, Chap. 9-1,13.
3- Balzhiser ,R.E., and Samuels, M.R., " Engineering Thermodynamics" , Prentice – Hall, 1977, Chap. 6-9,11.
4- Burghardt, M.D., and Harbach J.A., "Engineering Thermodynamics with Applications", Harper-Collins, 1993, Chap. 10-18.
5- Faires, V.M., "Thermodynamics", Macmillan, 5th Ed., 1962, Chap. 6, 8-16.
6- Lay, J.E., "Thermodynamics"Charles E. Merrill Books, 1963, Chap. 11, 13, 15-17, 19-20.
7- Zemansky, M.W., Abbott, M.M., Vannes, H.C., "Basic Engineering Thermodynamics", McGraw Hill, 2nd Ed., Chap. 9-10.
8- Moran, M.J., Shapiro, H.N., Boettner, D.D., Baily, M.B., Fundamentals of Engineering Thermodynamics, Wiley, 8th Ed., 2014, Chap8-13.
9- Çengel, Y.A., Boles, M.A., Kanoğlu, M., "Thermodynamics", McGraw Hill, 9th Ed., 2019, Chap. 9-18.