KIT 253/3 – Chemical Engineering Thermodynamic

Course Objective : To introduce some of the basic concepts of chemical engineering thermodynamics and its related industrial applications

Topic	**Content**	**Number of lecture hours**	**Expected outcome – upon completion of the course, the student should be able to:**
1. Work and Heat	• Concept of engineering thermodynamics • Work done due to ideal gas expansion, polytropic process • Heat	3	• Differentiate between thermodynamic properties and systems. • Calculate work done using ideal gas equation and polytropic process. • Identify heat or work transfer to and from the system.
2. Compressible Pure Substances	• Introduction to compressible pure substance • Vapour-liquid-solid phase diagram of water system. • Steam Table and application • Other pure substances (eg. ammonia and refrigerant R-12)	5	• Identify compressible pure substances. • Use Thermodynamic Tables for solving related problems.
3. First Law of Thermodynamics	• Conservation of energy and the First Law of Thermodynamics: Internal energy, heat and work • Conservation of mass and energy equations for control volume • Steady-state and steady flow processes • Application of conservation of mass and energy equations to the system such as heat exchanger, turbine, nozzle etc.	6	• Derive the energy and mass equations for a control volume based on the First Law Thermodynamics. • Use the above equations in solving the related thermodynamic systems.

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4. Second Law of Thermodynamics and Entropy	• Second Law of Thermodynamics • Entropy change, reversibility and increment for gases • Isentropic or reversible adiabatic process • Control volume equation • Efficiencies	7	• Calculate the entropy change of a system. • Calculate thermodynamic properties and identify the process reversibility. • Calculate the heat and work and other properties by using the second law control volume equation. • Derive and use efficiencies equation of the operation units.
5. Thermodynamic Cycles	• Carnot cycles • Air cycles • Steam cycles • Heat pump and refrigeration cycles	8	• Apply First and Second laws of thermodynamics for cycles analysis.
6. Thermodynamic Relationships and Equations	• Maxwell and Clapeyron equations • Thermodynamic relationships • Specific heat capacity, compressibility and expansibility • Fugacity	4	• Understand the relationship between thermodynamic properties and their applications in the derivation of heat capacity, compressibility, expansibility and fugacity.
7. Combustion of Fuel	• Combustion process	3	• Understand the combustion process equation. • Calculate theoretical air, air-fuel or fuel-air ratios based on fuel or combustion product composition. • Understand a simple mass balance.
TOTAL		**36**	