

Topic 2: Laws of Thermodynamics

Relevant course: Thermodynamics / Engineering Thermodynamics / Thermal Science

Relevant Department: Mechanical Engg., Aerospace Engg., Production Engg.,

Relevant Semester: This is for a beginning course which is typically offered in the 2nd,3rd or 4th semesters of the B.Tech. program.

Pre-requisite: None. A course in Physics that covers thermodynamics would be helpful.

Topic Description:

Session 1 –

Laws of thermodynamics

Zeroth Law of Thermodynamics. Temperature. Equality of temperature. Applications.

First Law of Thermodynamics. Energy.

- Energy
- Internal energy.
- Enthalpy.
- Application to control mass / Non-flow processes.
- Application to control volume / Flow processes
- Steady State Steady Flow (SSSF) processes
- Uniform State Uniform Flow (USUF) processes

Session 2 –

Second Law of Thermodynamics.

- Heat engine, efficiency. Heat pump, coefficient of performance. Reservoir.
- Statements
- Carnot cycle. The processes. Efficiency. Why it is the most efficient.
- Clausius inequality.
- Entropy.

Session 3 –

Second Law application to control mass and control volume.

Property relations. Property diagrams.

Bernoulli's equation.

Application of laws to a process: Throttling, flow or reciprocating compressor / expander (turbine),

pump, heat exchanger, nozzle/diffuser, etc. Focus here will be on systematic approach up to developing

the governing equations for any working substance.