

Department of Mechanical Engineering, IIT Kharagpur

Syllabus for new curriculum

Subject: Thermodynamics (ME22002) 3-1-0-4

Introduction and fundamental concepts, system and surroundings, concept of control mass and control volume with examples, unit system
Temperature and zeroth law of thermodynamics, thermodynamic state, thermodynamic processes and thermodynamic equilibrium
Simple compressible substance, pure substances, phase and phase rule
Concept of energy, energy stored and energy in transit, definition of thermodynamic work and heat transfer, different modes of work transfer
First law of thermodynamics; cyclic and non-cyclic processes, concept of internal energy, first law of thermodynamics applied to an open system, concept of enthalpy, steady state steady flow energy equation, unsteady state energy equation, first law applied to simple components such as nozzles, diffusers, pumps and compressors
Second law of thermodynamics, the directional aspects of spontaneous processes, second law applied to cyclic and non-cyclic processes, Clausius inequality, concept of entropy, entropy balance equations, concept of entropy increase, reversible and irreversible processes Formal statements of second law, Concept of heat engines, refrigerators and heat pumps, Carnot cycle and absolute temperature scale, Carnot theorems, Kelvin-Planck and Clausius statements Concept of availability and irreversibility
Thermodynamic properties, property relations, Maxwell relations, Clausius-Clayperon equation, specific heats and specific heat ratio, Joule-Thomson coefficient and inversion temperature
Thermodynamic properties of pure substances and mixtures, equations of state, ideal and real gases and gaseous mixtures Estimation of thermodynamic properties, sources of properties, tables, charts and property equations, use of various software (EES, RefProp etc.) for property evaluation, psychrometry, psychrometric properties and psychrometric chart
Basic thermodynamic cycles: Performance parameters, thermal efficiency, COP and second law efficiency Simple vapour cycles for power generation and refrigeration – Carnot, Simple Rankine and simple vapour compression refrigeration (Evans-Perkins) cycles Simple gas cycles for power generation and refrigeration – Carnot, Brayton, Joule, Stirling, Otto and Diesel cycles

TEXT BOOK IN SECTION 3

Suggested Books: [Thermodynamics by YA Cengel and MA Boles, 7e, McGraw Hill Education \(I\) Pvt. Ltd.](#)

Reference only

1. [Fundamentals of Thermodynamics, Richard Edwin Sonntag, Claus Borgnakke, Gordon John Van Wylen, Wiley, 2003](#)
2. [Fundamentals of Engineering Thermodynamics, Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, Wiley, 9th edition, 2018](#)