Sem.	Subject code	Course title	No. of hours	Credits	Paper type
V	17U5PMC6	Thermodynamics and statistical mechanics	5	5	Major Core

Objectives:

(i). To make the students understand the influence of heat and thermodynamic applications of bodies. (ii). To make the students learn the principles in the production of low temperature and liquefaction of gases. (iii) To make the student to have the basic understanding of statistical mechanics.

Learning outcome:

(i). Students will be able to solve the problem in heat and thermodynamics. (ii). Students will be able to appreciate the quantum statistical procedure. (iii). Students will be able to understand the low temperature, liquefaction of gases and entropy concept.

Unit I: Transmission of heat and radiation

Introduction-Coefficient of thermal conductivity-Rectilinear flow of heat along a bar-Ingen Hausz experiment-Lee's disc method of determination of thermal conductivity of bad conductor - Radiation-Black body-Wien's displacement law, Rayleigh-Jeans law and Planck's Radiation law (no derivation)-Stefan's law-Derivation of Stefan's law and its experimental verification- Solar constant and experimental determination of Solar constant (Angstrom's Pyrheliometer &Water flow Pyrheliometer).

Unit II: Laws of thermodynamics

Reversable and irreversible processes-Heat Engines-Definition of efficiency, Carnot's ideal heat engine-Carnot's cycle-Effective way to increase efficiency-Carnot's engine and refrigerator-Coefficient of performance-Second law of thermodynamics (various statements)-Carnot's Theorem-Carnot's cycle and its applications-Petrol engine and diesel engine.

Unit III: Entropy

Concept of entropy–Change in entropy in adiabatic process–Change in entropy in reversible cycle-Principle of increase of entropy-Change in entropy in irreversible process-T-S Diagram- Physical significance of entropy-Entropy of a perfect gas- Kelvin's thermodynamics scale of temperature-Third law of thermodynamics-Zero point energy-Negative temperature-Heat death of Universe-Four Maxwell's thermodynamic relations-Relation between thermodynamic variables.

Unit IV: Change of state

Joule-Thomson's effect-Porous plug experiment-Liquefaction of gases-Linde's method- Principle of Cascaded cooling-Liquefaction of Helium-Helium I and Helium II-Some peculiar properties of Helium II-Production of low temperatures-Adiabatic demagnetization working and theory-Refrigeration and air conditioning system (factors affecting comfort air conditioning, air conditioning system and equipments used in air conditioning system)

Unit V: Statistical mechanics

Probability-Macro state and microstate-Thermodynamic probability- Phase space-Elements of phase space-Fundamental postulates of statistical mechanics-Entropy and probability–Need for quantum statistics-Maxwell-Boltzmann energy distribution law-Bose-Einstein law-Fermi-Dirac distribution law.

Text Book(s):

1. Heat, Thermodynamics and Statistical Physics by Brijilal, N.Subramininan and P.S.Hemne, S. Chand & Co. Revised Edition, New Delhi, (2014)

Unit I: 15.1, 15.2, 15.6, 15.10, 8.6, 8.12, 8.14, 8.15, 8.17, 8.26, 8.28 & 8.29
Unit II: 4.20- 4.29, 4.32, 4.33
Unit III: 5.1–5.11, 5.15–5.18 & 6.3
Unit IV: 7.5-7.9, 7.11-7.13, 7.15-7.16, 7.21, 16.7, 17.1, 17.2. &17.3
Unit V: 9.2, 9.7, 9.8, 10.4, 10.8, 10.15, 11.3, 12.1, 12.5, 12.8

Books for Reference:

1. Heat and Thermodynamics, Mark Zemansky, Richard H Dittman, 8th ED McGraw Hill Education, (2011).
2. Thermodynamics and Statistical Physics, J. K. Sharma, K. K. Sarkar, Himalaya Publishing House, (1988).
3. Fundamental of Statistical mechanics, B.B.Laud, New Age International publishers, New Delhi, (2012).

Websites:

1. https://www.khanacademy.org> physics
2. web.mit.edu/16.unified/www/FALL/thermodynamics