Applied Thermodynamics			
Hours/Week L-T-P:	3-0-0	Credits:	3
Course Type:	Professional Core	Course Code:	MS2103

Course Objectives:

To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

Course Outcomes:

Upon the completion of this course the students will be able to

CO1: Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.

CO2: Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.

CO3: Apply Rankine cycle to steam power plant and compare few cycles improvement methods

CO4: Derive simple thermodynamic relations of ideal and real gases and calculate the properties of gas mixtures and moist air and its use in psychometric processes

UNIT-1 9 Hours

BASIC CONCEPTS: concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work. P-V diagram. Zeroth law of thermodynamics — concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems — steady and unsteady flow processes. Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries.

UNIT-2 **9 Hours**

ENTROPY, EXERGY: Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Exergy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT-3 9 Hours

PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE: Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

UNIT-4 9 Hours

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor- Principle of Corresponding states. - Generalized Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations. Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture — Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function.

Text Books:

1. Nag. P.K., "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill, New Delhi, 2013.
2. R.K. Rajput, "A Text Book Of Engineering Thermodynamics ", Fifth Edition,2017.
3. Yunus a. Cengel & Michael a. Boles, "Thermodynamics", 8th edition 2015.

Reference Books:

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Borgnakke & Sonntag, "Fundamental of Thermodynamics", 8th Edition, 2016.
3. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.
4. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	-	-	-	-	-	1	3	2	2
CO2	3	3	3	2	1	-	-	-	-	-	-	1	3	2	2
CO3	3	3	3	2	1	-	-	-	-	-	-	1	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	-	1	3	2	2