II B. Tech – II Semester

(20ME4634) ADVANCED THERMODYNAMICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	4

Pre-Requisites: Engineering Physics, Engineering mathematics, Thermodynamics Fundamentals

Course Objectives:

The Students will acquire the knowledge

- To interpret the knowledge on the concepts of thermodynamic systems, laws, related fundamental definitions with respect to energy, heat and work interactions of the system and surroundings.
- To discuss the properties of gases and gas mixtures.
- To outline the concepts underlying the phenomenon of combustion and to summarize the calculations involved in combustion.
- To interpret the working principles and working cycles of steam power plants and vapour compression refrigerator and to learn to analyze.
- To outline the outline the various direct conversion systems and their working principles.

UNIT-I: Review of Thermodynamic Laws and Corollaries:

Transient flow analysis, Second law of thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation. Entropy generation, Irreversibility-Gay Stodal equation.

UNIT-II: Ideal and Real gases:

Equation of state, Real gas behavior, Vander Waal's equation, Generalized compressibility factor. Energy properties of real gases. Vapour pressure, Clausius, Clapeyron equation. Throttling, Joule-Thompson coefficient. Non reactive mixtures of perfect gases. Governing laws, Evaluation of properties, Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers. Real gas mixtures.

UNIT-III: Combustion:

Combustion Reactions, Enthalpy of formation. Entropy of formation, Reference levels of tables. Energy of formation, Heat of reaction, Adiabatic flame temperature, Enthalpies, Equilibrium. Chemical equilibrium of ideal gas, The Vant Hoff's equation. The chemical potential and phase equilibrium. The Gibbs phase rule.

UNIT-IV: Vapour power cycles:

Properties of pure substances, Rankine cycle, Performance evaluation, Methods to improve performance, binary vapor cycle, cogeneration and combined cycles.

Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

UNIT-V: Direct Energy Conversion Introduction:

Fuel cells, Thermo electric energy, Thermo ionic power generation, Thermodynamic devices magneto hydronamic generations, Photovoltaic cells.

Course Outcomes:

A student who successfully fulfills this course requirement will be able to:

S. No	Course Outcome	BTL
1.	Explain the concepts of thermodynamic systems, governing laws, heat and work interactions and energy concepts.	L2
2.	Calculate the properties of real gases, illustrate Joule-Thompson experiment and calculate psychometric properties of wet air.	L2
3.	Illustrate the concepts underlying the phenomenon of combustion and to summarize the calculations involved in combustion.	L3
4.	Illustrate the working principles of vapor power cycles and refrigeration cycles and calculate the performance parameters.	L3
5.	Outline the various direct conversion systems and their working principles.	L3

Correlation of Cos with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	3	3	1	1	1	1	1	2	2
CO2	3	3	2	2	1	2	1	0	3	2	1	1	3	3
CO3	3	3	2	3	1	1	3	1	2	1	0	1	3	2
CO4	3	3	3	3	1	3	1	1	2	3	2	0	3	2
CO5	3	3	2	2	2	3	2	0	3	1	1	1	3	2

TEXT BOOKS

1. Thermodynamics - J.P.Holman, McGrawHill
2. Thermodynamics (Asia Adaptation): An Engineering Approach by Yunus A.Cengel
3. Engineering Thermodynamics, PK Nag,TMH.

References:

1. Engineering Thermodynamics - Jones & DuganPHI
2. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
3. Engineering Thermodynamics, R KRajput.
4. Basic Engineering Thermodynamics - A.Venkatesh - Universities press.
5. Stephen R. Turns, An Introduction to Combustion: Concepts & Applications, McGraw-Hill Education.