16CH101 CHEMICAL ENGINEERING THERMODYNAMICS-I

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	-	25	50	-	-	5	5

HEAT ENGINE

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with first, second and third laws of thermodynamics, volumetric properties, refrigeration and liquefaction processes. The objective of this course is to provide understanding in the theory and applications of classical thermodynamics, thermodynamic properties and equations of state.
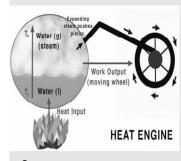
COURSE OUTCOMES:

Upon completion of the course, the student will able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Apply fundamental concepts of thermodynamics to engineering applications.	1,2
2	Estimate thermodynamic properties of substances in gas and liquid states.	3
3	Derive and discuss the first and second laws of thermodynamics.	4
4	Apply laws of thermodynamics to engineering applications.	6
5	Solve problems using the properties and relationships of thermodynamic fluids.	3,4

SKILLS:

✓ Estimation of thermodynamic properties.

✓ Determination of heat engine and pump efficiency.

✓ Identification of reversible and irreversible processes.

✓ Selection of refrigeration process and refrigerant.

✓ Describe the process in terms of the changes in system properties.

UNIT - I   **L-9, T-3**

BASIC CONCEPTS : The scope of thermodynamics; Dimensions and units; Measures of amount or size; Force; Temperature; Pressure; Potential energy; Internal energy; Heat; Work; Zeroth law.

FIRST LAW OF THERMODYNAMICS : Joule's experiment; Statement of first law; Energy balance for closed system; Thermodynamic state and state functions; Equilibrium; Phase rule; Reversible processes; Constant-v and constant-p processes; Enthalpy; Heat capacity; First law of thermodynamics for open systems.

UNIT - II   **L-9, T-3**

VOLUMETRIC PROPERTIES OF PURE FLUIDS : PVT behaviour of pure substances; Virial equations of state; Ideal gas; Applications of the virial equations; Cubic equations of state.

UNIT - III   **L-9, T-3**

HEAT EFFECTS : Sensible heat effects; Latent heats of pure substances; Standard heats of reaction, Standard heats of formation; Standard heats of combustion; Temperature dependency of heat of reaction; Heat effects of industrial reactions..

UNIT - IV   **L-9, T-3**

SECOND LAW OF THERMODYNAMICS: Statements of the second law; Heat engines; Thermodynamic temperature scales; Entropy; Mathematical statement of the second law; Maxwell relations.

PRODUCTION OF POWER FROM HEAT: Steam power plant, Rankine cycle, Otto engine, Diesel engine.

UNIT - V   **L-9, T-3**

REFRIGERATION AND LIQUEFACTION : The Carnot refrigerator; Vapor compression cycle; Choice of refrigerant; Absorption refrigeration; Liquefaction processes.

TEXT BOOKS:

1.   J. M. Smith, H. C. Vanness and M. M. Abbot, "Introduction to Chemical Engineering Thermo-dynamics", 6th edition, McGraw-Hill, 2005.

2.   Y. V. C. Rao, "Chemical Engineering Thermodynamics", 1st edition, Universities Press, 2004.

REFERENCE BOOKS:

1.   Dodge B. F., "Chemical Engineering Thermodynamics", 1st edition, McGraw-Hill, 1944.

2.   Kyle B. G., "Chemical and Process Thermodynamics", 1st edition, Prentice Hall of India, 1999.