

Thermodynamics

SUBJECT: ME-302: Thermodynamics

CREDIT HOURS: 2-1

CONTACT HOURS: 5 Hours per Week

TEXT BOOKS: *Fundamentals of Engineering Thermodynamics* by
Howard N. Shapiro and Michael J. Moran

REFERENCE BOOKS: *Thermodynamics: An Engineering Approach* by Y. A.
Cengel and M. A. Boles, Latest Edition

PREREQUISITE: None

MODE OF TEACHING: Lectures and Practical Work

COURSE DESCRIPTION:

This course begins with the study of basic concepts of thermodynamics and properties of thermodynamic systems. Students are also taught about different open and close systems and heat, mass, and work interactions. Based on these concepts first and second laws of thermodynamics, reversible and irreversible processes are taught to the students. Fundamental concepts topics like enthalpy, entropy, are taught. Furthermore, heat engines and refrigeration cycles are discussed.

COURSE OBJECTIVES:

By studying this course students will gain the basic knowledge and skills in the areas of thermodynamics. These concepts will help students in better understanding of machines that operate of principles of thermodynamics like IC engines, turbo machinery, steam and gas turbines and compressors etc. They will learn about the inter conversion of heat and work energies.

LEARNING OUTCOMES:

Upon successful completion of the course, the student will demonstrate competency by being able to:

1. Understanding the basic concepts of thermodynamics, properties of pure substances, and property diagrams

2. Understanding the first law of thermodynamics and inter-conversion of heat and work.
3. Understanding the concepts of enthalpy, entropy, and the 2nd law of thermodynamics, their application, and limitations.
4. Application of thermodynamic cycles including the steam and gas turbine cycles.
5. Understand the environmental impact and energy efficiency of thermodynamic applications such as power plants and refrigeration.

PRACTICAL APPLICATION:

Most of the equipments used in power generation and process industry are based on the principles of thermodynamics. These machines are designed and their operations and maintenance is done based on the knowledge and principles are learned in these subjects. Power generating equipment like engines and turbines and power consuming equipment like pumps and compressors play a very critical role in today's modern industry. Furthermore process industry like fertilizer, chemical, petrochemical, refinery, sugar plant, paper plant, cement plant and many other of the same kind constitute a major portion of latest industry. Having knowledge and skills pertaining to this technological area is crucial for engineers and will be covered in the said subject.

TOPICS COVERED:

S.No	Topic	Week/Lecture
1	Properties of Pure Substances: property tables, property diagrams, phase change, equations of state (ideal gas).	1-3
2	Energy: Energy transfer by heat, work and mass	4-5
3	The First Law of Thermodynamics: Closed system, open system, steady-flow engineering devices	6-8
4	The Second Law of Thermodynamics: Statements of the 2nd Law, reversible versus irreversible processes, the Carnot cycle.	9-11
5	Entropy and Enthalpy- Clausius inequality, enthalpy and specific heats;	12-13
6	Thermodynamic cycles: Heat Engines and refrigeration cycle.	14-16

COURSE TARGETS:

S#	Outcome	PLO	Level of Learning
1	Understanding the basic concepts of thermodynamics, properties of pure substances and property diagrams	1	C-2
2	Understanding first law of thermodynamics and inter conversion of heat and work.	2	C-2
3	Understanding the concepts of enthalpy, entropy and 2nd law of thermodynamics, its application, and limitations.	2	C-2
4	Application of thermodynamic cycles including the steam and gas turbine cycles.	2	C-3
5	Understand the environmental impact and energy efficiency of thermodynamic applications such as power plants and refrigeration.	7	C-2