

Ministry of Higher Education and Scientific research



**Department of Mechanical and Mechatronics**

**College of Engineering**

**Salahaddin University – Hawler**

**Subject: Thermodynamics I**

**Course Book –Second Year**

**Lecturer's name: Azhar Kareem Mohammed**

**Academic Year: 2019 -2020**

**Course Book**

<b>1. Course name</b>	<b>Thermodynamics</b>
<b>2. Lecturer in charge</b>	<b>Azhar Kareem Mohammed</b>
<b>3. Department/ College</b>	<b>Mechanical and Mechatronics Eng. Dept. College of Engineering</b>
<b>4. Contact</b>	<b>e-mail :- azhar.mohammed@su.edu.krd Tel:</b>
<b>5. Time ( hr. / week )</b>	<b>Theory: 3 hr and Practical: 2hr</b>
<b>6. Office hours</b>	<b>2 hours in days</b>
<b>7. Course overview:</b>	
<p>Thermodynamics is the science that deals with heat and work and those properties of substance that bear a relation to heat and work.</p> <p>Thermodynamics is the study of the patterns of energy change. Most of this course will be concerned with understanding the patterns of energy change.</p> <p>Basis of thermodynamics is experimental observation. In that sense it is an empirical science. The principles of thermodynamics are summarized in the form of four laws known as zero, first, second, and the third laws of thermodynamics.</p>	
<b>8. Course Objective:</b>	
<p>After studying this course the student will be learned:</p> <p>The zeroth law of thermodynamics deals with thermal equilibrium and provides a means of measuring temperature.</p> <p>The first law of thermodynamics deals with the conservation of energy and introduces the concept of internal energy.</p> <p>The second law of thermodynamics dictates the limits on the conversion of heat into work and provides the yard stick to measure the performance of various processes. It also tells whether a particular process is feasible or not and specifies the direction in which a process will proceed. As a consequence it also introduces the concept of entropy. The third law defines the absolute zero of entropy.</p>	
<b>9. Student's Obligation</b>	
<ul style="list-style-type: none"> <li>➤ Regular attendance is required according to the university rules.</li> <li>➤ The use of mobile phone during the class is prohibited.</li> <li>➤ Only the students who are officially enrolled can attend the class, guests and children are not admitted.</li> <li>➤ Daily participation and conducting assignments are required.</li> </ul>	
<b>10. Forms of Teaching</b>	
<p>Different forms of teaching will be used to reach the objectives of the course</p> <ol style="list-style-type: none"> <li>1. Power point for main parts (head titles, definitions, objectives, figures, design, tables and charts ...etc) each subject.</li> <li>2. White board will be used for presenting mathematical equations and solving examples.</li> </ol>	

For the student to achieve a level of excellence in this subject, the following points should be given utmost consideration:

1. Class attendance on regular basis for the purpose of learning.
2. Active participation in class discussions
3. Reviewing the lecture notes and topics on weekly basis, noting the ambiguous points, if any, and requesting clarification during instructor office hours
4. Visiting the library on regular basis and checking the Internet for other approaches or simplifications of topics and ideas
5. Giving adequate and sufficient priority to preparing for weekly, monthly and final tests.

## 11. Assessment Scheme

## 12. Student learning outcome:

**Ch. 1: INTRODUCTION AND BASIC CONCEPTS** (THERMODYNAMICS AND ENERGY, IMPORTANCE OF DIMENSIONS AND UNITS, SYSTEMS AND CONTROL VOLUMES, PROPERTIES OF A SYSTEM, Continuum, DENSITY AND SPECIFIC GRAVITY, PROCESSES AND CYCLES, TEMPERATURE AND THE ZEROth LAW OF THERMODYNAMICS, PRESSURE .....etc).

**Ch.2: ENERGY** (FORMS OF ENERGY, ENERGY TRANSFER BY HEAT, ENERGY TRANSFER BY WORK, MECHANICAL FORMS OF WORK, THE FIRST LAW OF THERMODYNAMICS ...etc).

**Ch.3: PROPERTIES OF PURE SUBSTANCES** (PURE SUBSTANCE , PHASES OF A PURE SUBSTANCE , PHASE-CHANGE PROCESSES OF PURE SUBSTANCES , Saturation Temperature and Saturation Pressure, PROPERTY DIAGRAMS FOR PHASE-CHANGE PROCESSES , PROPERTY TABLES , Moisture Content, Superheated Vapour, THE IDEAL-GAS EQUATION OF STATE,...etc).

**Ch.4: First Law of Thermodynamics (CLOSED SYSTEM).** (ENERGY ANALYSIS, Closed System First Law of a Cycle, INTERNAL ENERGY, ENTHALPY, AND SPECIFIC HEATS OF IDEAL GASES, ...etc)

**Ch.5: First Law of Thermodynamics (CONTROL VOLUMES)**( Conservation of Mass , Conservation of Mass Principle , FLOW WORK AND THE ENERGY OF A FLOWING FLUID , STEADY-FLOW ENGINEERING DEVICES , Nozzles and Diffusers , Turbines and Compressors , Throttling Valves , Mixing Chambers , Heat Exchangers

, Pipe and Duct Flow ...etc).

**Ch.6: THE SECOND LAW OF THERMODYNAMICS** (HEAT ENGINES , Thermal Efficiency, Kelvin–Planck Statement, REFRIGERATORS AND HEAT PUMPS, Coefficient of Performance, CARNOT CYCLE...etc).

**Ch.7: ENTROPY** (Internally Reversible Isothermal Heat Transfer Processes , ENTROPY CHANGE OF PURE SUBSTANCES , ISENTROPIC PROCESSES , ENTROPY CHANGE OF (Incompressible substances) LIQUIDS AND SOLIDS , THE ENTROPY CHANGE OF IDEAL GASES , Isentropic Efficiency of Turbines, Isentropic Efficiencies of Compressors and Pumps....etc).

**13. Course Reading List and References:**

- Thermodynamics An Engineering Approach 5th Edition by Yunus Cengel.
- Engineering thermodynamics by R.K Rajput 4th edition
- Fundamental of Thermodynamics by Sonntag, Borgnakke and van Wylen.
- Fundamentals of Engineering Thermodynamics 5th Edition (Moran & Shapiro).

**14. Course Reading List:**

**14 Weeks: From the 22<sup>th</sup> of October to 01<sup>h</sup> of February**

Weeks No.	Syllabus	Date
1-2	INTRODUCTION AND BASIC CONCEPTS	
3	ENERGY, ENERGY TRANSFER, AND GENERAL ENERGY ANALYSIS	
4-5-6	PROPERTIES OF PURE SUBSTANCES	
7-8	FIRST LAW OF THERMODYNAMICS (CLOSED SYSTEM)	
9-10	FIRST LAW OF THERMODYNAMICS (CONTROL VOLUMES)	
11-12	THE SECOND LAW OF THERMODYNAMICS	
13-14	ENTROPY	