



Module (Thermodynamics of Materials) Catalogue

2023-2024

College/ Institute	Erbil Technology College	
Department	Construction and Materials Technology Engineering Department	
Module Name	Thermodynamics of Materials	
Module Code	THM472	
Degree	Technical diploma <input type="checkbox"/>	Bachelor <input checked="" type="checkbox"/>
	High Diploma <input type="checkbox"/>	Master <input type="checkbox"/> PhD <input type="checkbox"/>
Semester	7	
Qualification	Ph.D.	
Scientific Title	Lecturer	
Credits	6	
Module type	Prerequisite <input type="checkbox"/>	Core <input checked="" type="checkbox"/> Assist. <input type="checkbox"/>
Weekly hours	2 hr.	
Weekly hours (Theory)	(2)hr. Class	(24) hr. Workload
Weekly hours (Practical)	()hr. Class	() hr. Workload
Number of Weeks	12	
Lecturer (Theory)	Dr. Bashir Eskander Kareem	
E-Mail & Mobile NO.	bashir.kareem@epu.edu.iq	
Lecturer (Practical)		
E-Mail & Mobile NO.		
Websites		

Course Book

Course Description	<p>Thermodynamics is the science that deals with heat and work and those properties of substance that bear a relation to heat and work. 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 zeroth, first, second and third laws of thermodynamics.</p>
Course objectives	<p>Completing the course, the student will have learned:</p> <ul style="list-style-type: none">• The zeroth law of thermodynamics that deals with thermal equilibrium and provides a means of measuring temperature.• The first law of thermodynamics that deals with the conservation of energy and introduces the concept of internal energy.• 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 process is feasible or not and specifies the direction in which a process will proceed. Therefore, it also introduces the concept of entropy. The third law defines the absolute zero of entropy.
Student's obligation	<ul style="list-style-type: none">• Attendance and participation in the lecture are mandatory and will be considered in the grading.• There will be several quizzes during the academic year, not necessarily announced. The quiz contains the materials covered in previous lectures.• There are 60-minute midterm exams and a 120 -minute final exam. All tests are in class, closed book, and closed notes.• Any quiz or test missed without a supported documented and excused absence will represent a zero.• Other activities like reports and mechanical project.

Required Learning Materials	<ul style="list-style-type: none"> Data show, white board and PowerPoint are used throughout the lecture, Testing in department's Laboratory. Publish all lecture notes in college website before the lecture day. 				
Evaluation	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
	Paper Review				
	Assignment	Homework	5		
		Class Activity	2		
		Report	5		
		Seminar	5		
		Essay			
		Project			
	Quiz		8		
	Lab.				
Midterm Exam		25			
Final Exam		40			
Specific learning outcome:	15. Student learning outcome: 1- Understanding thermodynamics and energy, dimensions and units, systems and control volumes, properties of a system, density and specific gravity, processes and cycles, temperature and the zeroth law of thermodynamics, pressure etc.).				

	<p>2- Understanding forms of energy, energy transfer by heat, energy transfer by work, mechanical forms of work, the first law of thermodynamics ...etc).</p> <p>3- Understanding pure substance, phases of pure substances, saturation temperature and saturation pressure, property diagrams for phase-change process, property tables, dryness fraction, superheated vapor. ideal-gas equation of state).</p> <p>4- Understanding moving boundary work, energy analysis of closed system, the cycle, internal energy, enthalpy and specific heats of ideal gases, ...etc.)</p> <p>5- Understanding mass and volume flowrate, energy analysis of a steady flow system, , steady-flow devices, nozzles and diffusers, turbines and compressors , throttling valves , mixing chambers , heat exchangers , ...etc.).</p> <p>6- Understanding the heat-engine (he), thermal efficiency, kelvin–planck statement, refrigerators and heat pumps (hp), coefficient of performance cop, the Carnot cycle...etc.</p> <p>7- Understanding internally reversible isothermal heat transfer processes, entropy change of pure substances, isentropic process, 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.</p>	
<p>Course References:</p>	<ul style="list-style-type: none"> • 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 9th Edition (Moran & Shapiro). 	
<p>Course topics (Theory)</p>	<p>Week</p>	<p>Learning Outcome</p>
<p>INTRODUCTION AND BASIC CONCEPTS</p>	<p>1</p>	<p>1</p>
<p>ENERGY, ENERGY TRANSFER, AND GENERAL ENERGY ANALYSIS</p>	<p>2</p>	<p>1</p>
<p>PROPERTIES OF PURE SUBSTANCES</p>	<p>3</p>	<p>2</p>
<p>ENERGY ANALYSIS OF CLOSED SYSTEMS</p>	<p>4</p>	<p>3</p>
<p>MASS AND ENERGY ANALYSIS OF CONTROL VOLUMES</p>	<p>5&6</p>	<p>3</p>
<p>THE SECOND LAW OF THERMODYNAMICS</p>	<p>7</p>	<p>4</p>
<p>GAS–VAPOR MIXTURES AND AIR-CONDITIONING</p>	<p>8&9</p>	<p>4</p>
<p>RENEWABLE ENERGY</p>	<p>10</p>	<p>5</p>

THERMODYNAMIC PROPERTY RELATIONS	11	6
ENTROPY	12	7
Practical Topics	Week	Learning Outcome

Questions Example Design

Q 1/ Distinguish between

- a) Intensive property and extensive property
- b) Heat and work

Q2/a- Entropy of 1 kg of steam at 5 bar is 5 kJ/kg.k, calculate the heat spent measured from water at 0°C to this final condition.

b- The Carnot cycle operates between temperature of 4.4°C and 32.2°C. investigate the effectiveness (respectively in terms of COP and η) of this cycle when its purpose is

- To provide refrigeration
- To deliver power

Q3/ True or False type of exams

Weight of a system is an intensive property whereas specific weight and specific gravity are extensive property.

TRUE/ FALSE√

Q4/Multiple choice

Which of the following is an intensive property of thermodynamic system?

- (a) Volume
- (b) Temperature
- (c) Mass
- (d) Energy

Extra notes:

No extra notes

External Evaluator

While reviewing the course catalogue and its contents, it appears that it offers the necessary areas for students to comprehend the principles of thermodynamics I and their analyses.



Assist. Prof. Dr. Banipal N. Yaqob

15/2/2024