هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Thermodynamics**
Course Code:	**PHY2504**
Program:	**B.Sc. Physics**
Department:	**Physics**
College:	**Applied sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:4
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 6th/2nd year
4. Pre-requisites for this course (if any): **General physics (3)**
5. Co-requisites for this course (if any):

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	40	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	40
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides the basic concepts in heat transfer and thermodynamics including basic definitions and laws relating to them and their applications. In this course students will study thermal properties of matter, kinetic theory of gasses, thermodynamic properties and processes, of zeroth, irst, second and third laws of thermodynamics, and thermodynamic potentials.

2. Course Main Objective: in this course student will be able to

1. state the first law of thermodynamic and define heat, work, thermal efficiency
2. Identify and describe energy exchange processes (in terms of various forms of energy, heat and work.
3. Explain the differences between different processes in thermodynamics.
4. Apply ideal cycle's analysis to simple heat engine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycles.
5. define deduce thermodynamics potentials, internal energy U, enthalpy (H), free energy of Gibbs (G) and Helmholtz free energy (A), Maxwell relations and their the application, TdS equations, Clausius Clapeyron equation

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Define basic information and principles in heat and thermodynamics.	K1
1.2	Memorize the zeroth, first, second and third laws of thermodynamics and their relationships and applications.	K2
2	**Skills:**	
2.1	Solve problems using suitable laws to calculate some parameters like entropy and its implications on thermodynamical variables.	S1
2.2	Explain Maxwell, TdS equations for thermodynamic and some Cycles and their efficiencies.	S2
3	**Values:**	
3.1	Collaborate and contribute responsibly and effectively in teamwork by introducing presentation in some subjects of materials.	V2

C. Course Content

No	List of Topics	Contact Hours
1	**Thermal properties of matter:** Temperature and Heat, Temperature scales, Type of thermometer, Zeroth law of Thermodynamic, Thermal transfers, thermal expansion.	8
2	**Thermodynamics properties:** equation of ideal gas, kinetic theory, Vander Waal equation for real gas, Deduction of the critical constant of a real gas of Vander Waal, Virial equation of state, Reduced equation of state, Adiabatic compressibility, P-V-T relationship of real gases, Phase diagram	6
3	**First law of thermodynamics, Heat and Energy**: The types of systems and the processing in thermodynamics, The definition of heat capacity, specific heat capacity, latent heat, apply the first law of thermodynamics to evaluate the temperature, work, the internal energy and energy conversion, enthalpy, the relationship between specific heat for gas, the work done in adiabatic process.	9
4	**Second law of thermodynamics:** heat engines, refrigerators, and heat pumps, reversible processes, statements of Kelvin - Planck and Clausius. Carnot machine and its efficiency, the principles of the Carnot cycle, and efficiency of Otto cycle and diesel fuel and gasoline	9
5	**Entropy and third law of thermodynamics:** the concept of entropy, entropy in the reversible processes, the third law of thermodynamics	4
6	**Thermodynamics potentials**: thermodynamics potentials, internal energy U, enthalpy (H), free energy of Gibbs (G) and Helmholtz free energy (A), Maxwell relations and their the application, TdS equations, Clausius Clapeyron equation	4

Total	40

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Define basic information and principles in heat and thermodynamics.	1. Demonstrating the basic information and principles through lectures. 2. Lecturing method: Board- Power point. 3. Discussions 4. Brain storming. 5. Start each chapter by general idea.	1. Solving examples in lectures. 2. Discussion during lecture. 3. Quizzes. 4. Mid-terms. 5. Final exams. 6. Homework.
1.2	Describe the first, second and third laws of thermodynamics and their relationships and applications.	1. Demonstrating the basic information and principles through lectures. 2. Lecturing method: Board, Power point. 3. Discussions 4. Brain storming.	1. Quizzes. 2. Mid-term. 3. Final exam. 4. Homework.
2.0	**Skills**		
2.1	Solve problems using suitable laws to calculate some parameters like entropy and its implications on thermodynamical Variables.	1. Following some proofs. 2. Define duties for each chapter. 3. Homework 4. Encourage the student to look for the information in different references	1. Quizzes. 2. Mid-terms. 3. Final exams. 4. Homework.
2.2	Explain Maxwell, TdS equations for thermodynamic and some Cycles and their efficiencies.	1.Encourage the student to look for the information in different references 2.Group discussions	1. Quizzes. 2. Mid-terms. 3. Final exams. 4. Homework. 5.
3.0	**Values**		
3.1	Collaborate and contribute responsibly and effectively in teamwork by introducing presentation in some subjects of materials.	1.Team work projects 2. Solving problems	Presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm	6th week	30 %
2	Home works, quizzes, activities	During the semester	20 %
3	Final Exam	End of the semester	50%
4			
5			
6			
7			
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : 4 office hours per week for support and advice students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Heat and Thermodynamics**, M.W Zemansky, R.H.Dittman 7th edition, McGraw-Hill, (1997).
Essential References Materials	**Heat and Thermodynamics,** J.K Roberts, A. R. Miller (1960).
Electronic Materials	
Other Learning Materials	**Heat and Thermodynamics,** Brij Lal, N. Subrahmanyam (2001)

2. Facilities Required

Item	Resources
Accommodation (Classrooms)	• good ventilation and lighting room suitable for number of students • board
Technology Resources (AV, data show, Smart Board, software, etc.)	• data show • laptop
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Teaching Strategies	Students	Questionnaire
Student assessment	Instructor	Exams
Course learning outcomes	Instructor	Course report
Quality of learning resources	Instructor	Course report

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Physics department**
Reference No.	
Date	**17/3/2022**