هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Heat and Thermodynamic**
Course Code:	**2032101-3**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 5th / 2nd
4. Pre-requisites for this course (if any)**: Calculus (1) (2021204-4)** **Differential and integral Calculus**
5. Co-requisites for this course (if any)**:** None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	5	100%
2	**Blended**	0	0%
3	**E-learning**	0	0%
4	**Distance learning**	0	0%
5	**Other**	0	0%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	50
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	**50**

B. Course Objectives and Learning Outcomes

1. Course Description

Basic concepts of thermodynamics. Property evaluation of ideal gases and compressible substances. Theory and application of the first and second laws of thermodynamics. Entropy and Carnot efficiency.

2. Course Main Objective

This course introduces basic concepts of thermodynamics. In addition to the theory and application of the most important laws of thermodynamics and the thermodynamics functions

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	State the basic concepts of thermodynamic laws to practical aspects in today's life and recognize how those principles relate to forefront areas of research.	K1
1.2	Recognize the Theory and application of the first and second laws of thermodynamics. Entropy and Carnot efficiency.	K3
2	**Skills :**	
2.1	Explain physical phenomena and concepts relevant to the course and their applications.	S4
2.2	Utilize critical thinking techniques to cause, listen, make observations, and draw conclusions.	S1
3	**Values:**	
3.1	Show responsibility for working independently and for continuous improvement of personal capacities.	V1

C. Course Content

No	List of Topics	Contact Hours
1	**Kinetic theory of gases:** ▪ Concept of system ▪ System boundary and system variables ▪ Hypothesis of kinetic theory of gases ▪ Calculation of the kinetic pressure of gas molecule ▪ Calculation of the mean square velocity of gas molecule	8
2	▪ **Thermodynamic systems:** ▪ Thermodynamic equilibrium ▪ P-V-curve of pure substance ▪ P-T-curve of pure substance ▪ P-V-T-surface ▪ Equation of states	6
3	**First law of thermodynamic:** ▪ Internal energy of the system ▪ Heat quantity of the system ▪ Mathematical form of the 1^{st} law of thermodynamics ▪ Differential form of the first law of thermodynamics ▪ Enthalpy	6
4	**Application of the first law of thermodynamics:** ▪ Energy equations at constant volume ▪ Energy equations at constant pressure ▪ Energy equations at constant temperature **Adiabatic process:** ▪ Equation of state in adiabatic process ▪ Work done in adiabatic process ▪ Definition of Gamma and its method of measurement	7

5	**Reversibility of Kelvin scale of temperature:** ▪ Reversibility and Irreversibility ▪ External mechanical irreversibility ▪ Internal mechanical irreversibility ▪ Internal-external thermal irreversibility ▪ Conditions of irreversibility ▪ Integration of Q ▪ Equality of ideal gas temperature and Kelvin temperature	6
6	**Second law of thermodynamic and Entropy**: ▪ Second Law of thermodynamic ▪ Carnot cycle and efficiency ▪ Principle of Entropy ▪ Ideal gas entropy ▪ Entropy and direction, absolute entropy ▪ Entropy and states of the systems	8
7	**Third law of thermodynamic** ▪ Third law of thermodynamic ▪ Helmholtz and Gibb functions	6
8	**Revision**	3
	Total	50

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	State the basic concepts of thermodynamic laws to practical aspects in today's life and recognize how those principles relate to forefront areas of research.	Lecture	Written exam and Homework reports
1.2	Recognize the Theory and application of the first and second laws of thermodynamics. Entropy and Carnot efficiency.	Lecture Discussion	Written exam
2.0	**Skills**		
2.1	Explain physical phenomena and concepts relevant to the course and their applications.	Lectures	Written exam and Homework reports
2.2	Utilize critical thinking techniques to cause, listen, make observations, and draw conclusions.	Groups discussion	Quizzes
3.0	**Values**		
3.1	Show responsibility for working independently and for continuous improvement of personal capacities.	Group discussion	Project

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Activities	Periodically	10%
2	Midterm exam	6th	30%
3	Short exam	9th	10%
4	Final exam	12th	50%

***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 :

6 Hours per week during office-hours, in teacher's staffroom or as per the arrangement made by the teacher.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Modern Engineering Thermodynamics, by Balmer, Robert T
Essential References Materials	1- Thermodynamic and statistical mechanics By: G Socrates , Butterworths 1971. 2-Heat and thermodynamic By: M.W.Zemanisky , Ritchard H.Dittman
Electronic Materials	Web Sites on the internet that are relevant to the topics of the course & general physics websites such as : http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show Laptop Smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	Indirect
Evaluation of Teaching	Instructor Program coordinator Departmental council Faculty council	Indirect
Improvement of Teaching	Program leaders Relevant committee	Direct
Quality of learning resources	Students Instructor Faculty	Indirect
Extent of achievement of course learning outcomes,	Program leaders Instructor	Direct
Course effectiveness and planning for improvement	Program leaders Instructor	Indirect
Student Feedback on Effectiveness of Teaching	Students	Indirect

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	Department Council / Committee of academic development
Reference No.	
Date	October 2, 2022