هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	Thermal physics
Course Code:	PHYS 241
Program:	B.Sc. in Physics
Department:	Department of Physics and astronomy
College:	College of Science
Institution:	King Saud University
Version:	2.0.0
Last Revision Date:	Sep 2023

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3(3+0+0)				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☒	Elective☐			
3. Level/year at which this course is offered:	First semester / third year				
4. Course general Description The course aims to introduce students to the basic thermal physics concepts and the four laws of thermodynamics, especially the first and second laws. The main topics are temperature and thermometer, state and process variables and functions, reversible and irreversible processes, work and heat and internal energy, engines & refrigerators and Carnot cycle, entropy, The thermodynamic functions U, H, S, F and G and the Maxwell relations, Phase transformation.					
5. Pre-requirements for this course (if any): Math 111					
6. Co- requirements for this course (if any):					
7. Course Main Objective(s) 1. To have a good understanding of the four laws of thermal physics. 2. To calculate state variables of a system (e.g. T, V ,P, S) and process variables (W, Q). 3. To apply the thermodynamics laws in modern technology (e.g. refrigerator) and physics phenomena (e.g. phase transformation). 4. To have a classical and modern understanding of entropy.					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100%
2.	E-learning	0	0
3.	Hybrid • Traditional classroom • E-learning	0	0
4.	Distance learning	0	0

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	0
3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Describe the basic concepts and principles of thermal physics	K1	• Give extensive examples during lecture. • Give problem sheets to be discussed during lecture..	• Hold Class discussion, tutorial sessions. • Give quizzes, mid-term exam and final exam.
1.2	Recognize the thermodynamics laws (0th, 1st, 2nd, and 3rd laws)	K2		
1.3	Link the laws of thermodynamics with modern applications (engine, refrigerator)	K3		
2.0	Skills			
2.1	Calculate process variables (heat, work) and state variables (T, P, V, S, U,…) of a system	S1	• Give extensive examples during lecture • Give problem sheets to be discussed during lecture and labs. • assignments. • Discussions in the classes	• Hold Class discussion, tutorial and lab sessions. • Give quizzes, mid-term exam and final exam.
2.2	Apply thermodynamics laws in thermal systems (1st and 2d laws) to solve	S2		
3.0	Values, autonomy, and responsibility			
3.1	Work in a team and share responsibilities	V1	• assignments. • Homework • Group presentation	Hold Class discussion

C. Course Content

No	List of Topics	Contact Hours
1.	**0th Law:** General definitions and basic concepts of thermal Physics and the concept of thermal equilibrium and temperature	4
2.	**Processes and Work:** definition of reversible and irreversible processes, and isothermal, isobaric, isochoric processes. Definition and calculation of work for different processes.	6
3.	**1st Law:** Joule experiment of heat and energy, adiabatic process, internal energy, heat capacity, calorimetry	7
4.	**2nd Law:** Carnot cycles, Efficiency of an engine, statements of the 2nd law, thermodynamic temperature scale. Engines and refrigerators.	6
5.	**Entropy:** Clausius Inequality, entropy classical definition, calculation of entropy, the principle of increasing entropy, entropy statistical definition	8
6.	**Thermodynamics Potentials**: definition of Enthalpy H, Helmholtz F, and Gibbs free energy G. spontaneous and nonspontaneous processes. definition of Maxwell Relations and their application.	5
7	**Phase transformation:** reading PVT surfaces, equilibrium condition for two phases. the Clausius-Clapeyron equation for 1st and 2nd phase change, open systems equilibrium and chemical potential	7
8.	**3rd Law:** statements of the 2nd law, entropy at 0 K, thermal properties such as heat capacity and thermal expansion coefficient at 0 K	2
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First Midterm examination	Approx. 7	15%
2.	Second Midterm examination	Approx. 12	15%
3.	HW and Quizzes	Weekly	30%
4.	Final examination	From 16 to 18	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	**Physical Chemistry** Authors: R. A. Silbey, R. A. Alberty, M. G. Bawendi 4th ed., 2005, John Wiley & Sons **Thermal Physics**, by C. B. P. Finn, 2nd Ed, Publisher: CRC Press Taylor & Francis Group

Supportive References	**Thermal Physics**, by Daniel V. Schroeder, Publisher: Addison Wesley Longman
Electronic Materials	None
Other Learning Materials	Internet sites relevant to the course

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom which accommodates 25 students.
Technology equipment (projector, smart board, software)	Whiteboard and Smart board
Other equipment (depending on the nature of the specialty)	Not applicable

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students\ Peer Reviewer	Indirect \ direct
Effectiveness of students assessment	Students- Faculty	Direct
Quality of learning resources	students	Indirect
The extent to which CLOs have been achieved	Faculty	Indirect
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	Physics Department's council
REFERENCE NO.	5th (1st term/1445)
DATE	13/04/1445