هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	Statistical physics I
Course Code:	PHYS 342
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

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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:	Sixth level / third year.				
4. Course general Description					

The course aims to introduce students to statistical physics and the relation to thermal physics and concentrate on the following topics:

Equipartition of energy: equipartition theorem, Brownian motion. The partition function: Its expression, the function of state, combining partition functions. Statistical mechanics of ideal gases: Density of states, quantum concentration, distinguishability, functions of states of ideal gases, Gibbs paradox, heat capacity of a diatomic gas. Chemical potential: definition, grand partition function, relation to Gibbs function, particle number conservation. Photons: radiation pressure, statistical mechanics of a gas of photons, Black body distribution. Phonons: the Einstein model, the Debye model. Overview of real gases, phase transitions, Bose-Einstein and Fermi-Dirac distributions, and quantum gases

5. Pre-requirements for this course (if any): Thermal Physics PHYS 241

6. Co- requirements for this course (if any):

7. Course Main Objective(s)

1. Make the connections between classical equilibrium thermodynamics and the basic statistical mechanics.
2. learn the basic techniques in statistical mechanics and the different types of ensembles applicable to physical systems.
3. Should gain the ability to apply the different ensembles to simple systems such as ideal gases and investigate the different properties of the system such as the specific heat capacity.
4. get acquainted with statistical description of systems that contains large number of particles

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100%

No	Mode of Instruction	Contact Hours	Percentage
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	Outline the main concepts of statistical mechanics	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 importance of statistical mechanics in describing physical phenomena in describing physical phenomena	K2		
2.0	Skills			
2.1	Calculate the relevant properties of physical systems using the methods of statistical mechanics	S1	• Give extensive examples during lecture • problem solving. • assignments. • Discussions in the classes	• Hold Class discussion, tutorial and lab sessions. • Give quizzes, homework, mid-term
2.2	Demonstrate mastery of the techniques used in statistical mechanics statistical mechanics	S2		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				exams and final exam.
3.0	Values, autonomy, and responsibility			
3.1	Work in a team and acknowledge others' work.	V1	• Homework • Small project	Hold Class discussion

C. Course Content

No	List of Topics	Contact Hours
1.	**Equipartition of energy:** equipartition theorem, Brownian motion. The partition function: Its expression, the function of state, combining partition functions.	9
2.	**Statistical mechanics of ideal gases:** Density of states, quantum concentration, distinguishability, functions of states of ideal gases, Gibbs paradox, heat capacity of a diatomic gas.	9
3.	**Chemical potential:** definition, grand partition function, relation to Gibbs function, particle number conservation.	9
4.	**Photons**: radiation pressure, statistical mechanics of a gas of photons, Black body distribution. **Phonons**: the Einstein model, the Debye model	9
5.	**Overview of real gases**: phase transitions, Bose-Einstein and Fermi-Dirac distributions, and quantum gases.	9
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	20%
2.	Second Midterm examination	Approx. 13	20%
3.	Class Activity	Weekly	20%
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	Concept of Thermal Physics- second edition by STEPHEN J. BLUNDELL AND KATHERINE M. BLUNDELL
Supportive References	**Introduction to Statistical Mechanics**, J. Walecka, World Scientific Publishing Company, 2011
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 20 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.	8th (1st term/1445)
DATE	06/06/1445