City University of Hong Kong
Course Syllabus

offered by Department of Physics
with effect from Semester A 2022/23

Part I Course Overview

Course Title:

Statistical Mechanics

Course Code:

PHY8252

Course Duration:

1 semester

Credit Units:

3 credits

Level:

R8

Medium of Instruction:

English

Medium of Assessment:

English

Prerequisites:
(Course Code and Title)

Nil

Precursors:
(Course Code and Title)

Nil

Equivalent Courses:
(Course Code and Title)

Nil

Exclusive Courses:
(Course Code and Title)

PHY6252 Statistical Mechanics

Part II Course Details

1. Abstract

This course aims to equip graduate students with knowledges of statistical mechanics that are necessary to conduct research and understand literature particularly relevant to condensed matter physics. The course shall start with the fundamental concepts of Statistical Mechanics. Then the course discusses weakly interacting systems and strongly interacting Systems. In the end, the fluctuation-dissipation theorem and other relevant knowledges of dissipative systems will be introduced.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Recognize and use appropriately important technical terms and definitions		✔		
2.	Use appropriate mathematical notations and apply in concise form the laws of quantum mechanics to the study of modern physics problems		✔	✔	
3.	Apply the laws of statistical mechanics to the study of modern physics problems		✔	✔	✔
4.	Solve real and hypothetical problems in statistical physics by identifying the underlying physics and analyzing the problem		✔	✔	✔
		100%			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture	Explain key concepts and theory of topics of the course	✔	✔	✔				2 hrs/wk
Tutorial	Explain how some problems are solved and the techniques used explain some concepts	✔	✔	✔	✔			1 hr/wk

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 70%								
Homework, Quizzes etc.	✔	✔	✔	✔			70%	
Examination: (duration: 2 hours)	✔	✔	✔	✔			30%	
							100%	

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignment	1. Capacity for using physics knowledge and theory to solve problems 2. Demonstrate correct understanding of key concepts.	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format
2. Examination	1. Capacity for using physics knowledge and theory to solve problems 2. Demonstrate correct understanding of key concepts and physics theory.	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding about experimental methods and the interpretation of results	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignment	1. Capacity for using physics knowledge and theory to solve problems 2. Demonstrate correct understanding of key concepts.	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a basic level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format

2. Examination	1. Capacity for using physics knowledge and theory to solve problems 2. Demonstrate correct understanding of key concepts and physics theory.	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a basic level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding about experimental methods and the interpretation of results	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format

Part III Other Information

1. Keyword Syllabus

Method of Statistical Mechanics: grand canonical ensemble, Bose and Fermi distributions, phases and partition functions.
Weakly Interacting Systems: non-ideal gas and the Virial expansion, van der Waals gas, mean field theory for magnetic systems.
Strongly Interacting Systems: phase transitions, critical phenomena, Ising model, Landau theory, ferroelectrics.
Dissipative Systems: Fluctuation-dissipation theorem, Langevin equation, correlations.

2. Reading List

2.1 Compulsory Readings

None.

2.2 Additional Readings

1.	Brian Cowan, Topics in Statistical Mechanics (Imperial College Press, 2005)
2.	R. K. Pathria and Paul D. Beale, Statistical Mechanics 3rd ed (Academic Press, 2011)
3.	Richard P. Feynman, Statistical Mechanics: A Set of Lectures (CRC Press, 1998)
4.	Kerson Huang, Statistical Mechanics (Wiley, 2008)