



# Course Specification

## (Bachelor)

Course Title: **Statistical Physics**

Course Code: **PHYS 0363**

Program: **Physics Program**

Department: **Physics Department**

College: **College of Science**

Institution: **Majmaah University**

Version: **1**

Last Revision Date: **6/12/2024**



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## A. General information about the course:

### 1. Course Identification

1. Credit hours: ( 3, 0, 0 )

### 2. Course type

A.  University  College  Department  Track  Others  
B.  Required  Elective

3. Level/year at which this course is offered: ( 4. )

### 4. Course General Description:

Statistical Mechanics is a probabilistic approach to equilibrium properties of large numbers of degrees of freedom. It include: Probability, One random variable, Some important probability distributions, Many random variables, Sums of random variables and the central limit theorem, Rules for large numbers, entropy, Kinetic theory of gases, Maxwell's distribution of the velocities of gas molecules and its applications, Distribution function of the energy of molecules, Liouville's theorem, Equilibrium properties, The microcanonical ensemble, Two-level systems, The ideal gas, Mixing entropy and the Gibbs paradox, The canonical ensemble, Canonical examples, The Gibbs canonical ensemble, The grand canonical ensemble,

### 5. Pre-requirements for this course (if any):

**PHYS 0262**

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

no

### 7. Course Main Objective(s):

1	Probability and density functions
2	Kinetic Theory of gases
3	Maxwell-Boltzmann statistics
4	Classical statistics (Canonical, Microcanonical and Grand Canonical Ensembles)

### 2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> <li>• Traditional classroom</li> <li>• E-learning</li> </ul>		



No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

### 3. Contact Hours (based on the academic semester)

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

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and understanding</b>			
1.1	Differentiate between the statistical ensembles	<b>K2</b>	Lecture Exercise Quizes Problem Solving	Standard Exams Assignments
1.2	Relate thermodynamical properties to atomic states	<b>K2</b>		
<b>2.0</b>	<b>Skills</b>			
2.1	Apply kinetic theory of gases and ideal gas law in various situations.	<b>S2</b>	Lecture Exercise Quizes Problem Solving Group Discution	Standard Exams Assignments Supervisor evaluation
2.2	Compare the statistical distributions (Maxwell-Boltzmann, Fermi-Dirac, Bose-Einstein <sup>1</sup> and apply them appropriately.	<b>S2</b>		





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
...	Derive entropy from a microscopic behavior of a system.	S2		
	Apply the statistical nature of atomic distribution to calculate specific heat.	S2		
<b>3.0</b>	<b>Values, autonomy, and responsibility</b>			
3.1	Work in a group and learn time management.	V1	Making students aware of time management in completing their assignments	Internal evaluation
...	Present a short report in a written form and orally using appropriate scientific language.	V3		

### C. Course Content

No	List of Topics	
		9
1.	➤ Probability and distribution functions	12
2.	➤ Kinetic Theory of Gases, Maxwell-Boltzmann Statistics	6
3	➤ Classical Statistics, Canonical Ensemble, Two level Systems	6
4	➤ Micro-Canonical ensemble,	6
5	➤ Grand Canonical Ensemble	6
6	➤ Quantum Statistics, Vibration of a solid	9
<b>Total</b>		<b>45</b>

### D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid- term 1*	6 or 7 week	15
2.	HW	Every unit of Topics	10
3.	Mid-term 2*	11 or 12 week	15
4	Quiz	5 and 10 week	10
5	Small project	13 week	10
6	Final exam *	15 or 16 week	40



No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
	total		100

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

## E. Learning Resources and Facilities

### 1. References and Learning Resources

<b>Essential References</b>	Statistical Physics of Particles, Mehran Kardar, Cambridge University Press 2007
<b>Supportive References</b>	An Introduction to Thermodynamics and Statistical Mechanics, Keith Stowe, Cambridge University Press, 2007
<b>Electronic Materials</b>	Saudi Digital Library (SDL)
<b>Other Learning Materials</b>	Excel software for drawing graphs.

### 2. Required Facilities and equipment

Items	Resources
<b>facilities</b> (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<i>Classrooms, data show, Smart Board, software</i>
<b>Technology equipment</b> (projector, smart board, software)	<i>Computer Lab. and internet lab.</i>
<b>Other equipment</b> (depending on the nature of the specialty)	<i>Library, Wi-Fi internet connections</i>

## F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	<i>Internal Reviewer committee</i>	<i>Direct</i>
Effectiveness of Students assessment	<i>Students</i>	<i>Indirect</i>
Quality of learning resources	<i>Peer Reviewer</i>	<i>Direct</i>
The extent to which CLOs have been achieved	<i>Internal Reviewer committee</i>	<i>Direct</i>
Other		

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

**COUNCIL /COMMITTEE**





REFERENCE NO.

DATE

