

*Faculty of Science  
Physics Department*

## **Course Outline of Statistical Mechanics (Master)**

### **1. Instructor's Information**

Instructor's / Coordinator's Name:	Dr. Ahmed Fawaz Al-Jamel
Office Hours:	TBA
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Research and Teaching Assistant / Supervisor / Technical (if any):	NA

### **2. Course Description**

This course develops concepts in classical laws of thermodynamics and their application, postulates of statistical mechanics, statistical interpretation of thermodynamics, microcanonical, canonical and grand canonical ensembles; the methods of statistical mechanics are used to develop the statistics for Bose-Einstein, Fermi-Dirac and photon gases; selected topics from low temperature physics and electrical and thermal properties of matter are discussed.

### **3. Course Information**

Course No.: 402742	Course Title: Statistical Mechanics	Level: Master
Course Type: Theoretical	Prerequisite / co-requisite: Statistical Mechanics/B.Sc.	Class Time: 14:00-17:00
Academic Year:2019-2020	Semester: Fall	Study hours:

### **4. Course Objectives:**

a-	Review the historical origin of statistical mechanics
b-	Introduce the main tools of statistical mechanics
c-	To explore various prototype applications from different fields of physics

d-	construct a bridge between macroscopic thermodynamics and microscopic statistical mechanics by using mathematical methods and fundamental physics for individual particles.
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## 5. Learning Outcomes (LO)

### (Knowledge, Skills, and Competencies)(K,S,C)

Upon successful completion of the course, the students will be able to:

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| <p>LO 1. Define various concepts related to the topic such as: phase space, microstates, density of states, ensembles.</p> <p>LO 2. Recognize the need for statistical treatment.</p> <p>LO 3. Distinguish between the different statistical ensembles (MCE, CE, GCE), their distribution functions, ranges of applicability. (LO1)(K)</p> <p>LO 4. Calculate thermodynamic properties various prototype examples from the partition function and statistical entropy (bridge equation). (LO3)</p> <p>LO 5. Perform simple calculations on more complicated systems (LO5).</p> |
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## 6. Course Content

Week	Subject
First	Introduction to the class: Review of Basic ideas.
Second	The Statistical Basis of Thermodynamics:
Third	Elements of Ensemble Theory
Fourth	Elements of Ensemble Theory
Fifth	The Canonical Ensemble
Sixth	The Canonical Ensemble
Seventh	The Grand Canonical Ensemble
Eighth	The Grand Canonical Ensemble
Ninth	Review before exam
Tenth	<b>The Mid-Exam: Wed Nov 06 2019</b>
Eleventh	Formulation of Quantum Statistics
Twelve	Formulation of Quantum Statistics
Thirteenth	The Theory of simple gases
Fourteenth	B-E and F-D Systems
Fifteenth	Review and HW discussions
Sixteenth	Final Exam

## 7. Teaching and Learning Strategies and Evaluation Methods

No.	Learning Outcomes	Teaching Strategies	Learning Activities	Evaluation /Measurement Method (Exam/ presentations/ discussion/ assignments)
1	(LO1)	trad. lect.	Discussion	HW+Mid-exam+Final Exam
2	(LO2)	trad. lect.	Discussion	HW+Mid-exam+Final Exam
3	(LO3)	trad. lect.	Discussion	HW+Mid-exam+Final Exam
4	(LO4)	trad. lect.	Discussion	HW+Mid-exam+Final Exam
5	(LO5)	trad. lect.	Discussion	HW+Mid-exam+Final Exam

## 8. Assessment

Methods Used	Assessment Time	Distribution of grades
1- semester work (report, assignments, attendance)	During semester	30%
3- Mid Exam	Tenth week	30%
4- Final Exam	Week of the final exams	40%

## 9. Textbook

Main Reference	<b>Statistical Mechanics</b> SBN-13: 978-0123821881 ISBN-10: 0123821886
Author	<a href="#">R K Pathria</a> and <a href="#">Paul D. Beale</a>
Publisher	Academic Press; 3 edition (March 14, 2011)
Year	2011
Edition	Third (or any previous Editions)
Textbook Website	<a href="https://www.amazon.com/Statistical-Mechanics-R-K-Pathria/dp/0123821886">https://www.amazon.com/Statistical-Mechanics-R-K-Pathria/dp/0123821886</a> Preview with <a href="#">Google Books</a>

## 10. Extra References (books and research published in periodicals or websites)

1-	F, Mandl, Statistical Physics, Second Edition, JOHN Wiley & Sons, LTD, 1997.
2-	David H. Trevena, Statistical mechanics, ISBN: 1-898563-89-6
3-	Huang, Kerson. <i>Statistical Mechanics</i> . 2nd ed. Wiley, 1987. ISBN: 9780471815181.