



Form: Course Syllabus	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	08

1.	Course title	Statistical Mechanics - 1
2.	Course number	0342756
3.	Credit hours	3
	Contact hours (theory, practical)	3 hours weekly (theory)
4.	Prerequisites	BSc in Physics
5.	Program title	M.Sc. in Physics
6.	Program code	0342
7.	Awarding institution	The University of Jordan
8.	School	Science
9.	Department	Physics
10.	Course level	MSc
11.	Year of study and semester(s)	Spring 2023/2024
12.	Other department(s) involved in teaching the course	none
13.	Main teaching language	English
14.	Delivery method	<input checked="" type="checkbox"/> Face to face learning <input type="checkbox"/> Blended <input type="checkbox"/> Fully online
15.	Online platforms(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom
		<input type="checkbox"/> Others.....
16.	Issuing/Revision Date	February, 2024

17. Course Coordinator:

Name: Usama al Khawaja	Contact hours: Sunday, Tuesday, Thursday 10:30-12:30
Office number:	Phone number: 22023
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18. Other Instructors:

Name:

Office number:

Phone number:

Email:

Contact hours:

19. Course Description:

Connection between Statistics and Thermodynamics; Entropy of Mixing and the Gibbs Paradox; Phase Space and Liouville's Theorem; Microcanonical, Canonical and Macrocanonical (Grand Canonical or Gibbs) Ensembles; Partition Function; Quantum States; Derivation of the Distribution Functions for an Ideal Classical Gas, an Ideal Fermi Gas and an Ideal Bose Gas; Thermodynamics of Ideal Gases; Energy Fluctuations; Statistics of a System of Harmonic Oscillators; Paramagnetism; Magnetic Cooling; A System of Molecules with Internal Motion.

20. Program Intended Learning Outcomes: (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. **SO1:** to be able to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.
2. **SO2:** to be able to formulate or design a scientific system, process, procedure or program to contribute achieving scientific desired needs.
3. **SO3:** to be able to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4. **SO4:** to be able to communicate his/her scientific contributions effectively with a range of audiences.



5. **SO5:** to be able to recognize and demonstrate social, ethical and professional responsibilities and the impact of technical and/or scientific solutions in global economic, environmental, and societal contexts.
6. **SO6:** to be able to function effectively independently and on teams for establishing goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

21. Course Intended Learning Outcomes: (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. **(Knowledge A1)** Explain the statistical Physics principle of thermodynamics
2. **(Skills B1)** Derive thermodynamic laws and quantities using statistical physics theoretical framework and ensemble theory
3. **(Skills B2)** Apply statistical Physics theory to the classical and quantum ideal gases.
4. **(Competences C1)** Formulate the quantum statistical Physics theory including Bose-Einstein and Fermi-Dirac quantum distribution functions.

Course ILOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1		✓	✓	✓		
2			✓	✓	✓	
3			✓			
4			✓	✓		



2٢. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program ILOs / Course ILOs	ILO (1)	ILO (2)	ILO (3)	ILO (4)	ILO (5)	ILO (6)
1	✓	✓				
2	✓	✓				
3	✓	✓				
4	✓	✓				

2٣. Topic Outline and Schedule:

Week	Lecture	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1	General Introduction	A1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	1.2	Statistical Basis of Thermodynamics	A1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
2	2.1	Statistical Basis of Thermodynamics	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	2.2	Statistical Basis of Thermodynamics	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
3	3.1	Statistical Basis of Thermodynamics	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	3.2	Statistical Basis of Thermodynamics	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
4	4.1	Ensemble Theory	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book



	4.2	Ensemble Theory	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
5	5.1	Ensemble Theory	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	5.2	Ensemble Theory	B1	Face to Face	Moodle Teams	Synchronous	First	E-learning portal +
6	6.1	Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning portal +
	6.2	Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
7	7.1	Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	7.2	Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
8	8.1	Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	8.2	Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
9	9.1	Grand Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	9.2	Grand Canonical Ensemble	B1	Face to Face	Moodle Teams	Synchronous	MT	E-learning + Book
10	10.1	Quantum Statistics	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	10.2	Quantum Statistics	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
11	11.1	Quantum Statistics	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	11.2	Quantum Statistics	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
12	12.1	Simple Gases	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	12.2	Simple Gases	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
13	13.1	Simple Gases	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	13.2	Simple Gases	B2	Face to Face	Moodle Teams	Synchronous		E-learning + Book
14	14.1	Ideal Bose Gas	C1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	14.2	Ideal Bose Gas	C1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
15	15.1	Ideal Fermi Gas	C1	Face to Face	Moodle Teams	Synchronous		E-learning + Book
	15.2	Ideal Fermi Gas	C1	Face to Face	Moodle Teams	Synchronous	Final	E-learning + Book



2٤. Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
HW	10%	Every chapter	A1,B1, B2,C1	At the end of every chapter	paper
Project	10%	To be discussed later	A1,B1	To be set later	Report and presentation
First exam	15%	Chs.1-2: Statistical Basis of Thermodynamics Ensemble Theory	A1, B1	60 Minutes	Paper
Mid exam	20%	Chs.1-4	A1, B1, B2	60 Minutes	Paper
Final exam	45%	All covered topics	All SLOs	120 Minutes	Paper

2٥. Course Requirements:

- MS Teams
- Every student should visit the following site for course material, quizzes and announcements.
Site address: elearning.ju.edu.jo
- MS Office 365

2٦. Course Policies:

A- Attendance policies:

1. According to UJ's policy
2. Maximum allowable absence 15% of number of Lectures/Semester

B- Absences from exams and handing in assignments on time:

It is the student's responsibility to ensure that he/she is aware of all assignments, announcements and contents of missed sessions

**C- Health and safety procedures:****D- Honesty policy regarding cheating, plagiarism, misbehavior:**

1. According to UJ's policy
2. It is the student's responsibility to ensure that he/she adheres with cheating, plagiarism, miss-behaviors

E- Grading policy:**Intended (Tentative) Grading Scale:**

Range	LG	الحرف	Range	LG	الحرف	Range	LG	الحرف
91 - 100	A	أ	74 - 77	B-	-ب	56 - 60	D+	+د
86 - 89	A-	-أ	70 - 73	C+	+ج	50 - 55	D	د
82 - 85	B+	+ب	66 - 69	C	ج	45 - 49	D-	-د
78 - 81	B	ب	61 - 65	C-	-ج	0 - 44	F	هـ

Grading and Evaluation Criteria: 100 points distributed as follows:

Weight	Criteria	Comments
10%	HW	Every chapter
10%	project	Topics TBA
15%	First exam	TBA (in due course)
20%	Midterm Exam	TBA (in due course)
45%	Final Exam	TBA

F- Available university services that support achievement in the course:**2v. References:**

A- Main text book: Pathria, R. K. and Beale, P. D. (2011), Statistical Mechanics (3rd ed.), Amsterdam: Elsevier. Chapters: 1-8.

B- Recommended books:

Huang, K. (1987), Statistical Mechanics (2nd ed.), New York: Wiley.

Reif, F. (1965), Fundamentals of Statistical and Thermal Physics, New York: McGraw-Hill.



Sethna, J. P. (2005), Statistical Mechanics: Entropy, Order Parameters and Complexity, <http://www.physics.cornell.edu/sethna/StatMech/book.pdf>.

Ashley H. carter (2001), Classical and Statistical thermodynamics, Printice Hall, New Jersey.

2^ Additional information:

1) Tardiness and/or absenteeism will have a negative impact on the course grade.

الامتناع المدير عن حضور المحاضرات أو الدروس أو عن الأعمال الأخرى التي تقضي الأنظمة بالمواظبة عليها ، وكل تحريض على هذا الامتناع سوف يؤدي الى حرمان الطالب من المادة المعنية.

في حالة التغيب عن الامتحانين الأول و الثاني لن يكون هناك امتحان تعويضي الا في حالة وجود عذر وحالة طارئة من المستشفى. على الطالب براز العذر لمدرس المادة في فتره لا تتجاوز الثلاثة ايام من تاريخ الامتحان, وللمدرس الحق في قبول او رفض العذر , وحسب التعليمات.

2) Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For the final complaints, there will be a committee to review grading the final exam.

3) Students are encouraged to make heavy use of the library, E-LIBRARY

<http://ezlibrary.ju.edu.jo/login> or from within the university using (<http://e-library>)

4) Students are encouraged to search for articles related to the material contents discussed during this

course, using designated sites, like <http://researchGate.com>

- The instructor can make changes to this syllabus when necessary.

- University regulations will be preserved at all times

5) For more details on University regulations please visit <http://www.ju.edu.jo/rules/index.htm>

Name of the Instructor or the Course Coordinator:

Usama Al Khawaja

Signature: U.

Date:

February-2024

Name of the Head of Quality Assurance
Committee/ Department

Signature:

Date:

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Name of the Head of Department

Signature:

Date:

.....
Name of the Head of Quality Assurance
Committee/ School or Center

Signature:

Date:

.....
Name of the Dean or the Director

Signature:

Date: