Form: Course Syllabus		
	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
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	Number of Pages	06

1.	**Course Title**	Statistical Thermodynamics
2.	**Course Number**	0303942
3.	**Credit Hours (Theory, Practical)**	(3, 0)
	Contact Hours (Theory, Practical)	(3, 0)
4.	**Prerequisites/ Corequisites**	None
5.	**Program Title**	Ph.D. in Chemistry
6.	**Program Code**	33
7.	**School/ Center**	School of Graduate Studies
8.	**Department**	Department of Chemistry
9.	**Course Level**	Graduate (PhD)
10.	**Year of Study and Semester (s)**	First or Second Year
11.	**Other Department(s) Involved in Teaching the Course**	None
12.	**Main Learning Language**	English
13.	**Learning Types**	■Face to face learning ☐Blended ☐Fully online
14.	**Online Platforms(s)**	■Moodle ■Microsoft Teams
15.	**Issuing Date**	
16.	**Revision Date**	

17. Course Coordinator:

Name: Prof. Dr. Fadwa Odeh Contact hours:

Office number: Phone number:

Email: f.odeh@ju.edu.jo

18. Other Instructors:

Name:
Office number:
Phone number:
Email:
Contact hours:
Name:
Office number:
Phone number:
Email:
Contact hours:

19. Course Description:

As stated in the approved study plan. Basic concepts in probability and statistics, introduction to statistical quantum mechanics, statistical thermodynamics and applications to ideal systems, systems of independent particles, systems involving intermolecular interactions, and quantum statistics.

20. Program Student Outcomes (SO's): (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

SO1. Develop chemistry expertise, focus on theory and practice, and contribute to advancing knowledge in a specific research field.

SO2. Conduct original, high-quality research that advances knowledge in chemistry by developing complex projects using innovative methodologies.

SO3. Mentor junior researchers and students and demonstrate leadership in the scientific community through collaboration, peer review, and knowledge exchange.

SO4. Recognize the ethical implications and responsibly use chemistry solutions to tackle global challenges.

SO5. Participate in ongoing professional development to stay up to date with the latest research and innovations.

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

CLO1. Understand the basic principles of probability and statistics and their applications to physical systems

CLO2. Analyze quantum systems using statistical mechanics

CLO3. Apply statistical thermodynamics to solve problems involving ideal and interacting systems

CLO4. Comprehend and utilize quantum statistics in various physical phenomena

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

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

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)
CLO (1)	✔	✔					
CLO (2)	✔	✔					
CLO (3)	✔	✔					
CLO (4)	✔	✔					

23. Topic Outline and Schedule:

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
1	1.1	Introduction		FF				Qizzes, exams, presentations, homeworks, term papers
	1.2	Probability fundamentals		"				"
	1.3	Distributions		"				"
2	2.1	Distributions		"				"
	2.2	Statistical analysis		"				"
	2.3	Statistical analysis		"				"
3	3.1	Introduction to Statistical Quantum Mechanics		"				"
	3.2	Quantum ensembles		"				"
	3.3	Density matrices and their physical significance		"				"
4	4.1	Partition functions		"				"
	4.2	Quantum states		"				"
	4.3	Q harmonic oscillator and particle in a box		"				"
5	5.1	Revision of thermodynamics		"				"
	5.2	Thermodynamics laws		"				"
	5.3	Ideal gas: classical and quantum considerations		"				"
6	6.1	Photon gas and black body radiation		"				"
	6.2	Independent particles		"				"
	6.3	Non-interacting particles		"				"
7	7.1	Energy levels		"				"
	7.2	Degeneracy		"				"
	7.3	Maxwell Boltzmann distribution		"				"

8	8.1	Bose-Einstein distribution		“				“
	8.2	Fermi-Dirac distribution		“				“
	8.3	Applications		“				“
9	9.1	Applications (heat capacity)		“				“
	9.2	Applications (free electron gas in metals)		“				“
	9.3	Systems involving intermolecular interactions		“				“
10	10.1	Intermolecular forces (IMF)		“				“
	10.2	Van der Waals interactions		“				“
	10.3	H-bonding interactions		“				“
11	11.1	IMF role in phase transitions		“				“
	11.2	Interacting systems		“				“
	11.3	Virial expansion and equation of state		“				“
12	12.1	Molecular dynamics		“				“
	12.2	Quantum statistics		“				“
	12.3	Fermi-Dirac &Bose-Einstein statistics		“				“
13	13.1	Occupation probabilities and quantum behavior		“				“
	13.2	Degenerate Fermi gases and Bose-Einstein condensation		“				“
	13.3	Applications		“				“
14	14.1	Electronic properties of metals and semiconductors		“				“
	14.2	Super fluidity and super conductivity		“				“
	14.3	Statistical behavior of photons and phonons		“				“
15	15.1	Students’ seminars		“				
	15.2	Students’ seminars		“				
	15.3	Students’ seminars		“				
16	Final Exam							

24. Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
Mid term exam	30				Written exam
Presentation, quizzes, homeworks	30				
Final exam	40				Written exam

25. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):

26. Course Policies:

A- Attendance policies:

B- Absences from exams and submitting assignments on time:

C- Health and safety procedures:

D- Honesty policy regarding cheating, plagiarism, misbehavior:

E- Grading policy:

F- Available university services that support achievement in the course:

27. References:

A- Required book(s), assigned reading and audio-visuals:

Introduction to statistical thermodynamics by Hill

B- Recommended books, materials, and media:

Research papers on statistical thermodynamics applications.

Computational guides for molecular dynamics and Monte Carlo methods

28. Additional information:

Name of the Instructor or the Course Coordinator: **Fadwa M Odeh**	Signature: *Fadwa Odeh*	Date: ……..……
Name of the Head of Quality Assurance Committee/ Department -	Signature: ……..……	Date: ……..……
Name of the Head of Department **Prof. Murad AlDamen**	Signature: ……..……	Date: ……..……
Name of the Head of Quality Assurance Committee/ School of Science **Prof. Emad A. Abuosba**	Signature: ……..……	Date: ……..……
Name of the Dean or the Director **Prof. Mahmoud I. Jaghoub**	Signature: ……..……	Date: ……..……