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جامعة كل العرب

**Course Syllabus**  
**Faculty of Arts and Science**  
**Academic Department Chemistry**  
**Academic Year 2021/2022 Semester: Second**

<b>Course Title :</b>	Physical Chemistry (3)
<b>Course No. :</b>	1722410
<b>Prerequisite :</b>	1722310
<b>Concurrent :</b>	-
<b>Department :</b>	Chemistry
<b>Coordinator :</b>	Dr. Dima Khater
<b>Mode of Instruction</b>	<b><u>On-Campus Learning</u></b> - 3 hours in-class (Synonym) learning

**\* Instructor:**

Lecturer	Office Phone	Room No.	Office Hours	E-mail
Dr. Dima Khater	1283	224	11.00-12.00 S, M, T, W, Th	<a href="mailto:d_khater@asu.edu.jo">d_khater@asu.edu.jo</a>

**Course Description**

Physical Chemistry (II) covers a brief introduction to basic principles of quantum chemistry. Particles in box (1D, 2D, and 3D), Simple Harmonic Motion, the Rigid Rotor, Atomic & Molecular Structure. The basic principle of vibrational, rotational, Raman, and electronic spectra of molecules. Chemical bond: Molecular orbital theory & LCAO (linear combination of atomic orbitals) theory.

**Intended Learning Outcomes**

Upon the completion of the course, this module should lead to the following learning outcomes:

**A. Knowledge and Understanding (Student should):**

- A1 describe and explain fundamental concepts of physical chemistry, including those of chemical kinetics, quantum mechanics, spectroscopy, and statistical mechanics.

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A2 recognize the importance of physical chemistry in industry, economics, and the environment.

### B. Cognitive and Intellectual Skills (Student should):

B1 apply its knowledge and skills to solve some theoretical problems in chemistry.

B2 perform calculations related to chemical kinetics, quantum mechanics, spectroscopy, and statistical mechanics.

### C. Subject Specific Skills (Student should):

C1 apply simple physical models to predict properties of chemical systems

### Program Learning Outcomes (PLOs):

1.1	Describe the fundamentals of chemistry including structure, reactivity, and properties of chemical substances, the different situations of reaction, and the states of matter.
1.2	Construct essential facts, principles, and theories across the four principal areas of chemistry, i.e. analytical, organic, inorganic, and physical.
1.5	Recognize certain subjects in biology, physics, and mathematics that serve the chemistry disciplines
1.7	State certain subjects that are academically and/or professionally related to chemistry
3.1	Demonstrate adequate life-long learning skills
3.3	Select appropriate techniques and procedures for chemical synthesis and analysis.
4.3	Interpret data derived from laboratory observations and measurements in terms of their significance and the theory underlying them.

Course Learning Outcomes Alignment Matrix					
PLO	A1	A2	B1	B2	C1
1.1	√				
1.2		√			
1.5			√		
1.7			√		
3.1				√	
3.3				√	
4.3					√



## Course Contents and Schedule

Week	Day and Date	Topics to be covered	Method of instruction	CLOs	PLOs
1	Sun. 6 <sup>th</sup> Mar.	9.6 molecular kinetics	In-class lecture	A1 B2	1.1
	Tue. 8 <sup>th</sup> Mar.	9.7 Arrhenius equation	In-class lecture		1.5
	Thur. 10 <sup>th</sup> Mar	9.9 Theories of reaction rates	In-class lecture		1.7
2	Sun. 13 <sup>th</sup> Mar.	9.10 Reaction in solution	In-class lecture	A1 B2	1.1
	Tue. 15 <sup>th</sup> Mar.	9.5 Techniques for very fast reaction	In-class lecture		1.5
	Thur. 17 <sup>th</sup> Mar	10.1 Composite reactions 10.2 Types of composite reaction	In-class lecture		1.7
3	Sun. 20 <sup>th</sup> Mar.	10.3 Rate equations for composite mechanism	In-class lecture	A1 A2	1.1
	Tue. 22 <sup>th</sup> Mar.	10.4 Principle of microscopic reversibility	In-class lecture		1.2
	Thur. 24 <sup>th</sup> Mar.	10.5 Chain reactions	In-class lecture		
4	Sun. 27 <sup>th</sup> Mar.	10.9 catalysis	In-class lecture	A2 C1	1.2
	Tue. 29 <sup>th</sup> Mar.	11.1 Electromagnetic Radiation and the Old Quantum Theory	In-class lecture		4.3
	Thur. 31 <sup>th</sup> Mar		In-class lecture		
5	Sun. 3 <sup>rd</sup> April	11.2 The Bohr's Theory	In-class lecture	C1	1.2
	Tue. 5 <sup>th</sup> April	11. 3 The Foundations of Quantum Mechanics	In-class lecture		
	Thur. 7 <sup>th</sup> April		In-class lecture		
6	Sun. 10 <sup>th</sup> April	11.4. Schrodinger's Wave Mechanics	In-class lecture	B1 B2	1.5
	Tue. 12 <sup>th</sup> April		In-class lecture		1.7
	Thur. 14 <sup>th</sup> April	11.5 Quantum-Mechanical Postulate	In-class lecture		3.1 3.3
7	Sun. 17 <sup>th</sup> April	11.6 Quantum Mechanics of Some Simple Systems	In-class lecture	B1 B2	1.5
	Tue. 19 <sup>th</sup> April		In-class lecture		1.7
	Thur. 21 <sup>st</sup> April	11.7 Quantum Mechanics of Hydrogen like Atom	In-class lecture		3.1 3.3
8.	Sun. 24 <sup>th</sup> April	11.8 Physical significance of the orbital quantum numbers,	In-class lecture	B1 B2	1.5
	Tue. 26 <sup>th</sup> April		In-class lecture		1.7
	Thur. 28 <sup>th</sup> April	11.9. Angular momentum and magnetic moment	In-class lecture		3.1 3.3
9	Sun 1 <sup>st</sup> May	Official holiday			



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	Tue. 3 <sup>th</sup> May				
	Thur. 5 <sup>th</sup> May				
10	Sun 8 <sup>th</sup> May	11.10 The rigid linear rotor, 11.11 Spin quantum numbers,	In-class lecture	B2 B1	1.5
	Tue. 10 <sup>th</sup> May		In-class lecture		1.7
	Thur. 12 <sup>th</sup> May		In-class lecture		3.1 3.3
11	Sun 15 <sup>th</sup> May	11.12 Many-electron atoms, 11.13 Approximation methods in quantum mechanics,	In-class lecture	B1 B2	.5
	Tue. 17 <sup>th</sup> May		In-class lecture		1.7
	Thur. 19 <sup>th</sup> May		In-class lecture		3.1 3.3
12	Sun. 22 <sup>nd</sup> May	12.1 Molecular orbital theory, 12.3 Hückel Theory for more complex molecules,	In-class lecture	C1	4.3
	Tue. 24 <sup>th</sup> May		In-class lecture		
	Thur.26 <sup>th</sup> May		In-class lecture		
13	Sun. 29 <sup>th</sup> May	13.1 Emission and absorption spectra, Lambert Beer law, Zimman effect, and an introduction to NMR molecular comparison	In-class lecture	A2	1.2 4.3 4.4
	Tue.31 <sup>th</sup> May		In-class lecture		
	Thur.2 <sup>rd</sup> Jun		In-class lecture		
14	Sun. 5 <sup>th</sup> Jun	18.7 Surface Tension and Capillary 19.1 Viscosity 19.2 Diffusion 19.3 Sedimentation	In-class lecture	A2 C1	1.2 4.3
	Tue.7 <sup>th</sup> Jun		In-class lecture		
	Thur.9 <sup>th</sup> Jun		In-class lecture		
15	Sun. 12 <sup>th</sup> Jun	revision	In-class lecture		
	Tue.14 <sup>th</sup> Jun		In-class lecture		
	Thur.16 <sup>th</sup> Jun		In-class lecture		
16.	Final Exam				





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### جامعة كل العرب

- “Physical Chemistry,” by G. K. Vemulapalli, Prentice-Hall Publishers, Englewood Cliffs, New Jersey (1993).
- “A Textbook of Physical Chemistry,” by K. K. Sharma and L. K. Sharma, Vani Educational Books, New Delhi, India (1986).
- “Principles of Physical Chemistry with Applications to the Biological Sciences,” by D. Freifelder, Jones and Bartlett Publishers, Boston, Massachusetts (1985).
- “Physical Chemistry,” 2nd Edition by J. P. Bromberg, Allyn and Bacon, Boston, Massachusetts (1984).
- “Physical Chemistry,” by W. J. Moore, Prentice-Hall Publishers, Englewood Cliffs, New Jersey (1972).



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Subject Coordinator

Dr. Dima Khater

Signature: -----

Head of Curriculum Committee

Dr. Hussam Miqdad

Signature: -----

Department Head

Dr. Hussam Miqdad

Signature: -----

Faculty Dean

Dr. Hadeel Ali Saed

Signature: -----

Copy to:

- Department Head.
- Head of Curriculum Committee.
- Course File.

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رمز النموذج: UF 28 / 2

رقم القرار 24 / 233

تاريخ الاعتماد 2021/10/18



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