جامعة الإسراء
ISRA UNIVERSITY

# Course Syllabus

***According to JORDAN National Qualification Framework (JNQF)***

# Course Name: Physical Chemistry (III)

# Course Number: 11014145

## General Course Information:

| | |
|---|---|
| Course title | **Physical chemistry (3)** |
| Course number | **11014145** |
| **Credit hours** | **3** |
| **Education type** | **[Face-to-Face]** |
| Prerequisites/corequisites | **11013143** |
| Academic Program | **Bachelor in Chemistry** |
| Program code | **01** |
| Faculty | **Science** |
| Department | **Chemistry** |
| Level of course | **Third or fourth year** |
| Academic year /semester | **2022/2023- First semester** |
| Awarded qualification | **Bachelor degree in Chemistry** |
| Other department(s) involved in teaching the course | **-** |
| Language of instruction | **English** |
| Date of production/revision | **1/10/2022** |

## Course Coordinator:

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| **Coordinator's name** | **Dr. Alaa Al-Ma'abreh** |
| **Office No** | **4204** |
| **Office Phone extension number** | **2527** |
| **Office Hours** | **10-11 Sunday, 8:30-9:30 Monday, 2-3 Tuesday, 11:00-12:30 Wednesday, 1-2 Thursday** |
| **Email** | **alaa.almaabreh@iu.edu.jo alaamabreh@yahoo.com** |

## Other Instructors:

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|---|---|
| **Instructor name** | **Dr. Alaa Al-Ma'abreh** |
| **Office No** | **4204** |
| **Office Phone extension number** | **2527** |
| **Office Hours** | **10-11 Sunday, 8:30-9:30 Monday, 2-3 Tuesday, 11:00-12:30 Wednesday, 1-2 Thursday** |
| **Email** | **alaa.almaabreh@iu.edu.jo alaamabreh@yahoo.com** |

## Course Description *(English/Arabic)*:

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|---|---|
| **English** | Basic principles in quantum chemistry, electromagnetic radiation and ancient quantum theory, quantum mechanics for simple systems (free body, body inside a box with one, two and three dimensions, rigid rotor, harmonic oscillator); atomic and molecular structure; methods of approximation in Quantum mechanics; the basics of vibration, rotation, and electronic transmission spectrum in molecules. |
| **Arabic** | المبادئ الأساسية في كيمياء الكم; الشعاع الكهرومغناطيسي و نظرية الكم القديمة; ميكانيكا الكم لعدد من الانظمة البسيطة (الجسم الحر, جسم داخل صندوق ذو بعد واحد و بعدين و ثلاثة ابعاد, الدوار الصلد, المتذبذب البسيط ); البنية الذرية و الجزيئية; الطرق التقريبية في ميكانيكا الكم; اساسيات الاهتزاز و الدوران و طيف الانتقال الالكتروني في الجزيئات. |

**Textbook:** ***Author(s), Title, Publisher, Edition, Year, Book website.***

1. K.J. Laidler& J.H. Meiser, Houghton Mifflin, Physical Chemistry, 4th edition, 2002

**References:** ***Author(s), Title, Publisher, Edition, Year, Book website.***

1. Peter Atkins & Julio De Paula, Physical chemistry, 10th edition, 2012
2. *Quantum Chemistry*, Levine, Ira N, 7th edition, 2014

## Course Educational Objectives (CEOs):

| | |
|---|---|
| **1.** | **Recognize basic concepts, theories, and laws related to behavior of ions in solutions, electrochemical cells, reaction rates, surface chemistry, colloids and transport properties.** |
| **2.** | **Performing calculations related to electrolytic solutions, electrochemical cells, reaction rate, surface chemistry, colloids, and transport properties.** |
| **3.** | **Derive relationships and law related to electrochemistry and kinetics.** |

## Intended Learning Outcomes (ILO's):

| **1.** | **Subject Intended learning outcomes (ILOs) describe what students are expected to know and be able to do at the end of the course. These outcomes are related to the knowledge, skill and competence that students acquire:** | **Relationship to CEOs** | **Contribution to PLOs** | **Bloom Taxonomy Levels*** | **Descriptors**** |
|---|---|---|---|---|---|
| **2. A** | **Knowledge and Understanding:** | | | | |
| **3. A1** | **Student will be able to recognize the behavior of ions in solutions, reaction rate concepts and principles, surface chemistry, colloids concepts, and transport properties based on the related laws and theories.** | **1** | **a** | **1** | **K** |
| **4. B** | **Intellectual skills:** | | | | |
| **5. B1** | **Student will be able to solve problems related to solutions of electrolytes, electrochemical cells, rate chemical reactions, surface chemistry, colloids, and transport properties.** | **2** | **d** | **3** | **S** |
| **6. C** | **Subject specific skills:** | | | | |
| **7. C1** | **Student will be able to derive laws related to electrochemistry, elementary and composite chemical reactions, and surface chemistry.** | **3** | **c** | **4** | **C** |
| **8. D** | **Transferable skills:** | | | | |
| **9. D1** | | | | | |

***Bloom Taxonomy Levels**

| Level # | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Level Name** | **Knowledge** | **Comprehension** | **Application** | **Analysis** | **Evaluation** | **Synthesis** |

## ** Descriptor (National Qualification Framework Descriptors): K : Knowledge, S: Skill, C: Competency.

## Program Learning Outcome (PLOs):

| **Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviours that students acquire as they progress through the program. A graduate of the (Bachelor in chemistry) program will demonstrate:** | | **Descriptors**** | | |
|---|---|---|---|---|
| | | **K** | **S** | **C** |
| **1.** | Describe the fundamental scientific principles and theories across the four subfields of chemistry (Organic, inorganic, analytical and physical). | √ | | |
| **2.** | Identify and confirm chemical compounds structures as well as determine chemical composition. | √ | | |
| **3.** | Establish and concludes mechanisms of physical and chemical processes in addition to the ability of mastering qualitative and quantitative determination. | | | √ |
| **4.** | Solve the scientific problems using different mechanisms and procedures based on critical thinking. | | √ | |
| **5.** | Conduct scientific experiments in chemistry. | | | √ |
| **6.** | Commitment and interest in lifelong learning, and collaborate effectively with other people in a team. | | | √ |
| **7.** | Prepare logical, organized and concise written reports, and oral and poster presentations that effectively communicate chemical content to other scientists. | | √ | |
| **8.** | Commitment to the ethical principles of chemical research. | | | √ |
| **9.** | Find information about chemistry through databases and information | | √ | |
| **10.** | Evaluation of calculations in chemistry experiments and information analysis using computer software. | | | √ |
| **11.** | Demonstrate safety laboratory techniques. | | √ | |

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

## Weekly Schedule *(please choose the type of teaching)*

## √ Face to Face

## □ Hybrid *(**2 Lectures** Face – To - Face **+1 Lecture** Asynchronous)*

## □ Hybrid (*1 Lectures* Face – To - Face ***+1 Lecture*** Asynchronous)

## □ Online *(**2 Lectures** Synchronous **+1 lecture Asynchronous**)*

| **Week** | **First Hour** (*Face – To - Face*) | **Second Hour** (*Face – To - Face*) | **Third Hour** (*Face – To - Face*) | **Ach. ILOs** | **Ach. PLOs** | **Descriptors*** |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Introduction to quantum chemistry | **10. Introduction to quantum chemistry** | Introduction to quantum chemistry | ILO1 | a | K |
| 2 | Introduction to quantum chemistry | **11. Introduction to quantum chemistry** | Introduction to quantum chemistry | ILO2 | d | S |
| 3 | Introduction to quantum chemistry | **12. Introduction to quantum chemistry** | Introduction to quantum chemistry | ILO2 | d | S |
| 4 | Postulates of quantum mechanics | **13. Postulates of quantum mechanics** | Postulates of quantum mechanics | ILO1 | a | K |
| 5 | Postulates of quantum mechanics | **14. Postulates of quantum mechanics** | Postulates of quantum mechanics | ILO2 | d | S |
| 6 | Applications of quantum mechanics in simple systems | **15. Applications of quantum mechanics in simple systems** | Applications of quantum mechanics in simple systems | ILO1 | a | K |
| 7 | Applications of quantum mechanics in simple systems | **16. Applications of quantum mechanics in simple systems** | Applications of quantum mechanics in simple systems | ILO2 | d | S |
| 8 | Applications of quantum mechanics in simple systems | **17. Applications of quantum mechanics in simple systems** | Applications of quantum mechanics in simple systems | ILO3 | c | C |
| 9 | Applications of quantum mechanics in simple systems | **18. Applications of quantum mechanics in simple systems** | Applications of quantum mechanics in simple systems | ILO3 | c | C |
| 10 | Approach to a real systems | **19. Approach to a real systems** | Approach to a real systems | ILO1 | c | K |
| 11 | Approach to a real systems | **20. Approach to a real systems** | Approach to a real systems | ILO2 | a | S |
| 12 | Approach to a real systems | **21. Approach to a real systems** | Approach to a real systems | ILO3 | c | C |
| 13 | Spectroscopic applications | **22. Spectroscopic applications** | Spectroscopic applications | ILO1 | a | K |
| 14 | Spectroscopic applications | **23. Spectroscopic applications** | Spectroscopic applications | ILO2 | a | S |
| 15 | Atomic structure | **24. Atomic structure** | Atomic structure | ILO3 | d | C |

* K: Knowledge, S: Skills, C: Competency

## Teaching Methods and Assignments:

**Development of ILOs is promoted through the following teaching and learning methods:**

- **Interactive videos**
- **Practice Labs**
- **Discussion Forums**
- **Quizzes**
- **Other Interactive online activities**
- **Reports**

## Course Policies:

A- Attendance policies:

The maximum allowed absences is 15% of the lectures.

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

Midterm exam can be retaken based on approval of excuse by the instructor's discretion.

Not handing assignment on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehaviour:

Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Practice labs, Discussion Forums, Quizzes) **20 %**
- Midterm **30 %**
- Final Exam **50 %**

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

## Required equipment:

- **PC / Laptop with webcam and mic**
- **Internet Connection**
- **Access to the IU E-Learning Platform at: https://elearn.iu.edu.jo/**
- **E-learning plan**
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning
- Training

## Assessment Tools implemented in the course:

√ Final Exam
√ Midterm Exam
• Quizzes
√ Homework
• Practice Labs
• Discussion Forums

- Periodic reports for learning assessment
- Improvement plans for online or face-to-face teaching
- Others:…….

## Responsible Persons and their Signatures:

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|---|---|---|---|
| **Course Coordinator** | **Dr. Alaa Al-Ma'abreh** | **Completed Date** | **1/10 /2022** |
| | | **Signature** | Alaa Al-Ma'abreh |

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|---|---|---|---|
| **Received by** (Department Head) | **Dr. Manal Al-Khabbas** | **Received Date** | **16/110/2022** |
| | | **Signature** |  |