جامعة الإسراء
ISRA UNIVERSITY

Course Syllabus

According to JORDAN National Qualification Framework (JNQF)

Course Name: Nuclear and Radiochemistry

Course Number: 11014226

General Course Information:

Course title	**Nuclear and Radiochemistry**
Course number	**11014226**
Credit hours	**3**
Education type	**Hybrid (Face-to-Face, Online (Asynchronous)**
Prerequisites/corequisites	**11012121**
Academic Program	**Chemistry**
Program code	**01**
Faculty	**Science**
Department	**Chemistry**
Level of course	**Third year**
Academic year /semester	**2021/2022- Second semester**
Awarded qualification	**Bachelor**
Other department(s) involved in teaching the course	**None**
Language of instruction	**English**
Date of production/revision	**6/3/2022**

Course Coordinator:

Coordinator's name	**Dr. Manal Alkhabbas**
Office No	**4231**
Office Phone extension number	**2510**
Office Hours	**11-12 Sun, Tue, and Thu, 11-12:30 Mon and Wed.**
Email	**manal.khabbas@iu.edu.jo**

Other Instructors:

Instructor name	**-**
Office No	
Office Phone extension number	
Office Hours	
Email	

Course Description *(English/Arabic)*:

English	**Introduction; nuclear structure and binding energy; radioactive decay processes; equations of radioactive decay and growth; interaction of radiation with matter; nuclear energy; application of nuclear chemistry.**
Arabic	**مقدمة، بنية النواة وطاقة الربط، طرق التحلل الإشعاعي النووي، معادلات تحلل ونمو النشاط الإشعاعي، تفاعلات الإشعاعات مع المادة، الطاقة النووية، تطبيقات الكيمياء النووية.**

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

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

Maheshwar Sharon, Madhuri Sharon, Nuclear Chemistry, Springer International Publishing, 2nd edition, 202, https://www.springerprofessional.de/en/nuclear-chemistry/18822026
Choppin, G., Jan-Olov Liljenzin, Rydberg, J. and Ekberg, C., Radiochemistry and Nuclear Chemistry, Elsevier, 4th edition, 2013, https://www.sciencedirect.com/book/9780124058972/radiochemistry-and-nuclear-chemistry#book-description

Course Educational Objectives (CEOs):

	By the end of this course, the student should be fully aware of:
1.	**Improve their knowledge of the basic information of Radiation and Nuclear chemistry; requirements, and application of Radioisotopes.**
2.	**Improve their knowledge of types of radioactive decay, natural decay series, nuclear reactions, interaction of radiation with matter.**
3.	**understand the operating procedures of nuclear plants.**
4.	**Perform calculations for rate of radioactive decay and mass energy relationships.**

Intended Learning Outcomes (ILO's):

	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**
1. A	**Knowledge and Understanding:**				
A1	**Define the fundamental concepts of radiation and nuclear chemistry.**	**1**	**1**	**1**	**K**
A 2	**Demonstrate Nuclear reactors and nuclear fuel cycle.**	**3**	**1**	**1**	**K**
2. B	**Intellectual skills:**				
B1	**Identify various types of nuclear transmutation including fission, fusion, and decay reactions.**	**2**	**3**	**4**	**S**
B2	**Solve different problems related to radiation and nuclear chemistry.**	**4**	**4**	**3**	**S**
B3	**Explain the initial interaction of radiation with matters and biological effects of radiation.**	**2**	**3**	**4**	**S**
3. C	**Subject specific skills:**				
C 1					
4. D	**Transferable skills:**				

	Make use of PowerPoint presentation on application of nuclear technology.	**1**	**7, 9**	**6**	**C S**

***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 (_____) 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).	**x**		
2.	Identify and confirm chemical compounds structures as well as determine chemical composition.	**x**		
3.	Establish and concludes mechanisms of physical and chemical processes in addition to the ability of mastering qualitative and quantitative determination.		**x**	
4.	Solve the scientific problems using different mechanisms and procedures based on critical thinking.		**x**	
5.	Conduct scientific experiments in chemistry.			**x**
6.	Commitment and interest in lifelong learning and collaborate effectively with other people in a team.			**x**
7.	Prepare logical, organized and concise written reports, and oral and poster presentations that effectively communicate chemical content to other scientists.			**x**
8.	Commitment to the ethical principles of chemical research.			**x**
9.	Find information about chemistry through databases and information		**x**	
10.	Evaluation of calculations in chemistry experiments and information analysis using computer software.			**x**
11.	Demonstrate safety laboratory techniques.		**x**	

**** 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 Lecture (Face – To - Face)**	**Second Lecture (Face – To - Face)**	**Third Lecture (Asynchronous)**	**Ach. ILOs**	**Ach. PLOs**	**Descriptors ****
1	Introduction Syllabus	Topic 1: Fundamentals of nuclear and radiation chemistry	Nuclides and nuclei-isotopes, isotones, and isobars	1 3	1 3	K S

		Discovery of Radioactivity				
2	- Chart of Nuclides - Types of radiation	Nuclear stability	Assignment (Atomic weight)			
3	Topic 2: Radioactive Decay Kinetics Radio activity	Rates of radioactive decay Half life	Examples on calculation of radio activity and kinetics of radioactive decay	1 4	1 4	K S
4	Natural Radioactive Series	Topic 3: Nuclear reactions Mass defect	Assignment on radioactive decay kinetics	1 4	1 4	K S
5	Binding energy	Fission reaction	Examples on calculation of mass defect and binding energy	1 3 4	1 3 4	K S
6	Fissionable and Fissile nuclides. Critical Energy	Nuclear chain reactions Fusion reaction	Fusion reaction	1 3 4	1 3 4	K S
7	Examples on calculation of enthalpy of nuclear reactions.	Topic 4: Nuclear reactors Nuclear reactor main components	Assignment: Preparation of report about types of nuclear reactors	1 3 4	1 3 4	K S
8	Fission Products Activation products	Solving problems	Midterm Exam	3 4	3 4	S
9	Nuclear Fuel Cycle Conversion	Uranium enrichment	Video about nuclear plant	1	1	K
10	Centrifuge Process Gaseous Diffusion Process	Radioactive Waste	Assignment	1	1	K
11	Topic 5: Interactions of Radiation with Matter Ionizing Radiation Attenuation	The Five Interactions of X and Gamma Rays With Matter	X- Ray	5	3	S
12	The Five Interactions of X and Gamma Rays With Matter	Interactions of particulate radiation with matter	Assignment	5	3	S
13	Topic 6: Radiation Exposure and Dosimetry Sources of radiation	Biological effects of ionizing radiation Radiation exposure and dose measurements	Examples on calculation of dosimetry	5 4	3 4	S
14	Topic 7: Application Introduction	Presentation	Application	1 3 4 6	1 3 4 7, 9	K S C
15	Presentation	Presentation	Assignment	6	7, 9	S C

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

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods: ▪ Assignments ▪ Presentation
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:

- **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:

- ✓ Oral Final Exam
- ✓ Training Form

Responsible Persons and their Signatures:

Course Coordinator	**Manal Alkhabbas**	**Completed Date**	**6/3/2022**
		Signature	

Received by (Department Head)	**Manal Alkhabbas**	**Received Date**	**6/3/2022**
		Signature