Course E-Syllabus

1	**Course title**	Nuclear and Radiochemistry
2	**Course number**	***0333323***
3	**Credit hours**	3
	Contact hours (theory, practical)	3 week
4	**Prerequisites/corequisites**	Chem 102
5	**Program title**	Bsc
6	**Program code**	3
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Chemistry Department
10	**Level of course**	Third
11	**Year of study and semester (s)**	Fall 2023/2024
12	**Final Qualification**	
13	**Other department (s) involved in teaching the course**	
14	**Language of Instruction**	Mixed English with Arabic
15	**Teaching methodology**	☐Blended ☒Online
16	**Electronic platform(s)**	☒Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others……
17	**Date of production/revision**	5/11/2023

18 Course Coordinator:

Name: Prof Dr Fawwaz I. Khalili Office number: 25 Phone number: 22142 Email: fkhalili@ju.edu.jo

19 Other instructors:

Name:
Office number:
Phone number:
Email:

Name:
Office number:
Phone number:
Email:

20 Course Description:

A This course will ensure that students become conversant with the following main aspects of chemistry:
A1 Major aspects of nuclear and radiochemical terminology, nomenclature, conventions and units.
A2 The major types of nuclear stability, nuclear and radiochemical reactions and decay and the main characteristics associated with them.
A3 Equations of radioactive growth and decay and transformations during nuclear reactions.
A4 The principles and procedures used in nuclear and radiochemical analysis and the characterization of nuclear and radiochemical compounds.
A5 The characteristics of the different methods of interactions of radiations with matter and the theories used to describe them.
A6 The principles and types of nuclear detection instruments.
s stated in the approved study plan.
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21 Course aims and outcomes:

To install in students a sense of enthusiasm for nuclear chemistry, an appreciation of its application in different contexts and to involve them in an intellectually stimulating and satisfying experience of learning and studying.
_ To provide students with a broad and balanced foundation of nuclear chemical knowledge and practical skills.
_ To develop in students the ability to apply their nuclear chemical knowledge and skills to the solution of theoretical and practical problems in nuclear and radiochemistry.
_ To develop in students, through an education in nuclear and radiochemistry, a range of transferable skills, of value in chemical and non-chemical employment.
_ To provide students with a knowledge and skills base from which they can proceed to further studies in specialized areas of nuclear and radiochemistry or multi-disciplinary areas involving nuclear and radiochemistry.
_ To generate in students an appreciation of the importance of nuclear and radiochemistry in an industrial, economic, environmental and social context.

A- Aims:

B1 Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas identified above.
B2 Ability to apply such knowledge and understanding to the solution of qualitative and quantitative problems of a familiar and unfamiliar nature.
B3 Ability to recognize and analyze novel problems and plan strategies for their solution.
B4 Skills in the evaluation, interpretation and synthesis of nuclear and radiochemical information and data.
B6 Ability to recognize and implement good measurement science and practice.
B7 Skills in presenting scientific material and arguments clearly and correctly, in writing and orally, to a range of audiences.
B8 Computational and data-processing skills, relating to nuclear and radiochemical information and data.

B- Intended Learning Outcomes (ILOs):
Upon successful completion of this course, students will be able to:

This course will ensure that students become conversant with the following main aspects of chemistry:
A1 Major aspects of nuclear and radiochemical terminology, nomenclature, conventions and units.
A2 The major types of nuclear stability, nuclear and radiochemical reactions and decay and the main characteristics associated with them.
A3 Equations of radioactive growth and decay and transformations during nuclear reactions.
A4 The principles and procedures used in nuclear and radiochemical analysis and the characterization of nuclear and radiochemical compounds.
A5 The characteristics of the different methods of interactions of radiations with matter and the theories used to describe them.
A6 The principles and types of nuclear detection instruments.

22. Topic Outline and Schedule:

Introduction	**3**
Atomic nuclei	**6**
Radioactive Decay Processes	**7**
Equations of radioactive Decay and growth	**7**
Interaction of radiation with matter	**10**
Nuclear energy and fission	**9**
Total	**42**

Week	Lecture	Topic	Teaching Methods*/platform	Evaluation Methods**	References
1	1.1	Introduction			
	1.2				
	1.3	Radioactive decay			
	1.4				
	1.5	Cosmic ray			
2	2.1	Atomic structure			
	2.2				
	2.3	Isotopes			
	2.4				
	2.5	Nuclear stability			
3	3.1	Mass defect			
	3.2				
	3.3	Semiempirical Binding energy equation			
	3.4				
	3.5	Mass Parabola			
4	4.1	Conservation laws			
	4.2				
	4.3	Alpha decay			
	4.4				
	4.5	Beta decay			
5	5.1	Gamma decay			
	5.2				
	5.3	Spontaneous fission			
	5.4				
	5.5	Decay schemes			
6	6.1	Closed energy cycle			
	6.2				
	6.3	Equation of decay			
	6.4				
	6.5	Average life			
7	7.1	Decay of mixtures			
	7.2				
	7.3	Growth of products			
	7.4				
	7.5	Secular equilibrium			
8	8.1	Successive decay			
	8.2				

	8.3	Units of radioactivity			
	8.4				
	8.5	Interaction of radiation with matter			
9	9.1	Range			
	9.2				
	9.3	Stopping power			
	9.4				
	9.5	Range energy relation			
10	10.1	Electrons			
	10.2				
	10.3	Gama ray			
	10.4				
	10.5	Pair production			
11	11.1	X- ray			
	11.2				
	11.3	Radiation protction			
	11.4				
	11.5	Internal radiation sources			
12	12.1	Nuclear energy			
	12.2				
	12.3	Nuclear reactor			
	12.4				
	12.5	Energy in fission			
13	13.1	Nuclear fission			
	13.2				
	13.3	Fission models			
	13.4				
	13.5	Oklo phenomenon			
14	14.1	Radioactive wastes			
	14.2				
	14.3	Solid wastes			
	14.4				
	14.5	Nuclear bombs			

- Teaching methods include: Synchronous lecturing/meeting; Asynchronous lecturing/meeting
- Evaluation methods include: Homework, Quiz, Exam, pre-lab quiz…etc

23 Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment

methods and requirements:

Evaluation Activity	Mark	Topic(s)	Period (Week)	Platform
quiz	30	Ch 1 and 2	Second -third week	Microsoft
Mid term	30	Ch 3, 4, 5	Six -Seventh week	Microsoft
Final	40	All chapters	Final week	Microsoft forms or model

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

students should have a computer, internet connection, webcam and an account on a Microsoft teams software/platform

25 Course Policies:

A- Attendance policies: yes

B- Absences from exams and submitting assignments on time: As regulations permit

C- Health and safety procedures: yes

D- Honesty policy regarding cheating, plagiarism, misbehavior: yes

E- Grading policy: As mentioned above

F- Available university services that support achievement in the course: Microsoft teams, forms and e learning

26 References:

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

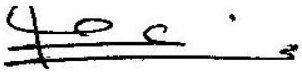
- Nuclear and radiochemistry (Arabic) 2nd

By F. Khalili

B- Recommended books, materials and media:

- Nuclear and radiochemistry 3rd
By G. Friedlander, J. W. Kennedy, E. S. Macias, J. M. Miller

27 Additional information:

Name of Course Coordinator: Fawwaz Khalili Signature:  Date: 6/11/2023

Head of Curriculum Committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------

Head of Curriculum Committee/Faculty: ---------- Signature: ----------

Dean: ---------- Signature: ----------