Course Specification
(Bachelor)

Course Title:	Nuclear and Radiochemistry
Course Code:	ICHM 345
Program:	Industrial Chemistry
Department:	Department of Chemistry
College:	College of Science
Institution:	Majmaah University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☒ University	☐ College	☒ Department	☐Track	☐Others
B.	☐ Required		☐Elective		
3. Level/year at which this course is offered: (6th Level/3rd year)					
4. Course General Description:					
Nature of nuclear chemistry and radiochemistry, sources of radiations, radioactive decay and standard-units system, interaction of radiations with matter, theories dealing with nuclear structure, nuclear models; liquid droplet model, nuclear fission and nuclear fusion and the liberated energy, radiochemistry of gases and liquids, effect of radiation on some organic and inorganic compounds, measurement of lower and higher radiation doses, effect of radiation on the biological systems and methods of protection, effects of radiation on biological tissues.					
5. Pre-requirements for this course (if any)**:**					
353 ICHM					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
Upon the completion of this course, the student will be able to: • Know how nuclear changes can occur, distinguish between natural and artificial radioactivity. • Describe what each emission is composed of and how they differ from each other with respect to mass, charge, penetrating power, and ionizing power. • Know what happens to an element that undergoes alpha decay, beta decay, or gamma decay. • Apply nuclear chemistry and radiochemistry. • Use modern and effective teaching methods.					

- View recent research in this specialty of chemistry
- Increase the use of information technology during the interaction with students

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Write, complete, and balance nuclear equations**	**S1**	**(PowerPoint) and Video related to the topic. - Demonstration of a large number of problems solution in the class - Discussions**	**- Midterms - Quizzes - Homework - Class participation - Encourage students to search the Internet for**
1.2	**Describe different radioactive radiations and the difference between chemical and nuclear reactions**	**S2**		

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			- E-learning - Self-learning	everything related to - Homework on the blackboard - Final exam - E-exam. Final Practical exam
...				
2.0	**Skills**			
2.1	Apply the basic laws of radioactivity in solving related problems.	K1	Cooperative learning -Problem Solving -Interactive teaching - Discussion and dialogue - Active Learning - Peer Learning -Encourage students to work as team in order To raise the spirit of cooperation among students - Lectures for detailed practical manuals are provided for all practical parts.	Self-performance in class. Written presentation of assignments. Direct contact during office hours.
2.2	Calculate the Q-values of various decay modes with the application of the selection rules for the allowed transitions.	K2		
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively in groups and exercise leadership when appropriate	V1	Assignments (individual or group) at regular intervals to solve	- Observing student's participation in group activity.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			and submit on time. • Participation of students in classroom discussion and problem solving sessions • Team work reports and presentations (data collection, internet search, data processing, analysis and reporting)	- Checklist of the tasks carried out by the student. Observing student's participation in group discussion. - Lab report - Checklist of student's punctuality in submitting work on time.
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction and history of nuclear chemistry	2
2.	Structure and properties of the atomic nucleus, nuclear systematics and reactions, Nuclear masses and stability, angular momentum of nucleus, nuclear models, nuclear forces	4
3.	Radioactive Decay: mass-energy relationships and decay mechanisms. Types of radioactive decay and decay law, radioactive decay processes	4
4.	alpha, beta and gamma decays, Interaction of radiation (α, β and γ rays) with matter	4
5.	Energetics and radionuclide production, Measurement of nuclear radiation.	4
6.	Nuclear fission, charge and mass distribution, Mechanism of nuclear fission and nuclear reactors.	4
7.	Environmental behavior of radioactive substances; Interaction of Radiation with Matter: Radiation detectors and health effects of radiation.	2
8.	Biological effects of ionizing radiation	2

9.	Radiation protection and safety	2
10.	Application of radiation technology	2
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework	Continues	5%
2.	Quizzes	End of topic	5%
3.	Presentation	One/semester	10%
4.	First midterm exam	6th	15%
5.	Second midterm exam	9th	15%
6.	E. exam	12th	10%
7.	Final written Exam	End of the semester	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	1. Nuclear and Radiochemistry: Fundamentals and Applications, 2 Volume Set, 3rd Edition, Jens-Volker Kratz, Karl Heinrich Lieser, e-book, 2013, ISBN: 978-3-527-32901-4. 2. Modern Nuclear Chemistry, WALTER D. LOVELAND,DAVID J. MORRISSEY & GLENN T. SEABORG, A JOHN WILEY & SONS, INC., PUBLICATION, 2006, ISBN-13 978-0-471-11532-8 3.Radiation Detection and Measurement; fourth edition, Glenn F. Knoll, John Wiley & Sons, Inc
Supportive References	1.Radiochemistry and Nuclear Chemistry, Fourth Edition , Gregory Choppin, Jan-Olov Liljenzin, JAN RYDBERG and Christian Ekberg, 4 edition academic Press, 2013, 10: 01240589733. 2. Nuclear and Radiochemistry, KH Lieser, 2nd revised ed., Wiley-VCH, Berlin, 2001
Electronic Materials	1.Radiochemistry and Nuclear Chemistry, Fourth Edition , Gregory Choppin, Jan-Olov Liljenzin, JAN RYDBERG and Christian Ekberg, 4 edition academic Press, 2013, 10: 01240589733.

	2. Nuclear and Radiochemistry, KH Lieser, 2nd revised ed., Wiley-VCH, Berlin, 2001
Other Learning Materials	**PowerPoint presentation. Interactive and multimedia soft-books**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms, E- learning, blackboard**
Technology equipment (projector, smart board, software)	**Data show, Smart Board**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**students**	**students**
Effectiveness of Students assessment	**Program/Department Instructor**	**Program/Department Instructor**
Quality of learning resources	**Program/Department Instructor**	**Program/Department Instructor**
The extent to which CLOs have been achieved	**Peer review**	**Peer review**
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	