هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Chemistry of Lanthanides and Actinides**
Course Code:	**CHEM 424 -3**
Program:	**Bachelor in Chemistry**
Department:	**Chemistry**
College:	**College of Science**
Institution:	**Jazan University (JU)**

Table of Contents

A. Course Identification

1. Credit hours: 3hrs Workload: 168 ECTS: 6.0	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: **L 8, Year 4**	
4. Pre-requisites for this course (if any)**:** **CHEM 323**	
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom** **LAB**	(2x15=30) (2x15=30)	%100
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre-requisite*
		Lec.	*Prac.*				
Chemistry of Lanthanides and	**Chem 424**	**2**	**2**	**3**	**4th**	**8th**	**CHEM323**

Course objectives:

1- Recognizing the concept of nuclear fission and fusion.
2- Recognizing the method of measuring of low and high radiation doses.
3- Recognizing the effect of radiation on biological systems and the ways of protection.
4- Recognizing the lanthanides and actinides elements.
5- Recognizing the electronic structures, chemical and physical properties, and the reactions of those elements

Syllabus: A-Theoretical contents

Nuclear and Radiochemistry: The nature of nuclear and radiochemistry and the sources of ionizing radiation – Radiation decay and standard units – Radiation interaction with matter – Theories related to the structure of nucleus – Nuclear fission and fusion and emitted energy
– Measurement of low and high radiation doses – The effect of radiation on biological systems and the ways of protection.
b. Lanthanides Group: Comparative study between lanthanides and transition elements – Comparative study between lanthanides and alkaline earth metals – The electronic structure of the elements – Different oxidation states – The physical properties such as magnetic, spectral and color properties – Electronic shield – Methods of separation: Fractional crystallization, ion exchange, etc.
c. Actinides Group: electronic structure – Methods of preparation – Radiation decay – Element
enrichment.

Syllabus: B-Practical contents

Selected experiments related to the determination of lanthanides, their chemical reactions and methods of separation

*See attachment

2. Course Main Objective

This course aims to give the students some information about the nuclear fission and fusion, how to measure the doses of radiation, recognizing the effect of radiation and the methods of protection and giving an idea about the elements of lanthanides and actinides

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding:** *Upon completion of the course, student will be able to:*	
1.1	*Demonstrate abroad knowledge and understanding on the properties, occurrence, separation and uses of lanthanides and actinides.*	K1
1.2	*Describe the radioactivity of unstable isotopes, fission and fusion reactions and their applications. (M)*	K2
2	**Skills:** *Upon completion of the course, student will be able to:*	
2.1	*Demonstrate the knowledge and skills required to solve problems in the nuclear equation, radioactivity half-life, decay series, fission and fusion.*	S1
2.2	Practice the experimental skills and to write a report in laboratory representing the obtained results. *(M)*	S2
2.3	Follow proper procedures and regulations for safe handling and use of chemicals.	S4
2.4	*Make effective use of communication, modern library searching and information technology about lanthanides, actinides and radioactivity topics. (M)*	
3	**Values:** *Upon completion of the course, student will be able to:*	
3.1	*Working as group leader and as a member of a team in Lab. (M)*	V1

C. Course Content

No	List of Topics	Contact Hours
1	Introduction Electronic structure, oxidation states, abundance, extraction and uses of lanthanides.	3
2	Separation of the lanthanide elements.	2
3	Chemical properties of (+iii), (+iv) and (+ii) lanthanides compounds.	2
4	Colour and spectra of lanthanides.	2
5	Magnetic properties, lanthanide contraction and complexes.	2
6	Electronic structure, oxidation states and occurrence of actinides.	2
7	Preparation of actinides.	2
8	General properties of actinides.	2
9	Occurrence, extraction and chemical properties of thorium and uranium.	2
10	Structure, forces and stability of the nucleus.	2
11	Modes of decay, half-life period, binding energy and nuclear stability	3
12	Nuclear fission, nuclear power stations, moderators and types of reactors.	3
13	Nuclear fusion and some applications of radioactive isotopes.	3
14	Selected Experiments related to course topics.	30
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding** *Upon completion of the course, student will be able to:*		
1.1	*Demonstrate abroad knowledge on the properties, occurrence, separation and uses of lanthanides and actinides. (M)*	Lectures, active learning Virtual sessions	Test, exam (MCQ, T/F, complete blank, Match) short and long answers question, reasoning. Both online and offline.
1.2	*Describe the radioactivity of unstable isotopes, fission and fusion reactions and their applications. (M)*	Lectures, active learning Virtual sessions	Test, exam (MCQ, T/F, complete blank, Match) short and long answers question, reasoning. Both online and offline.
2.0	**Skills** *Upon completion of the course, student will be able to:*		
2.1	*Demonstrate the knowledge and skills required to solve problems in the nuclear equation, radioactivity half-life, decay series, fission and fusion. (M)*	Lectures, virtual session	Numerical problem, test,
2.2	Practice the experimental skills, team work and to write a report in laboratory representing the obtained results. *(M)*	Demonstration in practical class	Practical assignments and laboratory reports / Individual and group project reports
2.3	Follow proper procedures and regulations for safe handling and use of chemicals. *(M)*	lab demonstrations / hands-on student learning activities /	Observation of practical skills / Safety exam / Practical assignments and laboratory reports
2.4	*Make effective use of communication, modern library searching and information technology about lanthanides, actinides and radioactivity topics. (M)*	Assignments, discussion, group activity	Oral, power point presentation.
3.0	**Values** *Upon completion of the course, student will be able to:*		
3.1	*Working as an individual and as a member of a team in Lab. (M)*	Group work Lab work	Oral Exam

2. Assessment Tasks for Students

#	Assessment task*		Week Due	Percentage of Total Assessment Score
1	Home work and Quizzes (Theory and Lab)		4	5%
2	Midterm		8	15%
4	Quiz in Safety		13	0
5	Lab exam	Sheet	15	5%
		Lab Report	15	5%
		Final Experiment	15	20%
6	Final Exam		16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: The instructor will be available for academic counseling on daily basis for 2h/day during office hours. More emphasis will be given to weak students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Lee, J. D. (2009) Concise Inorganic Chemistry, 5 th Edition Authorized Reprint Published by Blackwell Science Limited, France. 2. F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus. Basic Inorganic Chemistry, 3rd Edition ISBN: 978-0-471-50532-7 January 1995,
Essential References Materials	1. Simon A. Cotton, (2013) Lanthanide and Actinide Chemistry, Macmillan Education, 204p. 2. Walter D. Loveland, David J. Morrissey, Glenn T. Seaborg (2017) Modern Nuclear Chemistry, John Wiley & Sons.
Electronic Materials	• https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry • https://www.britannica.com/science/lanthanum • https://byjus.com/jee/f-block-elements/
Other Learning Materials	• https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Book%3A_Introductory_Chemistry_(CK-12)/06%3A_The_Periodic_Table/6.14%3A_Lanthanides_and_Actinides • https://chem.libretexts.org/Special:Search?qid=&fpid=230&fpth=&query=Lanhanides+and+actinides&type=wiki

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room(s) for groups of 50 students. Lab room(s) for groups of 15 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	AV, data show, Smart Board, software, etc.)
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Chemical Models, scientific videos

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and Assessment	**Student**	***Likert-type Survey (CES)*** ***Indirect***
Extent of achievement of course learning outcomes	**Instructor & Course coordinator**	***Class room evaluation (direct & indirect)***
Quality of learning resources	**Program Leaders**	***Indirect***
Exam Quality assessment	**Peer Reviewer**	***Indirect***

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Chemistry Department Council**
Reference No.	42 / 35 /102 112
Date	17 /09 /1442 Corresponding to 28 / 04 /2021

Course Name: Chemistry of lanthanides and actinides

Code: 424CHEM - 3 Year: 2020/2021 (1441/1442) Semester: First

Experimental Part

#	EXPERMENTS	Equipment, Chemicals and Tools.	No of weeks for each experiment
1	Introduction and lab safety		One week
2	The Structure of Atoms	Theoretical calculation	Two weeks
3	Chemical Periodicity	Theoretical calculation	Two weeks
4	Chemical Bonding	Theoretical calculation	Two weeks
5	Exam	Theoretical calculation	One week
6	Molecular Structure and Covalent Bonding Theories	Theoretical calculation	Two weeks
7	Coordination Compounds	Theoretical calculation	Two weeks
8	Revision		Two weeks
9	Final Exam		One week