Course Specification
(Bachelor)

Course Title:	Lanthanides & Actinides
Course Code:	424CHEM3
Program:	Bachelor of science in Chemistry
Department:	Physical Sciences
College:	College of Science
Institution:	Jazan University (JU)
Version:	TP-153 2024
Last Revision Date:	5/5/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3h)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (Level 8 / year 4)

4. Course general Description:

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre- requisite*
		Lec.	*Prac.*				
Lanthanides & Actinides	***424CHEM3***	***2***	***1***	***3***	***4***	***8***	***322CHEM4***

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

Course objectives: They are to identify the following.

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.
- 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.
- Actinides Group: electronic structure – Methods of preparation – Radiation decay – Element enrichment.

Syllabus: B-Practical contents

Experimental work illustrating selected parts of the theoretical content.

5. Pre-requirements for this course (if any)**:**

322CHEM4

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

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

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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**	30
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		60

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**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*	K(1.1)	***lecture / discussion Seminars /presentation***	***Objective question***

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	*Describe the radioactivity of unstable isotopes, fission and fusion reactions and their applications.* *(M)*	K(1.2)	***lecture / discussion / Seminars /Individual presentation***	Essay question
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*.	S(2.1)	***lecture / discussion / Seminars /Individual presentation***	Solving Problems
2.2	Practice the experimental skills and to write a report in laboratory representing the obtained results. *(M)*	S(2.2)	***Lab work, group work***	***Objective question, Essay question,*** ***lab report rubric***
2.3	Follow proper procedures and regulations for safe handling and use of chemicals.	S(2.3)	***lab demonstrations / hands-on student learning activities***	***Safety exam***
3.0	**Values, autonomy, and responsibility**; (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)*	V(3.1)	***lab demonstrations / whole group and small group discussion***	***Practical group work Rubric***

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction Electronic structure, oxidation states, abundance, extraction and uses of lanthanides.	***2***
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.	***3***
7.	Preparation of actinides.	***2***
8.	General properties of actinides.	***3***
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.	2
13.	Nuclear fusion and some applications of radioactive isotopes.	3
14.	Selected Experiments related to course topics.	30
Total		60

D. Students Assessment Activities

No	Assessment Activities *		Assessment timing (in week no)	Percentage of Total Assessment Score
1.	***Homework assignment***		***2-6***	***2 %***
2.	***Lecture Quizzes***		***4-6***	***3 %***
3.	***Mid-term exam***		***6-8***	***15 %***
4.	***Practical work***	***LAB Sheet***	***10***	***5 %***
5.		***Quiz in Safety***	***10-11***	***4%***
6.		***Final practical exam***	***14***	***7 %***
7.		***Lab report***	***2-13***	***8 %***
8.		***Group work evaluation***	***2-13***	***6%***
9.	***Final Exam***		***16-17***	***50 %***
	Total			***100 %***

*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. 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,
Supportive References	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. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	1 Lecture room(s) for groups of 50 students
Technology equipment (Projector, smart board, software)	Smart board, Data show, Black board, internet
Other equipment (Depending on the nature of the specialty)	none

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Likert-type Survey CES) Indirect
Effectiveness of Students assessment	Instructor & Course coordinator	Classroom evaluation (direct & indirect
Quality of learning resources	Program coordinator	Indirect
The extent to which CLOs have been achieved	Assessment committee	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physical Sciences Department Council
REFERENCE NO.	Psci2415
DATE	28/03/1446 Corresponding to 1 / 10 /2024

H. Attachments

1- Practical Work

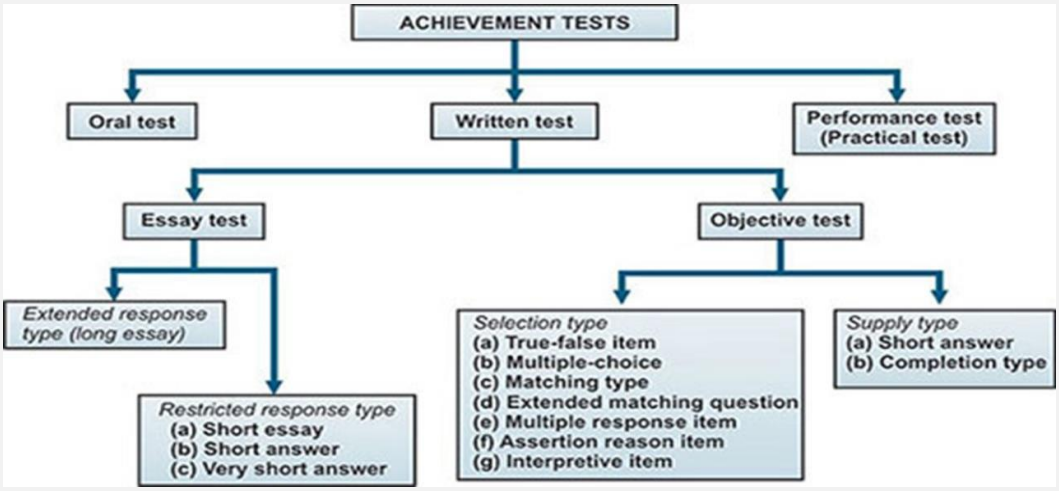
#	EXPERMENTS	Equipment, Chemicals and Tools.	No of weeks for each experiment
1	Introduction and lab safety		One week
2	The Structure of Atoms	Theoretical calculation	Two weeks
3	Chemical Periodicity	Theoretical calculation	Two weeks
4	Chemical Bonding	Theoretical calculation	Two weeks
5	Exam	Theoretical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

2- Blue Print

Course Name	Lanthanides & Actinides
Course Code	424CHEM -3

PLOs	K1	K2	S1	S2	S3	S4	V1	V2
CLOs	**1.1**	**1.2**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**
Marks	**10**	**18**	**42**	**20**	**4**	**--**	**6**	**--**

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
Knowledge & understanding	K1	**1.1 (10 M)**	Quiz	Objective Q	**2**	**2**	**1**
			Mid term	Objective Q	**8**	**4**	**2**
			Final Exam	Objective Q	**14**	**7**	**7**
	K2	**1.2 (18 M)**	Quiz	Essay Q	**2**	**2**	**1**
			Mid term	Essay Q	**4**	**4**	**4**
			Final Exam	Essay Q	**7**	**13**	**13**
Skills	S1	**2.1 (42 M)**	H.W	Solving Problems and Essay Q	**2**	**2**	**2**
			Quiz	Solving Problems and Essay Q	**2**	**2**	**1**
			Mid term	Solving Problems and Essay Q	**2** **3**	**3** **6**	**9**
			Final Exam	Solving Problems and Essay Q	**4** **6**	**12** **18**	**30**
	S2	**2.2 (20 M)**	Practical Sheet	Objective Q	**2**	**2**	**2**
				Essay Q	**3**	**3**	**3**
			Lab Report	Lab Rubric	**5**	**5**	**8**
			Final Lab Exam	I Task experiment	**7**	**7**	**7**
	S3	**2.3 (4 M)**	Safety Exam	Objective Q	**8**	**4**	**4**
Value	V1	**3.1 (6 M)**	Continuous assessment	Group evaluation rubric	**1**	**6**	**6**
TOTAL		**100**					100


ACHIEVEMENT TESTS
Oral test
Written test
Performance test (Practical test)
Essay test
Objective test
Extended response type (long essay)
Restricted response type
(a) Short essay
(b) Short answer
(c) Very short answer
Selection type
(a) True-false item
(b) Multiple-choice
(c) Matching type
(d) Extended matching question
(e) Multiple response item
(f) Assertion reason item
(g) Interpretive item
Supply type
(a) Short answer
(b) Completion type