هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification

(Bachelor)

Course Title:	**Nuclear and Radiation chemistry**
Course Code:	**CHM 1415**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	2024 V1 1
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 2 (2 Lectures, 0 Tutorials, 0 Lab)					
2 (2 Lectures, 0 Tutorials, 0 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: Level 7/ Year 4					
4. Course general Description:					
The course covers the following topics: introduction to nuclear chemistry, types of radiations, nuclear reactions, kinetics of nuclear decay, half-life, reactors, radiation detection, isotope separation and applications.					
5. Pre-requirements for this course (if any)**:**					
CHM1313 Organometallic Chemistry					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
At the end of this course the student will be able to:					

- **Improve their knowledge of the basic information of Radiation and Nuclear chemistry; requirements, methods of preparation, uses of Radioelements.**
- **Be aware of the contributions of chemistry to society**
- **Improve their knowledge of types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy, relationships, nuclear reactions, rates of radioactive decay, interaction of radiation with matter.**
- **Improve their knowledge of instrumentation and Introduction to health – physical applications in nuclear and radiochemistry.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	0	0
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		30

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

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recognize the basic information of radioactive and nuclear chemistry and to identify instrumentation and health applications in nuclear and radiochemistry.**	**K1, K2, K3**	• Two hours are weekly, containing lectures. • A Private study, including work on the home exam.	▪ Quizzes ▪ Assignments ▪ Oral Discussion ▪ Participation.
1.2	**To list types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy.**	**K1, K3**	• Two weekly hours, lectures • Group discussion	• Assignments. • Quizzes. • Final exam.
1.3	**To define environmentally harmful nuclear materials and name some applications of radio-isotopes.**	**K1, K3**	• Group discussions. • A Private study, including work on homework. • Think and outline harmful nuclear materials impact	• Midterms. • Assignments. • Oral test • Quizzes. • Final exam.
2.0	**Skills**			
2.1	**To differentiate between the different types of radioactive**	**S2, S3**	• Lectures activity	• Questions in Lectures.

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	decay and predict nuclides stability and nuclear reaction products.		• Think and talk about types of radioactive decay	• Short Quizzes and Exams. • Participation through Classwork and Homework.
2.2	**To calculate the mass defect and binding energy for fission and fusion reaction.**	**S1, S2**	Introduce some examples of the mass defect and binding energy for fission and fusion reactions.	• Questions in Lectures. • Short Quizzes and Exams. • Participation • Oral Discussion and Homework.
2.3	**To estimate ages of materials using carbon and uranium dating.**	**S1, S2**	Lectures activity	• Questions in Lectures. • Short Quizzes and Exams. • Participation. • Oral Discussion and Homework
2.4	**To develop effective written and oral communication skills, ability to present data in graphs through electronic mail, and Network skills with others**	**S1, S3**	• Encourage students to exchange their chemical thinking, and cooperatively with their peers to develop individual skills.	• Questions in Lectures. • Short Quizzes and Exams. • Oral Presentation ▪ Participation
3.0	**Values, autonomy, and responsibility**			
3.1	**To demonstrate teamwork, make a decision, and create awareness to maintain scientific integrity during different assessments, projects, and mini-reports.**	**V1, V2**	• Group discussions and assignment. • Homework • Mini-reports	• Oral presentation marks. • Assessments and homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction, Nuclear binding energy, Mass defect and binding energy, The average binding energy per nucleon.	4
2.	Radioactivity, Nuclear emissions, Nuclear transformations, The kinetics of radioactive decay, Units of radioactivity, Artificial isotopes, Bombardment of nuclei by high-energy a-particles and neutrons, Bombardment of nuclei by 'slow' neutrons.	6
3	Nuclear fission, The fission of uranium, The production of energy by nuclear fission, Nuclear reprocessing, Syntheses of transuranium elements, The separation of radioactive isotopes.	6
4	Chemical separation, The Szilard–Chalmers effect, Nuclear fusion, Applications of isotopes, Infrared (IR) spectroscopy, Kinetic isotope effects, Radiocarbon dating, Analytical applications, Sources of 2H and 13C, Deuterium: electrolytic separation of isotopes.	4
5	Carbon-13: chemical enrichment, Multinuclear NMR spectroscopy in inorganic chemistry, Which nuclei are suitable for NMR spectroscopic studies?	5
6	Chemical shift ranges, Spin–spin coupling, Stereochemically non-rigid species, Exchange processes in solution, Mo¨ ssbauer spectroscopy in inorganic chemistry, The technique of Mo¨ ssbauer spectroscopy, What can isomer shift data tell us?	5
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, Attendance, Participation, Home Exams	All the semester	20 %
2.	Midterm Exam 1	Around 6th & 7th week	20 %
3.	Midterm Exam 2	Around 11th & 12th week	20 %
4.	Final Exam	Around 16- 17th week	40 %
5.	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	**Inorganic Chemistry,** Catherine E. Housecroft and Alan G. Sharpe, 2nd ED. Pearson Education Limited, Essex CM20 2JE, England, 2005 (ISBN: 0130-39913-2)
Supportive References	**Inorganic Chemistry,** Atkins, P., and Overton, T., Rourke, J., Weller, M., Armstrong, F. and Hagerman, M. 5th Ed. New York, NY: W.H. Freeman and Company, 2010 (ISBN: 978-1-42-921820-7)
Electronic Materials	• Blackboard • http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true • http://www.chem1.com/acad/webtext/virtualtextbook.html http://www.shodor.org/UNChem/index.html
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Each classroom is equipped with PC and retro projector with a maximum of 25 students.
Technology equipment (projector, smart board, software)	The rooms are equipped with data show, Smart Board, WI-FI access.
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**	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students' assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
Quality of learning resources	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	**Course Responsible**	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leader	**Indirect:** Exams.

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**7 (NO. 2/3)**
DATE	**29/3/1446 - 2/10/2024**