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

Course Specification
(Bachelor)

Course Title:	**Inorganic Chemistry (2)**
Course Code:	**CHM 1311**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	2024 V 1
Last Revision Date:	13 October 2024

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3, 0, 3)					
4 (3 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 5/Year 2					
4. Course general Description:					
Topics covered in the course include Coordination Compounds and their magnetic properties, theories regarding complexes geometries with their electronic configuration, types of ligands and properties. The course will be provide the students with Basic information for transition metals including methods of preparation, uses of elements and compounds.					
5. Pre-requirements for this course (if any)**:**					
CHM 1211 Inorganic Chemistry (1)					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					

At the end of the course, Students should be able to:

- **Understanding Coordination compounds, their magnetic properties, theories regarding complexes geometries and their electronic configuration,**
- **Understanding ligands, their types and properties.**
- **Basic information about transition metals and analytical chemistry including methods of preparation, uses of elements and compounds**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**90**	**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**	**45**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		90

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 list the general characteristics of transition elements and identify a number of industrial and metallurgical processes.**	**K1; K2; K3**	• Six hours are weekly, containing lectures and laboratory activities. • A Private study including home exam.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation.
1.2	**To describe the Crystal Field Theory and the Molecular orbital theory**	**K1**	• six hours weekly containing lectures and Laboratory activities • Group discussion	• Quizzes • Assignments. • Oral Discussion Laboratory Reports
1.3	**To name complexes made of a central atoms and ligands and to recognize the origin of metals magnetism**	**K1; K3**	• Six hours are weekly for lectures and laboratory activities • Think, talk, and review complexes and ligands	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**	• Laboratory activities • Group discussion	▪ Quizzes ▪ MCQs, ▪ Laboratory Performance
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	**To summarize the common physical and chemical properties of s and d elements.**	**S1; S3**	Introduce some examples of s and d elements for Comparisons between its chemical properties.	• Questions in Lectures. • Short Quizzes and Exams. • Participation • Oral Discussion, • Laboratory Reports • Home Exam.
2.2	**To interpret electronic absorption spectra of complexes**	**S1; S2 and S3**	• Group Discussions • Laboratory Experiments	• Questions in Lectures. • Laboratory Reports • Short Quizzes and Exams. • Oral Discussion
2.3	**To outline ligands formation , and properties**	**S2; S3**	• Lectures • Oral Discussions. • Brainstorming Exercises	• Questions in Lectures. • Short Quizzes • Exams.
2.4	**To perform chemical experiments during Laboratory Classes, field tasks, and using Laboratory Instruments**	**S1; S2; S3**	• Seminars • Encourage the students to use the Chemicals, Glasswares, and Instruments with caring and safety • Laboratory activities. • .	• Presentation marks • Oral tests • Assignments • Laboratory Report. • Laboratory performance
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise effectively the collaboration and inter-professionalism in class discussions or teamwork.**	**V1;V2**	• Group Discussion • Virtual labs and demonstrations	• Oral tests, • Group worksheet assignments.

C. Course Content

No	List of Topics	Contact Hours
1.	**Werner's Coordination Theory**, ligand classification, Nomenclature of Coordination Compounds Complex formation, Variable oxidation states, Electroneutrality principle **Isomerism in d-block metal complexes**: Structural isomerism: ionization isomers, Structural isomerism: hydration isomers, Structural isomerism: coordination isomerism, Structural isomerism: linkage isomerism, Structural isomerism: polymerization isomerism, Stereoisomerism: geometrical isomers, Stereoisomerism: optical isomers. **Coordination numbers**, Factors Affecting Coordination Number, The Kepert model, Coordination number 2-7 , stability of complexes, Preparation of coordination complexes, Detection of complexes.	10
2.	d-Block chemistry: general considerations: Topic overview, Ground state electronic configurations, d-Block metals versus transition elements, Electronic configurations, Physical properties, The reactivity of the metals, Characteristic properties: a general perspective, Colour and Paramagnetism.	9
3	Scandium group: characterization, oxidation states, extraction, compounds, chemical reactions, oxidation states, extraction, compounds, separation, Titanium group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Vanadium Group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Chromium group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Manganese group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Iron group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Cobalt group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Nickel group, characterization, oxidation states, extraction, compounds, chemical reactions, separation, Copper group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Zinc group: characterization, oxidation states, extraction, compounds, chemical reactions, separation.	16
4	The f-block metals: lanthanoids and actinoids: Introduction, f -Orbitals and oxidation states, Atom and ion sizes, The lanthanoid contraction, **Coordination numbers**, Sources of the lanthanoids and actinoids, occurrence and separation of the lanthanoids, The actinoids, Lanthanoid metals, Inorganic compounds and coordination complexes of the lanthanoids, Halides, Hydroxides and oxides, Complexes of Ln(III), The actinoid metals, Inorganic compounds and coordination complexes of thorium, uranium and plutonium, Thorium, Uranium, Plutonium.	**10**
	TOTAL	**45**

No	List of Experiments	Contact hours
1	Laboratory safety and how to write a lab report	3
2	Determination of molarity & strength for Mg^{2+}, Zn^{2+} and Pb^{2+} ions	3
3	Determination of molarity & strength for Cu^{2+}, Ni^{2+} and Ca^{2+} ions	3
4	Determination of molarity & strength for Co^{2+} and Zn^{2+} ions	3
5	Determination of molarity & strength for Al^{3+}, Ni^{2+} and Mg^{2+} ions	3
6	Determination of molarity & strength for Fe^{3+} and Zn^{2+} ions	3
7	Analysis of Mg^{2+} + Zn^{2+} and Mg^{2+} + Ni^{2+} mixtures	3
8	Analysis of Mg^{2+} + Zn^{2+} and Mg^{2+} + Zn^{2+}+Cu^{2+} mixtures	3
9	Preparation of chloropentammine cobalt(III) chloride complex	3
10	Preparation of hexaammine Nickel(II) chloride complex	3
11	Separation of group I& II basic cations	3
12	Separation of group III basic cations	3
13	Separation of group IV basic cations	3
14	Separation of group V and VI basic cations	3
15	Revision	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam 1	5-6th week	10 %
2.	Midterm Exam 2	11-12th week	10 %
4.	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
5.	Laboratory	All the semester	30 %
6.	Final Exam	16th-17th week	40 %
7.	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	**Advanced Inorganic Chemistry: A Comprehensive Text**,F. A. Cotton, S. G. Wilkinson 3rd Edition, 1972. Published by John Wiley & Sons Inc. ISBN 13: 9780471175605

Supportive References	**Inorganic Chemistry,** Gary L. Miessleand Donald A. Tarr. 4th Edition, 2010, Publisher: Prentice Hall:, 2010 ISBN-10:0136128661
Electronic Materials	**Blackboard**
Other Learning Materials	Comprehensive Inorganic Chemistry. Sulekh Chandra, New Age International Limited Publishers, New Delhi, 2004 Descriptive inorganic chemistry, Rayner-Canham, Geoff., Publisher: W.H. Freeman, New York, 2006

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs
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)	• Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders) • Appropriate fine chemicals and solvents (distilled Water ammonium nitrate) • Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, Filter papers , clamps, stands

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.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	**Students**	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	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 Leaders	**Indirect:** Exams.
Lab Performance	**Students**	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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**