Course Specification
(Bachelor)

Course Title:	CO-ORDINATION CHEMISTRY
Course Code:	323CHEM-3
Program:	Bachelor of Science in Chemistry
Department:	PHYSICAL SCIENCES
College:	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: (6 L / 3 Y)

4. Course general Description:

This course aims to study the coordination and organometallic compounds, their methods of preparation and their uses.

Course Title	*Course Number*	*Contact Hours (CU)*		*Credit unit (CU)*	*Year*	*Level*	*Pre- requisite*
		Lec.	*Prac.*				
Coordination Chemistry	*CHEM 323*	*2*	*1*	*3*	*3*	*6*	*322CHEM4*

Course Objectives; They are to identify the following

1- Recognizing the stereochemistry of complexes and molecular symmetry.
2- Recognizing the concept of donating and accepting atom.
3- Recognizing the nomenclature rules of the complexes.
4- Recognizing the types of ligands and the coordination number.
5- Recognizing the polar and non-polar molecules.
6- Recognizing the methods of preparation of organometallic compounds.
7- Recognizing the uses of organometallic compounds.

Syllabus: A-Theoretical contents

a. Coordination Chemistry: Concept of donating and accepting atoms – Types of ligands – Coordination number - Stereochemistry of complexes and molecular symmetry – Central atom groups - Nomenclature rules of the complexes – Crystal field theory – Molecular orbital theory.
b. Organometallic Chemistry: General rules – Different methods of preparation – Uses of organometallic compounds in the organic preparations (organic compounds of lithium, magnesium, boron, aluminum and silicon) – Organometallic compounds of transition elements, reactions of these compounds and their uses in organic preparations.

Syllabus: A-Practical contents

Selected experiments Selected experiments related to preparation and reactions of the complexes.

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

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

None

7. Course Main Objective(s):

This course aims to study the coordination and organometallic compounds, their methods of preparation and their uses.

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 about the fundamentals and properties of main groups of transition elements in periodic table, coordination parameters, organometallic complexes etc .(P)	K (1.1)	Lecture /discussion Seminars /presentation	Objective Q

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	Describe the postulates of Werner theory, organometallic rules and coordination parameters. (P)	K (1.2)	lecture / discussion / Seminars /Individual presentation	Objective Q Essay Q
2.0	**Skills; (Upon completion of the course, student will be able to)**			
2.1	Demonstrate the knowledge and skills to calculate the coordination number, CFSE, oxidation state of metal and magnetic moments (P)	S (2.1)	lecture / discussion / Seminars /Individual presentation	Essay Q Solving Problems
2.2	Apply their experimental basics and skills to use laboratory equipment, modern instrumentation, and classical techniques for carrying out experiments as well as accurately record and analyze the results of such experiments. (P)	S (2.2)	Lab work, group work	Objective question, Essay question, lab report rubric
2.3	Examine his material and lab safety background to follow proper procedures and regulations for safe handling and use of chemicals. (I)	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 a group leader in cooperator with other colleagues. (P)	V (3.1)	Lab demonstrations /whole group and small group discussion	Practical group work Rubric

C. Course Content

No	List of Topics	Contact Hours
	Definitions, series theory and Werner's theory and types of complexes	2
	Calculations of oxidation state of central atom and charge on the coordination sphere, factors affecting of the complex formation	2
3.	Effective atomic number rules, Nomenclature, magnetic susceptibility, coordination numbers and the stereochemistry and types of chelates	6

4.	Isomerisms of coordination compounds.	3
5.	Bonding theories (VBT, CFT, LFT, CFSE, Jhan- Teller and MOT)	4
6.	Reaction mechanisms of coordination compounds (substitutions and elimination reactions)- Inert and Labile reactions	3
7.	Principles, Nomenclature, Preparation, properties, reactions of organometallic compound.	4
8.	16 AND 18 Rules of organometallic compounds and some exercises.	4
9.	Applications of coordination and organometallic compounds.	2
	Selected experiments related to the course topic	30
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *		Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework assignment		3-8	2%
2.	Lecture Quizzes		4-7	3%
3.	Mid-term exam		6-8	15%
4.	Practical Work	LAB Sheet	15	5%
5.		Safety Exam	14-15	4%
6.		Final Practical Exam	15	7%
7.		LAB Report	2-15	10%
8.		Group Work Evaluation	2-15	4%
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	• COORDINATION CHEMISTRY, Ajal Kumar, 4th Ed., AARYUSH EDUCATION, 2020. • Advanced Inorganic Chemistry, Author: Cotton Wilkinson Murillo Bochmann, 6th Edition, Wiley India Pvt Ltd., 2012.
Supportive References	• Concise Inorganic Chemistry, J. D. Lee, 5TH ED, Wiley India Pvt. Limited, 2008. • Introduction to Coordination Chemistry, G. A. Lawrance, A John Wiley and Sons, Ltd., 2010

	• Direct Synthesis of Coordination and Organometallic Compounds, A.D. Garnovskii and B.I. Kharisov, Elsevier Science, 1999.
Electronic Materials	Some course contents and materials are posted on Black board sites
Other Learning Materials	https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Modules_and_Websites_(Inorganic_Chemistry)/Coordination_Chemistry www.wikipedia.org/http://www.wpi.edu/Academics/Depts/Chemistry/Courses/General/

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

No. exp.	EXPERMENTS	Equipment, Chemicals and Tools.	No of weeks for each experiment
1	General rules of safety		
2	Introduction about coordination chemistry and the safety in the laboratory.	Periodic table	One week
3	***Direct Titration*** Determination of Magnesium (II)	**0.01M of EDTA **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator **Mg^{+2} solution	One week
4	***Direct Titration*** Determination of Zinc (II)	**0.01M of EDTA **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator **Zn^{+2} solution	One week
5	***Direct Titration*** Determination of cadmium (II)	**0.01M of EDTA **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator **Cd^{+2} solution	One week
6	***Direct Titration*** Determination of Copper (II)	**0.01M of EDTA **Buffer (PH=10) **Murexide (Indicator) **Cu^{+2} solution	One week
7	***Direct Titration*** Determination of Manganese (II)	**0.01M of EDTA **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator **Mn^{+2} solution	One week
8	***Direct Titration Exps.*** Determination of Lead (II)	**0.01M of EDTA **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator Pb^{+2} solution	One week
9	***Indirect and Back Titration Exps.*** Determination of Aluminum (III)	**0.01M of EDTA ** 0.01 M Zinc Sulphates **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator **Al^{+3} solution	One week
10	. ***Indirect and Back Titration Exps.*** Determination of Nickel (II)	**0.01M of EDTA ** 0.01 M Zinc Sulphates **Buffer (PH=10) ** Murexide (Indicator) ** Ni^{+2} solution	One week
11	***Substitution Titration Exp***. Determination of Calcium	**0.01M of EDTA **Ca^{+2} solution **Buffer (PH=10) **Magnesium Complex of EDTA (Mg-EDTA)	One weeks

12	***InDirect Titration Exps*.** Determination of Lead (II)	**0.01M of $MgSO_4$ **0.01M of EDTA **Buffer (PH=10) **Soiochrome Black T (E.B.T) Indicator Pb^{+2} solution	One week
13	Preparation and analysis of monooxalato iron(II) complex	** Glassware. ** Ferrous sulfate ** Ferrous ammonium sulphate. **oxalic acid dihydrate. ** Acetone. ** Ni^{+2} solution	One week
14	Preparation and characterization of potassium trisoxalatochromate(III) trihydrate **$K_3[Fe(C_2O_4)].3H_2O$**	** Glassware. **chromium sulfate ** Potassium dichromate ** Potassium oxalate monohydrate ** Oxalic acid dihydrate ** Sulphuric acid ** Potassium permanganate ** Ammonoium persulphate ** H_2O_2 ** Ethanol	One weeks
15	Preparation of potassium cis and trans-diaqua dioxalato chromate (III). **Cis &Trans $K[Cr(C_2O_4)_2(H_2O)_2]$**	** Glassware. ** chromium sulfate ** Potassium dichromate ** Potassium oxalate monohydrate ** Oxalic acid dihydrate ** Ethanol	One week

2- Blue Print

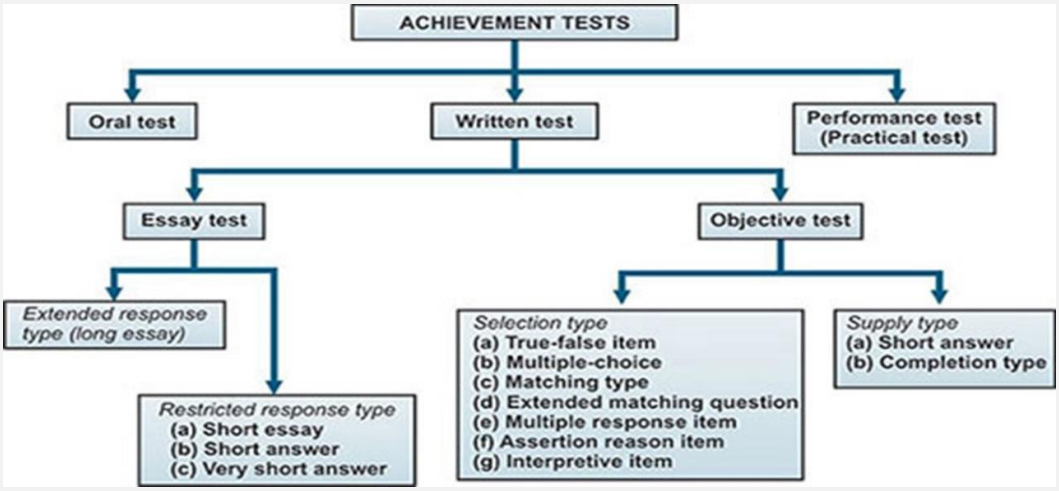
Course Name	Coordination and Organometallic Chemistry
Course Code	323 CHEM

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	15	21	34	22	4	--	4	---

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
Knowledge & understanding	K1	1.1 (15M)	Quiz	Objective Q *	2	2	1
			Mid term	Objective Q	6	3	3
			Final Exam	Objective	22	11	11
	K2	1.2 (21M)	Quiz	Objective Q	1	1	1
			Mid term	Objective Q Essay Q**	3	5	5
			Final Exam	Objective Q Essay Q	10 4	5 10	15
Skills	S1	2.1 (34M)	H.W	Essay Q Solving Problems	4	2	2
			Quiz	Objective Q Essay Q	1	1	1
			Mid term	Essay Q Solving Problems	3	7	7
			Final Exam	Essay Q Solving Problems	7	24	24
	S2	2.2 (22M)	Practical Sheet	Objective Q	6	3	3
				Objective Q Essay Q	2	2	2
			Lab Report	10 EXP.	10	10	10
			Final Lab Exam	Practical Exam	1	7	7
	S3	2.3 (4M)	Safety Exam	Objective Q	8	4	4
Value	V1	3.1 (4)	Continuous assessment	Practical group work Rubric	-	4	4
TOTAL		100					100

*True – false item, MCQ, Matching type, Assertion reason item and completion type.

**Short essay, short answer Q


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