هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Coordination and organometallic chemistry**
Course Code:	**CHEM 323 - 3**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Jazan University (JU)-College of Science**

Table of Contents

A. Course Identification

1. Credit hours:	**3 hrs**							
2. Course type								
a.	University	☐	College	☐	Department	√	Others	☐
b.	Required	√	Elective	☐				
3. Level/year at which this course is offered:	**L 6, Year 3**							
4. Pre-requisites for this course (if any)**:**	**CHEM 322-4**							
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 & LABs**	60	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.*				
Coordination and organometallic chemistry	*CHEM 323*	*2*	*2*	*3*	*3*	*6*	*CHEM 322-4*

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: B-Practical contents

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

*See attachment

2. Course Main Objective

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

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding:** ***Up on completing this 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

CLOs		Aligned PLOs
1.2	*Describe the postulates of Werner theory, organometallic rules and coordination parameters. (P)*	K.2
2	***Skills :*** ***Up on completing this 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.1
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
2.3	*Examine his material and lab safety background to follow proper procedures and regulations for safe handling and use of chemicals. (I)*	S.3
2.4	*Make effective use of communication, and online technology about transition elements topics in order to improve their basic knowledge in writing with a good verbal and clear scientific language. (I)*	S.4
3	**Values:** ***Up on completing this course, student will be able to***	
3.1	*Work as a group leader in cooperator with other colleagues. (P)*	V.1

C. Course Content

No	List of Topics	Contact Hours
1	Definitions, series theory and Werner's theory and types of complexes	4
2	Calculations of oxidation state of central atom and charge on the coordination sphere, factors affecting of the complex formation	3
3	Effective atomic number rules, Nomenclature, magnetic susceptibility, coordination numbers and the stereochemistry and types of chelates	6
4	Isomerisms of coordination compounds.	2 + 1Exam
	bonding theories (VBT, CFT, CFSE and MOT)	4
5	Reaction mechanisms of coordination compounds (substitutions and elimination reactions)- Inert and Labile reactions	5
6	Principles, Nomenclature, Preparation, properties, reactions of organometallic compounds – 16 and 18 rules of organometallic compounds-	4
	Applications of coordination and organometallic compounds.	1
	LAB work	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**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.1	*Demonstrate abroad knowledge about the fundamentals and properties of main groups of transition elements in periodic table, coordination parameters, organometallic complexes…etc (P)*	Lecture Open discussion in class	MCQ Short answer Q Fill-in the Blank
1.2	*Describe the postulates of Werner theory, organometallic rules and coordination parameters. (P)*	Lecture Open discussion in class	MCQ Short answer Q Fill-in the Blank
2.0	**Skills**		
2.1	*Demonstrate the knowledge and skills to calculate the coordination number, CFSE, oxidation state of metal and magnetic moments (P)*	Lecture Open discussion in class Web-based work	MCQ Short answer Q Fill-in the Blank
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)*	Lab work Group work	MCQ Short answer Q Practical Exam
2.3	*Examine his material and lab safety background to follow proper procedures and regulations for safe handling and use of chemicals. (I)*	Group work Lab work	MCQ in safety
2.4	*Make effective use of communication, and online technology about transition elements topics in order to improve their basic knowledge in writing with a good verbal and clear scientific language. (I)*	ppt. Presentations Group discussion	Presentation
3.0	**Values**		
3.1	Work as a group leader in cooperator with other colleagues. *(p)*	Lab work Group discussion Research group	Practical assignments Laboratory reports Web based research

2. Assessment Tasks for Students

#	Assessment task*		Week Due	Percentage of Total Assessment Score
1	**Lecture Quizzes**		**5, 8**	**3**
2	**Homework assignment**		**10**	**2**
3	**Mid-term exam**		**12**	**15**
4	**Quiz in safety**		**12**	**0**
5	**ppt. Presentation**		**12**	**0**
6	**Practical work**	**Lab report/Notebook**	**13**	**5**
7		**Sheet**	**14**	**10**
8		**Final Experiment**	**14**	**15**
9	**Final Exam**		**16**	**50**
	Total			**100**

***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.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1- *Concise Inorganic Chemistry, J. D. Lee, 5TH ED, Wiley India Pvt. Limited, 2008.* 2- *Introduction to Coordination Chemistry, G. A. Lawrance, A John Wiley and Sons, Ltd., 2010* 3- *Direct Synthesis of Coordination and Organometallic Compounds, A.D. Garnovskii and B.I. Kharisov, Elsevier Science, 1999.*
Essential References Materials	1- *Inorganic Chemistry: Principles of Structure and Reactivity, Okhil K. Medhi, James E. Huheey, Richard L. Keiter, Ellen A. Keiter, 4th Ed., Pearson Education Singapore Pte Ltd., 2006.* 2- *Advanced Inorganic Chemistry, Author: Cotton Wilkinson Murillo Bochmann, 6th Edition, Wiley India Pvt Ltd., 2012.*
Electronic Materials	https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Modules_and_Websites_(Inorganic_Chemistry)/Coordination_Chemistry
Other Learning Materials	1. www.wikipedia.org/ http://www.wpi.edu/Academics/Depts/Chemistry/Courses/General/

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	***1 Lecture room(s) for groups of 50 students*** ***1 Lab room(s) for groups of 25 students***
Technology Resources (AV, data show, Smart Board, software, etc.)	***Smart board, Data show, Black board, internet,***
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Glassware, Oven

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and Assessment	Student	Likert-type Survey (CES) Indirect

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	Instructor & Course coordinator	Class room evaluation (direct & indirect)
Quality of learning resources	Program coordinator	Indirect
Exam Quality assessment	Assessment committee	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

* Practical contents

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	One weeks

		** Oxalic acid dihydrate ** Sulphuric acid ** Potassium permanganate ** Ammonoium persulphate ** H_2O_2 ** Ethanol	
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