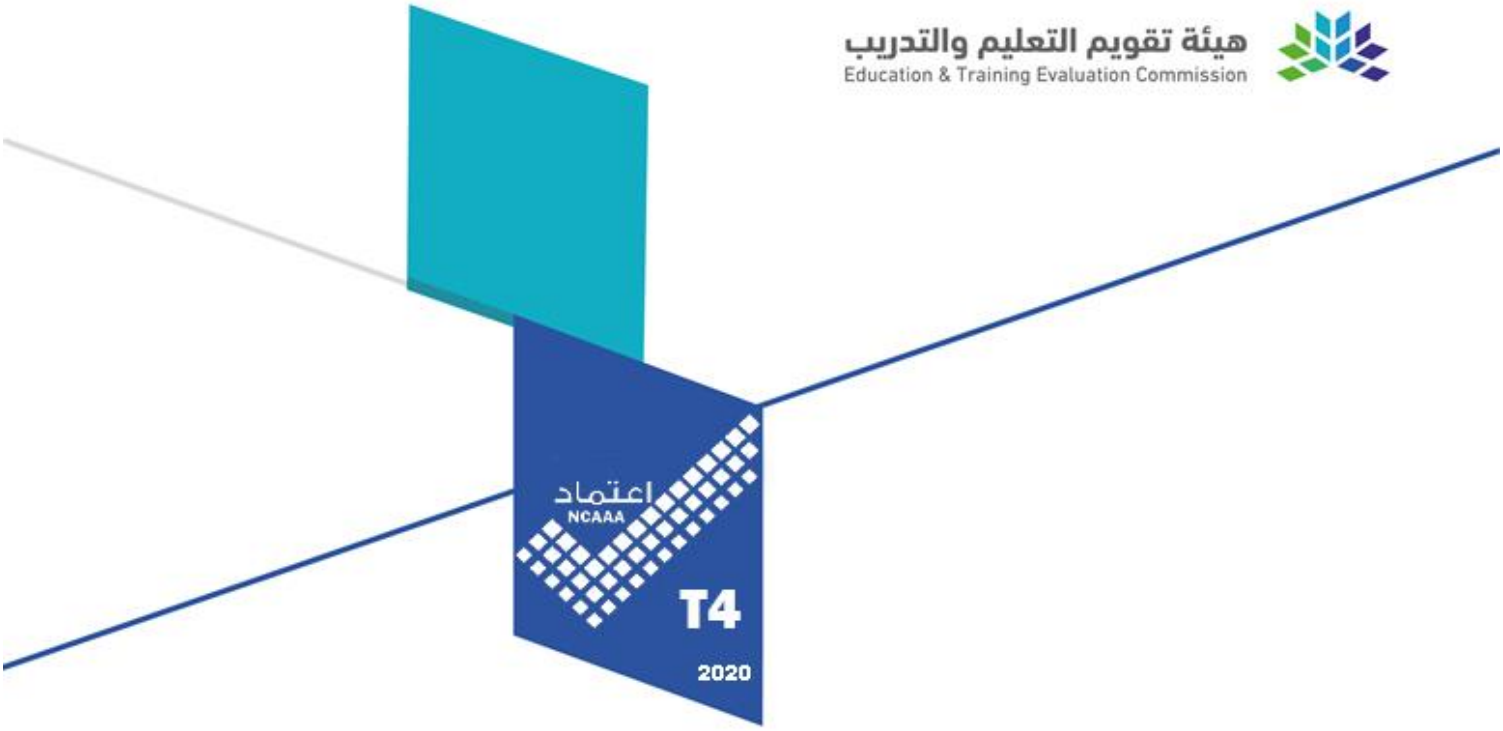
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	Coordination Chemistry
Course Code:	4023564-3
Program:	Chemistry
Department:	Chemistry
College:	Faculty of Applied Science
Institution:	Umm Al-Qura University

Table of Contents

A. Course Identification

1. Credit hours:
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 6th level / 3rd year
4. Pre-requisites for this course (if any)**:**Chemistry of Transition Elements
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**	√	75%
2	**Blended**		
3	**E-learning**	√	25%
4	**Distance learning**		
5	**Other**	--	--

7. Contact Hours (based on academic semester)

No	Activity	Learning Hours
1	**Lecture**	**22**
2	**Laboratory/Studio**	**30**
3	**Tutorial**	**---**
4	**Others** (E-learning, office hours and exams)	**15**
	Total	**67**

B. Course Objectives and Learning Outcomes

1. Course Description

This course deals with the main subjects in coordination chemistry including importance, nomenclature, isomerism, geometry, preparation, electronic and IR spectra, and biological activity of the metal complexes as well as theories explaining bonding in coordination compounds.

2. Course Main Objective

By ending this course, students should be familiar with:

a. The importance, nomenclature, isomerism, geometry, preparation of the metal complexes.
b. The different theories explaining the bonding in coordination compounds.
c. The magnetic, biological, electronic and IR spectral properties of metal complexes.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	Discuss the mode of bonding and geometries in coordination compounds using bonding theories.	K1
1.2	Name and classify coordination compounds.	K2
1.3	Give examples of metal complexes with biological importance.	K3
2	**Skills :**	
2.1	Apply the IUPAC rules for nomenclature of coordination compounds.	S2
2.2	Discuss the structure and stability of coordination compounds based on Werner and Effective atomic number theories to Recognize	S1
2.3	Employ the valence bond theory and crystal field theory to predict the geometrical structure and stability of metal complexes	S1
2.4	Practice the chemical processes and techniques for synthesis and characterization of metal complexes.	S3
2.5	Apply IT and communication technology in gathering and interpreting information and ideas concerning the newly discovered coordination compounds with biological importance.	S5
3	**Values:**	
3.1	Write and introduce chemical reports related to coordination chemistry topics.	V2
3.2	Work collaboratively and constructively in lab to manage the synthesis of coordination compounds and confirming their structures.	V3

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to the chemistry of coordination compounds - Werner theory of coordination compounds - Effective atomic number.	**4**
2	Ligands – nomenclature of metal complexes – symmetry in metal complexes.	**2**
3	Valence bond theory – coordination numbers and geometrical structures – inner and outer complexes.	**2**
4	Stability of metal complexes; factors affecting the stability of metal complexes – ionic and ionization potential – geometrical arrangement of ligands around the central metal ion - metal chelates.	**2**
5	Crystal field theory; ligand field in octahedral complexes – ligand field in tetrahedral complexes –	**4**
6	Midterm exam	**1**
7	ligand field in square planer complexes – Jahn-Teller effect (distortion from symmetrical arrangement) – crystal field stabilization energies.	**2**

8	Preparation of coordination compounds (complexes); direct reactions – oxidation and reduction reactions – thermal decomposition reactions.	**2**
9	Molecular orbital theory	**2**
10	Electronic spectrum of complexes - infrared spectra of the metal complexes.	**4E**
11	Metal complexes of significant biological activities.	**4E**
12	Final exam	**2**
13		
Total		**22+11=33**
No	**Practical Part:** **List of Topics**	**Contact Hours**
1	Introduction about coordination chemistry and safety rules in labs.	**3**
2	Preparation of $[Cu(en)_2](NO_3)_2$	**3**
3	Preparation of $[Co(NH_3)_5Cl]Cl_2$	**3**
4	Preparation of $K_3[Cr(C_2O_4)_3]$	**3**
5	Preparation of $[Ni(en)_3]Cl_2.2H_2O$	**3**
6	Preparation of $[Fe(acac)_3]$	**3**
7	Melting points of the metal complexes.	**3**
8	Solubility of the metal complexes.	**3**
9	Conductivity of the metal complexes.	**3**
10	Revision	**3**
11	Final practical exam.	**3**
Total		**30+3= 33**

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**		
1.1	Discuss the mode of bonding and geometries in coordination compounds using bonding theories.	Lectures scientific discussion	Quiz. Midterm exam. final exam.
1.2	Name and classify coordination compounds.	Lectures scientific discussion	Quiz. Midterm exam. final exam.
1.3	Give examples of metal complexes with biological importance.	Lectures scientific discussion	Quiz. Midterm exam. final exam.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0	**Skills**		
2.1	Apply the IUPAC rules for nomenclature of coordination compounds.	Lectures scientific discussion	Quiz. Midterm exam. final exam.
2.2	Discuss the structure and stability of coordination compounds based on Werner and Effective atomic number theories to Recognize	Lectures scientific discussion	Quiz. Midterm exam. final exam.
2.3	Employ the valence bond theory and crystal field theory to predict the geometrical structure and stability of metal complexes	Lectures scientific discussion	Quiz. Midterm exam. final exam.
2.4	How to illustrate the IR and electronic spectra of the complexes	E-learning	Quires on blackboard
2.5	How to evaluate the biological activity of the complexes	E-learning	Quires on blackboard
2.6	Practice the chemical processes and techniques for synthesis and characterization of metal complexes.	Lectures. Lab work.	Final exam. Lab reports. Lab exam.
2.7	Apply IT and communication technology in gathering and interpreting information and ideas concerning the newly discovered coordination compounds with biological importance.	web based study.	Class discussion.
3.0	**Values**		
3.1	Write and introduce chemical reports related to coordination chemistry topics.	Web based study. Library visits	Class discussion.
3.2	Work collaboratively and constructively in lab to manage the synthesis of coordination compounds and confirming their structures.	Lab work	Lab evaluation Final practical exam

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	E-learning	**Al weeks**	**5 %**
2	Assignments and activities	**Al weeks**	**5 %**
3	Mid-term Exam	**6**	**20 %**
4	Practical lab work(reports & exam)	**11**	**30%**
5	Final Exam (2 hours exam)	**12**	**40 %**

***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:

- Office hours: During the working hours weekly.

• Academic Advising for students. Availability of Staff members to provide counselling and advice

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	P. L. Soni, Vandna Soni, Coordination Chemistry: Metal Complexes, CRC Press, 2013.
Essential References Materials	• Geoffrey A. Lawrance, Introduction to Coordination Chemistry, John Wiley & Sons, 2009. • William L. Jolly, Modern Inorganic Chemistry; (2^{nd} edition) McGraw-Hill, New York, 1991. - Kazuo Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, John Wiley &Sons, 2009
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com http://www.rsc.org
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Well provided Classrooms with capacity of (30) students
Technology Resources (AV, data show, Smart Board, software, etc.)	Rooms equipped with computers, internet connection and data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and assessment	students	Questionnaire evaluation of the course.
Evaluation of the extent of achievement of course learning outcome	Program/Department Instructor	Annual course report

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Verification of Standards Achievement	Peer review	- Check marking of a sample of exam papers, or student work. -Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty.

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	Quality committee and department counsel
Reference No.	1st meeting
Date	2021

Head of Chemistry Department

Dr Moataz Morad