Course Specifications

Course Title:	Chemistry of Transition Elements
Course Code:	323CHEM-4
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	King Khalid University

Table of Contents

A. Course Identification

1. Credit hours:4 (3+1)
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: level 5/ year 3
4. Pre-requisites for this course (if any)**: CHEM222-2**
5. Co-requisites for this course (if any)**: co-requisite**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	3	75 %
2	**Blended**	0	0 %
3	**E-learning**	0	0 %
4	**Correspondence**	0	0 %
5	**Other**	1 hours practical	25 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	75
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	-
5	**Others** (specify)	-
	Total	60

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is the second in two-semester sequence in a comprehensive study of this course aims to study the chemistry of transition metals together with lanthanides and actinides and their uses. The emphasis will include a focus on coordination chemistry and theories that interpret bonding in complex formation and their applications in biological systems. The course is designed for science and other majors which require a thorough understanding of the current content knowledge in the transition metal chemistry.Three (3) lectures and one (1) two-hour laboratory period per week..

2. Course Main Objective

This course aims to study the chemistry of transition metals together with lanthanides and actinides and their uses. The emphasis will include a focus on coordination chemistry and theories that interpret bonding in complex formation and their applications in biological systems. This course Also aims to study different synthetic methods of preparation and structure elucidation of some complexes. Weekly laboratory experiments provide hands-on experience with quantitative techniques used by chemists and complement the lecture material.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Knowledge of the basic of coordination chemistry; Explain the fundamental concepts in coordination chemistry of transition metals; Explain the bonding characteristics in coordination compounds in term of Crystal Field Theory and Molecular Orbital Theory.	K1 and K3
1.2	Relate the physical properties and reactivities of selected transition metal complexes with their structure and bonding; Formulate mechanisms for reactions of transition metal complexes	K1 and K3
2	**Skills :**	
2.1	Developing an understanding of the range and chemistry of elements in the periodic table and their compounds	S1
2.2	Providing experience in some scientific methods employed in inorganic chemistry	S1 and S2
3	**Competence:**	
3.1	Developing skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments	C2, C3 and C4
3.2	Developing an understanding of the role of the chemist in measurement and problem solving in inorganic chemistry	C2, C3 and C4
3.3	To use computer at the solution of homework	C2, C3 and C4
3.4	To work effectively in diverse teams in laboratory sessions and acquire practical skills	C2, C3 and C4

C. Course Content

No	List of Topics	Contact Hours

1	Introduction to transition elements, lanthanides and actinides. Electronic configuration of transition elements. General properties of transition elements	6
2	Introduction to coordination chemistry, types of ligands, nomenclature of complexes, different oxidation states, coordination numbers.	9
3	Bonding theories of complexation: Coordination chemistry theory	6
4	Valence Bond Theory (VBT)	9
5	Effective Atomic Number (EAN), magnetic properties of complexes, Isomerism in metal complexes. Radioactive decay in lanthanides and actinides. Specrochemical series.	6
6	Molecular orbital theory (MOT).Crystal Field Theory (CFT), Jahn - Teller effect, Electronic spectra of metal complexes. Formation constants of complexes in solutions.	9
Total		45

Course Content (practical course):

No	List of Topics	Contact Hours
1	Safety instructions, Use of balance and the metric system	2
2	Preparation of a double salt from copper sulfate and ammonia	2
3	Preparation of a double salt from copper sulfate and ammonia	2
4	Preparation of tetraammine copper(II) sulfate complex	2
5	A comparative analysis of the double salt and the tetraammine copper(II) sulfate complex	2
6	Determination of Cu content (expressed by wt.%) in tetraammine copper(II) sulfate complex Preparation of the hexammine cobalt (III) chloride complex	4
7	Practical test 1 Analysis of the hexammine cobalt (III) chloride complex	4
8	Preparation of cis and trans Potassium bis(oxalato)diaquachromate(III) Analysis Cr(III) and oxalato in the complex (Potassium bis(oxalate)diaquachromate(III))	4
9	Preparation of Potassium tris(oxalato)iron (II) and Potassium tris(oxalato)iron (III) Preparation of the hexammine nickel (II) chloride complex	2
10	Analysis of ammonia in hexammine nickel (II) chloride complex ($NaHCO_3$)	2
11	Revision (R)	2
12	Final Practical Exam (Quiz + Practical Test)	2
Total		30

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**		
1.1	Knowledge of the basic of coordination chemistry; Explain the fundamental concepts in coordination chemistry of transition metals; Explain the bonding characteristics in coordination compounds in term of Crystal Field Theory and Molecular Orbital Theory	Lecture Research Cooperative Education.	Periodic tests, Oral Questions in lectures and exams. Research papers
1.2	Relate the physical properties and reactivities of selected transition metal complexes with their structure and bonding; Formulate mechanisms for reactions of transition metal complexes	Lecture Research Cooperative Education.	Periodic tests, Oral Questions in lectures and exams. Research papers.
2.0	**Skills**		
2.1	Developing an understanding of the range and chemistry of elements in the periodic table and their compounds	Laboratory demonstration and group work weekly. Assigning work to be completed on schedule.	Observation and Continuous Assessment by the Instructors. Laboratory assignments
2.2	Providing experience in some scientific methods employed in inorganic chemistry	Laboratory demonstration and group work weekly. Assigning work to be completed on schedule	Observation and Continuous Assessment by the Instructors. Laboratory assignments
3.0	**Competence**		
3.1	Developing skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments	Interaction with the students and encourage them to discussion during lectures	Oral discussions during lectures
3.2	Developing an understanding of the role of the chemist in measurement and problem solving in inorganic chemistry	Urged the students to accomplish their duties is collective self	Follow-up homework
3.3	To use computer at the solution of homework	Interaction with the students and encourage them to discussion during lectures	Oral discussions during lectures
3.4	To work effectively in diverse teams in laboratory sessions and acquire	Using available search engines and	e-learning.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	practical skills	Information Technology.	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	mid-term exam (1)	7th	10 %
	First Practical Exam	8th	10 %
2	mid-term exam (2)	11th	10 %
3	Weekly practical requirement	Weekly starting week 3	5 %
4	Quizzes	monthly	5 %
5	Practical tests	15th	10 %
6	final exam	End of semester	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 :

Contact with students by blackboard.
Office hours (10 / week)
Tutorial (1/ week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Ralph H. Petrucci, William S. Harwood, and F. Geoffrey Herring, "General Chemistry, Principles and Modern Applications", 10th Edition, Prentice Hall, 2009.
Essential References Materials	1. J.E.Huheey" ،Inorganic Chemistry 1 " ،th Edition, Harper and Row, 1993 2. G. Marr and B.W. Rockett , "Practical Inorganic Chemistry". Van Nostrand Reinhold Company. London 1972.
Electronic Materials	-Saudi digital Library, -http://antoine.frostburg.edu/chem/senese/101/index.shtml
Other Learning Materials	Power point – Projector

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom Laboratories
Technology Resources (AV, data show, Smart Board, software, etc.)	Projector
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course delivery (teaching methods and assessment methods)	Students	Questionnaire
	Departmental Plan and curriculum committee; external reviewers	Report and workshops
	Program Leader	Meetings
Course contents (update)	Departmental Plan and curriculum committee; external reviewers	Report and workshops
Quality of learning resources	External reviewers	Reports

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	Department counsel
Reference No.	1/22/142
Date	15-9-1442