جامعة المجمعة
Majmaah University

Course Specifications

Institution:	Majmaah University
Academic Department :	Chemistry
Programme :	Chemistry

This form compatible with NCAAA 2013 Edition

Course :	Coordination Chemistry
Course Coordinator :	Dr Mai Makki Mahmoud
Programme Coordinator :	.....
Course Specification Approved Date :	28/ 12 / 1436 H

A. Course Identification and General Information

1 - Course title	Coordination Chemistry	Course Code:	CHEM 324
2. Credit hours :	(**3hours**)		
3 - Program(s) in which the course is offered: Chemistry			
4 – Course Language :	Arabic language		
2. 5 - Name of faculty member responsible for the course: **Dr Mai Makki Mahmoud**			
6 - Level/year at which this course is offered : course offered in the fourth level of the chemistry curriculum			
7 - Pre-requisites for this course (if any) : Chemistry of the Main Group Elements			
8 - Co-requisites for this course (if any) : Coordination Chemistry Laboratory			
9 - Location if not on main campus **:**	on main campus		

10 - Mode of Instruction (mark all that apply)

A - Traditional classroom	*	What percentage?	**20%**
B - Blended (traditional and online)		What percentage?	**0 %**
D - e-learning	*	What percentage?	**60 %**
E - Correspondence		What percentage?	**0 %**
F - Other	*	What percentage?	**20 %**

Comments :
In 1436 *H* we use e-learning –correspondence(D2L)

B Objectives

What is the main purpose for this course?

1. To understand the key features of coordination compounds, including:
   - the variety of structures
   - oxidation numbers and electronic configurations
   - coordination numbers
   - ligands, chelates

- bonding, stability of complexes

-Naming of coordination compounds and draw the structure based on it's name.

3. Reorganization the types of isomers in coordination compounds.

Study the Crystal Field Theory and understand the magnetic properties (and in simple terms the colour) of coordination compounds.

5. To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them.

6. To become familiar with some applications of coordination compounds

2. o show how ligand design and synthesis is vital in modern coordination chemistry
3. To introduce students to advanced concepts of structure, bonding and reaction mechanism in organometallic chemistry.
4. To provide an introduction to, and a general overview of, the chemistry and physical properties of the f-block elements.
5. Name transition metal complexes according to IUPAC standards and identify (and name) structural and stereo isomers of these compounds.
6. Identify proper electronic configurations and electron counts of d-block metals, as well as explain their stable oxidation states.
7. Compare and contrast valence bond theory and molecular orbital theory.
8. Use the spectrochemical series to determine spectroscopic behavior and ligand substitutions.

9. Explain crystal field theory and how it accounts for physical and chemical properties such as color and magnetism.

10. Use ligand field theory to describe molecular bonding and the chemical/physical properties of transition metal complexes.

Briefly describe any plans for developing and improving the course that are being implemented :

- Use electronic Materials
- Use Web Sites
- The course content are reviewed and updated annually at the beginning of each academic year by the department curriculum committee and any major changes are reported to the college curriculum committee.

C. Course Description

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
Introduction to Transition Metal Ions and Coordination Chemistry.	1	2
Alfred"Werner" theory, Nomenclature of Coordination	2	2

Compounds systematic approach to naming and drawing complexes. oxidation numbers , electronic configurations, coordination numbers, - ligands, monodentate Ligands Polydentate Ligands chelates, bonding, stability of complexes, isomers in coordination compounds		
Valence bond Theory ,Successes of Valence bond Theory, Failures of Valence bond Theory	2	2
Crystal-field theory, hole formalism, application to octahedral, Magnetic Susceptibility ,tetrahedral and square planar geometries. High-spin and low-spin, Orbital occupancy for high- and low-spin complexes.	3	6

Molecular orbital theory, *Connection to M.O diagrams and molecular geometry,* Complexes with Sigma Bonds, Pi Bonds, Failures of Molecular orbital theory.

Introduction to **Electronic spectra of transitions metal complexes**.
. Electronic states and term symbols for free ions and metal complexes.
Energy level diagram for free ions and metal complexes.
Splitting of energy states corresponding to d terms
Free Ion Energy Levels
Energy level diagram indicating the assignment of the transitions in octahedral symmetry.
Spin-orbit coupling

Russel-Saunders or L-S coupling scheme

OR gel Diagrams Ligand Field Spectra
Spin selection rule
Selection Rules

Nephelauxetic Effect
•
Nephelauxetic : c loud expanding
Nephelauxetic Series
Spin Selection Rule
Energy level diagram indicating the assignment of the transitions in octahedral C4V symmetry.
Splitting of energy states
The Russell Saunders Coupling Scheme

Russell Saunders coupling

Electronic Spectra of Ni,		
Electronic states and term symbols for free ions and metal complexes. **Russel-Saunders or L-S coupling scheme**		
Spin-Orbit Coupling		
Ligand Field Theory		
Electronic Configurations of Transition Metal Complexes		
Coordination chemistry of the transition metals A. Dative Bonding: □□donors, □□donors, and □□acceptors B. Ligand Field Theory C. Classical complexes D. □-Bonding in coordination compounds V. Introduction to electronic spectroscopy of coordination compounds of highsymmetry. AB. Selection Rules C. Correlation diagrams D. Charge transfer spectra VI. Strong field ligand systems: electron counting, the 18-electron "rule", and formal oxidation states VII. Metal-ligand bonding, structure and reactivity of important functional groups transition metal compounds. A. Carbonyl, isocyanides, nitrosyl, and dinitrogen complexes B. Phosphine complexes C. cyclopentadienyl compounds D. Transition metal hydrides Chemistry of Coordination Compounds (12 lectures) • Transition metal (TM) complexes, nature of TM ligand bonds, classification of ligands. • Stereochemistry of coordination compounds, coordination numbers 4, 5 and 6. • Stereoisomerism, geometrical and optical. • Configuration of TM ions, hard and soft acid and bases (HSAB) principles. • Electronic properties of TM ions.		

• Crystal-field theory, hole formalism, application to octahedral, tetrahedral and square planar geometries. • Electronic spectra and magnetism as a tool to investigate the properties of coordination compounds. • Jahn-Teller effect and its consequences.		
Total	15	30
Laboratory part :		
• Synthesis and reactivity's of organocobaloximes. • Prepration of *tris*(acetylacetonato) iron(III). • Preparation *tris*(ethylenediammine)cobalt(II) ion and its resolution into optical antipodes. • Synthesis of hexamine cobalt(III) chloride and pentammineaquacobalt(III) chloride. • Silicones-its preparation and characterization. • Other silicone polymers and bouncing putty. • Preparation of an iron (or nickel) nitrosyl complex. • Synthesis of a cationic iodine complex. • Synthesis of *bis*(cyclopentadienyl)iron(II) (ferrocene). • Dilithiation of ferrocene and synthetic uses of the product in the preparation of acetyl ferrocene. • Preparation of *bis*(cyclopentadienyl) nickel (nickelocene). • Synthesis of a metal-metal bonded cyclopentadienyl complex of molybdenum, $Cp_2Mo_2(CO)_6$. • Synthesis of an arenetricarbonyl chromium(0) complex. • Preparation of boronic acid from Grignard reagents and trimethyl borate. • Preparation of chiral salen based catalysts of Co, Cr derived from 3,5-di-*tert*-butylsalicylaldehdye and *trans*-1,2-diaminocyclohexane, **Recommended Reading**	8	32
	7	28
Total	15	60

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	**30 hours**	**-**	**30 hours**	**-**	**-**	**60 hours**
Credit	**30hours**	**-**	**15 hours**	**-**	**-**	**45 hours**

3. Additional private study/learning hours expected for students per week. | **-**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	**To know basic concepts of coordination compounds .** **State and give examples of coordination compounds**	Use computer and internet in teaching procedure	Grading homework assignments, seminars, tests,
1.2	**Explain how the coordination compounds pounded**	Use photos and diagrams	Solve problems
1.3	**To know deferent theories explain the behavior of coordination compounds**	Encourage students to make dialogs	Grading research
1.4	**Explain the chemical and physical properties of coordination compounds**	Improve laprotarey skills of the students	Use group assignments

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.5	**Describe the molecular orbital theory of coordination bonding**	computer	
1.6			
2.0	**Cognitive Skills**		
2.1	Encourage the students to be creative and think about many ways to solve problems By the end of the course students should be able to		
2.2	**1-work in terms as well as independently**		
2.3	**To think and solve problems by work with others**	Groups during tutorial	
2.6	**Manage resources, time and other members**	Group assignment	
3.0			
4.0	**Communication, Information Technology, Numerical**		
4.1	**By the end of the course students should have the ability to make effective use of lap and chemicals used in coordination chemistry**	Comunecations of the student	
4.3	**Using computer as a tool in writing drawing chemical structures and data analy ses to communicate scientific information**		
4.4	**Report writing**		
4.5	**Use software and PowerPoint to improve student skills**		
4.6			
5.0	**Psychomotor**		
5.1	**Write and draw the the electron configuration and hyprdaizion of moluclelar orbitals**	Lectures	
5.2	**Draw an electronic energy level diagrm**	Home work	

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
5.3	**Work with others**	Groups during tutorial	
٥, ٤	**Manage resources, time and other members of the group.**	Group assignments	

5. Schedule of Assessment Tasks for Students During the Semester:

	Assessment task	Week Due	Proportion of Total Assessment
1	Participation, Written assignment. Reports	All term	10%
2	Term Paper on Descriptive in organic Chemistry II Topic	Through term	10%
3	first term exam	6th week	10%
4	Midterm exam	12th week	10%
5	Final exam	15th week	40%
6	Lab	15th week	20%
7	Total		100%
8			

D. Student Academic Counseling and Support

- Arrangements for availability of teaching staff for individual student consultations and academic advice:

-Every teaching staff has to be available for the students for 2 hours 3 days a week.

-There will be a schedule for office hours of every staff member declared to the students.

-Contact numbers, and mobile numbers should be available to the students.

-Office hours are held in faculties' offices of staff members.

E. Learning Resources

1. List Required Textbooks :

Chemistry ;principles and reactions by William l.masterton, cecile

Chemistry of coordination compounds;d.mohamed Abdulrahman gohar

F.A..Cotton,g.Wilkenson and P.L.Gaus, "Basic Inorganic Chemistry " 3rd Ed .John Wiley and Sons ,New York 1998.

2. List Ess

1-S.F.A.Kette,"Coordination Compounds "Thomas Nelson and sones ltd,1969.

2-D.Satton ,'' Electronic Spectra of transition metal complexes '' Mc-Graw Hill ,Lpndon,1968.

3. List Recommended Textbooks and Reference Material :

- 1-J.D.Woollins,;;Inorganic Experiments ":VCH,Germany,1994.
- W.L.Jolly,"The Synthesis and Characterization of Inorganic compounds.

4. List Electronic Materials :

Internet communication and using of Websites that are relevant to the topics of the course.

Course- lectures as videos from deferent universities .

5. Other learning material :

.lap rotary equipment ,lap rotary instrumental analysis ,glasswork ,multimedia associated with books and websites

F. Facilities Required

1. Accommodation

- Buildings, lap rotary, computer room contain all facilities needed . lecture room with at least 35 seats ,projector ,smart board .

2. Computing resources

- , computer room contain all facilities needed

3. Other resources

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G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching:

- Course evaluation by student
- Student –facuity meetings

2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor :

Department council discussions
Peer conclusion on teaching

3 Processes for Improvement of Teaching :

4. Processes for Verifying Standards of Student Achievement

- Check marking by an independent member teaching staff of a sample of student work.
- Check paper research by an independent member teaching staff of a sample of student work
- Workshops given by experts on the teaching and learning methodologies
- Periodical departmental revisions of its methods of teaching.

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement :

- This would be achieved by issuing an annual course report at the end of the academic year and which will encompass a corrective/improvement action plan.

Course Specification Approved
Department Official Meeting No (…..) Date … / …. / ….. *H*

Course's Coordinator		**Department Head**	
Name :	Dr Mai Makki Mahmoud	***Name :***	.....
Signature :	mai	***Signature :***	.....
Date :	28/ 12 / 1436 *H*	***Date :***	…./ … / …… *H*