Course Specification

(Postgraduate Programs)

Course Title:	**Advanced Coordination Chemistry**
Course Code:	**CHM 6113**
Program:	**Master of science in chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3 (3 Lectures, 0 Lab, 0 Tutorials)				
2. Course type				
A.	☐University	☐College	☐Department	☐Track
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered:	**Level 2/Year 1**			

4. Course General Description:

This course provides students with an introduction of advanced coordination chemistry, Molecular Orbital Treatment, Octahedral (with and without pi bonding) Tetrahedral and Square Planer Complexes in a Qualitative Manner .The course will cover the Synthesis of Coordination Compounds, Reaction of a Metal Salt with a Ligand, Ligand Replacement Reactions, Reaction of Two Metal Compounds, Oxidation-Reduction Reactions as well the Mixed Ligand Complexes. Magnetic Behavior will be included.

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

Inorganic Molecular Spectroscopy – CHM 6111

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

None

7. Course Main Objective(s):

- **Recognize the Theories of Metal-Ligand bonding.**
- **Be familiar for Transition Metal Preparation.**
- **Elucidate the Coordination Compounds Structures.**
- **Understand the Mixed Ligand Complexes stability and its role in a biological system.**
- **Study and compare the Magnetic Behavior of Coordination Compounds.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**45**	**100 %**
2	E-learning		
3	Hybrid • Traditional classroom		

No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)……**	**0**
	Total	45

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**			
1.1	**To list the different theories of Bonding in Complexes.**	**K1. Inorg.; K2. Inorg.; K4. Inorg**	• Five hours/week lectures. • Self-study • Home-exam. •	• Regular Exams • Assignments • Short Quizzes • Oral Discussion • Participation . •
1.2	**To describe the transition metal preparation and study of coordination compounds structures and the magnetic behavior of complexes**	**K1. Inorg.; K4.Inorg**	• Five hours/week lectures. • Think and justify the transition metal preparation and	• Oral Discussion marks • Literatures Survey • Mini-seminar.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			• coordination compounds structures, using available references (SDL) online. • Open discussion. •	• Participation .
1.3	**To state the importance of coordination chemistry in the biological systems.**	**K3. Inorg.; K4.Inorg**	• Five hours/week lectures. • Group Discussion on coordination chemistry in the biological systems using available references (SDL) online. •	• Midterm. • Assignments. • Group Discussions. • Literatures Survey • Mini-seminar. • Participation .
1.4	**To define the application Mimicking reactions in biological systems, Magnetic Behavior and Magnitude of Magnetic Moments.**	**K1. Inorg.; K3.Inorg.; K4.Inorg.**	• Five hours/ week lectures. • Group Discussion using available references (SDL).	• Assignments. • Open Discussions. • Literatures Surve. • Mini-seminar. • Participation .
2.0	**Skills**			
2.1	**To explain the concepts of different theories in the coordination and complexes chemistry.**	**S1. Inorg.; S2. Inorg.**	• Lectures activity • Self-study. Think, differentiate and discuss the coordination and complexes	• Questions in Lectures. • Short Quizzes and Exams. • Open Discussions. • Participation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			chemistry theories	• Mini - seminar.
2.2	**To summarize the different methods for Transition Metals preparation and studies of Coordination compounds structures.**	**S1. Inorg.; S2. Inorg.**	• Practice some examples for Transition Metals preparation methods achieving. • Brainstorming. • Self-study	• Questions in Lectures. • Participation. • Oral Discussion S hort Quizzes and Exams.
2.3	**To justify the magnetic properties relationship with the electronic configurations of complexes.**	**S1. Inorg.; S2. Inorg.; S3. Inorg.**	• Lectures. • Oral Discussions. • Brain storming Exercises. • Self-study	• Questions in Lectures. • Short Quizzes and Exams. • Oral Discussion. • Participation.
2.4	**To operate communication to Coordination Compounds formation and its applications, accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.**	**S1. Inorg.; S2. Inorg.; S4. Inorg.**	• Group Discussion and Assignments. • Practice on examples for coordination compounds applications, which will require reading, writing, and oral presentation in groups. • Encourage students to use	• Oral Discussion, Quizzes, and Exams. • Giving marks for Oral Discussion in Lectures. • Marks given for Assignments.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			electronic mail to submit Home Exams and Assignments.	
3.0	**Values, autonomy, and responsibility**			
3.1	**To perform a scientific presentation, research, and work independently and integrate with a collaborated group, Using IT to acquire, analyze, and communicate information.**	**V1. Inorg.**	• Brainstorming. • Exercises • Group Discussion. • Team work.	• Oral Discussion. • Group Discussion • Assignments.
3.2	**To demonstrate his ability to the effectively collaboration and inter-professionalism in class discussions or team works, as well as independently.**	**V1. Inorg.; V2.Inorg.**	• Small Group tasks • Open discussion at classroom. • Office hour guiding. • Group Presentation of mini-projects	• Participation • Homework's • Mini-project(s).

C. Course Content:

No	List of Topics	Contact Hours
1.	**Theories of Metal-Ligand bonding:** Molecular Orbital Treatment, Octahedral (with and without pi bonding) Tetrahedral and Square Planer Complexes in a Qualitative Manner, Comparison of Theories of Bonding,	13

	Valance Bond Theory (VBT), Crystal-Field Theory (CFT), Ligand Field Theory (LFT) and Molecular Orbital Theory (MOT).	
2.	**Transition Metal Preparation and Structural Studies of Coordination Compounds**: Synthesis of Coordination Compounds, Reaction of a Metal Salt with a Ligand, Ligand Replacement Reactions, Reaction of Two Metal Compounds, Oxidation-Reduction Reactions, Partial Decomposition, Size and Solubility Relationships, Reactions of Metal Salts with Amine Salts, Compounds of First Transition Series Elements, with Respect to their Electronic spectra, magnetic & thermal properties (DTA, TGA).	12
3.	**Mixed Ligand Complexes:** Stabilities of ternary Complexes, Dynamics of Formation of Ternary complexes reaction of Coordination ligand in Ternary Complexes, Mimicking reactions in biological systems, enzyme models, Amino acids Ester Hydrolysis, Peptide Synthesis & Hydrolysis, Detarbodylation of β-Keto acids.	10
4.	**Magnetic Behavior:** Diamagnetism, Para Magnetism, Ferro & Ferri, Antiferro and Magnetic Interaction, The Origin of Para Magnetism, Magnetic Behavior of Complexes, Simplification of Van Velck Equation, Magnitude of Magnetic Moments, Determination of Magnetic Susceptibility by Gouy and Faraday Method.	10
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)**	**weekly**	**30 %**
2.	**Midterm Exam**	**9th week**	**30 %**
3.	**Final Exam**	**17 th week**	**40 %**
4.	**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	• Introduction to Coordination Chemistry, G. A. Lawrance, John Wiley & Sons Ltd, 2010. ISBN: 978-0-470-51930-1 (HB), 978-0-470-51931-8 (PB). • Descriptive inorganic, coordination, and solid-state chemistry, G. E. Rodgers, 3rd Ed., Cengage Learning, 2011, ISBN: 978-0840068460
Supportive References	•
Electronic Materials	• European Journal Of Inorganic Chemistry • American Chemical Society (Relevant Journals) • Saudi Digital Library.
Other Learning Materials	• Blackboard • Multimedia associated with the text book and the relevant websites.

3. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.
Technology equipment (projector, smart board, software)	• The rooms are equipped with data show, Smart Board, • WI-FI access.
Other equipment (depending on the nature of the specialty)	• None

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: Questionnaire.
	Course Responsible	Direct: Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Peer Reviewer	Direct: Questionnaire. Indirect: External assessor report.
Effectiveness of students assessment	Program Leaders	Direct: Course e-Portfolio. Indirect: Course report.

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Students	Indirect: Second examiner checklist-Course report.
	Faculty (Academic Advisory-GCC)	Direct: course Entrance/Exit. Indirect: Observations - Accreditation review.
	Program Leaders	Direct: Course e-Portfolio. Indirect: Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	
The extent to which CLOs have been achieved	Course Responsible	Direct: Exams - Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Program Leaders	Indirect: Exams.

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Council of Chemistry Department
REFERENCE NO.	10 (No. 2/10)
DATE	21/04/1444- 15/11/2022