Course Specifications

Course Title:	Inorganic Reaction Mechanism and Spectra
Course Code:	4024573-2
Program:	Chemistry
Department:	Department of 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: 7th level / 4th year
4. Pre-requisites for this course (if any)**:** Coordination Chemistry
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**	√	100 %
2	**Blended**	---	---
3	**E-learning**	---	---
4	**Correspondence**	---	---
5	**Other**	---	---

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	**30**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**0**
4	**Others** (specify)	**0**
	Total	**30**
Other Learning Hours*		
1	**Study**	**30**
2	**Assignments**	**10**
3	**Library**	**3**
4	**Projects/Research Essays/Theses**	**3**
5	**Others**(specify): Quizzes and Exam preparation	**20**
	Total	**66**

***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 focused in main principles of inorganic reaction mechanisms and spectra such as rate Laws, labile and inert complexes, mechanism of substitution reactions, trans effect, mechanism for oxidation-reduction reactions, electronic spectra of transition metal complexes, and their energy level diagrams.

2. Course Main Objective

By the end of the study of this course students, will be aware fully with:

a. The basic concepts of mechanism of inorganic reactions, including the substitution reactions of the ligands and some oxidation & reduction reactions.

b. The basic concepts of the vibrational and electronic spectra of the transition metal complexes, which includes the charge transfer and ligand-field spectra.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Know several concepts and principles related to inorganic reaction mechanism such as complex geometries.	**K3**
1.2	Recall the history and aims of studying inorganic reaction mechanism.	**K1**
1.3	Understand the chemical behavior of inorganic compounds during chemical reactions.	**K3**
1.4	Know the scientific data and solving problems related to qualitative and quantitative information.	**K2**
2	**Skills :**	
2.1	Use the Internet for more information related to the course.	**S2**
2.2	Develop English language skills and symbolic thinking skills.	**S6**
2.3	Improve reasoning, perception, and intuition	**S8**
2.4	Develop attention, memory, self-regulation, and motor executive functions.	**S5**
2.5	Interpret, analyze, summarize, and evaluating the scientific materials.	**S1**
2.6	Demonstrate good understanding and retention of basic and advanced chemical principles.	**S1**
3	**Competence:**	
3.1	Communicating personal ideas and thoughts	**C1**
3.2	Responding to class discussions	**C2**
3.3	Developing teamwork skills	**C1**
3.4	Collaboration to finish team assignments	**C1**
3.5	What relation of Data, Information, and Knowledge	**C3**

C. Course Content

No	List of Topics	Contact

		Hours
1	Introduction on the basic concepts of inorganic reaction mechanism.	**2**
2	The rate Laws for several inorganic chemistry reactions.	**2**
3	Labile and inert complexes	**2**
4	Reaction mechanisms of ligand substitution.	**2**
5	Substitution reactions in square planar complexes, trans effect and the theories for it's explanation.	**2**
6	Reactions include the substitution of coordinating water.	**2**
7	Methods studying complexes reactions-octahedral & square- planar	**2**
8	Substitution reactions in octahedral complexes - dissociation and association mechanisms - equation reactions.	**2**
9	Aqueous ionic complexes, step wise complex formation, factors affecting the stability of complexes, acids and bases.	**4**
10	Mechanism for oxidation-reduction reaction, inner sphere and outer sphere reactions.	**4**
11	Introduction on the electronic spectra of transition metal complexes and Russell Saunders coupling effects.	**4**
12	Energy level diagrams for different selective complexes.	**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	Know several concepts and principles related to inorganic reaction mechanism such as complex geometries.	• Lectures using new techniques. • Meeting individual students and groups to solve their problems related to the course.	• Periodic and final exams. • Activities and assignments on e-learning site.
1.2	Recall the history and aims of studying inorganic reaction	• Lectures using new techniques.	• Periodic and final exams.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	mechanism.		
1.3	Understand the chemical behavior of chemical compounds during chemical reactions.	• Lectures using new techniques. • Scientific discussions.	• Periodic and final exams.
1.4	Know the scientific data and solving problems related to qualitative and quantitative information.	• Lectures. • Meeting individual students and groups to solve their problems related to the course.	• Activities and assignments on e-learning site.
2.0	**Skills**		
2.1	Use the Internet for more information related to the course.	• Using charts and concept maps. • Summarizing the findings of the online research.	• Individual assignments or oral exam for developing/solving a task • Midterm Exams and Final examination at the end of semester.
2.2	Develop English language skills and symbolic thinking skills.	• Class discussions. • Using the Internet to create learning activities.	• Individual assignments or oral exam for developing/solving a task • Midterm Exams and Final examination at the end of semester.
2.3	Improve reasoning, perception, and intuition	• Using charts and concept maps. • Class discussions.	• Individual assignments or oral exam for

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			developing/solving a task • Midterm Exams and Final examination at the end of semester.
2.4	Develop attention, memory, self-regulation, and motor executive functions.	• Using charts and concept maps. • Using the Internet to create learning activities.	• Individual assignments or oral exam for developing/solving a task • Midterm Exams and Final examination at the end of semester.
2.5	Interpret, analyze, summarize, and evaluating the scientific materials.	• Summarizing the findings of the online research • Class discussions. •	• Discussing and evaluating the topics that students learn from their textbooks and other sources. • Solving general chemistry problems related to qualitative and quantitative information at the end of each topic.
2.6	Demonstrate good understanding and retention of basic and advanced chemical principles.	• Making connections between different concepts across the domains.	• Discussing and evaluating the topics that students learn from their textbooks and other

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• Summarizing the findings of the online research • Class discussions.	sources. • Solving general chemistry problems related to qualitative and quantitative information at the end of each topic.
3.0	**Competence**		
3.1	Communicating personal ideas and thoughts	• Using computer science in finishing reports and other related subjects • Group working. • Mini seminars prepared by the students to present their team projects or reports.	• Evaluation of the duties associated with the appropriate use of communication skills • Group presentations.
3.2	Responding to class discussions	• Group working. • Mini seminars prepared by the students to present their team projects or reports.	• Evaluation of the duties associated with the appropriate use of communication skills • Assessments of student's assignments • Evaluate solving the equations and problems related to subjects
3.3	Developing teamwork skills	• Group working.	• Evaluation of the

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• Mini seminars prepared by the students to present their team projects or reports. • Visiting the University library and different web-sites to obtain some related subjects.	duties associated with the appropriate use of communication skills • Assessments of student's assignments • Groups presentations.
3.4	Collaboration to finish team assignments	• Using computer science in finishing reports and other related subjects • Group working. • Visiting the University library and different web-sites to obtain some related subjects.	• Evaluation of the duties associated with the appropriate use of communication skills • Evaluate solving the equations and problems related to subjects
3.5	What relation of Data, Information, and Knowledge	• Using computer science in finishing reports and other related subjects • Group working. • Mini seminars prepared by the students to present their team projects or reports.	• Evaluation of the duties associated with the appropriate use of communication skills • Assessments of student's assignments • Evaluate solving the equations and problems related to

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			subjects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework or activities.	--	**10 %**
2	First Periodic Exam.	**6**	**20 %**
3	Second Periodic Exam.	**12**	**20 %**
4	Final Exam. (2 hours exam)	**16**	**50 %**

***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 :
- Two office hours per week for each group of students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Robert B. Jordan, Reaction mechanisms of inorganic and organometallic systems, 3rd , Oxford University press, 2007. • Smiljko Asperger, Chemical kinetics and inorganic reaction mechanisms, 2ed, Kluwer Academic / Plenum Publisher 2003. • Kazuo Nakamoto, Infrared and Raman Spectra Of Inorganic And Coordination Compounds, John Wiley & Sons , 2009.
Essential References Materials	• "Kinetics and Mechanisms of Reaction of Transition Metal Complexes," Ralph G. Wilkins, 2nd Thoroughly Revised Edition, VCH Publishers, 1992, ISBN 9783527282531 (Online book access at http://onlinelibrary.wiley.com/book/10.1002/3527600825) • "Ligand Substitution Processes," C.H. Langford and H.B. Gray, W.A. Benjamin, Inc., 1966 (Online book access at • http://caltechbook.library.caltech.edu/100/1/Langford_Lsp.pdf) • Lecture Synopsis at http://www.chem.ox.ac.uk/icl/dermot/mechanism1/
Electronic Materials	• - Isisdraw and Chemdraw and Chemoffice • -MS-Office Software • http://scholle.oc.uni-kiel.de/herges/modeling/gliederung.html • http://phycomp.technion.ac.il/~ira/types.html
Other Learning Materials	None

2. Facilities Required

Item	Resources

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• A classroom containing at multi seats and equipped with projector and Internet access (scheduled for 2 hours once a week).
Technology Resources (AV, data show, Smart Board, software, etc.)	• Common computer labs connected directly with internet are available for all students with high speed internet access
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Programs for chemical applications.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes.	Peer Reviewer	Checking selected exam papers, and student assignments.
Effectiveness of teaching and assessment.	Program Leaders	Reviewing of final exams and the student's degrees in different exams.
Quality of learning resources	Students	Periodically, completing the questionnaire evaluation of the course.

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	
Reference No.	
Date	

Received by: Dr. Ismail Althagafi **Department Head**

Signature:  **Date: 20/12/2019**