Kingdom of Saudi Arabia

The National Commission for

Academic Accreditation & Assessment

COURSE SPECIFICATION

(Inorganic Chemistry 2, 402323-3)

1435 / 1436 H

Course Specification

Institution: **Umm Al-Qura University**
College/Department: **Faculty of Applied Sciences / Chemistry Department**

A. Course Identification and General Information

1. Course title and code: **Inorganic Chemistry 2, 402323-3**
2. Credit hours: **Three (2 theoretical + 1 practical) hrs.**
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) **Pure Chemistry**
4. Name of faculty member responsible for the course: **Prof. Abdalla Mohamed Khedr**
5. Level / year at which this course is offered: **6th level / 3**
6. Pre-requisites for this course (if any): **Inorganic Chemistry (1), 402251-2**
7. Co-requisites for this course (if any): ——
8. Location if not on main campus: ——

B. Objectives

1. Summary of the main learning outcomes for students enrolled in the course: • By finishing of this course, the students will be able to discuss and understand: i) The chemistry of transition elements. ii) Basic theories related to coordination chemistry. iii) Electronic spectroscopy along with reaction mechanisms for coordination compounds. vi) The basics of organometallic chemistry. v) The structure and properties of coordination complexes which prepared in the practical part by the students themselves.
2. **Briefly describe any plans for developing and improving the course that are being implemented.** (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)

- Variegation of learning sources for the course, so that students benefit from more than one reference.
- Encourage students to prepare reports include the preparation and chemical properties of coordination and organometallic compounds.
- Link the theoretical and practical sides of the course to give the students to understand and interpret the properties of the complexes.
- The use of teaching intelligent classes for lectures.

C. Course Description (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1 - Topics to be covered:

Theoretical part

Topic	No of Weeks	Contact hours
The reactivity of metals, electroneutrality principle, coordination numbers.	**2**	**4**
Geometries and isomerism of complexes.	**1**	**2**
Nature of metal-ligand bonding (valance bond theory).	**1**	**2**
Nature of metal-ligand bonding (crystal field theory).	**1**	**2**
Nature of metal-ligand bonding (molecular orbital theory).	**1**	**2**
Colours and electronic spectra of coordination compounds.	**2**	**4**
Magnetic properties and ligand field stabilization energy for coordination compounds.	**1**	**2**
Introduction to reaction mechanisms: ligand substitution and electron-transfer processes.	**2**	**4**
Introduction to organometallic chemistry.	**1**	**2**
Types of organometallic compounds and common types of ligands.	**1**	**2**
The 18-electron rule, metal carbonyls, reactions and heterogeneous catalysis.	**1**	**2**

Practical part

Topic	No of Weeks	Contact hours
Introduction about coordination chemistry and safety rules in labs.	**1**	**3**
Preparation of $[Cu(en)_2](NO_3)_2$	**1**	**3**
Preparation of $[Co(NH_3)_5Cl]Cl_2$	**1**	**3**
Preparation of $K_3[Cr(C_2O_4)_3]$	**1**	**3**
Preparation of $[Ni(en)_3]Cl_2 \cdot 2H_2O$	**1**	**3**
Preparation of $[Fe(acac)_3]$	**1**	**3**
Comploximetric titration of different metals	**2**	**6**
Melting Points of the Complexes.	**1**	**3**
Solubility of the Complexes.	**1**	**3**
Conductivity of the Complexes.	**1**	**3**
Werner Theory.	**1**	**3**
Potentiometry.	**1**	**3**
Final practical exam.	**1**	**3**

2- Course components (total contact hours per semester):			
Lecture: **28**	Tutorial: _____	Practical/Fieldwork /Internship: **42**	Other: _____

3. Additional private study/learning hours expected for students per week (This should be an average: for the semester not a specific requirement in each week):

- Students spend two hours a week to prepare reports, discuss, resolve questions and duties of the course.

4. Development of learning outcomes in domains of learning for each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to be developed.
- A description of the teaching strategies to be used in the course to develop that knowledge or skill.
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

a. Knowledge

(i) Description of the knowledge to be acquired:

At the end of this course, student will be able to:

- Understand the chemistry of transition elements.
- Explain the basic theories related to coordination chemistry.
- Define the electronic spectroscopy and reaction mechanisms for coordination compounds.
- Determine the basics of organometallic chemistry and heterogeneous catalysis.
- Outline the structure and properties of coordination complexes which prepared in the practical part by the students themselves.

(ii) Teaching strategies to be used to develop that knowledge:

- Scientific discussions during the lectures.
- The use of library work duties and a small research on the nature and types of metallic complexes.
- Resolve problems presented during lectures homework.
- Use of the internet to prepare some reports about common coordination and organometallic complexes.

(iii) Methods of assessment of knowledge acquired:

- Written mid-term and final exams.
- Scientific discussions and effective participations during the lectures.
- Practical exams.

• Preparing scientific reports.

b. Cognitive Skills

(i) Cognitive skills to be developed:

By ending of this course, the student will have the ability to:

• Apply the scientific way to solve problems and think proper to solve problems.

• Construct the structure and properties of coordination and organometallic compounds.

• Organize the molecular formula of compounds from analytical knowledge.

(ii) Teaching strategies to be used to develop these cognitive skills:

• Giving examples for students and practicing under the supervision of a lecturer.

• Assigning student's tasks duties that include open tasks designed for the application of prediction and analysis skills, problem solving.

• Giving some applied examples and problem and ask the students to find a strategic plan to resolve them.

(iii) Methods of assessment of student cognitive skills:

• A periodic tests and practical experiences.

• Measuring the response of students for the assignments.

• Adopting quizzes or fast exam.

c. Interpersonal Skills and Responsibility

(i) Description of the interpersonal skills and capacity to carry responsibility to be developed:

• Development the acceptance of student to his colleague opinion and working in a team work.

• The development of the student's ability to self-reliance and responsibility

(ii) Teaching strategies to be used to develop these skills and abilities:

• A division of students into groups to carry out a research work in a group.

• Practical experiences that carried out collectively.

• Periodic duties that carried out in individual to develop the skill of student to take

responsibility and self-reliance.

(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility:

- Evaluate the results and analysis of laboratory experiments and collective duties to determine the participation of each member and student's ability to work through the team.
- Individual tasks and duties tests and evaluated to determine the student's ability to self-reliance.

d. Communication, Information Technology and Numerical Skills

(i) Description of the skills to be developed in this domain:

- The ability to perform mathematical calculations and data analysis and described in a statistical picture and find out conclusions from them.
- Skill in dealing successful method is used in laboratories and how to follow the safety instructions in the laboratory.
- The ability to use computers and internet in making the calculations and to identify recent research relevant to the course.

(ii) Teaching strategies to be used to develop these skills:

- The use of computers in the training room of the department.
- Organizing group visits to the Central Library.
- The use of the international information network (internet).

(iii) Methods of assessment of students numerical and communication skills:

- Ask questions that test the student's ability to interpret simple statistical information.
- Assess the duties associated with the proper use of communication skills and numerical process.

e. Psychomotor Skills (if applicable)

(i) Description of the psychomotor skills to be developed and the level of performance required:

- Ability to proper scientific thinking and also conduct laboratory experiments with skill and effectiveness.

(ii) Teaching strategies to be used to develop these skills: • Training of students in the lecture within the proper scientific thinking. • Training of students in the lab to deal with the tools and chemicals.
(iii) Methods of assessment of student psychomotor skills: - Evaluate the ability of students to carry out practical exams in the lab.

5. Schedule of Assessment Tasks for Students During the Semester:			
Assessment	**Assessment task (eg. essay, test, group project, examination etc.)**	**Week due**	**Proportion of Final Assessment**
1	Class activities, Attendances and Duties	Throughout the Term	**10%**
2	Mid-Term Exam (s)	5-14	**20%**
3	Lab Activity and Final Exam on Lab	Throughout the Term	**30%**
4	Final Exam	End of the Term	**40%**
5	**Total**		**100%**

D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice (include amount of time faculty are available each week)**:** • Staff member's attendance of to provide counseling and advice to students. • Office hours: during the days of the week work days. • Academic mentoring for students who need it.

E. Learning Resources

1. Required Text(s): • All lectures are presented as electronic copy to the students.
2. Essential References: • J.E. Huheey, *Inorganic Chemistry*, Prentic Hall, 4th ed, 1997.

• J. D. Lee, *Concise Inorganic Chemistry*, 5th ed., Wiley-Blackwell, 1998. • F. Mathey and A. Sevin, *Molecular Chemistry of the Transition Elements: An Introductory Course*, John Wiley Interscience, 1996. • J. G. Ribas, *Coordination Chemistry*, 1st ed., John Wiley Interscience, 2008. • C. Housecroft and A.G. Sharpe, *Inorganic Chemistry*, 4th ed., Pearson, 2012.
3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List): • W. L. Jolly, *Modern Inorganic Chemistry*, 2nd, Ed., McGraw-Hill, New York, 1991. • S.F.A. Kettle, *Coordination Compounds*, Nelson, 1975. • K. Nakamoto, *Infrared and Raman Spectra of Inorganic and Coordination Compounds*, John Wiley &Sons, 2009.
4- Electronic Materials, Web Sites etc: • http//:www.science.uwaterloo.ca/~cchieh/cact/ • http//:www.sciencedirect.com/ • http://www.learnerstv.com/chemistry.php
5- Other learning material such as computer-based programs/CD, professional standards/regulations • CD contains programs specified to coordination and organometallic compounds.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc**.)**
1. Accommodation (Lecture rooms, laboratories, etc.): • Equipped lecture halls and laboratories specialized in inorganic chemistry.
2. Computing resources: • 30 computers, one slide show (Data Show) and TV.
3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list): • None.

G. Course Evaluation and Improvement Processes

1. Strategies for obtaining student feedback on effectiveness of teaching: • The educational process is evaluated using questionnaire forms or panel discussions with

students in order to identify and address weaknesses and strengths points.
2. Other strategies for evaluation of teaching by the instructor or by the department: • Prepare a course report for based on the results of the students to give us an indication about the planned outputs.
3. Processes for improvement of teaching: • Training programs and workshops for Staff members to improve the educational process level.
4. Processes for verifying standards of student achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) • We try to carry out it but it does not applied until now.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement: • A comparison of the course level should be made with similar courses at foreign universities.