# Kingdom of Saudi Arabia

# The National Commission for

# Academic Accreditation & Assessment



# Course Specifications

## Coordination Chemistry

## (402325-3)

# Course Specifications

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|---|---|
| Institution: **Umm Al-qura University** | Date of Report: **2015** |
| College/Department : **Faculty of Applied Science / Chemistry Department** | |

## A. Course Identification and General Information

1. Course title and code: **Coordination Chemistry / 402325-3**
2. Credit hours: **3 (2+1)**
3. Program(s) in which the course is offered. **Chemistry**
4. Name of faculty member responsible for the course: **Prof. Abdalla Mohamed Khedr**
5. Level/year at which this course is offered: 6$^{th}$ **level/3$^{rd}$ year**
6. Pre-requisites for this course (if any): - Chemistry of Transition Metals (402223-3)
7. Co-requisites for this course (if any)---
8. Location if not on main campus: **All campus (El-Abedyah, El-Zaher and Elaziziah)**
9. Mode of Instruction (mark all that apply)

| | | | |
|---|---|---|---|
| a. Traditional classroom | | What percentage? | |
| b. Blended (traditional and online) | ■ | What percentage? | 70% |
| c. e-learning | | What percentage? | |
| d. Correspondence | | What percentage? | |
| f. Other | ■ | What percentage? | 30% |

Comments:

2016

## B. Objectives

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| 1. What is the main purpose for this course?<br>By ending this course, students should be familiar with:<br>a. The nature, types, naming and importance of coordination compounds.<br>b. The different theories explaining the bonding in metal complexes.<br>c. The preparation methods of coordination compounds.<br>d. The spectral, magnetic and biological properties of metal complexes. |
| 2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)<br>• Using different learning sources of the course, so that the students make use of more than one reference.<br>• Encourage students to carry out reports in the field of coordination chemistry including preparation and study of some physical and chemical properties and link the practical side with the theoretical one in order to understand the nature of coordination compounds.<br>• The use of smart teaching halls 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 | | |
|---|---|---|
| List of Topics | No. of Weeks | Contact Hours |
| • Introduction to the chemistry of coordination compounds - Werner theory of coordination compounds - Effective atomic number. | 2 | 4 |
| • Ligands – nomenclature of metal complexes – symmetry in metal complexes. | 1 | 2 |
| • Valence bond theory – coordination numbers and geometrical structures – inner and outer complexes. | 2 | 4 |

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| • Stability of metal complexes; factors affecting the stability of metal complexes – ionic and ionization potential – geometrical arrangement of ligands around the central metal ion - metal chelates. | 2 | 4 |
| • Crystal field theory; ligand field in octahedral complexes – ligand field in tetrahedral complexes – ligand field in square planer complexes – Jahn-Teller effect (distortion from symmetrical arrangement) – crystal field stabilization energies. | 2 | 4 |
| • Preparation of coordination compounds (complexes); direct reactions – oxidation and reduction reactions – thermal decomposition reactions. | 2 | 4 |
| • Electronic spectrum of complexes - infrared spectra of the metal complexes. | 1 | 2 |
| • Metal complexes of significant biological activities. | 1 | 2 |
| • Acids and bases rigid and soft. | 1 | 2 |
| **Practical Part:** | | |
| • 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 $[Ni(en)_3]Cl_2.2H_2O$ | **1** | **3** |
| • Preparation of [Fe(acac)3] | **1** | **3** |
| • Melting points of the metal complexes. | **1** | **3** |
| • Solubility of the metal complexes. | **1** | **3** |
| • Conductivity of the metal complexes. | **1** | **3** |
| • Final practical exam. | **1** | **3** |

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

| | Lecture | Tutorial | Laboratory | Practical | Other: | Total |
|---|---|---|---|---|---|---|
| Contact Hours | 28 | - | | 30 | | 58 |
| Credit | 2 | - | | 1 | | 3 |

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

- The student spends two hours a week to prepare reports, discuss and resolve questions.

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 | Describe the nature, types and importance of coordination compounds. | • Lectures<br>• Scientific discussion<br>• Use the library to work duties and a small research on the nature and types of metallic complexes.<br>• Use of the Internet to carry out some reports on course subjects. | • Written mid-term and final exams.<br>• Long and short essays. |
| 1.2 | Explain the preparation methods of coordination compounds. | | |
| 1.3 | Name the complexes according to the IUPAC system. | | |
| 1.4 | Determine the mode of bonding in metal complexes using bonding theories. | | |
| 1.5 | Explain the spectral, magnetic and biological properties of metal complexes. | | |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | Confirm the molecular formula of metal | • Lectures | • Periodic tests and |

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| | complexes. | • Scientific discussion<br>• Library visits<br>• Web-based study | assignments and practical experiments.<br>• Measuring the response to the assignments. |
| 2.2 | Estimate the type of metal complex. | | |
| 2.3 | Apply the analytical calculations to know the complex. | | |
| 2.4 | Design scientific methods and think to solve problems concerning the course. | | |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | Operate in team work and accept his college's opinions. | • Dividing students into groups to carry out collective scientific reports.<br>• Practical experiments which is carried out in groups.<br>• Periodic individual duties to develop the skill of taking responsibility and self-reliance | • Evaluate the results of collective works and duties as well as knowing the contribution of each individual through dialogue and discussion.<br>• Assessment of individual tasks and duties to determine the student's ability to self-reliance. |
| 3.2 | Choose the suitable method to solve problems. | | |
| 3.3 | Develop the student's ability in self-reliance and responsibility. | | |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Evaluate the different methods of preparation of inorganic compounds. | • The use of computers in the training room of the department.<br>• Visiting research centers. | • Web-based student performance systems<br>• Individual and group presentations. |
| 4.2 | Use computers and the international information network (the Internet) to perform calculations and to identify recent research relevant to decision sources. | | |

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| | Perform mathematical calculations and data analysis. | • Using the internet for collecting data. | • Evaluation of the duties associated with the proper use of numerical and communication skills. |
| **5.0** | **Psychomotor** | | |
| 5.1 | Not applicable. | | |
| 5.2 | | | |

| 5. Schedule of Assessment Tasks for Students During the Semester | | | |
|---|---|---|---|
| | Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
| 1 | Homework and activities. | -- | 10% |
| 2 | Midterm 1 Exam. | 6 | 10 |
| 3 | Midterm 2 Exam. | 12 | 10 |
| 4 | Lab activities and practical exam. | 15 | 30 |
| 5 | Final Exam. | 16 | 40% |
| 6 | **Total** | **100%** | |

## D. Student Academic Counselling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
   - Availability of Staff members to provide counseling and advice.
   - Office hours: During the working hours weekly.
   - Academic Advising for students.

## E. Learning Resources

1. List Required Textbooks

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| • James E. Huheey , Inorganic chemistry , Prentic Hall ; (4th edition) , 1997 |
| 2. List Essential References Materials (Journals, Reports, etc.)<br>• William L. Jolly, Modern Inorganic Chemistry; (2nd edition) McGraw-Hill, New York, 1991.<br>• S.F.A. Kettle, Coordination Compounds, Nelson, 1975. |
| 3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)<br>• Kazuo Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, John Wiley &Sons, 2009. |
| 4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)<br>• http://www.chemweb.com<br>• http://www.sciencedirect.com<br>• http://www.rsc.org |
| 5. Other learning material such as computer-based programs/CD, professional standards or regulations and software. : - **Not required.** |

**F. Facilities Required**

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| Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.) |
| 1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)<br>• Equipped lecture halls and laboratories equipped specializing in inorganic chemistry. |
| 2. Computing resources (AV, data show, Smart Board, software, etc.)<br>• Room equipped with computer, data show and TV. |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)<br>• **No other requirements.** |

**G. Course Evaluation and Improvement Processes**

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| 1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching<br>• Complete the questionnaire evaluation of the course in particular. |
| 2. Other Strategies for Evaluation of Teaching by the Program/Department Instructor |

- Preparation of a course report and study of the results of the students to give us indication about the planned outputs and the extent to which student's benefits.

3. Processes for Improvement of Teaching

- Training programs and workshops for Staff member.
- Review of strategies proposed.
- Providing new tools for learning.
- The application of e-learning.
- Exchange of experiences internal and external.

4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)

- Check marking of a sample of exam papers, or student work.
- Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty.

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

- Periodic review of the contents of the syllabus and modify the negatives.
- Consult other staff of the course.
- Hosting a visiting staff to evaluate of the course.
- Workshops for teachers of the course.

**Faculty or Teaching Staff:** **Prof. Abdalla Mohamed Khedr**

**Signature:** **Date Report Completed: 2015**

**Received by: Dr. Hatem Altass** **Department Head**

**Signature: _____** **Date: _____**