



University of Petra		
Faculty of Arts and Sciences	جامعة البتراء	كلية الآداب والعلوم
Department of Chemistry		قسم الكيمياء

### Course Syllabus

Year : 2019/2020 Semester : 1<sup>st</sup>

Course No.	Course Title	Prerequisite	Co-requisite	Credit Hours Lectures / European Credit Transfer System ECTS:
101232	Inorganic Chemistry (II)	101231		3/6

Instructor Name	e-mail	Office No.	Office ext.	Office Hours
Dr. Hani .A.Yasin	hmohammad@uop.edu.jo	7213	7213	Tue.,Thu., 12-13 Mon.,Wed., 09:30-11:00

Coordinator's Name: (if applicable)	Dr. Hani .A.Yasin
--	-------------------

Course Description		
Lewis Acids and bases; Transition Metals & coordination chem., Isomerism Bonding and Electronic Structure in complex ions: crystal field theory, Ligand-Field Theory, Transition Metal Complexes and Color Electronic spectra of atoms., Reaction mechanisms of d-metal complexes.		Chap.05 Chap.07 Chap.07 Chap.07 Chap.13 Chap.14

#### Course Objectives

- To instill in students a sense of enthusiasm for inorganic chemistry, an appreciation of its applications in coordination chemistry of transition metals, and to involve them in an intellectually stimulating and satisfying experience of learning and studying.
- To develop in students the ability to apply their chemical knowledge and skills to the solution of theoretical and practical problems in coordination chemistry.
- To provide students with a knowledge and skills base from which they can proceed to further studies in specialized areas of inorganic chemistry or multi-disciplinary areas involving coordination chemistry.
- To generate in students an appreciation of the importance of complex chemistry in an industrial & applied context.

#### Course Intended Learning Outcomes (ILOs) and their Alignment with Program ILO ,Teaching and learning methods and Assment methods:

Upon successful completion, this course , students are xpected to achieve the following larning outcomes.

Course ILOs	Program ILOs	Teaching and Learning Method	Assessment Method
<b>Knowledge (K)</b>			
1- Inspect Transition metals and their properties and understad of lewis acids and bases 2- Draw structures for inorganic complexes and inspection of their physical properties and molecular symmetry properties. 3- Differentiate between different theories of bonding : VBT,CFT,& LFT.	K1 K2 K3	Lectures, Discussions, & H.W	Exams, Quizzez
<b>Intellectual Skills (I)</b>			
1- study of Reaction mechanisms of d-metal complexes 2- inspect electronic spectra of d-metal complexes	I1 I2	Lectures, Discussions, & H.W	Exams, Quizzez

#### Assessment Methods:

Method	Lectures and Discussions
Contact Hours	3 hrs / week

Assessment method	% Grade	Date
1 <sup>st</sup> Exam	30	Th.22- 11-2018
2 <sup>nd</sup> Exam	30	Th. 03-01-2019
Quizzes	-	-
Final Exam	40	29-01-2019

#### Alignment of Teaching and Learning Methods, Assessment and Course ILOs:

Teaching method	Contact Hours	Assessed through	ILOs numbers
Lectures and Discussions	3 hrs / week	Exams, Reaction of students in lectures & Homework's	All ILOs

**Course Schedule:**

Week	Topic	Topic details	Course ILOs	Ref.
1	Acids and bases:	Bronsted acidity, The Lewis acids and bases: 5.7-Examples of Lewis acids and bases, 5.8- boron and carbon group acids, 5.9- Nitrogen & Oxygen group acids, 5.10- halogen acids, 5.11- reaction of lewis acids and bases.	K1	shriver chap.5
2	20.1-20.2 Transition Metals & coordination chem.	Importance of T.M / * Industry , General properties of T. M. 20.1 T. M. A survey ; Physical Properties of T. M :Variations in phys. Properties; Variations in chemical properties ; Selected properties of the 1 <sup>st</sup> raw T.M. ; Oxidation states and I.E's ; Some properties of 4d and 5d elements :	K1	Zumdahl
3	20.3-Coordination Compounds	complex ions, <i>Ligands, Nomenclature</i>	K2	Zumdahl
4	20.4 Isomerism	Stereoisomerism, Geometrical isomerism, Optical isomerism	K2	Zumdahl
5	20.5 Bonding in complex ions:	<i>valence bond theory.</i> ; The Crystal Field Model, <i>Octahedral complexes, Spectrochemical series. The visible spectrum, Other coordination geometries</i> , square planar complexes , <i>linear complexes</i> ; role of <b>T.M</b> ions in living organisms: Hemoglobin, Vitamin B12.	K2	Zumdahl
6	d-Metal complexes II	- Definitions :Structures and Symmetries :7.1 Constitution / Factors determining the C.N of a complex; Low coordination numbers:C.N = 4, T <sub>d</sub> complexes, sq. planar complexes, C. N 5 , C.N 6 : O <sub>h</sub> , Higher Coordination Numbers	K2	shriver
7	7.2 Representative ligands and nomenclature 7.3 Isomerism and Chirality	MX <sub>4</sub> Y <sub>2</sub> , X <sub>3</sub> Y <sub>3</sub> , Chirality and isomerism , Chirality and symmetry Absolute configuration of an M(L-L) <sub>3</sub> O <sub>h</sub> . complexes, The resolution of enantiomers	K2	shriver
8	7.4 /Bonding and Electronic Structure	<i>Crystal-field Theory, Liganad-Field Theory, spectrochemical series</i> :Ligand-Field Stabilization Energies ,Magnetic properties & Electronic structure, Magnetic measurements. Thermochemical correlations.	K3	shriver
9	7.5- The electronic structures of 4-coordinate complexes	orbital energy level diagram ,Tetragonal and sq. planar complexes, The Jahn-Teller effect	K3	shriver
10	7.6 Ligand-Field Theory	a-σ-bonding, b- M-L π-bonding/shriver " <i>π-donor ligand</i> ", " <i>π-acceptor ligand</i> " , <i>MO energy level diagram</i> , Mulliken Symbols for Irreducible representations, <i>Mulliken</i> Symmetry Labels	K3	Shriver
11	Transition Metal Complexes and Color	Seeing Color, Transition Metal Complexes, d-Orbital Splitting, The Nature of the Ligands	K3	Internet
12	Electronic spectra of atoms. Chap.13, shriver; Chap.11- Miessler	13.1-Spectroscopic terms, 13.2- Terms of a d <sup>2</sup> configuration (a)- The classification of microstates., (b)-the energies of the terms., Electronic spectra Of complexes.	I1	shriver; Miessler
13	Electronic spectra of atoms. Chap.13, shriver; Chap.11- Miessler	13.3- Ligand field transitions, (a)-The spectroscopic terms., (c) The energies of the terms. (c)- Weak and strong field limits.13.4- Charge- transfer bands, (a)- LMCT transitions, (b)- MLCT transitions. 13.5-Selection rules and intensities,(a)- Spin selection rules,(b)- Laporte selection rules.	I1	shriver; Miessler
14	Reaction mechanisms of d-metal complexes. Chap.14-	Ligand substitution reactions, 14.1- Patterns of reactivity., 14.2- The classification of mechanisms, (a)- association, dissociation, and interchange,(b)- the rate-determining step. Ligand substitution in square-planar complexes. 14.3- The nucleophilicity of the entering group	I1	shriver
15	Reaction mechanisms of d-metal complexes. Chap.14-	14.4- The shape of the activated complex, (a)- the trans effect, (b)- steric effects, (c)- stereochemistry, (d)- Temp. & Pressure Dependence (e)- The Thermodynamic considerations.,	I1	shriver
16	Reaction mechanisms of d-metal complexes. Chap.14-	14.5- The k <sub>1</sub> pathway., 14.7 – The activation of Octahedral complexes, a- leaving group effects, b- Th effects of spectator ligands, c- Steric effects. 14.8 – Stereochemistry.	I1	shriver

**Grading Scale :**

90-100 A ; 85-89 A<sup>+</sup> ; 80-84 B<sup>+</sup> ; 75-79 B ; 70-74 B<sup>-</sup> ; 65-69 C<sup>+</sup> ; 60-64 C ; 56-59 C<sup>-</sup> ; 53-55 D<sup>+</sup> ; 50-52 D ; 45-49D<sup>-</sup> ; < 45 F

**References:**

**Textbook:** "Inorganic Chemistry " by Duward shriver & Peter Atkins, 3<sup>rd</sup> edition, Oxford, 2003.

**Other References:**

- 1- Chemistry; By Zumdahl, 5<sup>th</sup>. Ed.
- 2- Inorganic Chemistrv, 2<sup>nd</sup> Edition, by GARY L. MIESSLER , DONALD A. TARR, St. Olaf College, Northfield, Minnesota
- 3- Internet notes.

**3- Other Resources:** <<Labs, computer resources, lecture rooms needed for the course>>

**Course Policies<sup>1</sup>**

- **Attendance Policy :** University regulations apply to attendance.
- **Academic Honesty :** Academic dishonesty is an unacceptable mode of conduct, and will not be tolerated in any form at University of Petra. All persons involved in academic dishonesty and plagiarism in any form will be disciplined in accordance with University rules and regulations.

Approved by	Name	Date	Signature
Head of Department			
Faculty Dean			

<sup>1</sup> Additional information may be added in this section according to the nature of the course.

---