Course Specification
(Bachelor)

Course Title:	Spectroscopy of Inorganic Compounds
Course Code:	CEM456
Program:	General Chemistry
Department:	Chemistry
College:	College Of Science
Institution:	Majmaah University
Version:	TP-153
Last Revision Date:	16 December 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3h)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (7th Level / 4th Year)					
4. Course General Description:					
This course focused on the spectral principles for characterizing inorganic materials. IR, NMR, MS, UV-Vis and magnetic the changes on the organic ligand and the transition elements after complexation.					
5. Pre-requirements for this course (if any)**:**					
Organometallics Chemistry CEM353					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
By end of this course, students are expected to: • Studying the spectral techniques used to characterize inorganic compounds • Study how to differentiate the IR spectra of organic compounds and the coordinating compounds • Identifying the importance of UV-Vis spectra in complex geometry • Recognize the influence of the organic Ligand on the electronic transition within transition elements • Studying how to determine the magnetic moments of the inorganic compounds and the factors affecting on it					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	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**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	10
Total		40

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Knowing the concepts and principles to spectral characterization of inorganic compound	**K1**	- lectures (PowerPoint) and Video related to the topic. - Discussions - E-learning - Self-learning	- Midterms - Quizzes - Homework - Class participation - Encourage students to search the Internet for everything related to - Homework on the blackboard - Final exam
1.2	Demonstrate the changes in spectra of IR or UV-Vis and NMR after forming the complexes			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
				- E-exam.
2.0	**Skills**			
2.1	Communicate effectively to form group and distribution of tasks	**S2**	Cooperative learning -Problem Solving - Interactive teaching - Discussion and dialogue - Active Learning - Peer Learning - Encourage students to work as team in order to raise the spirit of cooperation among students	- Assignment - Homework - Midterm Exam - Final Exam -Research papers Request a share Presentation and homework and then presented them on the class. -Present a presentation for each group
2.2	Demonstrate the ability to use modern technology and statical applications to identify the inorganic compounds	**S3**		
	Apply the rules to solve and analysis the spectral of inorganic compounds	**S4**		
3.0	**Values, autonomy, and responsibility**			
3.1	act responsibly and personality for their own learning and development	**V3**	Assignments (individual or group) at regular intervals to solve and submit on time. • Participation of students in classroom discussion and problem-solving sessions • Team work reports and presentations (data collection, internet search, data processing, analysis and reporting)	- Observing student's participation in group activity. - Checklist of the tasks carried out by the student. Observing student's participation in group discussion. - Checklist of student's punctuality in submitting work on time.

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction on the spectroscopic types used for inorganic compounds	3
2.	Mass Spectrometry: Introduction of theory, ionization methods, molecule fragmentation. • Mass Spectrometry: Case studies	3
3.	NMR Spectroscopy: Introduction of theory, 1H and 13C NMR, Spin-Spin Coupling • Case studies on 1D NMR • 2D NMR techniques, pulse sequences • Case studies on 2D NMR	4
4.	Infrared Spectroscopy: Steady-state and time-resolved Infrared spectroscopy: from overview to potential applications • Case studies on IR spectrum	3
5.	Raman Spectroscopy: Standard Raman Spectroscopy vs Resonance-enhanced Raman Spectroscopy	3
6.	Photoelectron spectroscopy: x-ray and Auger photoelectron spectroscopy, electron energy loss spectroscopy	4
7.	Ultraviolet and Visible Spectroscopy: electronic transitions, radiative processes, energy diagram, internal conversion, conical intersection, Frank Condon principle, Kasha's rule, structure determination and solvent effect, and Fluorescence spectroscopy, Stokes Shift, fluorescence experiments, quenching, lifetime and quantum yield, fluorescence anisotropy.	4
8.	Microwave spectroscopy: rotation of molecular- rotational spectra- diatomic molecules	3
9.	Electronic spectroscopy of atomic structure: • atomic-electronic angular momentum • multi-electron atoms-angular momentum	3
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Case studies-Problem sheet- Homework-presentation-Participation	Continues	20%
2.	midterm exam 1	7th	15%
3.	midterm exam 2	12th	15%
4.	E. exam	15th	10%
5.	Final Theoretical exam	18th	40%

*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	• Spectroscopy of Inorganic Compounds: Principles, Problems and their Solutions; Jagdamba Singh , Jaya Singh , Pandey M D (2020) • Kazuo Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, John Wiley & Sons , 2009. • Electronic Structure and Magnetism of Inorganic Compounds; P Day
Supportive References	• Electronic Structure and Magnetism of Inorganic Compounds: Volume 4 (Specialist Periodical Reports): Day, P: 9780851862811: Amazon.com: Books • Handbook of Infrared and Raman Spectra of Inorganic Compounds and Organic Salts, Four-Volume Set: Nyquist, Richard A., Kagel, Ronald O., Putzig, Curtis L., Leugers, M. Anne: 9780125234443: Amazon.com: Books • Spectroscopic Properties of Inorganic and Organometallic Compounds (RSC Publishing)
Electronic Materials	Relevant Website • ISIS Draw 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	PowerPoint presentation. Interactive and multimedia soft-books

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, E- learning, blackboard
Technology equipment (projector, smart board, software)	data show, Smart Board
Other equipment (depending on the nature of the specialty)	Program for chemical applications

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	students	Questionnaire evaluation of the course. Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students' assessment	Program/Department Instructor	Annual course report. Direct
Quality of learning resources	Program/Department Instructor	Annual course report. Direct
The extent to which CLOs have been achieved	Peer review	- 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. Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**CHEMISTRY DEPARTMENT COUNCIL**
REFERENCE NO.	**17**
DATE	**16-12-2024**