



Form: Course Syllabus	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	06

1.	Course Title	Modern Methods in Chemical Analysis
2.	Course Number	0353711
3.	Credit Hours (Theory, Practical)	(3,0)
	Contact Hours (Theory, Practical)	Theory: three hour-lecture/week
4.	Prerequisites/ Corequisites	Non
5.	Program Title	MS in Chemistry
6.	Program Code	3
7.	School/ Center	Faculty of Graduate Studies
8.	Department	Chemistry
9.	Course Level	MSc degree
10.	Year of Study and Semester (s)	First year- 1 st and 2 nd Semesters
11.	Other Department(s) Involved in Teaching the Course	Non
12.	Main Learning Language	English
13.	Learning Types	<input checked="" type="checkbox"/> Face to face learning <input type="checkbox"/> Blended <input type="checkbox"/> Fully online
14.	Online Platforms(s)	<input type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams
15.	Issuing Date	05/12/2022
16.	Revision Date	Nov 5, 2024

17. Course Coordinator:

Name: Prof. Dr. Mohammed Khair Hourani	Contact hours: Sun/Tue/Thu 11:00-12:00 pm
Office number: 4	Phone number: 065355000 Ext. 22140
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18. Other Instructors: (other semesters)

Name: Prof. Dr. Sharif Arar

Office number: 203

Phone number: 065355000 Ext. 22150

Email: s.arar@ju.edu.jo

Contact hours: Sun/Tue/Thu 11:00 am -12:00 pm

19. Course Description:

Sampling and statistical analysis, signal and noise, instrumental methods covering atomic and molecular spectroscopy, electrochemical methods with emphasis on voltammetric methods. In addition to chromatographic methods, hyphenated mass spectrometry instruments, with focusing in all methods on recent developments and applications.

20. Program Intended Learning Outcomes: (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

- SO1.** Demonstrate comprehensive knowledge and understanding of chemistry topics, achieving expertise in foundational research principles.
- SO2.** Develop independent research skills to solve complex problems, focusing on analytical and critical thinking.
- SO3.** Improve communication of scientific knowledge through structured reports, presentations, and discussions.
- SO4.** Engage in activities that enhance practical scientific skills and improve professional expertise.
- SO5.** Maintain ethical standards in research.

21. Course Intended Learning Outcomes (CLO's): (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

- 1. How to perform and design sampling procedures and conduct statistical analysis and related calculations**
- 2- Gained advanced knowledge in instruments signal to noise ratio, fundamentals of lowest detected signals, and methods to reduce and enhance obtained instruments signals**
- 3. Obtained deep knowledge in spectroscopy, ability to handle related instrumentation, design experiments, and conduct data interpretation and related calculations**



4. Obtained deep knowledge in selected electrochemistry methods and techniques, ability to handle related instrumentation, design experiments, conduct data interpretation and related calculations

5. Obtained advanced knowledge in chromatography, ability to handle related instrumentation, design experiments, conduct data interpretation and related calculations

Course ILOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1	✓	✓		✓		
2	✓	✓		✓		
3	✓	✓		✓		
4	✓	✓		✓		
5	✓	✓		✓	✓	

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SOs / Course CLOs	SO(1)	SO(2)	SO(3)	SO(4)	SO(5)
1	✓	✓		✓	
2	✓	✓		✓	
3	✓	✓		✓	
4	✓	✓		✓	
5	✓	✓		✓	



23. Topic Outline and Schedule:

Week	Lecture	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous	Evaluation Methods	Learning Resources
1	1	Introduction to instrumental analysis and types of samples and sampling methodologies	1	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.2
	2	Sampling objectives and sampling errors and Probability laws in determining the weight or size of gross sample	1	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.2
2	1	Terminology: Null hypothesis	1	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.2
	2	t-rest, paired t-test, F-test	1	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.2
3	1	Dixon's Test (Q-test)	1	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.2
	2	Analysis of Variance (ANOVA)	1	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.2
4	1	Signal and noise, sources	2	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
	2	Software and hardware modulators, and applications to AAS, NMR, FTIR	2	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
5	1	Atomic absorption spectroscopy, FAAS and atomization methods	3	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
	2	Special atomization methods, GFAAS, hydride generation, cold vapor, and modern AAS spectrophotometers, light sources, detectors	3	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
6	1	Atomic emission spectroscopy focusing on inductively coupled plasma-optical emission spectroscopy fundamentals	3	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1



	6 . 2	ICP-OES instrumentation, spectrophotometers, and modes of operation sequential and simultaneous	3	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
	7 . 1	ICP- mass spectrometry	3	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
7	7 . 2	Molecular absorption spectroscopy, with focusing on instrumentation and applications	3	Face to face	-	S	Quizzes/group discussion+ Mid-exam	Lecture notes, Ref.1
	8 . 1	Molecular fluorescence and chemiluminescence spectroscopy, with focus on instrumentation and applications	3	Face to face	-	S	Quizzes/group discussion+ Mid exam	Lecture notes, Ref.1
8	8 . 2	Infrared molecular spectroscopy, fundamentals, instrumentation, detectors	3	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
	9 . 1	Attenuated total reflectance (ATR)-infrared Fourier transformation (ATR-FTIR), Ramman spectroscopy	3	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
9	9 . 2	Voltammetry and linear scan voltammetry	4	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
	1 0 . 1	Cyclic voltammetry	4	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
1 0	1 0 . 2	Voltammetric methods including pulse and stripping methods	4	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
	1 1 . 1	Chromatography – Gas chromatography advances	5	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
1 1	1 1 . 2	Chromatography- liquid chromatography updates	5	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
1 2	1 2 . 1	Hyphenated mass spectrometry-I	5	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1



	1 2 .		5	Face to face	-	S	Quizzes/group discussion+ Final exam	Lecture notes, Ref.1
	2	Hyphenated mass spectrometry-II						
1 3	1 3 .	Seminar topics and class discussions	1,2,3,4, and 5	Face to face	-	S	Discussion And instructor evaluation	Topic seminar references
	1							
	1 3 .	Seminar topics and class discussions	1,2,3,4, and 5	Face to face	-	S	Discussion And instructor evaluation And instructor evaluation	Topic seminar references
	2							
1 4	1 4 .	Seminar topics and class discussions	1,2,3,4, and 5	Face to face	-	S	Discussion And instructor evaluation	Topic seminar references
	1							
	1 4 .	Seminar topics and class discussions	1,2,3,4, and 5	Face to face			Discussion And instructor evaluation	Topic seminar references
	2							

24. Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
Oral presentations /term paper	15	All related topics in the course	1,2,3,4, and 5	13-14	Face to face In the department
Quizzes, HomeWorks and assignments	15	Weeks 1-10	1,2,3,4,	3, 6, 11	Face to face In the department
Mid exam	30	Weeks 1-10	1,2, 3	11-12	Face to face In the department
Final Exam	40	All topics weeks 1-12	1,2,3,4, and 5	15-16	Face to face



					In the department

25. Course Requirements:

Students should have a computer, internet connection, Microsoft teams

26. Course Policies:

A- Attendance policies:

Attending the course is mandatory. Failure to sit an exam will result in a mark of zero, unless a valid reason (with supporting documentation) for the absence is presented.

B- Absences from exams and handing in assignments on time:

Proof of illness requires a signed medical certificate. Notify me as soon as possible if you are going to miss an exam. If any course component is missed for a valid reason, that portion of the exam grade will/may be shifted to the final examination.

C- Health and safety procedures:

Special Needs Students: Feel free to inform your instructor of your special needs in order for you to have a productive learning experience.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

When writing a report or paper on a given topic, you must read up the necessary information on the topic, and then present it in your own words and writing. If you want to use an exact sequence of text or an idea or data from someone else's work, that is considered a quote, then that work must be cited (you must give a proper credit to the author) specifically as a reference. Therefore, if you are caught cheating on any component of Chem.741 you will be assigned a grade of zero for the course. We shall also place a letter describing the offense in your student file.

If you see someone cheating during an exam or writing a paper or report, inform us/the proctors in the following ways: 1) Write a short message on your exam paper or report indicating what is happening. 2) Raise your hand and the proctor or myself will come over – then let us know and point out your note; we will take it from there.

It is important to point out that there is a difference between plagiarism and working out answers to a lab report or an assignment with a friend. If your writing is based on your own words and your understanding of the material, then that is acceptable. If, however, you simply write your friend's thought or answer, i.e. the same thing (cut and paste), then you have committed plagiarism. Simply, plagiarism is cheating; if you are unclear about any part of this issue or have any question, please speak up and let me know.

E- Grading Scheme and policy:

- Assignments are due at the beginning of the class, unless otherwise specified.



- Assignments, and suggested problems are intended as partial preparation for exams. Failure to put forth effort is perilous.
- Assignments are due on the dates noted. Assignments will be done individually; each student must hand in their own answers. It is acceptable, however, for students to help each other in collaborating to solve problems and figuring out answers. We will be assuming that, you will be taking the responsibility to make sure you personally understand the solution to any problem arising from such collaboration. You also must indicate on each assignment with whom you collaborated.
- The final exam for this course is cumulative covering all material presented in the class, the exam will test your comprehension and your ability to problem solve.

F- Available university services that support achievement in the course:

- E-Learning resources and Microsoft teams
- Computer Lab

27. References:

A- Required book (s), assigned reading and audio-visuals:

- Handouts
- Lecture Notes (hard or soft copies)
- Videos (Recorded Lectures) if needed

B- Recommended books, materials, and media:

1. Skoog, D.; Holler, and West, Principles of Instrumental Analysis, 7th edition, 2016
2. Miller, J. N. and Miller, J., C, Statistics and Chemometrics for Analytical Chemistry, 5th edition, Pearson-Prentice Hall, 2005.
3. Kellner, R; Mermet, J.-M.; Otto, M.; and Widmer, H. M., (Eds.) Analytical Chemistry, The Approved Text to the FECS Curriculum Analytical Chemistry, Wiley-VCH, 1998.
4. Rubinson, K. A. and Rubinson, J. F., Contemporary Instrumental Analysis, Printice-Hall, New York, 2000.
5. Lecture notes, handouts, and papers.
5. محمدخير الحوراني، التحليل الآلي: الجزء الأول الطرق الطيفية و الكروماتوغرافية، الجامعة الأردنية، عمان ، 2016.
6. محمدخير الحوراني، الكيمياء الكهرتحليلية، دار الضياء، عمان، 2010.
7. Relevant websites

28. Additional information:



NA

Name of the Instructor or the Course Coordinator: Signature: *mohd Hawrani* Date: 11-11-2024
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The Head of Graduate Studies Committee/
Department Chemistry
Dr. Murad AlDamen, Prof. Signature: Date:

The Head of Department of Chemistry
Dr. Murad AlDamen, Prof. Signature: Date:

Vice Dean for Graduate Studies and Scientific
Research / School of Science
Dr. Kamal Sweidan, Prof. Signature: Date:

The Dean of School of Science
Dr. Mahmoud I. Jaghoub, Prof. Signature: Date: