Course Specification

(Postgraduate Programs)

Course Title:	**Advanced Analytical Chemistry**
Course Code:	**CHM 6131**
Program:	**Master of science in chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: 4 (4 Lectures, 0 Lab, 0 Tutorials)				
2. Course type				
A.	☐University	☐College	☐Department	☐Track
B.	☒ Required		☐ Elective	
3. Level/year at which this course is offered: Level 1/Year 1				

4. Course General Description:

This course is designed to provide comprehensive topics of sampling and modern sample preparation techniques. The course will cover the classical methods of analysis (gravimetric methods and volumetric methods). The topics include advanced aspects of Spectroscopic methods of analysis, Electro-chemical methods of analysis, and Chromatographic techniques.

5. Pre-requirements for this course (if any):

None

6. Pre-requirements for this course (if any):

None

7. Course Main Objective(s):

- **Recognize the required techniques for a variety of sampling types.**
- **Develop awareness with handlings samples preparation in an appropriate way.**
- **Be familiar with volumetric and gravimetric analysis and their application in different fields.**
- **Develop awareness with spectral, electrochemical, and chromatographic methods; and choosing the appropriate technique.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**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**	**60**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)……**	**0**
	Total	60

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recall the principles of a wide range of modern analytical methods of sampling types.**	**Inorganic Chemistry Track: K1. Inorg.; K4. Inorg.** **Organic Chemistry Track: K1. Org.; K4. Org.** **Analytical Chemistry Track: K1. Anal.; K2. Anal.; K3. Anal.; K4. Anal** **Physical Chemistry Track: K2. Phy.; K4. Phy.**	• Five hours/week lectures. • Self-study. • Home-exam. •	• Regular Exams • Assignments • Short Quizzes • Oral Discussion • Participation . •

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	**To list principles in Analytical Chemistry**	**Inorganic Chemistry Track: K1. Inorg.; K4. Inorg** **Organic Chemistry Track: K2. Org.** **Analytical Chemistry Track: K2. Anal.; K3. Anal.; K4. Anal.** **Physical Chemistry Track: K2. Phy.; K4. Phy.**	• Five hours/week lectures. • Think, to justify the principles of analytical chemistry, available references (SDL) online. • Open discussion. •	• Oral Discussion marks • Literatures Survey • Mini seminar. • Participation . •
1.3	**To describe Spectral Methods applications in Analytical Chemistry.**	**Inorganic Chemistry Track: K2. Inorg.; K3. Inorg** **Organic Chemistry Track: K2. Org.; K3. Org.** **Analytical Chemistry Track: K2. Anal.; K3. Anal.; K4. Anal** **Physical Chemistry Track: K2. Phy.; K3. Phy.; K4. Phy.**	• Five hours/week lectures. • Group Discussion using available references (SDL) online. •	• Midterm. • Assignments. • Group Discussions. • Literatures Survey • Mini seminar. • Participation . •
1.4	**To state the Chromatographic and Electrochemical Methods.**	**Inorganic Chemistry Track: K1. Inorg.; K4. Inorg** **Organic Chemistry Track: K2. Org.; K3. Org.** **Analytical Chemistry Track: K1. Anal.; K2. Anal.; K4. Anal**	• Five hours/week lectures. • Group Discussion Analytical methods for separation using	• Assignments • Open Discussions. • Literatures Survey • Mini seminars. • Participation .

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
		Physical Chemistry Track: K4. Phy.	available **refere**nces online. •	•
2.0	**Skills**			
2.1	**To analyze problems and explore strategies for Volumetric and Gravimetric Methods applications.**	**Inorganic Chemistry Track: S1. Inorg.; S2. Inorg.; S3. Inorg.** **Organic Chemistry Track: S1. Org.; S4. Org.** **Analytical Chemistry Track: S1. Anal.; S2. Anal.; S3. Anal** **Physical Chemistry Track: S2. Phy.; S3. Phy**	• Lectures activity • Self-study. • Deep discussions on the Volumetric and Gravimetric Methods applications.	To analyze problems and explore strategies for Volumetric and Gravimetric Methods applications.
2.2	**To interpret the obtained data from different Spectral Methods.**	**Inorganic Chemistry Track: S2. Inorg.; S3. Inorg.** **Organic Chemistry Track: S2. Org.; K3. Org.** **Analytical Chemistry Track: S2. Anal.; S3. Anal.** **Physical Chemistry Track: S2. Phy.; S3. Phy.**	• Practice examples Spectral Methods interpretation. • Brainstorming. 6. Self-study	To interpret the obtained data from different Spectral Methods.
2.3	**To choose the appropriate techniques in Electrochemical analytical methods for a specific sample.**	**Inorganic Chemistry Track: S2. Inorg.; S3. Inorg** **Organic Chemistry Track: S2. Org.; S3. Org.**	• Lectures and Oral Discussions. • Brainstorming.	To choose the appropriate techniques in Electrochemical analytical

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
		Analytical Chemistry Track: S1. Anal.; S2. Anal.; S3. Anal	• Self-study.	methods for a specific sample.
		Physical Chemistry Track: S1. Phy.; S2. Phy.		
2.4	**To demonstrate Oral Communication on applying analytical chemistry techniques in the industry and their impact in KSA, accompanying mini-Reports, operating electronic mail, and Network in communicating with others.**	**Inorganic Chemistry Track: S1. Anal.; S3. Inorg.; S4. Inorg.**	• Group Discussion and Assignments. • Suggest application of analytical chemistry techniques in the industry and its impact in KSA, which will require reading, writing, and oral presentation. 1. Encourage students to use electronic mail to submit Home Exams and Assignments.	To demonstrate Oral Communication on applying analytical chemistry techniques in the industry and their impact in KSA, accompanying mini- Reports, operating electronic mail, and Network in communicating with others.
		Organic Chemistry Track: S1. Org.; S3. Org.; S4. Org.		
		Analytical Chemistry Track: S1. Anal.; S4. Anal.		
		Physical Chemistry Track: S2. Phy.; S4. Phy.		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	**To Perform communications to integrity, academic ethical practices to find solutions for scientific and social issues, and a commitment to responsible citizenship and using IT.**	**Inorganic Chemistry Track: V1. Inorg.** **Organic Chemistry Track: V1. Org.** **Analytical Chemistry Track: V1. Anal.** **Physical Chemistry Track: V1. Phy.**	• Brainstorming Exercises • Group Discussion	• Oral Discussion. • Group Discussion • Assignments.
3.2	**To Appraise effectively in research or professional groups and make decisions, develop knowledge, enhance society's quality, and contribute to its advancement.**	**Inorganic Chemistry Track: V1. Inorg.; V2. Inorg** **Organic Chemistry Track: V1. Org.; V2. Org.** **Analytical Chemistry Track: V1. Anal.; V2. Anal.** **Physical Chemistry Track: V1. Phy.; V2. Phy.**	• Small Group tasks • Open discussion at classroom. • Office hour guiding. • Group Presentation of mini projects	• Participation • Homework's • Mini project(s).

C. Course Content:

No	List of Topics	Contact Hours
1.	Various sampling techniques of organic, inorganic analytes.	**7**
2.	Scientific principles in analytical chemistry	**10**
3.	**Volumetric and Gravimetric Methods**: Principle, Stoichiometric calculations in Volumetric and Gravimetric Analysis and their application	**10**
4.	**Spectral Methods:** Recent techniques in spectroscopic methods of analysis, Infrared spectroscopy (Definition - Theory – Infrared instruments), Ultraviolet/Visible spectroscopy (Principle – Instrumentation – Applications), and atomic spectroscopy (Principle – Instrumentation – Applications).	**15**
5	**Electrochemical Methods**: Simple introduction, Potentiometry, conductometry, coulometry, polarography, amperometry, voltammetry.	**10**
6	**Chromatographic Methods**: Principles, Theory and different types.	**8**
Total		60

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
2.	**Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)**	**weekly**	**30 %**
3.	**Midterm Exam**	**9th week**	**30 %**
4.	**Final Exam**	**17 th week**	**40 %**
4.	**Total**		**100%**

*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	• Fundamentals of analytical chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. 9th Edition. ISBN-13: 978-0-495-55828-6. • Analytical Chemistry, Gary D. Christian, Purnendu K. (Sandy) Dasgupta, Kevin A. Schug., 7th Edition. ISBN: 978-0-470-88757-8
Supportive References	• None
Electronic Materials	• The Journal of Analytical Chemistry • Saudi Digital Library
Other Learning Materials	• Blackboard • Multimedia associated with the text book and the relevant websites.

3. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.
Technology equipment (projector, smart board, software)	• The rooms are equipped with data show, Smart Board, • WI-FI access.
Other equipment (depending on the nature of the specialty)	• None

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: Questionnaire.
	Course Responsible	Direct: Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Peer Reviewer	Direct: Questionnaire. Indirect: External assessor report.
Effectiveness of students assessment	Program Leaders	Direct: Course e-Portfolio. Indirect: Course report.

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Students	Indirect: Second examiner checklist-Course report.
	Faculty (Academic Advisory-GCC)	Direct: course Entrance/Exit. Indirect: Observations - Accreditation review.
	Program Leaders	Direct: Course e-Portfolio. Indirect: Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	
The extent to which CLOs have been achieved	Course Responsible	Direct: Exams - Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Program Leaders	Indirect: Exams.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Council of Chemistry Department
REFERENCE NO.	10 (No. 2/10)
DATE	21/04/1444- 15/11/2022