Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS & APPLIEED

SCIENCES

Faculty of Laboratory medicine

Course Specification of Analytical chemistry
Course No. (02,04,309)

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr. Abdulsalam Alsubari	Dr\Ghamdan Ahmed Altahish		Dr\Gamil Taher Abdul Mughni	Associate Prof. Dr. Ebtesam Al-Zabedi

I. Course Identification and General Information:

1	**Course Title:**	Analytical chemistry			
2	**Course Code & Number:**	02,04,309			
3	**Credit Hours:**	**Theory Hours**			
		Lecture	**Exercise**	Practical	**Credit Hours**
		2	0	2	3
4	**Study Level/ Semester at which this Course is offered:**	1st Level / 1st Semester			
5	**Pre –Requisite (if any):**	General chemistry			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Bachelor in laboratory medicine			
8	**Language of Teaching the Course:**	English			
9	**Study System:**	Semester			
10	**Mode of Delivery:**	Regular			
11	**Location of Teaching the Course:**	University Campus			
12	**Prepared by:**	Dr. Abdulsalam Alsubari			
13	**Date of Approval:**	2023			

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II.Course Description:

This course provides an introduction to the principles and techniques of analytical chemistry. Topics covered include, Basic concepts of analytical chemistry, Separation techniques, Qualitative analysis, Quantitative analysis, Instrumental analysis, Data analysis and interpretation

III. Alignment Course Intended Learning Outcomes with program outcomes		
III. Course Intended Learning Outcomes (CILOs)		**Referenced PILOs**
A. Knowledge and Understanding: ***Upon successful completion of the course, students will be able to:***		
a1	**Define** the basic concepts of analytical chemistry.	**A3**
B. Intellectual Skills: ***Upon successful completion of the course, students will be able to:***		
b1	**Develop** critical and analytical thinking to recognize errors and solve problems of chemical equivalents and expressing concentration units	B4
C. Professional and Practical Skills: ***Upon successful completion of the course, students will be able to:***		
c1	**Perform** qualitative analysis using a variety of techniques	C1
c2	**Perform** quantitative analysis using gravimetric, volumetric, and instrumental methods	C1
c3	**Take responsibility** in analysis and clinical decision-making such as recognizing and resolving issues related to pre-analytical, analytical, and post-analytical steps of the testing process	C3
D. Transferable Skills: ***Upon successful completion of the course, students will be able to:***		
d1	**Communicate** in groups and team in laboratory experiments	D3

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IV. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods :			
(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1	**Define** the basic concepts of analytical chemistry.	• Interactive lectures • Self-learning • Discussion	• Written exam (mid and final terms and quizzes)
(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1	**Develop** critical and analytical thinking to recognize errors and solve problems of chemical equivalents and expressing concentration units	• Interactive lectures • Self-learning	• Written exam (mid and final terms and quizzes).
C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1	**Perform** qualitative analysis using a variety of techniques	• Practical session	• Written exam (mid and final terms and quizzes). • practical exam
c2	**Perform** quantitative analysis using gravimetric, volumetric, and instrumental methods	• Practical session	• Written exam (mid and final terms and quizzes). practical exam
c3	**Take responsibility** in analysis and clinical decision-making such as recognizing and resolving issues related to pre-analytical, analytical, and post-analytical steps of the testing process	• Practical session	• Written exam (mid and final terms and quizzes). practical exam
(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and			

Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1	**Communicate** in groups and team in laboratory experiments	• Seminars • Discussion	• Assignment: - Research - Homework - Team work

V. Course Content:

A – Theoretical Aspect:

NO.	Units/Topics List	Sub Topics List	Number of Weeks	contact hours	Learning Outcomes (CILOs)
1	Introduction to Analytical Chemistry	- Analytical Chemistry: Definition, Importance, and Applications - Classification of Analytical Techniques - Basic Terms and Concepts in Analytical Chemistry	1	2	a1
2	Chemical Measurements	- Units and Dimensions of Measurement - Significant Figures and Uncertainty - Errors in Measurements - Statistical Analysis of Data	1	2	b1
3	Sampling and Sample Preparation	- Sampling Techniques - Types of Samples - Sample Preparation Techniques - Preservation of Samples	1	2	b1
4	Gravimetric Analysis	- Principles of Gravimetric Analysis - Types of Gravimetric Analysis	1	2	a1

		- Precipitation and Digestion - Calculation of Results			
5	Titrimetric Analysis	- Principles of Titrimetric Analysis - Types of Titrimetric Analysis - Acid-Base Titrations - Redox Titrations	1	2	b1
6	Spectrophotometric Analysis	- Principles of Spectrophotometry - Beer-Lambert Law - UV-Visible Spectrophotometry - Infrared Spectrophotometry	1	2	b1
7	Chromatographic Techniques	- Principles of Chromatography - Types of Chromatography - Gas Chromatography - High-Performance Liquid Chromatography	1	2	b1
8	Electroanalytical Chemistry	- Principles of Electrochemistry - Electrochemical Cells - Potentiometry and Conductometry -Voltammetry	1	2	a1
9	Mass Spectrometry	- Principles of Mass Spectrometry - Ionization Techniques - Mass Analyzers - Interpretation of Mass Spectral Data	1	2	a1
10	Nuclear Magnetic Resonance Spectroscopy	- Principles of NMR Spectroscopy - Chemical Shift - Spin-Spin Coupling - Interpretation of NMR Spectra	1	2	a1
11	Surface Analysis Techniques	- Principles of Surface Analysis - X-Ray Photoelectron Spectroscopy - Auger Electron Spectroscopy - Scanning Electron Microscopy	1	2	b1
12	Quality Control and Method Validation	- Principles of Quality Control - Control Charts	1	2	a1

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		- Method Validation			
13	Analytical Method Development	- Principles of Method Development - Optimization of Analytical Methods - Method Validation and Verification	1	2	b1
14	FINAL THEORTICAL		1	2	C1
			14	28	

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	1- Simple acid radicals (groups I , II-III and mixtures).	**1**	**2**	c1,c2,c3
2	2- Acid radical mixtures without interference and with interference.	**1**	**2**	c1,c2,c3
3	3- Interfering acid radical mixtures.	**1**	**2**	c1,c2,c3
4	4- Organic acid radicals.	**1**	**2**	c1,c2,c3
5	5- Basic radicals (silver group, copper-arsenic group, iron group, zinc group, alkaline-earths group, alkali metal group).	**1**	**2**	c1,c2,c3
6	6- Interference in cation analysis (oxidizing agents, organic matter, insolubles, phosphate).	**1**	**2**	c1,c2,c3
7	7- Preciptimetric titrations: Determination of chloride by Mohr's and Fajan's method, bromide by Volhard's method; Determination of zinc salts; Determination of HgCl2. Determination of chloride and iodide mixture;	**1**	**2**	c1,c2,c3
8	8- Complexometric titrations: Determination of Cu2+, of mixture of (Ca2+ and Mg2+) and of Zn2+	**1**	**2**	c1,c2,c3
9	9- Gravimetric analysis: Determination of Ca2+ as oxalate, and Ni2+ as dimethylglyoximate	**1**	**2**	c1,c2,c3
Number of Weeks /and Units Per Semester		**9**	**18**	

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V. Teaching Strategies of the Course:	
1-	Lectures
2-	Practical session
3-	Seminars
4	self-learning
5	Discussion

VI. Assessment Methods of the Course:	
No	**Assignment**
1	Written Exams (Short Essays) and Quizzes
2	Multiple Choice Questions (MCQ)
3	Practical Exams (PE)
4	**Assignment**

VII. Assignments:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
	Assignment		10	10%	d1
1	**Midterm Exam**	8	20	20%	a1,b1
2	**Practical exam**	12	30	30%	c1,c2,c3
3	**Final Exam**	16	50	50%	a1,b1
	Total	100		100%	

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IX. Learning Resources:	
1- Required Textbook(s)	
1-	Analytical Chemistry by Harris, D.C
2-	Fundamentals of Analytical Chemistry, Skoog,West and Holler, 7th Ed, Saunders College Publishing, 2000 (we prefer the latest edition)
2- Essential References.	
1-	Fundamentals of Analytical Chemistry by Skoog, D.A., West, D.M., Holler, F.J., and Crouch, S.R.
2-	Principles of Instrumental Analysis by Skoog, D.A., West, D.M., Holler, F.J., and Crouch, S.R.
3- Electronic Materials and Web Sites *etc*.	
1-	https://en.wikipedia.org/wiki/American_Chemical_Society
2-	https://www.rsb.org.uk/get-involved/biology-for-all/science-at-home/royal-society-of-chemistry
3-	https://en.wikipedia.org/wiki/Analytical_Chemistry_(journal)
4-	https://www.metallomics2017.at/support/special-issue-springer/
	https://www.sciencedirect.com/journal/talanta

XI. *Course Policies:*	
1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** -If the student dose not attend for more than 6 times, the student will be obligated to withdrew from the course
3	**Exam Attendance/Punctuality:**

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	No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration