هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification

(Bachelor)

Course Title:	General Chemistry 1
Course Code:	CHM1101
Program:	Chemistry
Department	Chemistry
College:	Science
Institution	Umm Al-Qura University
Version:	1
Last Revision Date:	Al-27 December 2024

Ministry Of Education-Umm Al-Qura University
Jameum University College-Chemistry Department

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A. General information about the course:

1. Course Identification

1. Credit hours: (2 Theoretical + 1 Experimental)					
2. Course type					
A.	☐University	☒ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (1/1)					
4. Course general Description:					
This course presents the essential principles and common applications of chemistry. It introduces the elementary principles and theories of chemistry, electronic structure of atoms, quantum mechanics and atomic orbitals; representations of orbitals, gases laws and properties, Intermolecular forces, liquids, solids, solutions, kinetics, equilibria, precipitation, thermodynamics, electrochemistry, organic chemistry					
5. Pre-requirements for this course (if any):--					
6. Pre-requirements for this course (if any):--					
7. Course Main Objective(s):					
The course introduces some basic principles of physical, organic and inorganic chemistry.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100 %
2	E-learning	-	
3	Hybrid • Traditional classroom • E-learning	-	
4	Distance learning	-	

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	

5.	**Others (specify)**	
Total		75

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	Explain fundamental concepts and principles of units, measurements, physical, inorganic and organic chemistry.	K1	Lectures Library visits	Exam
2.0	**Skills**			
2.1	Demonstrate the ability to use basic laboratory techniques, tools, to conduct experiments, collect data, and analyze results related to fundamental chemistry topics	S1	Laboratory	Practical Exam Lab Reports Quiz
2.2	Solve quantitative and qualitative problems related to chemical equations, thermochemical processes, and kinetics.	S2	Lectures Web-based study	Quiz. Exam. Class discussion
2.3	Analyze and interpret data related to chemical equilibria and electrochemical reactions.	S3	Lectures Scientific discussion Web-based study	Quiz. Exam. Class discussion
3.0	**Values, autonomy, and responsibility**			
3.1	Ability to demonstrate learning skills to work as a team in a multidisciplinary environment.	V1, V2	Scientific discussion	long and short essays posters lab manuals

C. Course Content

No	List of Topics	Contact Hours
1.	Electronic structure of atoms, quantum mechanics and atomic orbital	4
2.	Gases laws and properties	4
3.	Intermolecular forces, liquids, solids, solutions	4
4.	Chemical kinetics	4
5.	Chemical equilibria	4
6.	Thermodynamics,	4
7.	Electrochemistry,	4
8.	Organic chemistry	2
	List of Experiments	
1.	safety in chemistry laboratory	3
2.	intermolecular forces: viscosity, density, and surface tension	12
3.	atomic structure and quantum mechanics	3
4.	acids and bases titration	9
5.	determination of the heat capacity of the calorimeter	6
6.	solutions	6
7.	chemical equilibrium	6
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
	Class activities, and Assignments	Throughout the Term	10%
	Mid-Term Exam (s)	8	20%
	Lab Activity	Throughout the Term	20%
	Practical Exam	15	10%
5.	Final Exam.(2 hours exam)	End of the Term	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	Steven S. Zumdahl, Susan A. Zumdahl, 9th ed., 2009, New York.
Supportive References	P. Atkins and J. de Paula, Physical Chemistry, 10th ed., 2006, New York.
Electronic Materials	Power point lectures.
Other Learning Materials	Course available online

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	The classroom is equipped with computer and projector.
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	Indirect: course evaluation and graduates survey).
Effectiveness of students' assessment	Department	Improving course quality and effectiveness.
Quality of learning resources	Students	Direct: (feedback from faculty). Indirect (online survey at the end of the semester
The extent to which CLOs have been achieved	Faculty members	Direct:(Comments of course instructors regarding evaluation of teaching strategies for learning outcomes mentioned in course report).
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-151

Program Specification

(Bachelor)

Program:	**Chemistry**
Program Code (as per Saudi university ranking):	053101
Qualification Level:	6
Department:	**Chemistry**
College:	**Sciences**
Institution:	**Umm Al-Qura University**
Program Specification:	New ☐ updated* ☒
Last Review Date:	23/7/1446

*Attach the previous version of the Program Specification.

Table of Contents

A. Program Identification and General Information

1. Program's Main Location :

Main campus / Al-Abdiyyah, Makkah / Male Students

Main campus / Al-Zaher, Makkah / Female Students

2. Branches Offering the Program (if any):

- Jamoum University College
- Al-Lith University College
- Al-Qunfudhah University College

3. Partnerships with other parties (if any) and the nature of each:

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4. Professions/jobs for which students are qualified

- Chemical technician in educational and industrial organizations
- Chemist specializing in toxicology, quality management, and health laboratories
- Chemistry teacher
- Water quality chemist
- Analytical chemist
- Synthetic chemist
- Quality control chemist
- Petroleum chemist
- Forensic scientist
- Hazardous waste chemist
- Chemist in petrochemical industries
- Materials scientist
- Chemical engineer
- Chemist in pharmaceutical industries
- Chemist in food industries
- Educators for pre-university education at the Ministry of Education (elementary, middle, and high schools
- Academic staff and/or administrators.

5. Relevant occupational/ Professional sectors:

- Educational and industrial organizations
- Quality management
- Teaching
- Pharmaceutical Companies
- Analytical Chemistry Sectors
- Forensic Sector
- Petrochemical industries
- Toxicology units
- Chemical engineering laboratories
- Organic and Inorganic Chemistry
- Food Technology companies
- Environmental Units

6. Major Tracks/Pathways (if any):

Major track/pathway		Credit hours (For each track)	Professions/jobs (For each track)
1.	Chemistry	140	• Chemical technician in educational organizations • Chemist specializing in toxicology and health laboratories • Chemistry teacher • Water quality chemist • Analytical chemist • Synthetic chemist • Quality control chemist • Petroleum chemist • Forensic scientist • Hazardous waste chemist • Chemist in petrochemical industries • Materials scientist • Chemist in pharmaceutical industries • Educators for pre-university education at the Ministry of Education (elementary, middle, and high schools) • Academic staff and/or administrators.

2. Chemical analysis and quality measurements	140	• Chemical technician in industrial organizations • Chemist specializing in toxicology, quality management, and health laboratories • ▪ Water quality chemist • Petroleum chemist • Forensic scientist • Hazardous waste chemist • Chemist in petrochemical industries • Chemist in pharmaceutical industries • ▪ Chemists in food industries
3.		
...		

7. Exit Points/Awarded Degree (if any):

exit points/awarded degree	Credit hours
1. Diploma in Chemistry	28
2. Higher Diploma in Chemistry	68

8. Total credit hours: 140

B. Mission, Objectives, and Program Learning Outcomes

1. Program Mission:

The program educates and trains undergraduate students to become skilled scientists and researchers. It focuses on innovative research and solving real-world scientific and industrial challenges. The program supports Saudi Arabia's development goals by fostering education, research, and community impact.

2. Program Goals:

- Prepare cognitive, professional, and distinguished chemists by providing them with high quality courses.
- Provide the society with skilled graduates who are dedicated to the betterment of teaching, research, and community engagement.
- Build appropriate infrastructure to achieve well-rounded quality education and distinct scientific research.
- Develop student and faculty staff involvement in local and national professional activities to contribute in the service of society and its developments
- Strengthen scientific partnerships with advanced research centers.

3. Program Learning Outcomes*

Chemistry Track	
Knowledge and Understanding	
K1	The graduate will have broad knowledge and understanding of the underlying theories, principles, and concepts in one or more disciplines in chemistry fields
K2	The graduate will have knowledge and understanding of processes, materials, techniques, practices, conventions and/or chemical terminology
Skills	
S1	Students will be able to use and adapt chemical processes, techniques, tools, instruments, and/or materials to deal with various complex practical activities.
S2	Students will be able to apply broad theories, principles, and concepts in various contexts, in chemistry

S3	Students will be able solve complex problems in various contexts related to chemistry and overlapped disciplines quantitatively and qualitatively
Values, Autonomy, and Responsibility	
V1	Students will demonstrate commitment to professional and academic values, and ethics in the field of chemistry.
V2	Students will be able to demonstrate learning skills to work as a team in a multidisciplinary environment.

* Add a table for each track or exit Point (if any)

3. Program Learning Outcomes*	
Chemical analysis and quality measurements	
Knowledge and Understanding	
K1	The graduate will have broad knowledge and understanding of the underlying theories, principles, and concepts in one or more disciplines in chemistry fields
K2	The graduate will have knowledge and understanding of processes, materials, techniques, practices, conventions and/or chemical terminology
Skills	
S1	Students will be able to use and adapt chemical processes, techniques, tools, instruments, and/or materials to deal with various complex practical activities.
S2	Students will be able apply broad theories, principles, and concepts in various contexts, in chemistry
S3	Students will be able solve complex problems in various contexts related to chemistry and overlapped disciplines quantitatively and qualitatively
Values, Autonomy, and Responsibility	
V1	Students will demonstrate commitment to professional and academic values, and ethics in the field of chemistry.
V2	Students will be able to demonstrate learning skills to work as a team in a multidisciplinary environment.

C. Curriculum

1. Curriculum Structure

1.1. Chemistry Track

Program Structure	Required/ Elective	No. of courses	Credit Hours	Percentage
Institution Requirements	Required	9	18	12.9
	Elective	1	2	1.4
College Requirements	Required	6	18	12.9
	Elective	---	---	---
Program Requirements	Required	36	91	65

	Elective	1	2	1.4
Capstone Course/Project		1	3	2.1
Field Training/ Internship		1	6	4.3
Residency year		---	---	---
Others		---	---	---
Total		55	140	100

1.2. Chemical Analysis and Quality Measurements Track

Program Structure	Required/ Elective	No. of courses	Credit Hours	Percentage
Institution Requirements	Required	9	18	12.9
	Elective	1	2	1.4
College Requirements	Required	6	18	12.9
	Elective	---	---	---
Program Requirements	Required	36	91	65
	Elective	1	2	1.4
Capstone Course/Project		1	3	2.1
Field Training/ Internship		1	6	4.3
Residency year		---	---	---
Others		---	---	---
Total		55	140	100

* Add a separated table for each track (if any).

2. Program Courses

2.1. Chemistry Track

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours	Type of requirements (Institution, College, or Program)
Level 1	QR1101	Holy Quraan Tajweed	Required	---	2	Institution
	IND1101	Design Thinking	Required	---	2	Institution
	ELIN1301	English Language 1	Required	---	3	Institution
	CHM1101	General Chemistry 1	Required	---	3	College
	MTH1101	Calculus 1	Required	---	3	College
	CHM1102	Techniques in Chemical Laboratories	Required	---	2	Department
	CHM1201	Principles of Analytical Chemistry	Required	---	3	Department
Level	QR2102	Holy Quraan Memorization 1	Required	---	2	Institution

2	CUR1101	University Skills	Required	---	0	Institution
	ELIN1302	English Language 2	Required	---	3	Institution
	BIO1101	General Biology	Required	---	3	College
	PHY1101	General Physics 1	Required	---	3	College
	MTH1121	Calculus 2	Required	MTH1101	3	Program
	CHM1103	General Chemistry 2	Required	CHM1101	3	Department
	CHM1202	Volumetric and Gravimetric Analysis	Required	CHM1201	3	Department
Level 3	QR2103	Holy Quraan Memorization 2	Required	---	2	Institution
	AI2001	Introduction to Artificial Intelligence	Required	---	2	Institution
	MTH2122	Multivariable calculus	Required	MTH1121	2	Program
	PHYS3304	Electricity and Magnetism for Chemists	Required	PHY1101	3	Program
	CHM2502	Thermodynamics	Required	CHM1101 MTH1101	3	Department
	CHM2401	Chemistry of Aliphatic Compounds	Required	CHM1101	3	Department
	CHM2301	Chemistry of Main Group Elements	Required	CHM1103	2	Department
	CHM2501	Solutions Chemistry and kinetic theory of gases	Required	CHM1202	1	Department
Level 4	QR3104	Completion of the Holy Quran	Required	---	2	Institution
	ICC1201	Values and Ethics	Required	---	2	Institution
	MTH2123	Introduction to Differential Equations	Required	MTH2122	3	Program
	CHM2503	Chemical Kinetics	Required	CHM2502	3	Department
	PHYS4506	Quantum Physics for Chemists	Required	MTH2122	2	Program
	CHM2203	Spectrophotometric and Electroanalytical Methods	Required	CHM1202	3	Department
	CHM2402	Aromatic and Heterocyclic Chemistry	Required	CHM2401	3	Department
	CHM2302	Chemistry of the Transition Elements	Required	CHM2301	2	Department
Level 5		Elective 1	Elective	---	2	Institution
	ICC4202	The Family in Islam	Required	---	2	Institution
	CHM3303	Coordination Chemistry	Required	CHM2302	3	Department

	CHM3504	Colloids and Phase Rule	Required	CHM2503	1	Department
	CHM3505	Electrochemistry	Required	CHM2501	3	Department
	CS3021	Introduction to Computer Programing	Required		3	Program
	CHM3403	Organic Reactions and Preparations	Required	CHM2402	3	Department
	CHM3404	Physical Organic and Stereochemistry	Required	CHM2402	2	Department
Level 6	CHM3304	Solid State Chemistry	Required	CHM2302	2	Department
	CHM3506	Surface Chemistry and Catalysis	Required	CHM3504	3	Department
	CHM3204	Separation Methods and Thermal Analysis	Required	CHM2203	3	Department
	CHM3205	Principles of Environmental Chemistry	Required	CHM2203	2	Department
	CHM3507	Quantum Chemistry	Required	CHM1103 MTH2123	2	Department
	CHM3405	Organic Spectroscopy	Required	CHM3403	2	Department
	CHM3406	Petroleum and Petrochemicals	Required	CHM2402	3	Department
	CHM3305	Organometallic Chemistry	Required	CHM3304	2	Department
Level 7	CHM4601	Cooperative Training	Required	CHM3204	6	Department
Level 8	BUS1099	Professional Development Skills	Required		2	Institution
	CHM4602	Graduation Project	Required	CHM4601	3	Department
		Chemistry Elective 1	Elective	CHM3506 CHM3205	2	Department
	CHM4508	Materials Chemistry	Required	CHM3506	2	Department
	CHM4509	Spectroscopy Molecular	Required	CHM3507	2	Department
	CHM4407	Bioorganic Chemistry	Required	CHM3405	2	Department
	CHM4408	Polymer Chemistry	Required	CHM3406	3	Department
	CHM4409	**Chemistry of Natural Products**	**Required**	**CHM3405**	**2**	**Department**
	CHM4306	Reaction Inorganic Mechanism and Spectra	Required	CHM3305	2	Department

2.2. Chemical analysis and quality measurements Track

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours	Type of requirements (Institution, College, or Program)
Level 1	QR1101	Holy Quraan Tajweed	Required	---	2	Institution
	IND1101	Design Thinking	Required	---	2	Institution
	ELIN1301	English Language 1	Required	---	3	Institution
	CHM1101	General Chemistry 1	Required	---	3	College
	MTH1101	Calculus 1	Required	---	3	College
	CHM1102	Techniques in Chemical Laboratories	Required	---	2	Department
	CHM1201	Principles of Analytical Chemistry	Required	---	3	Department
Level 2	QR2102	Holy Quraan Memorization 1	Required	---	2	Institution
	CUR1101	University Skills	Required	---	0	Institution
	ELIN1302	English Language 2	Required	---	3	Institution
	BIO1101	General Biology	Required	---	3	College
	PHY1101	General Physics 1	Required	---	3	College
	MTH1121	Calculus 2	Required	MTH1101	3	Program
	CHM1103	General Chemistry 2	Required	CHM1101	3	Department
	CHM1202	Volumetric and Gravimetric Analysis	Required	CHM1201	3	Department
Level 3	QR2103	Holy Quraan Memorization 2	Required	---	2	Institution
	AI2001	Introduction to Artificial Intelligence	Required	---	2	Institution
	MTH2122	Multivariable calculus	Required	MTH1121	2	Program
	PHYS3304	Electricity and Magnetism for Chemists	Required	PHY1101	3	Program
	CHM2502	Thermodynamics	Required	CHM1101 MTH1101	3	Department
	CHM2401	Chemistry of Aliphatic Compounds	Required	CHM1101	3	Department
	CHM2301	Chemistry of Main Group Elements	Required	CHM1103	2	Department
	CHM2501	Solutions Chemistry and kinetic theory of gases	Required	CHM1202	1	Department
Level	QR3104	Completion of the Holy Quran	Required	---	2	Institution

4	ICC1201	Values and Ethics	Required	---	2	Institution
	MTH2123	Introduction to Differential Equations	Required	MTH2122	3	Program
	CHM2503	Chemical Kinetics	Required	CHM2502	3	Department
	PHYS4506	Quantum Physics for Chemists	Required	MTH2122	2	Program
	CHM2203	Spectrophotometric and Electroanalytical Methods	Required	CHM1202	3	Department
	CHM2402	Aromatic and Heterocyclic Chemistry	Required	CHM2401	3	Department
	CHM2302	Chemistry of the Transition Elements	Required	CHM2301	2	Department
Level 5		Elective 1	Elective	---	2	Institution
	ICC4202	The Family in Islam	Required	---	2	Institution
	CHM3303	Coordination Chemistry	Required	CHM2302	3	Department
	CHM3504	Colloids and Phase Rule	Required	CHM2503	1	Department
	CHM3505	Electrochemistry	Required	CHM2501	3	Department
	CS3021	Introduction to Computer Programing	Required		3	Program
	CHM3403	Organic Reactions and Preparations	Required	CHM2402	3	Department
	CHM3404	Physical Organic and Stereochemistry	Required	CHM2402	2	Department
Level 6	CHM3304	Solid State Chemistry	Required	CHM2302	2	Department
	CHM3204	Separation Methods and Thermal Analysis	Required	CHM2203	3	Department
	CHM3506	Surface Chemistry and Catalysis	Required	CHM3504	3	Department
	CHM3410	Organic Spectroscopy	Required	CHM3403	3	Department
	CHM3206	Industrial Analysis and Quality Control	Required	CHM2203	3	Department
	CHM3207	Bioanalytical Chemistry	Required	CHM2203	3	Department
	CHM3208	Food Analysis	Required	CHM2203	3	Department
Level 7	CHM4601	Cooperative Training	Required	CHM3204	6	Department
Level 8	BUS1099	Professional Development Skills	Required		2	Institution
	CHM4602	Graduation Project	Required	CHM4601	3	Department

	CHM4209	Chemistry Elective 1	Elective	CHM3205	2	Department
	CHM4512	Quantum Chemistry and Molecular Spectroscopy	Required	MTH2123 PHYS2506	2	Department
	CHM4411	Petroleum Chemistry and Quality Standards	Required	CHM3405	3	Department
	CHM4210	Air and Soil Analysis	Required	CHM3208	3	Department
	CHM4216	Environmental Chemistry	Required	CHM3207	2	Department
	CHM4211	Forensic Chemistry	Required	CHM3205	3	Department

* Include additional levels (for three semesters option or if needed).
** Add a table for the courses of each track (if any)

3. Course Specifications:

Insert hyperlink for all course specifications using NCAAA template (T-104)

https://uquadmin-my.sharepoint.com/:f:/g/personal/chmscimm_uqu_edu_sa/Eqn7oenUkwFLnUIY8hD0YcUBL-QcXgLjL3hXNs_ZOxtQFA?e=mvUzDK

4. Program learning Outcomes Mapping Matrix:

Align the program learning outcomes with program courses, according to the following desired levels of performance *(I = Introduced & P = Practiced & M = Mastered).*

Course code & No.	**Program Learning Outcomes**-Chemistry						
	Knowledge and understanding		**Skills**			**Values, Autonomy, and Responsibility**	
	K1	K2	S1	S2	S3	V1	V2
CHM1101	I		I	I	I	I	I
CHM1102	I	I	I	I			I
CHM1202	I		I	I		I	P
CHM1103	I		I	I	I	I	p
CHM1202	I	I	I	I	I	I	P
CHM2502	I	I	I	I	I	I	I
CHM2401	I	I	I	I	I	I	I
CHM2301	I	I		I	I	p	I
CHM2501	M	I		P		I	
CHM2503	I	I	P	I	I	P	P
CHM2203	I	I	P	P	P	P	I
CHM2402	I	P	P	P	P	P	P
CHM2302	I	p		p	p	p	M
CHM3303	M	M	M	M	M	P	P
CHM3504	I	I		I	P	I	P
CHM3505	I	I	I	I	P	I	P

CHM3403	P	P	P	P	P	P	P
CHM3404	M	M		M	M	P	P
CHM3304	P	P		P	P	P	P
CHM3506	M	M	M	M		M	
CHM3204	M	M	M	M	M	M	M
CHM3205	M	M	M	M		M	M
CHM3507	I	I		P	P	I	I
CHM3405	M	M	M	M	M	P	P
CHM3406	P	P	P	P	P		P
CHM3305	p	p	P	p	p	p	
CHM4508	P	P		P	P	P	
CHM4509	M	M		M	M	M	
CHM3407	P	M	M		M	M	M
CHM4407	p	p		p	p	p	P
CHM3306	I	I		I	P	I	P
CHM3206	M	M		M	M	M	M
CHM4510	P	M		M	M	M	M
CHM4511	p	p		p	p	p	P
CHM4407	M	P		M	M	M	M
CHM4408	P	M	M		M	M	M
CHM4409	p	p		p	p	p	P

Course code & No.	**Program Learning Outcomes- Chemical analysis and quality measurements**						
	Knowledge and understanding		**Skills**			**Values, Autonomy, and Responsibility**	
	K1	**K2**	**S1**	**S2**	**S3**	**V1**	**V2**
CHM1101	I		I	I	I	I	I
CHM1102	I	I	I	I			I
CHM1202	I		I	I		I	P
CHM1103	I		I	I	I	I	p
CHM1202	I	I	I	I	I	I	P
CHM2502	I	I	I	I	I	I	I
CHM2401	I	I	I	I	I	I	I
CHM2301	I	I		I	I	p	I
CHM2501	M	I		P		I	
CHM2503	I	I	P	I	I	P	P
CHM2203	I	I	P	P	P	P	I
CHM2402	I	P	P	P	P	P	P
CHM2302	I	p		p	p	p	M
CHM3303	M	M	M	M	M	P	P
CHM3504	I	I		I	P	I	P
CHM3505	I	I	I	I	P	I	P

CHM3403	M	M	M	M	M	P	P
CHM3404	M	M		M	M	P	P
CHM3304	P	P		P	P	P	P
CHM3204	M	M	M	M	M	M	M
CHM3506	M	M	M	M		M	
CHM3405	M	M	M	M	M	P	P
CHM3207	I	M	M	P	P	M	P
CHM3205	M	M	M	M		M	M
CHM3208	M	M		M		M	M
CHM3206	P	M	M	P	P	P	P
CHM4512	M	M		M	M	M	M
CHM4410	P	P	P	P		P	
CHM4411	P	M	M	P	P	P	P
CHM4210	P	M	M	P	P	P	P
CHM4211	M	M		M	M	P	M
CHM4212	P	P		P	P	P	P
CHM4213	P	P		P		P	P
CHM4214	M	M		M	P	P	M
CHM4215	P	P		P	P	P	M
CHM4216	P	P		P		P	P

* Add a separated table for each track (if any).

5. Teaching and learning strategies applied to achieve program learning outcomes.

Describe teaching and learning strategies, including curricular and extra-curricular activities, to achieve the program learning outcomes in all areas.

The following is a comprehensive list of **teaching and learning strategies**, including **curricular activities**, suggested to achieve a scientific program's learning outcomes across **all domains** (Knowledge, skills, and values).

1. Knowledge and Thinking Skills

Traditional Lecture Strategies:

1-Problem-Based Learning (PBL): during delivering lectures faculty encourages critical thinking and application of knowledge. A Case studies on real-world scientific challenges also could be a strategy.

2-Flipped Classroom: Assign readings/videos before class; use in-class time for active problem-solving and group work.

3-**Simulation-Based Learning:** for example using virtual labs or simulations to understand complex processes like ……….

4-Collaborative Projects: by choosing a topic in the lecture content

Research Assignments: as Literature reviews or small-scale research projects.

5-Inquiry-Based Learning: Students generate hypotheses, design experiments, and analyze results.

Lab-Based Learning: Conducting experiments in chemistry labs to develop technical skills. In addition to **Competency-Based Assessments:** such as demonstrate skills, such as pipetting, microscopy, or operating advanced instruments (e.g., spectrophotometer, NMR potentiostat and IR).

Capstone Projects: Designing and implementing a chemical prototype is a curricular activity that aligns with all domains of the chemistry program, integrating theoretical knowledge with practical applications

in areas such as chemical synthesis, material science, analytical techniques, and industrial processes. This activity fosters students' understanding of chemical principles while enhancing their skills in research, experimentation, and real-world problem-solving.
Integrated Courses with Experiential Learning: for example, a course on sustainability that combines lectures (cognitive), lab-based work (practical), and community engagement.

In addition to some **extra-curricular activities** that align with achieving learning outcomes for a scientific program:

1. Research-Oriented Activities

- **Student Research Symposiums:** Presenting findings from independent or group research projects.
- **Laboratory Assistantships:** Supporting faculty-led experiments to develop technical lab skills.
- **Field Studies and Expeditions:** Conducting field research in ecology, geology, or environmental science.
- **Hackathons or Dataphones:** Applying data science or computational skills to solve scientific problems.

2. Science Communication and Outreach

- **Science Fairs or Exhibitions:** Designing exhibits to explain scientific concepts to diverse audiences.
- **Professional Development Opportunities such as in Internships:** Gaining real-world experience through placements in research labs, biotech companies, or governmental agencies.
- **Workshops and Certification Programs:** Completing specialized training in Chemoinformatics Software like . ChemDraw, Chem3D, Avogadro, Origin……

3. Collaborative and Interdisciplinary Activities

- **Science Clubs or Societies:** Engaging in team-based projects
  Students participate in collaborative activities like interdisciplinary research projects Students can participate in collaborative activities like interdisciplinary research projects, where they work alongside peers from fields such as biology, physics, or environmental science to solve real-world problems. They can also engage in team-based lab experiments, integrating chemistry with other scientific domains. These activities foster teamwork, cross-disciplinary knowledge, and problem-solving skills. to solve real-world problems. They can also engage in team-based lab experiments, integrating chemistry with other scientific domains. These activities foster teamwork, cross-disciplinary knowledge, and problem-solving skills.

6. Assessment Methods for program learning outcomes.

Describe assessment methods (Direct and Indirect) that can be used to measure the achievement of program learning outcomes in all areas.

The program should devise a plan for assessing Program Learning Outcomes (all learning outcomes should be assessed at least twice in the bachelor program’s cycle and once in other degrees).

Assessment strategies in the chemistry program reflect the learning outcomes of the program and make a positive contribution to the student's learning experience.
Assessment is both:

- Formative (in which the goal is usually to enhance student learning by providing ongoing feedback)
- Summative (in which the goal is normally to evaluate student learning at the end of a learning process by making an academic judgment against a standard).

Feedback on all assessment activities is essential for student development and progression. Methods of assessment reflect progression within the study plan, focusing on both knowledge

and skills and enabling students to demonstrate their level of attainment of knowledge, skills and values.
The use of diverse assessment strategies meets the varied needs of students and provides the opportunity to incorporate innovative and original approaches.
The assessment strategies adopted include individual and group work approaches, including:

- Examinations
- Written and practical tests
- Active participation of students within their group
- Project production
- Discussion sessions
- Report and research
- Answers through discussion in Blackboard (online)
- Achievement file

- Students will submit laboratory reports where they have engaged in the various processes of chemistry science demonstrating these qualities, along with comments/grades from their instructor.
- Students will submit answers to exam questions or papers demonstrating their knowledge of major theories.

D. Student Admission and Support:

1. Student Admission Requirements

All information about Student Admission Requirements are available in the UQU website in the following link: https://uqu.edu.sa/App/Admission
The guide for admission could be found here:
https://drive.uqu.edu.sa/_/dadregis/files/46/1/Q/QR46N.pdf

2. Guidance and Orientation Programs for New Students

(Include only the exceptional needs offered to the students of the program that differ from those provided at the institutional level).

No exceptional needs offered to the students of the program

3. Student Counseling Services

(Academic, professional, psychological and social)
(Include only the exceptional needs offered to the students of the program that differ from those provided at the institutional level).

No exceptional needs offered to the students of the program

4. Special Support

(Low achievers, disabled, gifted, and talented students).

Here are examples of special support provided to low-achieving students

. Academic Support:

- Extra sessions focusing on foundational concepts (e.g., basic mathematics for physics, essential chemistry principles and this could be done by the faculty member during office hours.
- Offering short, intensive courses using blackboard before the semester to reinforce prerequisite knowledge.

Technical and Practical Skill Support :

- Extended Lab Hours: Allowing additional time in labs for students to practice skills.
- Small-group workshops to reinforce hands-on techniques under direct faculty or lab technician supervision.

Cognitive Skill Development

- Using Concept Simplification Tools: such as using animations, videos, and interactive apps to explain abstract or difficult scientific concepts.

Use of Technology and Resources: Providing low achievers access to recorded lectures, quizzes, and additional practice materials. Also, E-Learning Modules: Creating self-guided modules on foundational topics that students can revisit anytime.
Extracurricular and Motivational Support: by engagement in Science Clubs or Activities. Thus, Encouraging participation in non-competitive, hands-on activities
Guest Lectures or Career Talks: Inviting professionals to inspire low achievers by connecting classroom learning to real-world applications.

An institutional support for People with Special Needs is acting in UQU via " Ghaly Department for special needs students" the link here of this department in the deanship of student's affairs.:
https://uqu.edu.sa/studaff/119197
Examples of services for this category of students including;

- Issuing care entry licenses.
- Allotting seats for them in the transportation mean of the students.
- Allotting toilets for them at all buildings of the university
- Allotting seats and tables for them in all study halls
- Allotting lounges for them in all colleges. Such lounges must fit their needs and include seats, tables and drinking water;
- Giving care to their study schedules and taking to consideration the closeness of the classrooms in this regard
- Introducing the students' clubs to them along with the students' activities and prepare them in such manner that fits their special needs.

E. Faculty and Administrative Staff:

1. Needed Teaching and Administrative Staff

Academic Rank	Specialty		Special Requirements / Skills (if any)	Required Numbers		
	General	Specific		M	F	T
Professor	Chemistry	Organic chemistry	Well-established in their specialization area through: - High quality publications	6	3	9
	Chemistry	Inorganic chemistry		1	1	2
	Chemistry	Analytical chemistry		---	1	2

	Chemistry	Physical chemistry	- Well renowned in their area of specialty. - Experienced in teaching and advising graduate students.	6	6	12
Associate Professor	Chemistry	Organic chemistry		2	5	7
	Chemistry	Inorganic chemistry		--	2	2
	Chemistry	Analytical chemistry		5	2	7
	Chemistry	Physical chemistry		2	4	6
Assistant Professor	Chemistry	Organic chemistry		5	5	10
	Chemistry	Inorganic chemistry		--	1	1
	Chemistry	Analytical chemistry		1	3	4
	Chemistry	Physical chemistry		2	5	7
Lecturer	Chemistry	Organic chemistry	--	--	3	3
	Chemistry	Analytical chemistry	--	--	2	2
Teaching Assistant	Chemistry	Chemistry	- Excellent academic record - Approved skills and experience in supporting practical sessions.	7	6	13
Technicians and Laboratory Assistant	Chemistry	Chemistry	- Skills in preparation of lab experiment requirement such as standard solutions, buffers... - Ability to run laboratory inventor. - Maintain safe practice and	6	8	14

			skills in handling chemicals.			
Administrative and Supportive Staff	--	--	--	1	1	2
Others (specify)	--	--	--	--	--	--

F. Learning Resources, Facilities, and Equipment:

1. Learning Resources

Learning resources required by the Program (textbooks, references, and e-learning resources and web-based resources, etc.)

- Assigning textbooks through a committee after reviewing the appropriateness of the material by concerned faculty and approval in the departmental and higher academic councils
- Writing laboratory manuals and some other textbooks by faculty and reviewing them proficiently before approval
- Uploading courses on the web via blackboard platform
- Analysis of students' questionnaires
- Analysis of students' results and course reports of the last semesters.
- Writing the action plan of the course by course-coordinator
- Committees for inspecting the current textbook and comparing it to the most recent textbooks in the field.

The new book selected will be approved by departmental and higher academic councils in the university

2. Facilities and Equipment

(Library, laboratories, classrooms, etc.)

- All the faculty members are asked through the heads of their departments to submit the learning resource requirements (books, software, lab equipment/instrument) required for optimum course delivery, as well as for their research.
- Curriculum development committees collect all pertinent requirements, while lab equipment/reagents are dealt with by the Committee for labs.
- The specifications are discussed and approved by the committee and are recommended to the College Council.
- Demands for required text and reference books for courses is forwarded to the Deanship of library affairs for purchase and provision in the library.

The laboratory and classroom resources are forwarded to the purchasing Department of the University.

3. Procedures to ensure a healthy and safe learning environment

(According to the nature of the program)

The college of science provides Secure and safe environment for faculty, students, and other supporting staff that ensure appropriate teaching and learning environment as follows:

1. All laboratories are provided with laboratories' safety manual and safety instruction posters.
2. College of applied science maintains first aid boxes, which are available almost in all working places and laboratories.

3.Laboratories and other facilities are equipped with fire distinguisher, fire exit doors, fume hoods, eyewash and shower stations when needed.
4. Security personnel perform routine checks and workplace inspections to ensure that the work environment is safe and secure.
5. Laboratories are access controlled; all laboratories are kept close when not engaged in teaching or research activities.
7. College of Science building is equipped with an Emergency Evacuation Alarm System that is kept active and maintained.
8. In conjunction with Human Resources, UQU has a team of dedicated First Aid Officers able to respond to any first aid event, critical incident, or medical emergency.
In addition, at the beginning of each semester the department offers a general lecture delivered by a teaching staff member about the lab, safety and healthy environment.

A complete description of arrangements to maintain a healthy and safe environment was included in the safety guide of the program:

(https://uquadminmy.sharepoint.com/:f:/g/personal/uqu_qad_uqu_edu_sa/EmEFbH2D4VVCrK9qrGvKJQcBQO-1q61jUg5BkfMYE6RuaQ?e=Dk8ij6)

G. Program Quality Measurements:

1. Program Quality Measurements System

Provide a link to quality measurements manual.

https://uquadmin-my.sharepoint.com/:f:/g/personal/uqu_qad_uqu_edu_sa/EuU50oiV-C5HljXB6dynmnEBXi8SciUfJGSlKsvCQLagjA?e=gdHEKE

2. Procedures to Monitor Quality of Courses Taught by other Departments

The program communicates its needs to the other programs at the Faculty of Science to ensure that the course coverage fulfils the requirements of the program. The courses contents are reviewed and approved by Curriculum Committee which is responsible for ensuring the integration of courses content to match with the final program outcomes and ensure the compliance to the requisites

3. Procedures Used to Ensure the Consistency between Main Campus and Branches (including male and female sections).

A scheduled meeting was held online via Webex and all the following recommendations were taken into considerations:

1. All branches should participate in the unified departmental committees involve male and female members with defined tasks and responsibilities.
2. All branches' members are involved in planning, delivering and managing the program.
3. Teaching strategies and assessment methods are unified for all branches:

a- The course content for all branches is unified and identical to that described in the course specification.

b- Course content (syllabus) is offered to students at the beginning of every semester on the university website under supervision of the unified curriculum committee.

c- Course coordinator, with the help offered by course instructors, takes responsibilities to organize and manage the course delivery.

d- Frequent communications between course coordinators and instructors ensure that all students are equally treated and receive identical information and equal rights in all branches.

e- All exams for all courses in the program all branches subjected to same assessment methods.

g- Quality measurements committee prepares the annual program report which includes all information and outcomes of the program derived from both male and female sections.

4. Both male and female sections are represented equally in department council in each branch.

5. Equal sharing of resources in both male and female sections.

4. Assessment Plan for Program Learning Outcomes (PLOs),

1-The assessment of the PLO's will be done according to the PLO;s assessment Plan (https://uquadmin-my.sharepoint.com/:f:/g/personal/uqu_qad_uqu_edu_sa/Er3RflgMEMdDv0EKHTWJqSoBHUvIK2BX7laEeRTZ5PftZw?e=MstWy6) via:

- Direct: From Exams results
- Indirect: Course Evaluation Survey:

A Course Evaluation Survey is distributed to students at the end of the course. The survey includes questions about several aspects of each course. It is intended to provide a summary question that can be used as a general quality indicator.

2-Course Reports:

At the end of each semester or year in which a course is taught the instructor should prepare and submit a summary report to the program coordinator. This should be attached to a copy of the course specification and CLO's assessment results, included in a subject file or portfolio, and used for consideration in the program review.

3-Annual Program Reports:

A program report should be prepared at the end of each year after consideration of course reports and other information about the delivery of the program. The report should be based on the program specification and PLO's assessment plan results, describes what happened in the program compared with that was intended to happen, reports on its quality, and indicates any changes that should be made for future delivery because of experience in the year concerned.

4. Program Evaluation Matrix

Evaluation Areas/Aspects	Evaluation Sources/References	Evaluation Methods	Evaluation Time
Attainment of the program's educational objectives and outcomes	Employers, advisory committee and/or other stakeholders	Surveys	Every year

Evaluation Areas/Aspects	Evaluation Sources/References	Evaluation Methods	Evaluation Time
Program evaluation	Independent evaluators	On-site course revision Inspection of classrooms, labs and equipment Interviews with faculty, staff and students	At 5 years intervals
Program and learning experience	Current students	Surveys	Each semester
Effectiveness of teaching	Students and program leaders	- Online survey at the end of the semester (Program survey, Experience survey &course evaluation) and graduates survey.	End of each semester.
Program Learning Outcomes	Faculty and Committee of PLO's Assessment	Direct by PLO's assessment Plan	End of each semester.
Quality of learning resources	Students and faculty members	- Feedback from students and faculty members. - Online surveys (Program survey, Experience survey & course evaluation) and graduates survey.	Annual (Faculty) Students (End of each semester)
Facilities and Equipment	Students and faculty members	Feedback from students and faculty members. - Online surveys (Program survey, Experience survey & course evaluation) and graduates survey.	Annual (Faculty) Students (End of each semester)
Student Admission and support	Students	Feedback from students. - Online surveys (Program survey, Experience survey & course evaluation) and graduates survey.	End of each semester.

Evaluation Areas/Aspects (e.g., leadership, effectiveness of teaching & assessment, learning resources, services, partnerships, etc.)
Evaluation Sources (students, graduates, alumni, faculty, program leaders, administrative staff, employers, independent reviewers, and others.
Evaluation Methods (e.g., Surveys, interviews, visits, etc.)
Evaluation Time (e.g., beginning of semesters, end of the academic year, etc.)

6. Program KPIs*

The period to achieve the target (one) year(s).

No.	KPIs Code	KPIs	Targeted Level	Measurement Methods	Measurement Time
1	KPI-P-01	Students' Evaluation of quality of learning experience in the program	4.5	Surveys	End of academic year
2	KPI-P-02	Students' evaluation of the quality of the courses	4.5	Surveys	End of academic year
3	KPI-P-03	Completion rate	>70%	Program report	End of academic year
4	KPI-P-04	First-year students retention rate	60%	Program report	Beginning of semesters and end of academic year
5	KPI-P-05	Students' performance in the professional and/or national examinations	60%	Program report	End of academic year
6	KPI-P-06	Graduates' employability and enrolment in postgraduate programs	30%	Program report	End of academic year
7	KPI-P-07	Employers' evaluation of the program graduate's proficiency	4	Surveys	End of academic year
8	KPI-P-08	Ratio of students to teaching staff	15/1	Program report	Beginning of semesters

No.	KPIs Code	KPIs	Targeted Level	Measurement Methods	Measurement Time
9	KPI-P-09	Percentage of publications of faculty members	100%	Scientific research report	End of academic year
10	KPI-P-10	Rate of published research per faculty member	3	Scientific research report	End of academic year
11	KPI-P-11	Citations rate in refereed journals per faculty member	4:1	Scientific research report	End of academic year

* including KPIs required by NCAAA

H. Specification Approval Data:

Council / Committee	
Reference No.	
Date	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Electricity and magnetism for chemists
Course Code:	PHYS3304
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	47
Last Revision Date:	12/1/2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (Level 1)					
4. Course General Description:					
This course will provide a conceptual background in physics of electricy and magnetism. It covers the following: Electric charge, electric fields, superposition, Gauss' Law, surface integrals, electric flux, the electric potential, simple circuits, Ohm's Law, and capacitors, Magnetic Fields, Magnetic Fields due to Currents, Maxwell's equation.					
5. Pre-requirements for this course (if any)**:**					
General Physics PHYS1101					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

After completing this course students should be able to deal with the following concepts:

1. properties of the electric charge
2. Electric field
3. Electric potential
4. Electric flux through a surface.
5. Electric current, resistors, batteries, and capacitors, Ohm's Law, Kirchhoff's laws, and RC charging and decay circuits.
6. Magnetic field
7. In addition to these items, the students should gain practical skills through performing some experiments.In addition to these items, the students should gain practical skills through performing some experiments.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%

No	Mode of Instruction	Contact Hours	Percentage
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		75

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	Define the concepts of electricity such as electric charge, Coulomb law, Electric field, Electric potential, Electric flux through a surface..	K1	Lectures and lab experiments	Exams, Homework and Quizzes
1.2	Explain the phenomenon of electromagnetic induction.	K2		
...				

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Relate DC current variables to AC current variables	S1	Lectures and lab experiments	Exams, Homework and Quizzes
2.2	Calculate the magnetic field.	S2		
2.3	Analyze electric circuit theoretically and experimentally	S3		
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively individually or within a team	V1	• Lectures and lab experiments	Exams, Homework and • Quizzes
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Coulomb's Law • Electric Charge, Coulomb's Law.	2
2.	Electric Fields • The Electric Field, Electric field lines, Electric Field Due to a Charged particle, Electric Dipole, The Electric Field Due to an Electric Dipole.	4
3.	Gauss' Law • Flux of an Electric Field, Gauss' Law, Applying Gauss' Law	2
4.	Electric Potential • Electric Potential, Electric Potential Energy, Equipotential surfaces, Calculating the potential from the field, Potential Due to a Point Charge, Potential Due to a Continuous Charge Distribution.	4
5.	Capacitance • Capacitors, Capacitance, Calculating the Capacitance, Capacitors in Parallel and in Series, Energy Stored in an Electric Field.	3
6.	Current and Resistance • Electric Currents, Current density, Resistance and Resistivity, Ohm's Law, Power in Electric Circuits.	3
7.	Circuits	2

	• Single-Loop circuits, Multiloop Circuits (resistors in parallel and in series), Charging and Discharging a Capacitor. Sample problems.	
8.	Magnetic Fields • The source of a Magnetic Field The Definition of the Magnetic Field, A Circulating Charged Particle, Cyclotrons and Synchrotrons, Magnetic Force on a Current-Carrying Wire, Torque on a Current Loop, The Magnetic Dipole Moment.	2
9.	Magnetic Fields Due to Currents • Calculating the Magnetic Field Due to a Current, Force Between Two Parallel Currents, Ampere's Law, Solenoids and Toroids.	2
10.	Induction and Inductance • Faraday's Law of Induction, Inductors and Inductance, Self-Induction.	2
11.	Maxwell's Equations; Magnetism of Matter • Gauss' Law for Magnetic Fields, Induced Magnetic Fields, Displacement Current, Maxwell's Equations, Magnets, Magnetism and Electrons, Magnetic Materials, Diamagnetism, Paramagnetism, Ferromagnetism	4
12.	Practical Part: • Students will conduct various experiments in the practical part of the course. Each student will perform the experiment, collect data, extract result, and prepare a written report every week.	45

Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	8^{th} week	20%
2.	HomeWorks & Quizzes	All weeks	10%
3.	Lab. Reports	All weeks	10%
4.	Lab. Exam	End of term	10%
5.	Final Exam	End of term	50%
...	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	• Halliday & Resnick, Jearl Walker, "Fundamentals of Physics" 10th Edition (2018)
Supportive References	• Physics for Scientists & Engineers with Modern Physics 4th Edition by Douglas Giancoli, 4th Edition (2014).
Electronic Materials	Physics is Beautiful | Free, interactive physics lessons Khan Academy Physics | Physics videos The Feynman Lectures on Physics PhET Simulations | Online physics simulations
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom • Laboratory
Technology equipment (projector, smart board, software)	• Blackboard • Projector
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Questionnaire
Effectiveness of Students assessment	Instructor	Exams
Quality of learning resources	Instructor	Course report
The extent to which CLOs have been achieved	Instructor	Course report
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physics Department Council
REFERENCE NO.	Minutes of session No. xx
DATE	x/x/2025

Course Specification

(Bachelor)

Course Title:	Techniques in Chemical Laboratories
Course Code:	CHM1102
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	2
Last Revision Date:	19-02-2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hrs)					
1 theoretical + 1 practical					
2. Course type					
A.	☐University	☐College	☑**Department**	☐Track	☐Others
B.	☑**Required**		☐Elective		
3. Level/year at which this course is offered: (1st level/1st year)					
4. Course general Description:					
This course provides a thorough understanding of key laboratory techniques in chemistry. It focuses on the practical application of chemical principles, the proper use of laboratory equipment, and following safety standards. Students will gain knowledge of quantitative and qualitative analysis, separation and purification processes, as well experimental documentation.					
5. Pre-requirements for this course (if any)**:**					
N/A					
6. Co-requirements for this course (if any)**:**					
N/A					

7. Course Main Objective(s):

By the end of the course, students will be able to:

- Demonstrate knowledge of laboratory safety protocols and chemical handling.
- Operate laboratory equipment effectively and accurately.
- Discuss the impact of laboratory practices on the environment
- Perform basic chemical separation, purification, and analysis techniques

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	15	26%
2	E-learning	0	0
3	Hybrid	0	0

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	0	0
5	Other (Laboratory)	42	74%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	15
2.	Laboratory/Studio	42
3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
Total		57

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	Describe how chemicals should be handled, stored, and disposed of in accordance with safety and environmental standards.	K2	Lecture	Exam
1.2	List some basic chemical methods used in every-day laboratory	K1, K2	Lecture, library visit	Exam
1.3	Identify the purpose and mode of operation of the different lab instruments and devices.	K2	Lecture, library visit	Homework and exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Operate lab equipment safely and effectively and Design and plan experiments using suitable materials and techniques to meet predetermined objectives.	S1	Lab experiments Lectures	Group discussion, homework and exam
2.2	Examine experimental data, pinpoint error causes, and assess the precision and reliability of findings.	S3	Lab experiments Lecture, scientific discussion	Group discussion, homework and exam
2.3	Solve practical problems in the laboratory by applying critical thinking and a methodical approach.	S2	Lab experiments Lectures	Group discussion, homework and exam
2.4	Apply laboratory methods for chemical purification and isolation, such as extraction, distillation, and recrystallization.	S1	Lab experiments Lectures	Lab exam homework and exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate learning skills to work as a team in a multidisciplinary environment and demonstrate effective writing, oral communication skills and using ICT tools	V2	Web-based study Library visits	Class and tutorial discussion. Assignment activities, Homework

C. Course Content

No	List of Topics	Contact Hours
1.	Laboratory Safety and Protocols	**2**
2.	Laboratory Equipment and Their Uses	**2**
3.	Basic Laboratory Techniques	**2**
4.	Separation Techniques	**2**
5.	Purification Techniques	**2**
6.	Reaction Monitoring and Control	**2**
7.	Instrumental Analysis	**2**
8.	Principles of green chemistry in the lab	**1**
	List of Experiment	
1.	Lab Safety Rules and Guidelines	**3**
2.	Common Laboratory Equipment Names and Their Uses	**3**
3.	Preparation of standard solution from solid and liquid compound	**6**
4.	Basic laboratory techniques and procedures used in Chemistry laboratory: Purification by recrystallization	**9**
5.	Separation method of solid-liquid mixture: filtration	**6**
6.	Extraction procedure of compound using two miscible liquids using distillation technique	**6**
7.	Extraction procedure of compound using two immiscible liquids using separatory funnel	**6**
8.	Synthesis of Biodiesel from Vegetable Oil (Green Chemistry Approach)	**3**
Total		**57**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	--	10 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
2.	Midterm Exam.	7-8	20 %
3.	Practical section activities and exam	15	30%
4.	Final Exam.	16-17	40 %
5.	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	- John RDean, Alan MJones, David Holmes, Rob Reed, Jonathan Weyers and Allan Jones, Practical skills in chemistry, (2002)
Supportive References	- A.I. Vogel, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, and A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry" - Roy A. Straughan, "The Art of Chemistry: Practical Laboratory Skills"
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	•Microsoft Power Point, Excel, and Microsoft Word •Professional standards or regulations and software •Computer-based programs/CD

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	The classroom is suitable for Group discussions and project-based learning.
Technology equipment (projector, smart board, software)	Classroom equipped with computer and projector.

Items	Resources
Other equipment (depending on the nature of the specialty)	---

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect: Regular surveys to evaluate teaching effectiveness and course relevance. Direct: CLO' assessment
Effectiveness of Students assessment	Faculty, Peer Review	Direct: Annual review of course content by faculty members and external experts
Quality of learning resources	Students	Indirect: Regular surveys to evaluate Quality of learning resources
The extent to which CLOs have been achieved	Peer Review	Direct: Annual review of course content by faculty members and external experts
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

2023
TP-153

Course Specification

(Bachelor)

Course Title:	General Chemistry 1
Course Code:	CHM1101
Program:	Chemistry
Department	Chemistry
College:	Science
Institution	Umm Al-Qura University
Version:	1
Last Revision Date:	Al-27 December 2024

وزارة التعليم - جامعة أم القرى
الكلية الجامعية بالجموم - قسم الكيمياء
Jamoum University College - Chemistry Department
Ministry Of Education - Umm Al-Qura University

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 Theoretical + 1 Experimental)

2. Course type

A.	☐University	☒ College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	

3. Level/year at which this course is offered: (1/1)

4. Course general Description:

This course presents the essential principles and common applications of chemistry. It introduces the elementary principles and theories of chemistry, electronic structure of atoms, quantum mechanics and atomic orbitals; representations of orbitals, gases laws and properties, Intermolecular forces, liquids, solids, solutions, kinetics, equilibria, precipitation, thermodynamics, electrochemistry, organic chemistry

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

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

7. Course Main Objective(s):

The course introduces some basic principles of physical, organic and inorganic chemistry.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100 %
2	E-learning	-	
3	Hybrid • Traditional classroom • E-learning	-	
4	Distance learning	-	

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	

5.	**Others (specify)**	
Total		75

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	Explain fundamental concepts and principles of units, measurements, physical, inorganic and organic chemistry.	K1	Lectures Library visits	Exam
2.0	**Skills**			
2.1	Demonstrate the ability to use basic laboratory techniques, tools, to conduct experiments, collect data, and analyze results related to fundamental chemistry topics	S1	Laboratory	Practical Exam Lab Reports Quiz
2.2	Solve quantitative and qualitative problems related to chemical equations, thermochemical processes, and kinetics.	S2	Lectures Web-based study	Quiz. Exam. Class discussion
2.3	Analyze and interpret data related to chemical equilibria and electrochemical reactions.	S3	Lectures Scientific discussion Web-based study	Quiz. Exam. Class discussion
3.0	**Values, autonomy, and responsibility**			
3.1	Ability to demonstrate learning skills to work as a team in a multidisciplinary environment.	V1, V2	Scientific discussion	long and short essays posters lab manuals

C. Course Content

No	List of Topics	Contact Hours
1.	Electronic structure of atoms, quantum mechanics and atomic orbital	4
2.	Gases laws and properties	4
3.	Intermolecular forces, liquids, solids, solutions	4
4.	Chemical kinetics	4
5.	Chemical equilibria	4
6.	Thermodynamics,	4
7.	Electrochemistry,	4
8.	Organic chemistry	2
	List of Experiments	
1.	safety in chemistry laboratory	3
2.	intermolecular forces: viscosity, density, and surface tension	12
3.	atomic structure and quantum mechanics	3
4.	acids and bases titration	9
5.	determination of the heat capacity of the calorimeter	6
6.	solutions	6
7.	chemical equilibrium	6
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
	Class activities, and Assignments	Throughout the Term	10%
	Mid-Term Exam (s)	8	20%
	Lab Activity	Throughout the Term	20%
	Practical Exam	15	10%
5.	Final Exam.(2 hours exam)	End of the Term	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	Steven S. Zumdahl, Susan A. Zumdahl, 9th ed., 2009, New York.
Supportive References	P. Atkins and J. de Paula, Physical Chemistry, 10th ed., 2006, New York.
Electronic Materials	Power point lectures.
Other Learning Materials	Course available online

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	The classroom is equipped with computer and projector.
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	Indirect: course evaluation and graduates survey).
Effectiveness of students' assessment	Department	Improving course quality and effectiveness.
Quality of learning resources	Students	Direct: (feedback from faculty). Indirect (online survey at the end of the semester
The extent to which CLOs have been achieved	Faculty members	Direct:(Comments of course instructors regarding evaluation of teaching strategies for learning outcomes mentioned in course report).
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Principles of Analytical Chemistry
Course Code:	CHM1201
Program:	Chemistry – Two Tracks
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	21 / 12 / 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
(2+1)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (1st level/1st year)					
4. Course general Description:					
The course provides students with the necessary background of qualitative analysis of different compounds and its application. Also, the course is designed for teaching students how to interpret analytical data and address the accuracy and precision of the measurements.					
5. Pre-requirements for this course (if any)**:**					
None					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
By the end of this course, students will be able to know the fundamentals of analytical chemistry and has the ability to identify different methods used for qualitative analysis. Also, students should know: a. The meaning of accuracy and precision. b. How to express their results statistically. c. Distinguish between accepted values and rejected values based on some credible tests.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	E-learning	---	---
3	Hybrid	---	---

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	---	---

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		72

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	Recognize classification and application of qualitative analysis (ionic and nonionic, electrolytic and non-electrolytic compounds)	K1	Lectures	Homework and exams
1.2	Describe the factors affecting on the solubility, precipitation	K1	Lectures	Homework and exams
1.3	Recognize the different ways of determining the accuracy and	K1	Lectures	Homework and exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	precision of analytical data			
...				
2.0	**Skills**			
2.1	Develop the reverse think skills and student gains the practical skills to choose the suitable methods for aqueous solutions solubility and redox processes	S1	Lab	Homework and Practical exams
2.2	Select the suitable method for expressing concentrations and predict conditions of ideal precipitation	S2	Lectures	Homework and exams
2.3	Interpret the analytical data in terms of accuracy and precision	S1	Lab and Lectures	Homework and Practical exams
2.4	Distinguish between accepted values and rejected values in chemical measurements	S2	Lectures	Homework and exams
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Manage resources, time and collaborate with members of the group.	V1	Presentation	Observation by the instructor
3.2	Work effectively both in a team, and independently on solving chemistry problems.	V2	Presentation	Observation by the instructor
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Analytical chemistry: definition, introduction, types and importance.	2
2.	Qualitative chemical analysis and basic tools and operations of analytical chemistry	2
3.	Solutions, concentrations and the solutions preparation	2
4.	Acid and base equilibrium, dissociation of water and indicator	2
5.	Hydrolysis of salts, acids and weak base. Buffer solutions, preparation and importance	2
6.	The precipitates and law of solubility product	2
7.	The precipitates and solubility products	2
8.	The factors effecting on the solubility of precipitates and separations of ionic groups.	2
9.	Mid-term exam	2
10.	Accuracy and precision, their meaning and measuring ways.	4
11.	Significant figures and introduction to statistics and data handling in analytical chemistry	2
12.	Tests of significance. Rejection of a result: The Q test.	2
13.	Linear least squares-How to plot the right straight line. Correlation coefficient and coefficient of determination.	2
14.	Detection limits and quantification limit; LOD and LOQ. Slope, intercept, and coefficient of determination.	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-term Exam	9	20%
2.	Homework and quiz	Every 3 or 4 weeks	10%
3.	Laboratory sessions	15	30%
4.	End-of-term Exam	16-17	40%
	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	Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. Fundamentals of analytical chemistry, 9th edition , Brooks Cole (2014)
Supportive References	Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014).
Electronic Materials	http://www.chemhelper.com/ http://www.chemweb.com/ http://www.science.uwaterloo.ca/~cchieh/cact/ http://www.sciencedirect.com/
Other Learning Materials	---

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom suitable for the number of students. Chemical laboratories equipped with safety tools and chemicals.
Technology equipment (projector, smart board, software)	Projector, board.
Other equipment (depending on the nature of the specialty)	---

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources

Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CHEMISTRY DEPARTMENT / FACULTY OF SCIENCE
REFERENCE NO.	
DATE	21 / 12 / 2024

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Volumetric and Gravimetric Analysis	
Course Code: CHM1202	
Program: Chemistry- Two Tracks	
Department: Chemistry	
College: Faculty of Science	
Institution: Umm Al-Qura University	
Version: *Course Specification Version Number*	
Last Revision Date: 20/12/2024	

وزارة التعليم - جامعة أم القرى
الكلية الجامعية بالجموم - قسم الكيمياء
Jamoum University College-Chemistry Department
Ministry Of Education-Umm Al-Qura University

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (2nd level/1st year)					
4. Course general Description:					
Volumetric and gravimetric analysis course provide students with the necessary background of quantitative analysis of different compounds using different tools of analysis and its application. The gravimetric part deals with the principles and methods applied for gravimetric analysis.					
5. Pre-requirements for this course (if any):					
Principles of Analytical Chemistry CHM1201					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					
1. Describe the theoretical principles of volumetric and gravimetric analysis. 1. Familiar with statistical methods and solution concentration parameters in chemical measurements 1. Apply the procedures required for gravimetric analysis and factors which effect the precipitation process 1. Be further prepared for the necessarily rigorous sequence in chemistry courses need the volumetric and gravimetric analysis.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	E-learning	---	---
3	Hybrid • Traditional classroom • E-learning	---	---
4	Distance learning	---	---

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		72

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	Express analytical results using appropriate units of concentrations and statistical forms.	K1	- Lectures - Scientific discussion	Mid-term exam Final exam
1.2	Recognize the fundamentals of titration theories and precipitation equilibria.	K2	- Lectures - Web based study	Mid-term exam Final exam
2.0	**Skills**			
2.1	Recall various applications of various types of titrations.	S1	Lab experiments	- long and short essays - posters lab manuals
2.2	Apply calculations for titrations and precipitation equilibria.	S1	Lab experiments Lectures	Lab exam
2.3	Apply the suitable methods referred to concentration units.	S2	- Lectures	Final exam
3.0	**Values, autonomy, and responsibility**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.1	Work effectively both in a team, and independently on solving some titration and gravimetric analysis problems.	V1	- Project - Presentation	Write a report and Observation of group's teamwork performance
3.2	Manage resources, time and collaborate with members of the group.	V2	- Group discussion	Observation by the instructor

C. Course Content

No	List of Topics	Contact Hours
1.	Classification and applications of quantitative analysis and solution concentration parameters	**2**
2.	The principles of volumetric analysis– Acid–base titrations	**2**
3.	Neutralization titrations and the applications of neutralization titrations - Stoichiometric Calculations: The Workhorse of the Analyst	**4**
4.	Precipitation theory, adsorption indicators, applications of precipitation titrations and titrations which include complexes formation.	**2**
5.	Complexometric reactions and titrations and their applications in water analysis and manufacture and reduction – oxidation (Redox) titrations and their applications.	**2**
6.	Principles and requirements of gravimetric analysis and precipitation equilibria	**2**
7.	Theoretical principles of precipitation and stages of saturated, supersaturated and solubility product, precipitation formation (nucleation, precipitate growth)	**2**
8.	Mid Term exam	**2**
9.	Factors affecting the solubility of precipitate, precipitation from homogeneous solution and contamination of precipitates, types of contaminates (co-precipitation, post precipitation, surface adsorption)	**2**
10.	The methods of contaminates removing or minimizing	**2**
11.	Organic precipitants, requirements and its application-Inorganic precipitants, requirements and its application	**4**
12.	Calculations of gravimetric analysis	**2**
13.	Revision	**2**

Total	30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and/or activities.	During all weeks	10%
2.	Midterm Exam.	8	20%
3.	Practical Exam.	15	30%
4.	Final Exam. (2 hours exam)	16-17	40%
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	1- Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014). 2- Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014).
Supportive References	---
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	Lecture Handouts available on the coordinator website

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms capacity (40) students. - Lab's capacity (20) students. -Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (depending on the nature of the specialty)	No other requirements

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students' assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other	---	---

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CHEMSITY DEPARTMENT, FACULTY OF SCIENCE
REFERENCE NO.	
DATE	20/12/2024

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Spectrophotometric and Electroanalytical Methods	
Course Code: CHM2203	
Program: Chemistry- Two Tracks	
Department: Chemistry	
College: Faculty of Science	
Institution: Umm Al-Qura University	
Version: *Course Specification Version Number*	
Last Revision Date: *Pick Revision Date.*	

وزارة التعليم - جامعة أم القرى - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education-Umm Al-Qura University
Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hours)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	

3. Level/year at which this course is offered: (4th level/2nd year)

4. Course general Description:

This course describes and explains the basis for using different spectrophotometric device and electroanalytical methods for determination of different analytes.

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

Volumetric and Gravimetric Analysis (CHM1202)

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

7. Course Main Objective(s):

By finishing the course, the students will have all information about the spectrophotometric and electroanalytical methods of analysis and have ability to determine the trace amounts of different compounds.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72 hours	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		72

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	Recognize the essential theoretical concepts of spectroscopic and electrochemical methods of analysis.	K1	Lectures	Final and mid-term exam.
1.2	Identify the potentials, limitations, and applications of spectroscopic and electrochemical techniques.	K2	Lectures	Exams
2.0	**Skills**			
2.1	Performing many experiments using spectroscopic and electrochemical methods	S1	Laboratories and Lectures	Overall student performance in Lab
2.2	Applying spectrophotometric technique to characterize	S2	Lectures Scientific discussion	Quiz. Exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	materials in various samples.			
2.3	Solving analytical problems using spectroscopic and electrochemical methods	S3	Lectures Scientific discussion	Quiz. exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate commitment to professional and academic values, and ethics in the field of spectrophotometry	V1	Lectures	Class discussion.
3.2	Ability to work in a team to perform specific experimental tasks.	V2	Lectures laboratory	Lab demonstration

C. Course Content

No	List of Topics	Contact Hours
1	General properties of electromagnetic radiation and its interaction with matter	4
2	Absorption and emission concepts	2
3	Spectrophotometric instrumentation	2
4	Spectrophotometric measurements theory, Beer's law, and its deviation	2
5	Absorbing species	2
6	Applications of spectrophotometric methods	2
7	Atomic absorption and emission spectroscopy and devices	4
7	Turbidimetry and nephelometry	2
8	Molecular fluorescence and phosphorescence	2
10	Introduction to Electrochemistry	2
11	Types of electrodes	2
12	Electroanalytical techniques and its applications.	4
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1	Homework or activities.	During term	10 %
2	Midterm Exam.	8	20 %
3	Practical Exam.	15	30 %
4	Final Exam. (2hours Exam)	16	40 %
5	**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	1.Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014) 2.Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014) 3.Dhruba Charan Dash. Analytical Chemistry (2017) PHI Learning Private Limited.
Supportive References	Lecture handouts available on the coordinator website
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	•Classrooms capacity (30) students. •Laboratory capacity (20) students.
Technology equipment (projector, smart board, software)	•Room equipped with projector.
Other equipment (depending on the nature of the specialty)	•No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct
Effectiveness of Students assessment	Course teacher	Direct
Quality of learning resources	Program Leaders	Direct
The extent to which CLOs have been achieved	Peer Reviewer	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Chemistry of Aliphatic Compounds
Course Code:	CHM2401
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	1st
Last Revision Date:	31-12-2024

نسّقة:الفرنسية (فرنسا)
نسّقة:الفرنسية (فرنسا)

جامعة أم القرى - وزارة التعليم - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University - Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hours) (2 theoretical + 1 practical)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (3rd level / 2th year)					
4. Course general Description:					
This course provides a comprehensive introduction to aliphatic compounds, covering their definition, classification, and methods of nomenclature. Students will explore the physical and chemical properties of various aliphatic compound families, along with their methods of preparation and practical applications in different industries. Through theoretical discussions and practical examples, the course aims to build a strong foundation in understanding the role of aliphatic compounds in organic chemistry.					
5. Pre-requirements for this course (if any):					
General Chemistry 1 (CHM1101)					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					
Understand the Fundamentals – Define and classify aliphatic compounds, recognizing their significance in organic chemistry. Apply Nomenclature Rules – Use systematic IUPAC naming conventions for different families of aliphatic compounds, including stereochemical descriptors (R/S and E/Z). Analyze Properties – Explain the physical and chemical properties of various aliphatic compounds and how they influence reactivity and applications. Describe Preparation Methods – Identify and compare different methods of synthesizing aliphatic compounds.					

تعليق عليه **[EF1]:** This table needs to be carefully revised. The program skills outcomes must be adhered to so that S1 for the lab skills, S2 and S3 for the classroom skills. Moreover, program values are V1 and V2 only.

Explore Stereochemistry – Understand molecular chirality, types of stereoisomerism (enantiomers, diastereomers, conformers)

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		75

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	Recognize the physical, chemical properties and applications of aliphatic compounds.	K1	Lectures Lab work	Quiz. Final and mid-term exam. Lab exam
1.2	Explain the mechanism of reactions of aliphatic compounds and their interconversions based	K2	Lectures	Quiz. Final and mid-term exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	on the theoretical background.			
2.0	**Skills**			
2.1	Apply the IUPAC rules for nomenclature of all aliphatic compounds	S1	Lectures Web based study.	Quiz. Final and mid-term exam. Assignments and activities
2.2	Predict the expected product and mechanism of different reactions of aliphatic compounds.	S2	Lectures	Quiz. Final and mid-term exam.
2.3	Apply the different strategies for preparation of aliphatic compounds	S1	Lectures	Quiz. Final and mid-term exam. Lab exam
2.4	Show chemical processes and techniques for identification and investigation of aliphatic compounds.	S3	Lectures Lab work	Quiz. Final and mid-term exam. Lab exam
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate commitment to professional and academic values, and ethics in the field of Aliphatic compounds	V1	Research activity. Web based study.	Portfolios Assignments and activities

C. Course Content

No	List of Topics	Contact Hours
1.	Structure, bonding and reactivity in organic molecules	**3**
2.	Nomenclature, physical, chemical properties, and preparations of different classes of hydrocarbons	**6**
3.	Nomenclature, physical, chemical properties, and preparations of different families according to functional groups including Alcohols, ethers, carbonyl compounds, carboxylic acids and their derivatives and amines	**12**

4.	Nomenclature, reactivity and used of organo-halogen compounds	**3**
5.	Introduction to isomerism and stereochemistry	**6**
	Total	**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-term exam	8-10	20%
2.	Assignments and activities		10%
3.	Practical Exam	15	30%
4.	Final Exam. (2 hours exam)	16	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	1. Amit Arora "*Introductory Organic Chemistry*" **2006**, Discovery Publishing House New Delhi 2. T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder "*Organic Chemistry, 11th Edition, International Student Version*" **2013**, John Wiley & Sons.
Supportive References	John McMurry's "*Organic Chemistry, 8th edition, International Edition*" **2011**, Brooks/Cole.
Electronic Materials	-Lecture Hand-out available as a PowerPoint presentation. -http://www.chemweb.com -http://www.sciencedirect.com -http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities	Classroom with capacity of (30) students. A laboratory with capacity of (15) students

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Including all practical facilities Providing teaching halls including computers and projector.
Technology equipment (projector, smart board, software)	Teaching halls and laboratories are equipped with projectors.
Other equipment (depending on the nature of the specialty)	-------

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program leader, curriculum committee	Direct (classroom observation using the Teaching Observation Concepts and Teaching Observation Proforma
Effectiveness of Students assessment	external reviewers	Direct
Quality of learning resources	Students, faculty members and External reviewers	Direct (feedback from faculty). Indirect (online survey at the end of the semester (Program survey, Experience survey & course evaluation) and raduates survey.
The extent to which CLOs have been achieved	Peer Reviewer	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Aromatic and Heterocyclic Chemistry
Course Code:	CHM2402
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	1
Last Revision Date:	20 February 2025

نسّقه:الفرنسية (فرنسا)

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 Hrs)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (4th level, 2th year)					
4. Course general Description:					
Aromatic and heterocyclic chemistry focuses on the study of organic compounds containing ring structures. The course includes definition of aromaticity, the classification and nomenclature of aromatic and heterocyclic ring systems, properties, applications and preparations of different families of aromatic compounds and heterocyclic compounds.					
5. Pre-requirements for this course (if any):					
Chemistry of Aliphatic Compounds (CHM2401)					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					
By the end of this course student will be familiar with the concept of aromaticity, including Huckel's rule and its application to determine aromatic, anti-aromatic, and non-aromatic compounds, including nomenclature, physical, chemical properties, and preparations of different aromatic families according to functional groups and different heterocyclic compounds as well as applications of specific groups of heterocyclic systems. In addition to an introduction to polynuclear aromatic hydrocarbons.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	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**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		75

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	Define aromaticity and the criteria for aromatic compounds, including the structure and bonding in such compounds.	**K1**	Lectures	Final and mid-term exam.
1.2	Name and classify the aromatic and heterocyclic compounds.	**K2**	Lectures	Quiz. Final and mid-term exam.
1.3	State the physical and chemical properties of benzene, heterocyclic compounds and describe its electrophilic aromatic substitution reactions.	**K1**	Lectures	Final and mid-term exam.
2.0	**Skills**			
2.1	Demonstrate the ability to predict aromaticity in given compounds using	**S2**	Lectures	Assignments and activities

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Hückel's rule and structural analysis and Synthesize multi-functionalized aromatic and heterocyclic compounds		Scientific discussion	Final and mid-term exam.
2.2	Perform systematic procedures to identify aromatic hydrocarbons, and Synthesize aromatic and heterocyclic compounds	S1	Lectures Lab work	Lab exam
3.0	**Values, autonomy, and responsibility**			
3.1	Commit to following safety protocols and best practices while handling hazardous chemicals in practical applications of aromatic and heterocyclic chemistry.	V1	Scientific discussion during lab work	Class discussion. Assignment activities.
3.2	Communicate the importance of aromatic and heterocyclic compounds in industrial, environmental, and pharmaceutical applications to diverse audiences.	V2	Lectures	Class discussion. Assignment activities.
...				

C. Course Content

No	List of Topics	Contact Hours
1.	The definition of aromaticity: structure, bonding, and aromaticity in aromatic compounds.	**2**
2.	Nomenclature, physical, chemical properties, and electrophilic aromatic substitution reactions of benzene.	**2**
3.	Mechanism of electrophilic aromatic substitution and second electrophilic substitution (directing effect).	**2**
4.	Nomenclature, physical, chemical properties, and preparations of aryl halides and different aromatic families according to functional groups including phenols, ethers, aromatic carbonyl compounds, aromatic carboxylic acids, and aromatic amines.	**10**
5.	Introduction to chemistry of polynuclear aromatic compounds.	**2**
6.	Classification of heterocyclic compounds.	**2**
7.	Nomenclature of heterocyclic compounds.	**2**
8.	Bonding, structure and aromaticity applied to heterocyclic compounds.	**2**
9.	Structure and reactivity of five and six-membered heterocyclic compounds.	**2**
10.	Synthesis and reactions of five membered rings and their benzo fused systems.	**2**

11.	Synthesis and reactions of six membered rings and their benzo fused systems.	2
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	5	10 %
2.	Midterm Exam.	7	20 %
3.	Practical section activities and exam	15	30%
4.	Final Exam.	16-17	40 %
5.	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	Organic Chemistry" by Paula Yurkanis Bruice This book provides a comprehensive foundation in organic chemistry, with in-depth coverage of aromatic compounds and heterocyclic chemistry, including their structures, reactions, and applications. Edition: Latest (8th edition or higher) Publisher: Pearson Heterocyclic Chemistry" by J. A. Joule and K. Mills Edition: 5th Edition (2010) Publisher: Wiley-Blackwell This book provides an in-depth exploration of heterocyclic compounds, focusing on their structure, reactivity, and synthesis. POWELL'S BOOKS
Supportive References	Focuses specifically on aromatic compounds, discussing their structure, reactivity, and industrial significance in depth. Edition: Latest Publisher: Oxford Chemistry Primers
Electronic Materials	Aromatic Heterocycles I" by Khan Academy

	Publication Year: 2012 An educational video that explains the aromaticity of heterocycles, beneficial for visual learners seeking to understand this concept. YOUTUBE "Heterocyclic Aromatic Compounds" by Chemistry LibreTexts Publication Year: 2013 An online resource that provides detailed information on heterocyclic aromatic compounds, including their structures and properties. LIBRETEXTS CHEMISTRY
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	projector
Other equipment (depending on the nature of the specialty)	-----

تعليق عليه **[EF1]:** This table should be completed.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching		
Effectiveness of Students assessment		
Quality of learning resources		
The extent to which CLOs have been achieved		
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	

DATE	

2023
TP-153

Course Specification
(Bachelor)

Course Title: Separation Methods and Thermal Analysis	
Course Code: CHM3204	
Program: Chemistry – Two Tracks	
Department: Chemistry	
College: Faculty of Science	
Institution: Umm Al-Qura 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: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6th level/3rd year))					
4. Course general Description:					
This course describes the fundamental basis of separation methods that are used in analytical chemistry such as gas and liquid chromatography, size and ion chromatography and electrophoresis. It explains theoretical basis of thermal analysis methods including thermogravimetry (TG), differential scanning calorimetry (DSC), differential thermal analysis (DTA), and thermomechanical analysis (TMA).					
5. Pre-requirements for this course (if any)**:**					
Spectrophotometric and Electroanalytical Methods (CHM2203)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
The main objective of this course is to familiarize students with the fundamental principle of separation processes used in analytical chemistry. By completion of the course, also to gain laboratory skills in certain separation techniques.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72 hours	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		72

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	Identify the principles of chromatographic methods and its classification.	**K1**	**Lectures**	**Mid-term and Final exams**
1.2	Recognize the essential theoretical concepts of chromatographic methods, and thermal analyses.	**K2**	**Lectures**	**Mid-term and Final exams**
2.0	**Skills**			
2.1	Carry out experiments using the different types of chromatographic techniques.	**S1**	**Experiments in Lab**	**Student performance in Lab**
2.2	Suggest appropriate chromatographic methods for	**S2**	**Lectures and Scientific discussion groups**	**Quiz and HomeWorks**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	separation of mixtures.			
2.3	Solve analytical problems in chromatographic methods.	**S3**	**teamwork**	**Assignments activities**
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate commitment to professional and academic values, and ethics in the field of separation.	**V1**	**Lectures**	**Class discussion**
3.2	Ability to work in a team to perform specific experimental tasks and participate in class or laboratory discussions.	**V2**	**Research activities**	**Assignments activities**
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Separation methods in analytical chemistry, classifications, and solvent extraction technique.	4
2.	Principles of chromatographic methods and its classification. Column chromatography.	2
3.	Liquid-liquid chromatography and Solid-liquid chromatography.	2
4.	Ion exchange chromatography, ionic chromatography and HPLC.	4
5.	Gas Chromatographic Methods with Different Detectors	4
6.	Mid-term exam	2
7.	Gas chromatography in qualitative, quantitative, medical and petroleum analysis.	2
8.	Thin layer chromatography (TLC), paper chromatography (PC) and electrophoresis method.	2
9.	Thermal analysis methods: thermo-gravimetric analysis (TGA), (DTG), (DSC) and (DTA).	4

10.	Coulometric analysis and thermal titrations.	2
11.	Application of TLC and HPLC chromatographic methods in chemical analysis.	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homework and activities**	**-**	**10%**
2.	**Midterm Exam**	**8 or 9**	**20%**
3.	**Practical Exam**	**15**	**30%**
4.	**Final Exam**	**16 or 17**	**40%**
5.	**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	1. Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014). 2. Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014). 3. Dhruba Charan Dash. Analytical Chemistry)2017(PHI Learning Private Limited.
Supportive References	Lecture handouts available on the coordinator website
Electronic Materials	1. http://www.chemweb.com 2. http://www.sciencedirect.com 3. http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classrooms capacity (30) students. • Laboratory capacity (20) students.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and smartboard.

Items	Resources
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Principles of Environmental Chemistry	
Course Code: CHM3205	
Program: Chemistry (Chemistry Track)	
Department: Chemistry	
College: Faculty of Science	
Institution: Umm Al-Qura University	
Version: *Course Specification Version Number*	
Last Revision Date: 25/12/2025	

وزارة التعليم - جامعة أم القرى
الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University
Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6th level/ 3rd year)					
4. Course general Description:					
The course deals with the principles of environmental chemistry. This includes the study of the effect of the chemical species and their processes on environment, air and water pollution and soil chemical analysis process.					
5. Pre-requirements for this course (if any):					
Spectrophotometric and Electroanalytical Methods (CHM2203)					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					
By the end of this course the students will: 1- **Have information about the basis of environmental chemistry.** 2- **Familiar with air and water pollution.** 3- **Gain basic information on soil analysis.**					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100 %
2	E-learning	--	0
3	Hybrid • Traditional classroom • E-learning	--	0
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 ((E-Learning +Exams +Office hours))	--
Total		30

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	Identify the principle of environmental chemistry and related chemical species.	K1	Lectures	Homework and exams
1.2	Explore the different types of environmental pollutions	K2	Lectures	Homework and exams
2.0	Skills			
2.1	Classify the types of chemical pollutions on environment.	S2	Lectures	Homework and exams
2.2	Discuss different strategies in controlling environmental pollutions.	S3	Lectures	Homework and exams
3.0	Values, autonomy, and responsibility			
3.1	Write and present a chemical report related to environmental chemistry.	V1	Presentation	Observation by the instructor
3.2	work individually and in a team to prepare a report on	V2	Presentation	Observation by the instructor

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	environmental analysis			

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction.	2
2.	Principles of environmental chemistry and chemical analysis.	4
3.	Energy and energy cycles and gases cycles.	4
4.	Role of human in environmental pollution.	4
5.	Atmosphere chemistry.	2
6.	Air pollution (classification-sources –problems-global warming phenomenon).	2
7.	Mid-term exam	2
8.	Water treatment chemistry.	4
9.	Water pollution (water quality- types of contaminants- water pollution control).	4
10.	Soil chemical analysis.	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Mid-term Exam**	**9**	**30 %**
2.	**Homework and quiz**	**Every 3 or 4 weeks**	**20 %**
3.	**End-of-term Exam**	**16-17**	**50 %**
	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	Stanley E. Manahan, ***ENVIRONMENTAL SCIENCE, TECHNOLOGY, AND CHEMISTRY,*** 2000, CRC Press LLC. **Donald L. Sparks**, ***Environmental Soil Chemistry***, 2nd Edition, Academic Press (2003).

Supportive References	
Electronic Materials	**http://www.chemweb.com** **http://www.sciencedirect.com** **http://www.rsc.org**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classroom suitable for the number of students**
Technology equipment (projector, smart board, software)	**Chemical laboratories equipped with safety tools and chemicals**
Other equipment (depending on the nature of the specialty)	**Projector, board**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching		
Effectiveness of teaching	Students	Questionnaire (indirect)
Effectiveness of Students assessment	Students	Questionnaire (indirect)
Quality of learning resources	Program leader	Analysis of data results
The extent to which CLOs have been achieved	Course instructor	Analysis of data from end-of-term exam.

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

G. Specification Approval

COUNCIL /COMMITTEE	**CHEMISTRY DEPARTMENT / FACULTY OF SCIENCE**
REFERENCE NO.	
DATE	**25 / 12 / 2024**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Industrial Analysis and Quality Control
Course Code:	CHM3206
Program:	Chemistry (Chemical Analysis and Quality Measurements Track)
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

وزارة التعليم • جامعة أم القرى • الكلية الجامعية بالجموم-قسم الكيمياء
Ministry Of Education-Umm Al-Qura University • Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6th level/3rd year))					

4. Course general Description:

The course aims to shed light on the meaning of quality in analytical chemistry and how to measure the quality of different analytical methods and identify the different tests used in it. The students will also be mentioned to prepare an essay or a report from literature using the library, data base services, and/or websites to follow up and update the new topics of the subject of the course

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

Spectrophotometric and Electroanalytical Methods (CHM2203)

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

7. Course Main Objective(s):

The course aims to shed light on the meaning of quality in analytical chemistry and how to measure the quality of different analytical methods and identify the different tests used in it.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		72

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	Define the quality in chemical analysis	K1	**Lectures**	**Mid-term and Final exams**
1.2	Know the meaning of quality and quality measurements	K1	**Lectures**	**Mid-term and Final exams**
1.4	Recognize procedures for the execution and evaluation of interlaboratory	K2	**Lectures**	**Mid-term and Final exams**
1.4	Outline reports for analytical results	K2	**Lectures**	**Mid-term and Final exams**
2.0	**Skills**			
2.1	Apply the analytical errors that can be detected using statistical quality control methods	S1	**Experiments in Lab**	**Student performance in Lab**
2.2	Analyze the meaning of quality and quality measurements	S2	**Lectures and Experiments in Lab**	**Assignments activities**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Summarize the Procedures for the execution and evaluation of interlaboratory	S2	**Lectures and Experiments in Lab**	**Assignments activities**
3.0	**Values, autonomy, and responsibility**			
3.1	Ability to work independently to handle chemicals	V2	**Research activities**	**Assignments activities**
3.2	Use information and communication technology.	V1	**Research activities**	**Assignments activities**

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction about industrial color testing	3
2.	Measurement and evaluation of object colors	2
3.	Determination of hiding power and transparency	2
4.	Measurement of film thickness	2
5.	Determination of tinting strength and lighting power	2
6.	Meaning of quality and quality measurements	2
7.	Quality in chemical analysis- Reliability in analytical chemistry	2
8.	Mid-term exam	2
9.	Quality of analytical processes and results - Establishing a new analytical procedure	2
10.	Reporting analytical results - Analytical errors that can be detected using statistical quality control methods	3
11.	Interlaboratory tests for process standardization	2
12.	Quality management system of the provider of an interlaboratory test	3
13.	Procedures for the execution and evaluation of interlaboratory	3
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and activities	-	10%
2.	Midterm Exam	8	20%
3.	Practical Exam	15	30%
4.	Final Exam	16 or 17	40%
5.	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	1. Hans G. Volz, ***Industrial color testing, Fundamentals and techniques***, 2nd Edition, Wiley(2002)
Supportive References	Lecture handouts available on the coordinator website
Electronic Materials	1. http://www.chemweb.com 2. http://www.sciencedirect.com 3. http://www.rsc.org
Other Learning Materials	- **W. Funk, V. Dammann, G. Donnevert, *Quality Assurance in Analytical Chemistry*, 2007 WILEY-VCH** - **Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, *Analytical Chemistry*, 7th edition, WILEY (2014)** - **Dhruba Charan Dash. *Analytical Chemistry* (2017) PHI Learning Private Limited**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classrooms capacity (30) students. • Laboratory capacity (20) students.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and smartboard.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Bioanalytical Chemistry
Course Code:	CHM3207
Program:	Chemistry -Chemical Analysis and Quality Measurements Track
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	25/12/2024

وزارة التعليم - جامعة أم القرى
الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education-Umm Al-Qura University
Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 credit hours)					
(2 theoretical + 1 practical)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (6th level / 3rd year)					
4. Course general Description:					
Bioanalytical chemistry is a subdiscipline of analytical chemistry that involves the separation, detection, identification and quantification of biological samples in different settings. It often involves the study of molecules such as proteins, peptides, DNA and drugs.					
5. Pre-requirements for this course (if any):					
Spectrophotometric and Electroanalytical Methods CHM2203					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					

On completion of this course students will become familiar with:

- General principles of biochemical investigation
- Basic principles of Analytical Biochemistry
- Spectrophotometer
- Chromatographic methods
- Electrophoretic techniques
- Isolation and purification of nucleic acids
- Introduction to tissue culture
- Molecular biochemistry techniques
- Radioisotopes in biochemistry
- Immunological assay
- Photometry and its application in biochemistry (UV, VIS, IR, fluorescence, atomic emission and NMR)

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	--
4.	**Tutorial**	--
5.	**Others (specify)**	--
Total		72

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	Define the fundamental principles and theories of instrumental methods covered in this course	**K1**	Lectures and Scientific discussion	Participation - exams – assignment
1.2	Describe the performance characteristics of different analytical techniques, their potentials, and their	**K2**	Lectures and Scientific discussion	Participation - exams – assignment

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	limitations			
...				
2.0	**Skills**			
2.1	Employ laboratory experiments by using a proper instrumental technique for a given analytical problem.	**S1**	Lecture and lab -Group discussion	Participation - exam - assignment- Report
2.2	Communicate effectively in both written and oral forms in information related to techniques covered in Analytical Biochemistry	**S2**	Lecture and Active Learning -Group discussion	participation, project Report
2.3	Evaluate the biochemical calculations and data for a given analytical problem.	**S1**	Lecture and self-learning	Exams-report
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate commitment to professional and academic values in accordance with the ethical standards in the field of biochemistry.	**V1**	Lectures- self learning -lab-project	Presentation - Participation - assignment-lab report-project
3.2	Participate in leadership roles and high levels of responsibility in academic, scientific, and societal obligations.	**V2**	Group discussion lab- project	Presentation, Project
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to analytical biochemistry	2
2.	Steps in a typical analysis Quality of data, Types of errors, Analytical methods and their assessment.Quality assurance in analytical biochemistry.	2
3.	Separation methods. Chromatographic principles, Factors cause the distribution and separation. Measurements and parameters used to achieve separation	4
4.	Methods based on polarity, Liquid liquid chromatography (LLC) Liquid Solid Chromatography (LSC)	2
5.	Ways of chromatographic performance. Classification of chromatographic methods. Liquid chromatography	2
6.	Method based on ionic nature -Ion-exchange chromatography	2
7.	Method based on size -Gel permeation (Gel filtration).Chromatography	2
8.	Method based on shape - Affinity Chromatography (LSC) Gas chromatography	2
9.	Mid-term exam	2
10.	HPLC Electrophoretic techniques . Electrophoresis .Agarose Gel Electrophoresis	2
11.	Molecular Biochemistry technique Polymerase Chain Reaction (PCR). Genetic engineering	2
12.	Introduction to tissue culture Immunoassay technique (ELISA) , Radioisotopes in biochemical research	2
13.	Immunoassay technique (ELISA)	2
14.	Radioisotopes in biochemical research, Photometry and its application in biochemistry	2
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework	---	10%
2.	Midterm Exam	8	20 %
3.	Practical	15	30 %
4.	Final Exam	16 or 17	40 %
5.	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	Basha, Mahin. Analytical Techniques in Biochemistry. Humana Press, 2020.
Supportive References	Andreas Hofmann, Samuel Clokie. Wilson and Walker's principles and techniques of biochemistry and molecular biology. Cambridge University Press, 2018
Electronic Materials	Saudi digital Library https://sdl.edu.sa/SDLPortal/ar/Publishers.aspx
Other Learning Materials	Multimedia associated with the textbook and the relevant

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	Projector, smart board
Other equipment (depending on the nature of the specialty)	Chemicals and equipment to conduct experiments

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct (Exams) Indirect (Survey)
Effectiveness of Students assessment	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Quality of learning resources	Peer review	Direct: annual review of course contents by faculty members
The extent to which CLOs have been achieved	Students	Indirect: regular surveys to evaluate quality of learning resources
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	PROGRAMS AND PLANS COMMITTEE
REFERENCE NO.	
DATE	25/12/2024

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023

TP-153

Course Specification

(Bachelor)

Course Title:	Food Analysis
Course Code:	CHM3208
Program:	Chemistry- Chemical Analysis and Quality Measurements track
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

وزارة التعليم - جامعة أم القرى
الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University
Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 h)					
2. Course type					
A.	☐ University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6/3)					
4. Course general Description:					
This course focuses on the fundamental, theoretical principles, tools and techniques used in analysis of food. It also covers the chemical and physical methods used for food analysis to evaluate food composition, quality, and safety.					
5. Pre-requirements for this course (if any)**:**					
Spectrophotometric and Electroanalytical Methods (CHM2203)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
- Provide students with strong foundation and understanding of the core principles of food analysis and compositions. - Equip students with knowledge and practice experience to utilize various techniques and tools in food analysis, quality and their applications.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	%100
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		72

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	Familiar with a broad knowledge, theories, principles, and concepts in food analysis	K1	Lectures	Mid-term and Final Exam
1.2	Recognize the chemical and physical characterization of food analysis and quality	K2	Lectures	Final Exam
2.0	**Skills**			
2.1	Apply chemical processes, techniques, tools, and instruments for the analysis of food systems	S1	Laboratory and Lectures	Overall students performance in the lab
2.2	Assess food composition and quality using various	S2	Lectures and class discussion	Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	analytical methods and tools			
2.3	Solve problems in various contexts related to food analysis	S3	Lectures and class discussion	Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Report project work by employing knowledge and practical skills learned in this course aligned with effective use of chemical literatures	V1	Lectures and group discussion	Report
3.2	Present chemical data and reports scientifically in the application of food analysis, using proper written or oral communication and adhering to scientific conduct	V2	group discussion	Presentation

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Food Chemistry	2
2.	General concepts of food analysis	2
3.	Sample preparation for food analysis	2
4.	Methods for Analyzing Food Composition (moisture - protein - fat - carbohydrates)	6
5.	Methods for Analyzing Food Composition (Vitamins – Minerals)	4
6.	Mid-term exam	2
7.	Analysis of food Additives and Contaminants	4
8.	Physical and Chemical Testing of Food	2
9.	Regulatory Control of Food Composition, Quality, Certification, and Safety	2

10.	Advances in Food Analysis	2
11.	Applications of food analysis	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and activities	During the term	10 %
2.	Written Mid-term test	8	20 %
3.	Written final Exam	16 or 17	40 %
4.	Lab Assessment	During the term	30 %

*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	• B. Pam Ismail, S. Suzanne Nielsen "Nielsen's Food Analysis" 6th Edition, springer Cham,2024. https://doi.org/10.1007/978-3-031-50643-7 • S. Suzanne Nielsen "Food Analysis Laboratory Manual" 3rd Edition, springer Cham,2017. https://doi.org/10.1007/978-3-319-44127-6
Supportive References	• K. Gupta, V. Jain, S. Jain, K. Dhawan, G. Talwar, "ANALYSIS OF FOOD", Academic Press, 2003, Pages 206-215. https://doi.org/10.1016/B0-12-227055-X/00044-4. (https://www.sciencedirect.com/science/article/pii/B012227055X000444)
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classrooms capacity 30 students • Laboratory capacity 20 students
Technology equipment (projector, smart board, software)	The room is equipped with projector.
Other equipment (depending on the nature of the specialty)	-

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Organic Reactions and Preparations
Course Code:	CHM3403
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	1st
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 3 hs (2 theoretical + 1 practical)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (5th level / 3rd year)

4. Course general Description:

This course includes description of the use of different function groups interconversions and synthetic strategies used in organic synthesis of different classes of organic compounds. Also, the course involves studying name reactions, pericyclic reactions, retrosynthetic approach and types of molecular rearrangements in organic reactions.

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

Aromatic and Heterocyclic Chemistry (CHM2402)

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

7. Course Main Objective(s):

The objective of this course is to provide students with a comprehensive understanding of functional group interconversions and synthetic strategies in organic synthesis. Students will explore various classes of organic compounds, study named reactions, pericyclic reactions, the retrosynthetic approach, and types of molecular rearrangements. The course aims to equip students with the knowledge and skills needed to design and execute complex organic syntheses.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		75

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	Understand the principles and techniques of organic synthesis, including carbon-carbon (C-C) bond formation, protection and deprotection of functional groups, and the significance of named reactions, particularly base and acid-catalyzed reactions.	K1	• Interactive Lectures • Collaborative Learning • Simulation Tools	Assignments, quizzes, practices in class, and exams.
1.2	Grasp the mechanisms and significance of pericyclic reactions, and comprehend the retrosynthetic approach in planning	K2	• Interactive Lectures • Collaborative Learning	Assignments, quizzes, practices in class, and exams.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	the synthesis of complex organic molecules.		• Simulation Tools	
2.0	**Skills**			
2.1	Perform experimental techniques and procedures to synthesize various organic compounds.	S1	Lab work	Theoretical lab exam
2.2	Analyze reaction mechanisms and predict the outcomes of various organic reactions.	S2	• Interactive Lectures • Collaborative Learning • Simulation Tools	Assignments, quizzes, practices in class, and exams.
2.3	Design synthetic pathways for the preparation of organic compounds, incorporating appropriate protection and deprotection strategies	S2	• Interactive Lectures • Collaborative Learning • Simulation Tools	Assignments, quizzes, practices in class, and exams.
2.4	Explain the choice of methods and reagents used in organic synthesis projects, and apply the retrosynthetic approach to design efficient synthetic routes for target molecules.	S3	• Interactive Lectures • Collaborative Learning • Simulation Tools	Assignments, quizzes, practices in class, and exams.
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate honesty and ethical behavior in all aspects of organic synthesis, from experimental design to data reporting	V1	• Interactive lectures • lab work	Assignments, quizzes, exams, and performance in class/lab

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.2	Display professionalism in all interactions, whether in the laboratory, classroom, or professional settings.	V2	• Interactive Lectures • Collaborative Learning • lab work	Performance in class/lab, assignments, and lab reports

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to organic synthesis	**2**
2.	Chemistry of functional groups and their transformations	**4**
3.	Types of organic reactions and mechanisms	**4**
4.	Regioselectivity and Chemoselectivity	**2**
5.	Protection and deprotection of function groups: Hydroxyl group, carbonyl group, carboxylic group, and amino group	**4**
6.	Named reactions: Aldol condensation - Claisen condensation – Cannizzaro reaction – Friedel Crafts acylation – Mannich reaction– Grignard reaction –Michael addition – Wittig reaction – Suzuki cross coupling – Diels-Alder cylocaddition – Friedel-Crafts alkylation – Biginelli reaction.	**6**
7.	Pericyclic reactions	**4**
8.	Retrosynthetic approach	**4**
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and/or quizzes	--	10 %
2.	Midterm Exam.	8	20 %
3.	Practical Exam.	16	30 %
4	Final Exam.	17	40 %
	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	**The course content presented by the lecturer**
Supportive References	**• T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder "Organic Chemistry, 11th Edition, International Student Version" 2013, John Wiley & Sons.** **• J. McMurry "Organic Chemistry, 8th edition, International Edition" 2011, Brooks/Cole**
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom with capacity of (30) students. A laboratory with capacity of (15) students Including all practical facilities
Technology equipment (projector, smart board, software)	Teaching halls and laboratories are equipped with data show.
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program leader, curriculum committee	Direct (classroom observation using the Teaching Observation Concepts and Teaching Observation Proforma
Effectiveness of Students assessment	**External reviewer**	**Direct**
Quality of learning resources	Students, faculty members and External reviewers	Direct
The extent to which CLOs have been achieved	**Peer Reviewer**	Direct
Other		

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

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Physical Organic and Stereochemistry	
Course Code: CHM3404	
Program: Chemistry	
Department: Chemistry department	
College: Science college	
Institution: Umm Al-Qura University	
Version: 3	
Last Revision Date: 29-12-2024	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2h)					
2. Course type					
A.	☐ University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (5th level / 3rd year)					

4. Course general Description:

Physical organic and Stereochemistry focuses on relating structure to the reactivity of Organic molecules through the electronic effects and the steric effect. The different methods of determining a reaction mechanism, interpret and suggest the mechanisms of some common organic reactions such as nucleophilic and electrophonic substitution reaction, elimination and addition reactions. Also, different types of intermediates and their stability are discussed and study the principles of stereochemistry.

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

Aromatic and Heterocyclic Chemistry CHM2402

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

7. Course Main Objective(s):

This course introduces in-depth the reaction mechanism of different types of reactions, such as: Substitution, elimination, and addition reactions for all organic compounds categories, and the detailed description of physical tools to purpose the mechanisms of these reactions. In addition, by end of this course student will gain the basic principles of various types of isomerism and stereochemistry

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 • E-learning	--------	---------

No	Mode of Instruction	Contact Hours	Percentage
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)**	
Total		30

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	Recognize and characterize types of reaction mechanism and illustrate principles of molecular rearrangements and structure-reactivity.	K1	Lectures	Final and mid-tern exams.
1.2	Identify methods used for the investigation of reaction mechanisms, energy considerations and	K2	Lectures	Final and mid-term exams.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	stereochemical considerations.			
2.0	**Skills**			
2.1	Apply reaction mechanisms, stereochemistry, and kinetics in the identification of structures of organic compounds.	S2	Lectures and tutorials	Final , mid-term, and quizzes.
2.2	Compare reactivity based on physical and chemical properties of the molecular structure.	S3	Lectures and tutorials	Final , mid-term, and quizzes.
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate learning skills to work as a team in a multidisciplinary environment and demonstrate effective writing, oral communication skills and using ICT tools	V2	Web-based study Library visits	Class and tutorial discussion. Assignment activities, Homework

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction, thermodynamic and activation energy. physical and chemical methods for the identification of reaction mechanism	2
2.	Reaction kinetics and mechanism, isotope effect labeling and intermediates determinations.	2
3.	Mechanisms of aliphatic nucleophilic substitution reactions, SN1, SN2	4
4.	Mechanisms of addition and elimination reactions, E1, E2	4
5.	Electrophilic addition to carbon-carbon double bond	2
6.	Mechanisms of nucleophilic addition to carbonyl group	2
7.	Mechanisms of radical reactions and photochemistry	2
8.	Solvent effect on chemical reactions	2

9.	The chemistry of the reactive intermediate such as carbanion, carbocation, carbens and free radicals	4
10.	Introduction to stereochemistry: conformational isomerism, geometrical isomerism, optical isomerism and Chiral study and their properties	4
11	Application of stereochemistry in prediction of reaction mechanism	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	Over all weeks	20%
2.	Mid-term Exam.	7	30%
3.	Final Exam.	16-17	50%
...			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	John McMurry, Organic Chemistry, ninth Edition, 2015. Robert J. Ouellette and J. David Rawn "Organic Chemistry, Structure, Mechanism and synthesis’’2014
Supportive References	Eric V. Anslyn, Dennis A. Dougherty "Modern Physical Organic Chemistry", University Science Books Sausalito, California, 2005.
Electronic Materials	PPT file containing the slides representing the course
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Projector
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect: Regular surveys to evaluate teaching effectiveness and course relevance. Direct: CLO' assessment
Effectiveness of Students assessment	Faculty, Peer Review	Direct: Annual review of course content by faculty members and external experts
Quality of learning resources	Students	Indirect: Regular surveys to evaluate Quality of learning resources
The extent to which CLOs have been achieved	Peer Review	Direct: Annual review of course content by faculty members and external experts
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

Course Specification

(Bachelor)

Course Title:	Organic Spectroscopy
Course Code:	CHM3405
Program:	Chemistry - Chemistry track
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	3
Last Revision Date:	2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 2h					
2. Course type					
A.	☐University	☐College	☐Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6^{th}/3)					
4. Course general Description:					
This course is designed to help the students to an understanding of the various spectroscopic characterization techniques and how to determine the structure of organic compounds utilizing spectroscopic techniques which is an important part of modern-day research and development. and focusing on applications in determining the structure of the organic molecules					
5. Pre-requirements for this course (if any)**:**					
Aromatic and Heterocyclic Chemistry (CHM2402)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
By the end of this course, students will be familiar with compounds analysis by (UV-Spectroscopy, Infra-Red Spectroscopy, NMR-Spectroscopy, Mass Spectroscopy). The students will be trained in using database services and/or websites to improve interpretation of compounds with spectroscopy.					

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 • 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)**	
Total		**30**

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	Recognize the general Principals of different spectroscopy.	K1	Lectures	• Final and Mid-term exams.
1.2	List of the factors affecting absorption frequency	K1	• Lectures • Scientific discussion	• Final and Mid-term exams.
1.3	Describe the organic compounds using spectroscopy	K2	Lectures	• Final and Mid-term exams.
1.4	Determine the type and numbers of signals for NMR spectra in the different compounds	K2	• Lectures • Scientific discussion	• Final and Mid-term exams.
1.5	Identify the examples of common types of fragmentation processes	K2	Lectures	• Final and Mid-term exams.
…				
2.0	**Skills**			
2.1	Identify the structure of compounds using spectroscopic tools.	S1	• Lectures • Lab section	• Final and Mid-term exams.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				• Lab exam • Assignment activities.
2.2	Explain the different Benefits for study organic spectroscopy	S2	• Lectures • Scientific discussion	• Final and mid-term exams. • Assignment activities.
2.3	Determine the structure of compounds by spectroscopy	S2	• Lectures • Scientific discussion	• Final and mid-term exams. • Assignment activities.
2.4	Compare between different spectroscopic tools	S3	• Lectures • Scientific discussion	• Final and Mid-term exams. • Assignment activities.
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate learning skills to work as a team in a multidisciplinary environment and demonstrate effective writing, oral communication skills and using ICT tools	V2	• Web-based study. • Library visits.	• Class discussion. • Assignment activities
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Theoretical principles of spectroscopy.	2
2.	Principles of UV absorption spectroscopy: Ground and excited states, molar absorptivity, and calculation of λ_{max} to the possible structures.	4
3.	Applications for UV spectroscopy and solving problems.	2

4.	IR spectroscopy: Principles-experimental aspects - Factors affecting absorption frequency, experimental aspects of IR spectroscopy.	4
5.	Interpretation of IR charts.	2
6.	NMR spectroscopy: Types and principles - The nature of NMR absorption instrumentation; chemical shifts in ^{1}H NMR spectroscopy.	4
7.	Shielding and de shielding effect magnetic anisotropy, spin-spin coupling in ^{1}H NMR spectroscopy.	2
8.	^{13}C NMR spectroscopy: types - applications	2
9.	Mass Spectrometry (MS): Ionization process, instrumentation	2
10.	Examples of common types of fragmentation processes.	2
11.	use the synergistic information afforded from the combination of mass, UV, IR and NMR spectra to identify the structure of an organic molecule: (Applications and solving problems)	4

Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment activities	1-15	20%
2.	Mid-term exam	7-8	30%
3.	Final written exam	16-17	50%
...	**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	• Pavia, D.; Lampman, G.M.; Kriz, G.S.; Vyvyan, J.R. Introduction to Spectroscopy, 4th edition, 2009, Belmont: Brooks/Cole, Cengage Learning. • Silverstein, R.M.; Webster, F.X.; Kiemle, D.J. Spectrometric Identification of Organic Compounds. 7th edition, 2005, N.Y.: John Wiley & Sons, Inc.
Supportive References	1- L D Field, S Sternhell and J R Kalman. ORGANIC STRUCTURES FROM SPECTRA. 4th Ed. 2008, John Wiley & Sons, Inc.
Electronic Materials	• http://www.organic-chemistry.org/reactions.htm

	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org • http://www.orgsyn.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms capacity (50) students. Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer Reviewer	Direct
Effectiveness of student's assessment	Peer Reviewer	Direct
Quality of learning resources	Student	Indirect
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Petroleum and Petrochemicals**
Course Code:	**CHM3406**
Program:	**Chemistry- Chemistry track**
Department:	**Department of Chemistry**
College:	**Science**
Institution:	**Umm Al-Qura University**
Version:	**1st**
Last Revision Date:	**Pick Revision Date.**

جامعة أم القرى - وزارة التعليم • Ministry Of Education-Umm Al-Qura University • الكلية الجامعية بالجموم-قسم الكيمياء Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hrs (2 hrs. Theoretical + 1 hr. Practical))					
2. Course type					
A.	☐University	☐College	☐ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6^{th} / 3^{rd})					
4. Course general Description:					
Study the theories of petroleum formation, petroleum classifications and quality. Study the fractional distillation of petroleum and its products, the chemical processes. Study of petrochemical industries and their importance and uses.					
5. Pre-requirements for this course (if any):					
Aromatic and Heterocyclic Chemistry (CHM2402)					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					
By the end of the course the student will 1. Petroleum formation, classifications and quality. 2. Petroleum distillation and its products. 3. Crude oil products ~~treatment~~are treated by chemical processes. 4. Petrochemical industries and their importance and ~~uses~~use.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	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**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		75

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	Are fully conversant with various theories for oil formation and oil traps , Demonstrate and understanding of fundamental elements and chemical composition of crude oil	K1	Lectures and Library visit and discussions and in small groups	Quiz and discussions
1.2	Gain knowledge of the different ways fractional distillation of crude oil and distillate in each stage and its products and chemical process of cracking, combining,	K2	Lectures and research	Quiz and discussions

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	rearrangement and purification process.			
2.0	**Skills**			
2.1	The student acquires knowledge of chemical structures and predict its presence in petroleum distillates.	S1	Discussions	Quiz
2.2	Problem-solving skills, relating to petroleum products improvement like treatment and purification	S2	Through assignments and homework	Quiz
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate skills in the usage of computer, network, and software packages relevant to chemistry; e.g. Chem-draw, Microsoft ward. and demonstrate written of research and presenting skills.	V1	Through assignments and homework	Quiz

C. Course Content

No	List of Topics	Contact Hours
1. 1	Definition of Petroleum and it origin formation and traps	**2**
2. 2	Methods of exploration and Petroleum Classification	**2**
3. 3	Chemical Composition of Petroleum	**2**
4	Field separation of crude oil (Desalting, water treatment, gas treatment)	**4**
5	Refining operations and Fractional Distillation of crude oil	**4**
6	Crude oil Distillation products~~: light~~: light distillates (natural Gas, gasoline and naphtha) - Mild distillates (kerosene, heating oil and jet fuel and diesel fuel) - heavy distillates (lubricates oil and waxes, asphalt and coke oil).	**4**
7	Chemical conversion processes of crude oil: Cracker processes (thermal cracking and catalytic ~~cracking and~~cracking and hydrocracking) - Combining processes (polymerization and alkylation) - Rearrangement processes (catalytic	**4**

	reforming and isomerization and improving the octane and cetane ~~number~~ ~~)~~number) - Purification by hydrogen treatment (removing hydrogen sulfide compounds mercaptans and compounds of nitrogen. Etc.).	
8	Petrochemicals definition – History of Petrochemicals industry	4
9	Production of petrochemicals and industrial uses	4
	Total	**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1. 1	**Homework and/or activities**	**--**	**10 %**
2. 2	**Midterm Exam**	**8**	**20 %**
3. 3	**Practical Exam.**	**15**	**30 %**
4	**Final Exam).2 hours exam)**	**16**	**40 %**
5	**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	Petroleum and petrochemical course presented by the lecturer.
Supportive References	• J. G. Speight, The Chemistry and Technology of Petroleum, 5th ed. CRC Press, 2014, P. 953, ISBN: 9781439873892. • R. Curley, Fossil Fuels. Britannica, 2012, P. 160, ISBN 9781615305407. • M. A. Fahim, T. A. Alsahhaf, A. Elkilani, Fundamentals of Petroleum Refining, Elsevier, 2010, P. 496, ISBN 9780444527851. • D. S. J. Jones, Peter R. Pujadó, Handbook of petroleum processing, Springer Dordrecht Netherlans, 2006. • S. Matar, L. F. Hatch, Chemistry of Petrochemical Processes, 2nd ed. 2001, P. 392, ISBN 9780884153153. • Uttam Ray Chaudhuri. Fundamentals of Petroleum and Petrochemical Engineering. December 13, 2010 by CRC Press.

	• Uttam Ray Chaudhuri. Fundamentals of Petroleum and Petrochemical Engineering (Chemical Industries) Hardcover – Import, 28 Jan 2011. CRC Press; 1 edition (28 January 2011). • International petroleum encyclopedia, Tulsa, Oklahoma: Pennwell, Corporation, 2007.
Electronic Materials	• http://www.chemhelper.com/ • http://www.chemweb.com/ • http://www.sciencedirect.com/
Other Learning Materials	• Microsoft Power Point, Microsoft Word. • Video show on thermodynamics. Learning CD on thermodynamics.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classroom capacity (30) students. - Processing of the classroom with appropriate educational means, including computers
Technology equipment (projector, smart board, software)	Classroom is equipped with a computer, Data Show and TV.
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Extent of achievement of course learning outcomes	Observations and the assistance of colleagues.	Direct
Quality of learning resources	Students	A questionnaire
Effectiveness of teaching and assessment	Peer Reviewer and Program Leaders	Direct

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

Assessment Methods (Direct, Indirect)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Organic Spectrometry	
Course Code: CHM3410	
Program: Chemistry - Chemical analysis and quality assurance track	
Department: Chemistry	
College: Science	
Institution: Umm Al-Qura University	
Version: 3	
Last Revision Date: 2025	

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 3h (2 theoretical + 1 practical)					
2. Course type					
A.	☐University	☐College	☐Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6^{th}/3)					
4. Course general Description:					
This course is designed to help the students to an understanding of the various spectroscopy characterization techniques and how to determine the structure of organic compounds utilizing spectroscopic techniques which is an important part of modern-day research and development. and focusing on applications in determining the structure of the organic molecules					
5. Pre-requirements for this course (if any)**:**					
Organic Reactions and Preparations (CHM3403)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
By the end of this course, students will be familiar with compounds analysis by (UV-Spectroscopy, Infra-Red Spectroscopy, NMR-Spectroscopy, Mass Spectroscopy). The students will be trained in using database services and/or websites to improve interpretation of compounds with spectroscopy.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		**75**

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	Recognize the general Principals of different spectroscopy.	K1	Lectures	• Final and Mid-term exams.
1.2	List of the factors affecting absorption frequency	K1	• Lectures • Scientific discussion	• Final and Mid-term exams.
1.3	Describe the organic compounds using spectroscopy	K2	Lectures	• Final and Mid-term exams.
1.4	Determine the type and numbers of signals for NMR spectra in the different compounds	K2	• Lectures • Scientific discussion	• Final and Mid-term exams.
1.5	Identify the examples of common types of fragmentation processes	K2	Lectures	• Final and Mid-term exams.
...				
2.0	**Skills**			
2.1	Identify the structure of compounds using spectroscopic tools.	S1	• Lectures • Lab section	• Final and Mid-term exams.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				• Lab exam • Assignment activities.
2.2	Explain the different Benefits for study organic spectroscopy	S2	• Lectures • Scientific discussion	• Final and mid-term exams. • Assignment activities.
2.3	Determine the structure of compounds by spectroscopy	S2	• Lectures • Scientific discussion	• Final and mid-term exams. • Assignment activities.
2.4	Compare between different spectroscopic tools	S3	• Lectures • Scientific discussion	• Final and Mid-term exams. • Assignment activities.
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate learning skills to work as a team in a multidisciplinary environment and demonstrate effective writing, oral communication skills and using ICT tools	V2	• Web-based study. • Library visits.	• Class discussion. • Assignment activities
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Theoretical principles of spectroscopy.	2
2.	Principles of UV absorption spectroscopy: Ground and excited states, molar absorptivity, and calculation of λ_{max} to the possible structures.	4
3.	Applications for UV spectroscopy and solving problems.	2

4.	IR spectroscopy: Principles-experimental aspects - Factors affecting absorption frequency, experimental aspects of IR spectroscopy.	4
5.	Interpretation of IR charts.	2
6.	NMR spectroscopy: Types and principles - The nature of NMR absorption instrumentation; chemical shifts in ^{1}H NMR spectroscopy.	4
7.	Shielding and de shielding effect magnetic anisotropy, spin-spin coupling in ^{1}H NMR spectroscopy.	2
8.	^{13}C NMR spectroscopy: types - applications	2
9.	Mass Spectrometry (MS): Ionization process, instrumentation	2
10.	Examples of common types of fragmentation processes.	2
11.	use the synergistic information afforded from the combination of mass, UV, IR and NMR spectra to identify the structure of an organic molecule: (Applications and solving problems)	4

Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignment activities	1-15	10
2.	Mid-term exam	7-8	20%
3.	Lab exam	15	30%
4.	Final written exam	16-17	40%
...	**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	• Pavia, D.; Lampman, G.M.; Kriz, G.S.; Vyvyan, J.R. Introduction to Spectroscopy, 4th edition, 2009, Belmont: Brooks/Cole, Cengage Learning. • Silverstein, R.M.; Webster, F.X.; Kiemle, D.J. Spectrometric Identification of Organic Compounds. 7th edition, 2005, N.Y.: John Wiley & Sons, Inc.
Supportive References	1- L D Field, S Sternhell and J R Kalman. ORGANIC STRUCTURES FROM SPECTRA. 4th Ed. 2008, John Wiley & Sons, Inc.

Electronic Materials	• http://www.organic-chemistry.org/reactions.htm • http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org • http://www.orgsyn.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms capacity (50) students. Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer Reviewer	Direct
Effectiveness of student's assessment	Peer Reviewer	Direct
Quality of learning resources	Student	Indirect
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

2023

TP-153

Course Specification

(Bachelor)

Course Title:	Air and Soil Analysis
Course Code:	CHM4210
Program:	Chemistry (Chemical Analysis and Quality Measurements track)
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	21 / 12 / 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th / 4th year)					
4. Course general Description:					
The course discusses some physical and chemical properties of soils and air as well as how to determine these properties and how to evaluate their quality, air and soil , using chemical methods.					
5. Pre-requirements for this course (if any)**:**					
Food Analysis (CHM3208)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
By finishing the course, the students will have studied the composition of air and soil, their properties, sampling and the analytical methods used for their analysis.					

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 • 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)**	--
Total		30

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	**Describe how spectroscopic and analytical methods are used to analyze soil and air samples.**	**K1**	**Lectures**	**Homework and exams**
1.2	**List the methods used for evaluating the properties of soil and air.**	**K2**	**Lectures**	**Homework and exams**
1.3	**Explain the importance of analyzing soil and air.**	**K1**	**Lectures**	**Homework and exams**
...				
2.0	**Skills**			
2.1	**Explain the methods and ways of analytical chemistry to determine pollutants presented in soil and air**	**S2**	**Lectures**	**Homework and exams**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	Apply the qualitative and quantitative principles for analyzing soil and air samples	S3	Lectures	Homework and exams Lab exam
3.0	**Values, autonomy, and responsibility**			
3.1	Work collaboration and choose the suitable analytical device to analyze real soil and air samples.	V1	Presentation	Observation by the instructor
3.2	Work effectively both in a team, and independently on solving chemistry problems.	V2	Presentation	Observation by the instructor
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Soil composition [Sand, silt, clay, organic compounds, minerals, water and organisms].	2
2.	Soil physical properties [Such as texture, structure, bulk density and temperature].	2
3.	Soil chemical properties [Such as electrical conductivity, pH and nutrient availability] and components interactions.	2
4.	Soil quality indicator. Soil analysis [Definition, importance, methodology]. Soil samples' preparation methods.	4
5.	Electrical and pH analysis of soils using titrimetric measurement and electroanalytical methods.	4
6.	Determination of soil organic matter, ammonia, nitrogen, nitrate and nitrite, carbonate and halogen ions.	2
7.	Mid-term exam	2
8.	Analysis of soil samples using spectroscopic and chromatographic methods.	4
9.	Chemical composition of air.	2

10.	Air pollution [Types, sources, impacts on health and environment, smog, acid rain and global warming].	2
11.	Volatile organic compounds, VOCs and air sampling methods	2
12.	Determination methods of carbon oxides, sulfur dioxide, nitrogen oxides, particulate matter and hydrocarbons from the atmosphere.	2

Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-term Exam	9	30%
2.	Homework and quiz	Every 3 or 4 weeks	20%
3.	End-of-term Exam	16-17	50%
...			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	Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014)
Supportive References	
Electronic Materials	http://www.chemweb.com http://www.sciencedirect.com http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom suitable for the number of students. Chemical laboratories equipped with safety tools and chemicals.
Technology equipment (projector, smart board, software)	Projector, board.

Items	Resources
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**CHEMISTRY DEPARTMENT / FACULTY OF SCIENCE**
REFERENCE NO.	
DATE	**21 / 12 / 2024**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Forensic Chemistry
Course Code:	CHM4211
Program:	Chemistry - Chemical Analysis and Quality Measurements Track
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	47
Last Revision Date:	19/02/2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 h)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (8th Level/4th year)					
4. Course general Description:					
This course will provide an introduction to forensic chemistry and prepare students to build a sound knowledge in chemical, biochemical, and instrumental methods for forensic analysis and statistical analysis of forensic data. The class will cover principles and applications of chemical, biochemical, spectroscopic, and chromatographic methods for analysis and characterization of forensic samples.					
5. Pre-requirements for this course (if any)**:**					
Environmental Chemistry (CHM3205)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
• To provide a general overview of the prevalent chemical principles, methods, and instrumentation involved in the analysis of physical evidence. • To emphasize instruction and experience in the most commonly employed chemical and instrumental methods of forensic analysis. • To provide the student a background in statistical analysis of data. • To describe basic instrumentation used in forensics analysis and the principles behind their function. • To familiarize the student with the methodologies involved in analysing forensic samples including fingerprints, hair, Forgery of Banknotes, documents. • To emphasize the importance of sound science and ethics in the analysis of forensic evidence and in the reporting of the findings of such analyses.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100 %
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	42
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		72

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	Familiar between quality assurance - quality control - quality management - Internal quality control - External quality control.	K2	• Lectures • Scientific discussion • Library visits • Web-based study	• Exams • web-based student performance systems • portfolios • long and short essays • posters
1.2	Describe the science of forensic chemistry.	K1		
1.3	Explain how to take a representative sample for analysis and the associated problems during sample preparation	K1		
2.0	**Skills**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	Apply statistical analysis of data	S2	1. Group discussions 2. Case study. 3.Homework assignment containing problem 4. Thinking activities	1.Midterm exam 2.quizzes 3.Group discussion 4.Final exam
2.2	Show the different analytical methods used in forensics analysis	S3		
3.0	**Values, autonomy, and responsibility**			
3.1	Develop the quality in chemical analysis.	V2	1. Group discussions 2. Case study. 3. Data presentation 4. Thinking activities	1.Midterm exam 2.Quizzes 3.Group discussion 4.Final exam
3.2	Work collaboration and choose the suitable analytical device to analyse real samples in forensic chemistry	V3		

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to forensic chemistry	2
2.	The quality in chemical analysis - quality assurance - quality control - quality management - Internal quality control - External quality control	4
3.	Statistics used in analysing the results	2
4.	Sample preparation, representative sampling techniques, reproducibility, replicates, duplicates, external standard, internal standard and matrix effect.	4
5.	The most important analytical devices used in the chemical analysis process to analyse the ambiguity of the crime scene in forensic Chemistry	4
6.	Mid Term exam	2
7.	Video Comparative spectrum device, A highly efficient liquid chromatography, atomic absorption spectrometry, Ultraviolet and visible spectrometer).	2
8.	Analysis of Forensic Samples - Drug Analysis - Inks, Paints, Pigments, Blood Alcohol Analysis	4
9.	Applications of analytical chemistry in the hair analysis - fingerprinting - forgery of banknotes and documents	4
10.	The use of analytical chemistry in the analysis of firearms, toxins (drug analysis) - Chemical - abusive drugs	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and/or activities.	During all weeks	10%
2.	Midterm Exam.	8	20%
3.	Practical part	--	30%
4.	Final Exam.	16	40%
	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	Jay A. Siegel, Forensic Chemistry: Fundamentals and Applications, Wiley & Sons, 2015, ISBN: 978-1-118-89772-0.
Supportive References	-----------
Electronic Materials	• http://www.chemhelper.com/ • http://www.chemweb.com/ • http://www.science.uwaterloo.ca/~cchieh/cact/ http://www.sciencedirect.com/
Other Learning Materials	Lecture Handouts available on the coordinator website

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms capacity (40) students. -Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (depending on the nature of the specialty)	No other requirements

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching

Assessment Areas/Issues	Assessor	Assessment Methods
		effectiveness and course relevance.
Effectiveness of Students' assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other	---	---

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Sample Preparation Methods
Course Code:	CHM4212
Program:	Chemistry- Chemical Analysis and Quality Measurements Track
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	47
Last Revision Date :	23/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hours (theoretical))					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (8th Level /4th year)					
4. Course general Description:					
This course aims at providing students with the necessary knowledge and procedures that used in sampling and preparing samples for chemical analysis					
5. Pre-requirements for this course (if any)**:**					
Separation methods and thermal analysis CHM3204					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
By the end of this course the students will be familiar with a necessary knowledge on sampling, sample preservation, types of sampling and the procedures that used in preparing a representative analytical samples and associated quality control.					

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 • 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)**	--
Total		30

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	List the steps involving in analysis and preparation of the samples			K1
1.2	find the suitable method of preservation of different samples			K2
2.0	**Skills**			
2.1	Explain different strategies for sampling, sample preservation and preparation			S2
2.2	Suggest suitable preparation or preservation method of different samples			S3
3.0	**Values, autonomy, and responsibility**			
3.1	Write and present a report related to samples' preparations			V2&V3

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction, the need for collecting samples; sampling.	2
2.	Types of samplings	2
3.	Sampling plans	2
4.	Sampling of different environmental samples (Air, water, solid and sediments sampling)	4
5.	Sample preservation methods	2
6.	Sample preparation methods	2
7.	Sampling Techniques	4
8.	Biological Sample Preparation	2

7.	Chemical Sample Preparation Technique(Digestion- Extraction- Purification)	2
8.	Quality control in sample preparation	2
9.	Thermal Sample Preparation	2
10.	Instrumentation for Sample Preparation	2
11.	Application in sample preparations methods	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities or assignments or oral presentation	--	20%
2.	Mid-term exam	6	30%
3.	End-of-term exam.	--	50 %
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	• Lecture Handouts available on the coordinator website
Supportive References	• Somenath Mitra, Sample preparation techniques in analytical chemistry. Wiley (2003). https://onlinelibrary.wiley.com/doi/book/10.1002/0471457817 • E. Eljarrat, Methodologies for Sample Preservation and Stabilization. Elsevier (2012). https://www.sciencedirect.com/science/article/pii/B9780123813732000041?via%3Dihub • Miguel De La Guardia, Salvador Garrigues, Handbook of green analytical chemistry, Wiley (2012) • Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug. Analytical Chemistry, 7th edition, Wiley (2013) Janusz Pawliszyn, Heather L. Lord, Handbook of sample preparation. Wiley (2010).
Electronic Materials	• http://www.chemweb.com

	• http://www.sciencedirect.com
Other Learning Materials	• Microsoft Power Point, Excel and Microsoft Word • Professional standards or regulations and software

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classrooms capacity (30) students. • Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV
Other equipment (depending on the nature of the specialty)	------

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (Online survey at the end of the semester (Program survey, Experience survey &course evaluation) and graduates survey.
Effectiveness of Students assessment	Faculty members	Direct (classroom observation using the Teaching Observation Concepts and Teaching Observation Preform
Quality of learning resources	Faculty members	Direct (Comments of course instructors regarding evaluation of teaching strategies for learning outcomes mentioned in course report).
The extent to which CLOs have been achieved	--	--
Other		

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

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

Course Specification

(Bachelor)

Course Title:	Instrumental analysis and verification methods
Course Code:	CHM4213
Program:	Chemistry - Chemical Analysis and Quality Measurements Track
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura university
Version:	*Course Specification Version Number*
Last Revision Date:	25/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 credit hours)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (8th level / 4th year)					

4. Course general Description:

This course will be concerned with the theory and practice of instrumental methods for the identification and quantitative analysis of chemical substances

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

Industrial Analysis and Quality Control CHM3206

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

7. Course Main Objective(s):

By the end of this course students have all information about the instrumental analysis and have ability to determine compounds, molecules and trace amounts of different compounds and metals.

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 E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	0
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		30

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	Describe the principles and applications of spectrophotometric, electroanalytical and chromatographic analysis techniques	**K1**	Lectures and Scientific discussion	Participation - exams – assignment
1.2	Recognize the spectrophotometric, electroanalytical and chromatographic measurements theory, the potentiometric methods and potentiometric titrations	**K2**	Lectures and Scientific discussion	Participation - exams – assignment
2.0	**Skills**			
2.1	Apply broad theories, principles, and concepts in various contexts, in spectrophotometric, electrochemical and chromatographic techniques	**S2**	Lectures	Participation – exam assignment-Report
2.2	Solve complex problems in various contexts	**S2**	• Lectures Lab work	participation, projec t، Report

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	related to spectrophotometric, electrochemical and chromatographic techniques and overlapped disciplines quantitatively and qualitatively.			
2.3	Use and adapt spectrophotometric, electrochemical, chromatographic and spectroscopic processes, techniques, tools, instruments, and/or materials that are advanced to deal with various complex practical activities	**S3**	• Lectures Lab work	Exams-report
3.0	**Values, autonomy, and responsibility**			
3.1	Write and present a chemical report and solve problems related to spectrophotometric, electrochemical, chromatographic and spectroscopic analysis.	**V1**	• Lab Work. Class discussion and research activity.	Presentation - Participation - assignment-lab report-project
3.2	Work collaboratively and constructively in teams with responsibility to perform a specific experiment or preparing a report on the spectrophotometric, electrochemical, chromatographic and spectroscopic processes.	**V2**	• Lab Work. Class discussion and research activity	Presentation, Project
...				

C. Course Content

No	List of Topics	Contact Hours
1.	General properties of electromagnetic radiation and its interaction with matter, the electromagnetic spectrum as well as the absorption and emission of electromagnetic radiation	**2**
2.	Ultraviolet and visible molecular absorption spectroscopy, Beer's law, true and apparent deviations from Beer's law, application of Beer's law, calibration curve.	**4**
3.	Qualitative and quantitative analysis by UV-Vis. Applications of spectrophotometric methods in chemical equilibrium studies, spectrophotometric titrations	**4**
4.	Flame emission and atomic absorption spectroscopy, nebulisation, burners and nebulizers, flames and flame temperature, interferences, flame spectrometric techniques, flame emission spectrometry, flame photometer, flame atomic absorption spectrometry and applications	**4**
5.	ICP and its use for the analysis of environmental samples	**2**
6.	Mid-term exam	**2**
7.	Introduction to electroanalytical methods; types and components.	**2**
8.	Applications of electroanalytical methods for analysis of analysis of environmental samples.	**2**
9.	Introduction to chromatographic methods; types and components.	**4**
10.	Applications of chromatographic methods for environmental samples.	**2**
11.	Applications of x-ray spectrometry, FT-IR and Raman spectrometry for the analysis of environmental samples.	**2**
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Home work		20%
2.	Midterm Exam.	8	30%
3.	Final Exam.	16 or 17	50%
...	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	Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014)
Supportive References	Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014) Dhruba Charan Dash. Analytical Chemistry) PHI Learning Private Limited, 2017.
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	Projector, smart board
Other equipment (depending on the nature of the specialty)	Chemicals and equipment to conduct experiments

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have	Peer reviewer	Direct: annual review of

Assessment Areas/Issues	Assessor	Assessment Methods
been achieved		course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	

2023

TP-153

Course Specification

(Bachelor)

Course Title: Water Analysis and Treatments	
Course Code: CHM4214	
Program: Chemistry – Chemical Analysis and Quality Measurements Track	
Department: Chemistry	
College: Faculty of Science	
Institution: Umm Al-Qura University	
Version: *Course Specification Version Number*	
Last Revision Date: *Pick Revision Date.*	

جامعة أم القرى • وزارة التعليم • الكلية الجامعية بالجموم-قسم الكيمياء
Ministry Of Education-Umm Al-Qura University • Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)					
2. Course type					
A.	☐ University	☐College	☒ Department	☒ Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (8/4)					

4. Course general Description:

This course provides exploration of water analysis and treatment aspects. Students will gain knowledge of water quality assessment, contamination detection, and treatment technologies. The course covers the physical and chemical processes involved in water and wastewater treatment.

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

Separation Methods and Thermal Analysis CHM3204

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

7. Course Main Objective(s):

- Develop understanding of the concepts of water analysis and treatment processes.
- Analyze water quality parameters and their significance.
- Gain skills to design and optimize water analysis and treatment systems.

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 • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		30

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	Familiar with a broad knowledge, theories, principles, and concepts in water analysis and treatments	K1	Lectures	Mid-term and Final Exam
1.2	Recognize the chemical and physical characterization of the quality of water	K2	Lectures	Final Exam
2.0	**Skills**			
2.1	Apply chemical processes, techniques and tools in analysis and treated of water systems	S2	Lectures and class discussion	Final Exam
2.2	Assess the quality of water using various analytical methods and tools	S3	Lectures and class discussion	Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	Ability to work in a team to perform specific report on water treatment	V1	Class discussion	Report
3.2	Present chemical data and reports scientifically in the application of quality of water, using proper oral communication and adhering to scientific conduct.	V2	Class discussion	Presentation

C. Course Content

No	List of Topics	Contact Hours
1.	Fundamental principles of Water Analysis and Treatment	2
2.	Water Quality physical Parameters and Analysis (Temperature, turbidity, and color)	4
3.	Water Quality chemical Parameters and Analysis (Dissolved oxygen, pH, and alkalinity	4
4.	Physical techniques of water treatment	4
5.	Mid-term exam	2
6.	Chemical process of water treatments	6
7.	Advanced Treatment Technologies of water	4
8.	Application in water treatments	4
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Written Mid-term test	8	30 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Written final Exam	16 or 17	50 %
2.	Homework and report or presentation	During the term	20 %

*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	• Walid Elshorbagy and Rezaul Kabir Chowdhury, "Water Treatment" Edited by First published in Croatia, 2013 by INTECH d.o.o. http://dx.doi.org/10.5772/2883. • Leo M.L. Nollet, Leen S. P. De Gelder "Handbook of Water Analysis", CRC press, 2014.
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms capacity 30 students
Technology equipment (projector, smart board, software)	The room is equipped with projector.
Other equipment (depending on the nature of the specialty)	-

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching

Assessment Areas/Issues	Assessor	Assessment Methods
		effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTMENT COUNCIL**
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Organic Analytical Chemistry
Course Code:	CHM4215
Program:	**Chemistry -** Chemical Analysis and Quality Measurements
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

وزارة التعليم - جامعة أم القرى - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University - Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)					
2. Course type					
A.	☐ University	☐College	☒ Department	☒ Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (8/4)					
4. Course general Description:					
This course focuses on the principles and methods of several traditional qualitative and quantitative analytical techniques used for the analysis of main elements and functional groups present in organic compounds and their applications.					
5. Pre-requirements for this course (if any)**:**					
Bioanalytical Chemistry CHM3207					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
- Provide students with strong foundation and understanding of the basic principles of analysis of organic materials - Equip students with knowledge to utilize various techniques and tools in organic materials analysis and its applications.					

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 • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		30

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	Understand the fundamental principles of organic compounds analysis.	K1	Lectures	Mid-term and Final Exam
1.2	Recognize the methods and tools for detecting elements and functional groups in organic compounds.	K2	Lectures	Final Exam
2.0	**Skills**			
2.1	Develop problem-solving skills to find the composition and purity of different organic compounds.	S2	Lectures and class discussion	Final Exam
2.2	Apply critical and scientific explanations for methods and outcomes of organic materials analysis	S3	Lectures and class discussion	Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	Ability to work in a team to perform specific report on organic materials analysis	V1	group discussion	Report
3.2	Present chemical data and reports scientifically in the application of organic analysis, using proper oral communication and adhering to scientific conduct.	V2	group discussion	Presentation

C. Course Content

No	List of Topics	Contact Hours
1.	General introduction of organic analysis concepts	2
2.	Determination of elements in organic compounds	4
3.	Determination of Carboxylic acids	2
4.	Determination of esters	2
5.	Determination of amino groups	2
6.	Determination of hydroxylic groups	2
7.	Mid-term exam	2
8.	Determination of carbonyl groups	4
9.	Determination of nitro and nitroso groups	2
10.	Determination of the state of unsaturation in organic compounds	2
11.	Determination of isothiocyanate and isocyanates	2
12.	Applications in organic analysis	4
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Written Mid-term test	8	30 %
1.	Written final Exam	16 or 17	50 %
2.	Homework and activities	During the term	20 %

*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	• Jag Mohan "Organic Analytical Chemistry-theory and practice" Alpha Science International Ltd, 2003.
Supportive References	---
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classrooms capacity 30 students
Technology equipment (projector, smart board, software)	The room is equipped with projector.
Other equipment (depending on the nature of the specialty)	-

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO

Assessment Areas/Issues	Assessor	Assessment Methods
		Indirect: regular surveys to evaluate teaching effectiveness and course relevance.
Effectiveness of Students assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Environmental Chemistry
Course Code:	CHM4216
Program:	Chemistry (Chemical Analysis and Quality Measurements Track)
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	*Course Specification Version Number*
Last Revision Date:	25/12/2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)					
2. Course type					
A.	☐University	☐College	☒ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th level/ 4th year)					
4. Course general Description:					
The course deals with the principles of environmental chemistry. This includes the study of the effect of the chemical species and their processes on environment, air and water pollution and soil chemical analysis process.					
5. Pre-requirements for this course (if any)**:**					
Spectrophotometric and Electroanalytical Methods (CHM2203)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
By the end of this course the students will: 1- **Have information about the basis of environmental chemistry.** 2- **Familiar with air and water pollution.** 3- **Gain basic information on soil analysis.**					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100 %
2	E-learning	--	0
3	Hybrid • Traditional classroom • E-learning	--	0
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 ((E-Learning +Exams +Office hours))**	--
Total		30

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	Identify the principle of environmental chemistry and related chemical species.	K1	Lectures	Homework and exams
1.2	Explore the different types of environmental pollutions	K2	Lectures	Homework and exams
2.0	**Skills**			
2.1	Classify the types of chemical pollutions on environment.	S2	Lectures	Homework and exams
2.2	Discuss different strategies in controlling environmental pollutions.	S3	Lectures	Homework and exams
3.0	**Values, autonomy, and responsibility**			
3.1	Write and present a chemical report related to environmental chemistry.	V1	Presentation	Observation by the instructor
3.2	work individually and in a team to prepare a report on	V2	Presentation	Observation by the instructor

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	environmental analysis			

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction.	2
2.	Principles of environmental chemistry and chemical analysis.	4
3.	Energy and energy cycles and gases cycles.	4
4.	Role of human in environmental pollution.	4
5.	Atmosphere chemistry.	2
6.	Air pollution (classification-sources –problems-global warming phenomenon).	2
7.	Mid-term exam	2
8.	Water treatment chemistry.	4
9.	Water pollution (water quality- types of contaminants- water pollution control).	4
10.	Soil chemical analysis.	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Mid-term Exam**	**9**	**30 %**
2.	**Homework and quiz**	**Every 3 or 4 weeks**	**20 %**
3.	**End-of-term Exam**	**16-17**	**50 %**
	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	Stanley E. Manahan, ***ENVIRONMENTAL SCIENCE, TECHNOLOGY, AND CHEMISTRY,*** 2000, CRC Press LLC. **Donald L. Sparks**, ***Environmental Soil Chemistry***, 2nd Edition, Academic Press (2003).

Supportive References	
Electronic Materials	**http://www.chemweb.com** **http://www.sciencedirect.com** **http://www.rsc.org**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classroom suitable for the number of students**
Technology equipment (projector, smart board, software)	**Chemical laboratories equipped with safety tools and chemicals**
Other equipment (depending on the nature of the specialty)	**Projector, board**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching		
Effectiveness of teaching	Students	Questionnaire (indirect)
Effectiveness of Students assessment	Students	Questionnaire (indirect)
Quality of learning resources	Program leader	Analysis of data results
The extent to which CLOs have been achieved	Course instructor	Analysis of data from end-of-term exam.

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CHEMISTRY DEPARTMENT / FACULTY OF SCIENCE
REFERENCE NO.	
DATE	25 / 12 / 2024

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Principles of Forensic Chemistry
Course Code:	CHM4217
Program:	Chemistry (Chemistry Track)
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	47
Last Revision Date:	19/02/2025

وزارة التعليم - جامعة أم القرى - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University
Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		

3. Level/year at which this course is offered: (8th Level/4th year)

4. Course general Description:

This course will provide an introduction to forensic chemistry and prepare students to build a sound knowledge in chemical, biochemical, and instrumental methods for forensic analysis and statistical analysis of forensic data. The class will cover principles and applications of chemical, biochemical, spectroscopic, and chromatographic methods for analysis and characterization of forensic samples.

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

Environmental Chemistry (CHM3205)

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

7. Course Main Objective(s):

- **To provide a general overview of the prevalent chemical principles, methods, and instrumentation involved in the analysis of physical evidence.**
- **To emphasize instruction and experience in the most commonly employed chemical and instrumental methods of forensic analysis.**
- **To provide the student a background in statistical analysis of data.**
- **To describe basic instrumentation used in forensics analysis and the principles behind their function.**

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 • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		30

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	Familiar between quality assurance - quality control - quality management - Internal quality control - External quality control.	K2	• Lectures • Scientific discussion • Library visits • Web-based study	• Exams • web-based student performance systems • portfolios • long and short essays • posters
1.2	Describe the science of forensic chemistry.	K1		
1.3	Explain how to take a representative sample for analysis and the associated problems during sample preparation	K1		
2.0	**Skills**			
2.1	Apply statistical analysis of data	S2	1. Group discussions 2. Case study. 3.Homework assignment containing problem	1.Midterm exam 2.quizzes 3.Group discussion
2.2	Show the different analytical methods used in forensics analysis	S3		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			4. Thinking activities	4.Final exam
3.0	**Values, autonomy, and responsibility**			
3.1	Develop the quality in chemical analysis.	V1	1. Group discussions 2. Case study. 3. Data presentation 4. Thinking activities	1.Midterm exam 2.Quizzes 3.Group discussion 4.Final exam
3.2	Work collaboration and choose the suitable analytical device to analyse real samples in forensic chemistry	V2		

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to forensic chemistry	2
2.	The quality in chemical analysis - quality assurance - quality control - quality management - Internal quality control - External quality control	4
3.	Statistics used in analysing the results	2
4.	Sample preparation, representative sampling techniques, reproducibility, replicates, duplicates, external standard, internal standard and matrix effect.	4
5.	The most important analytical devices used in the chemical analysis process to analyse the ambiguity of the crime scene in forensic Chemistry	4
6.	Mid Term exam	2
7.	Video Comparative spectrum device, A highly efficient liquid chromatography, atomic absorption spectrometry, Ultraviolet and visible spectrometer).	2
8.	Analysis of Forensic Samples - Drug Analysis - Inks, Paints, Pigments, Blood Alcohol Analysis	4
9.	Applications of analytical chemistry in the hair analysis - fingerprinting - forgery of banknotes and documents	4
10.	The use of analytical chemistry in the analysis of firearms, toxins (drug analysis) - Chemical - abusive drugs	2

Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and/or activities.	During all weeks	20%
2.	Midterm Exam.	8	30%
4.	Final Exam. (2 hours exam)	16	50%
	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	Jay A. Siegel, Forensic Chemistry: Fundamentals and Applications, Wiley & Sons, 2015, ISBN: 978-1-118-89772-0.
Supportive References	-----------
Electronic Materials	• http://www.chemhelper.com/ • http://www.chemweb.com/ • http://www.science.uwaterloo.ca/~cchieh/cact/ http://www.sciencedirect.com/
Other Learning Materials	Lecture Handouts available on the coordinator website

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms capacity (40) students. -Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (depending on the nature of the specialty)	No other requirements

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: assessment of CLO Indirect: regular surveys to evaluate teaching

Assessment Areas/Issues	Assessor	Assessment Methods
		effectiveness and course relevance.
Effectiveness of Students' assessment	Peer review	Direct: annual review of course contents by faculty members
Quality of learning resources	Students	Indirect: regular surveys to evaluate quality of learning resources
The extent to which CLOs have been achieved	Peer reviewer	Direct: annual review of course contents by faculty members
Other	---	---

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Bioorganic Chemistry
Course Code:	CHM4407
Program:	Chemistry – Chemistry track
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	1
Last Revision Date:	29-12-2024

جامعة أم القرى - الكلية الجامعية بالجموم - قسم الكيمياء - وزارة التعليم
Ministry Of Education-Umm Al-Qura University
Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2)					
2. Course type					
A.	☐University	☐College	☐ Department	☒ Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (8th level/ 4th year)					

4. Course general Description:

The course include study the main biomolecules in living organisms which are also related to the field of organic chemistry. Therefore, learn their definition, structure, importance, roles in the life, functions, classifications, physical properties, synthesis, chemical reactions, metabolism and proteins synthesis. All information available for the student to learn and does not studied in the other pervious courses.

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

Organic Spectroscopy (CHM3405)

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

No

7. Course Main Objective(s):

At the end of this course, the student will be familiar with a fundamental concepts and chemistry of the living cells organic biomolecules, such as carbohydrates, nucleic acids, proteins and lipids. Also, learn the definition, structure, importance, roles in the life, functions, classifications, physical properties, synthesis, chemical reactions and metabolism of these biomolecules, beside proteins synthesis.

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 • 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)**	
Total		30

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	Define the living cells organic biomolecules of living cells such as carbohydrate, nucleic acid, proteins and lipids.	K1	- Lectures. - Scientific discussion. - Library visits. - Web-based study.	- Med Exam. - Final Exam. - Class discussion. - Assignment.
1.2	Identify the sources, structure, classification and functions of different organic biomolecules of living cells.	K2	- Lectures. - Scientific discussion. - Library visits. - Web-based study.	- Med Exam. - Final Exam. - Class discussion. - Assignment.
1.3	Understand the physical properties of living cells organic biomolecules.	K1	- Lectures. - Scientific discussion. - Library visits. - Web-based study.	- Med Exam. - Final Exam. - Class discussion - Assignment.
	Recognize the different methods of preparations of living cells organic biomolecules.	K1	- Lectures. - Scientific discussion. - Library visits. - Web-based study.	- Med Exam. - Final Exam. - Class discussion. - Assignment.
1.4	Learn the chemical properties of living	K2	- Lectures. - Scientific discussion.	- Med Exam. - Final Exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	cells organic biomolecules.		- Library visits. - Web-based study.	- Class discussion. - Assignment.
1.5	Demonstrate the metabolism pathways of living cells organic biomolecules.	K1	- Lectures. - Scientific discussion. - Library visits. - Web-based study.	- Med Exam. - Final Exam. - Class discussion. - Assignment.
1.6	Summarize the protein synthesis.	K2	- Lectures. - Scientific discussion. - Library visits. - Web-based study.	- Med Exam. - Final Exam. - Class discussion. - Assignment.
2.0	**Skills**			
2.1	Ability to work in a team to perform a specific task.(Extracurricular activities).	S2&S3	Extracurricular activities.	Extracurricular activities.
3.0	**Values, autonomy, and responsibility**			
3.1	Assignment activities.	V1&V2	Home work.	Home work.

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to carbohydrate chemistry (definition, importance, classification, and stereochemistry of monosaccharides).	2
2.	Monosaccharides sources, structure, functions and physical properties.	2
3.	Monosaccharides synthesis and chemical reactions.	2
4.	The carbohydrate digestion and main process of carbohydrate metabolism.	2
5.	Introduction to proteins chemistry (definition, characterization, importance, sources, general structure, classification and denaturation).	2
6.	Introduction to amino acid chemistry (definition, structure, importance, classifications, physical properties, synthesis and chemical reactions).	2
7.	The protein digestion and Urea cycle.	2
8.	Introduction to nucleosides, nucleotides and nucleic acids.	2
9.	DNA replication and RNA processing.	2

10.	The genetic code.	2
11.	Biosynthesis of proteins (five stages of protein synthesis).	2
12.	Introduction to lipids chemistry (definition, characterization, importance, sources, general structure and classification).	2
13.	Introduction to fatty acids chemistry (definition, classification, nomenclature of fatty acids, physical properties and chemical reactions).	2
14.	The important class of derived lipids (glycerides).	2
15.	The digestion of lipids and beta oxidation of fatty acids.	2
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Extracurricular activities.**	**During the term**	**20%**
4.	**Med term Exam.**	**7 or 8**	**30%**
5.	**Final Exam.**	**16 or 17**	**50%**

*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	- Principle of biochemistry (Lehninger) - Biochemistry (Stryer) - Biochemistry (Lippincott)
Supportive References	- Lecture Handout
Electronic Materials	- http://www.scopus.com - http://www.sciencedirect.com - https://pubmed.ncbi.nlm.nih.gov
Other Learning Materials	- Microsoft Power Point, Excel and Microsoft Word. - Professional standards or regulations and software. - Computer-based programs (endnote – chem draw).

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms capacity (40) students.
Technology equipment (projector, smart board, software)	- Room equipped with computer and projector and TV and board.

Items	Resources
Other equipment (depending on the nature of the specialty)	- No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (Online survey at the end of the semester (Program survey, Experience survey &course evaluation) and graduates survey.
Effectiveness of Students assessment	Faculty members	Direct (60% of the students achieved ≥ 70% of the degree assigned to the course learning outcome).
Quality of learning resources	Students	Direct (feedback from faculty). Indirect (online survey at the end of the semester (Program survey, Experience survey & course evaluation) and graduates survey.
The extent to which CLOs have been achieved	Faculty members	Direct (Comments of course instructors regarding evaluation of teaching strategies for learning outcomes mentioned in course report).
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TPG-153

Course Specification
(Postgraduate)

Course Title:	Polymer Chemistry
Course Code:	CHM4408
Program:	Chemistry - Chemistry track
Department:	Chemistry
College:	College of Science
Institution:	Umm A-Qura University
Version:	1
Last Revision Date:	26 December 2024

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☐ Department	☒ Track	
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th / 4th)					
4. Course general Description:					
Introduce students to the fundamental concepts of polymers, including their chemical structures and physical properties. Explain the mechanisms of different polymerization reactions (addition, condensation, etc.). Explore the relationship between the chemical structure and physical/mechanical properties of polymers. Highlight industrial applications of polymers and their environmental impacts.					
5. Pre-requirements for this course (if any):					
Petroleum and Petrochemicals (CHM3406)					
6. Pre-requirements for this course (if any):					
NA					
7. Course Main Objective(s):					
By the end of this course student will be familiar with different reactions to synthesis of different classes of polymer chemistry					

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**	45
3.	**Field**	--
4.	**Tutorial**	--
5.	**Others (specify)……**	--
	Total	75

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	Know the modern methods used in the preparation of various polymer chemistry	K1	Lectures	Final and mid-term exams.
1.2	Identify the different protecting and deprotecting groups used in polymer synthesis.	K2	Lectures	Final and mid-term exams.
1.3	Predict the products of the chemical reactions correctly.	K2	Lectures	• Final and mid-term exams. • Quizzes
1.4	Determine the type of mechanism in different polymer reactions.	K2	• Lectures. • Scientific discussion.	• Final and mid-term exams. • Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.5	Understand the importance of polymer synthesis in scientific and industrial fields.	K3	• Lectures. • Scientific discussion.	• Final and mid-term exams. • Quizzes
2.0	**Skills**			
2.1	Design synthetic pathways of different polymer compounds using retrosynthetic approach	S1	• Lectures. • Scientific discussion. • Web-based study.	• Mid-term exam. • Final exam. • Assignment and activity.
2.2	Physica and Chemical Properties of Polymers: Structural characterization. Thermal properties (TG, DSC). Mechanical properties.	S1	• Lectures. • Scientific discussion	• Mid-term exam. • Final exam. • Quizzes.
2.3	Polymer-related environmental issues and Recycling techniques	S3	• Lectures. • Scientific discussion.	• Final and mid-term exams. • Quizzes
2.4	Apply synthetic methodologies to perform advanced polymer synthesis.	S3	• Lectures. • Scientific discussion.	• Final and mid-term exams. • Quizzes • Assignment and activity.
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate commitment to professional and academic values, and	V1	• Web-based study • Library visits	• Class discussion. • Assignment activities

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	ethics in the field of polymer chemistry.			
3.2	Write and present a chemical report related to polymer chemistry	V2	• Web-based study. • Library visits	• Class discussion. • Assignment activities

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to Polymers**	~~3~~2
2.	**Types of Polymers**	~~6~~4
3.	Polymer Synthesis Methods	~~6~~4
4.	**Physical and Chemical Properties of Polymers 1**	~~6~~4
5.	**Physical and Chemical Properties of Polymers 2**	~~3~~2
6.	**Analytical Techniques for Polymers 1**	~~3~~2
7.	**Analytical Techniques for Polymers 2**	~~6~~4
8.	**Applications of Polymers** 1	~~3~~2
9.	**Applications of Polymers** 2	~~3~~2
10.	**Environmental Impact and Recycling** 1	~~3~~2
11.	**Environmental Impact and Recycling** 2	~~3~~2
Total		~~45~~30

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-term exam	7-8	20%
2.	assignment activities	1-15	10%
	Practical exam	15	30%
3.	Final written exam	16-17	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	• Polymer Chemistry by Paul C. Hiemenz and Timothy P. Lodge. • Introduction to Polymers by Robert J. Young and Peter A. LovellMichael Smith, *Organic Synthesis*, 4th ed, Elsevier, 2016. • Recent research articles on polymer science and technology.
Supportive References	• Warren, Stuart, and Paul Wyatt. Organic synthesis: the disconnection approach. John Wiley & Sons, 2008.
Electronic Materials	• http://www.organic-chemistry.org/reactions.htm • http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org • http://www.orgsyn.org
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms capacity (50) students. Providing hall of teaching aids including computers and projector.
Technology equipment (Projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (Depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer Reviewer	Direct
Effectiveness of student's assessment	Peer Reviewer	Direct
Quality of learning resources	Student	Indirect
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

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

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	

DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Chemistry of Natural Products
Course Code:	CHM4409
Program:	Chemistry- Chemistry track
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	3
Last Revision Date:	2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 h)					
2. Course type					
A.	☐University	☐College	☐Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8/4)					

4. Course general Description:

This course provides a comprehensive study of different natural products, classification, nomenclature, methods of preparation, study of the various properties and their reactions.

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

Organic Reactions and Preparations (CHM3405)

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

7. Course Main Objective(s):

This course aims to provide students with the basic knowledge about the main classes of natural products, their distinctive structures, nomenclature, means of extraction, isolation, structure characterization, preparations, reactions and their most important applications.

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 • 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)**	
Total		**30**

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	Outline the theoretical foundation for the identification and elucidation of various classes of natural products.	K1	Lectures	• Final and Mid-term exams.
1.2	Demonstrate a comprehensive understanding of the major classes of natural products, their chemical structures, and their important applications.	K2	Lectures	• Final and Mid-term exams.
...				
2.0	**Skills**			
2.1	Summarize different methods for the preparation of various natural products.	S2	Lectures	• Final and Mid-term exams. • Assignment activities.
2.2	Classify the main families of natural products based on their chemical structure	S2	Lectures	• Final and mid-term exams. • Assignment activities.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Describe the various strategies employed for the structural elucidation of different classes of natural products.	S3	Lectures. Scientific discussion	• Final and Mid-term exams. • Assignment activities.
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate learning skills to work as a team in a multidisciplinary environment and demonstrate effective writing, oral communication skills and using ICT tools	V2	Web-based study. Library visits.	• Class discussion. • Assignment activities
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to natural products chemistry:** primary and secondary metabolites, classification, nomenclature, methods of isolation and identification.	**2**
2.	**Terpenes and Terpenoids:** Introduction, isolation, their distinctive structures classification, nomenclature, general methods for molecular structures determination, synthesis, and applications. <u>Examples</u>: Acyclic monoterpenoids (myrcene), Monocyclic monoterpenoids (limonene, α-terpinol), Bicyclicmonoterpenoids (camphor), Triterpenoids (squalene), Tetraterpenoids (β-carotene).	**8**
3.	**Steroids:** Introduction, classification, nomenclature, structure elucidation, synthesis, and applications. <u>Examples</u>: Sterols (cholesterol) – Sex hormones: Estrogens (estradiol), Androgens (testosterone) and Gestogenes (progesterone) - Bile acids (cholanic acid).	**6**
4.	**Alkaloids:** Introduction, methods of extractions, general properties, classification, structure elucidation, synthesis, and applications. <u>Examples</u>: Phenylethylamines (adrenaline, ephedrine), Pyrrolidines (hygrine), Pyridine-Piperidine (trigonelline), Pyrrolidine-Pyridine	**8**

	(nicotine), Indoles (heptaphylline), Quinolines (Quinine), Isoquinolines (Papaverine), Phenanthrenes (morphine) and Tropane (Cocaine). **Flavonoids:** biosynthesis, structure, and classification (Anthraquinones, Coumarins, Xanthones).	
5.	**Polyketides:** Introduction, classification, structure elucidation, synthesis, and applications Examples: Ansamycin, Macrolides, Tetracyclines, Polyenes and Acetogenin	**4**
6.	Medical application of natural products	**2**

Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-term exam	7-8	30%
2.	Self-learning: Presentation, drug profiling,	1-15	20%
3.	Final written exam	16-17	50%
...			

*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	1- Raymond Cooper, George Nicola" Natural Products Chemistry: Sources, Separations and Structures, 1stEdition" 2014, CRC Press. 2- Sujata V. Bhat,B.A. Nagasampagi, Meenakshi Sivakumar "Chemistry of natural products", 2005, Springer.
Supportive References	1- Talapatra, Sunil Kumar, and Bani Talapatra. *Chemistry of Plant Natural Products: Stereochemistry, Conformation, Synthesis, Biology, and Medicine*. Springer, 2015.
Electronic Materials	• http://www.organic-chemistry.org/reactions.htm • http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org • http://www.orgsyn.org

Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms capacity (50) students. Providing hall of teaching aids including computers and projector.
Technology equipment (projector, smart board, software)	Room equipped with computer and projector and TV.
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer Reviewer	Direct
Effectiveness of student's assessment	Peer Reviewer	Direct
Quality of learning resources	Student	Indirect
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Petroleum Chemistry and Quality Standards
Course Code:	CHM4411
Program:	Chemistry - Chemical analysis and quality assurance track
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	1st
Last Revision Date:	25 / 1 / 2025

جامعة أم القرى - وزارة التعليم - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University - Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hrs)					
(2 hrs. Theoretical + 1 hr. Practical)					
2. Course type					
A.	☐University	☐College	☐ Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th/4th)					
4. Course general Description:					
This course concerns theories of petroleum formation, petroleum classifications and focus on quality standards of petroleum. Study the fractional distillation of petroleum and its products, the chemical treatment processes to increase petroleum quality.					
5. Pre- requirements for this course (if any)**:**					
Organic Spectroscopy (CHM3410)					
6. Pre-requirements for this course (if any)**:**					
-					
7. Course Main Objective(s):					
By the end of the course the student will be familiar with Petroleum formation, classifications and quality standards and Petroleum distillation and its products, In addition to crude oil products treatment by chemical processes and increasing the petroleum quality.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		75

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	Familiar with all principles, theories, chemistry, processes of petroleum treatments and quality test of petroleum products	K1	Lectures	Final and mid-tern exams.
1.2	Identify chemicals and chemical process in petroleum industry	K2	Lectures	Final and mid-term exams.
2.0	**Skills**			
2.1	Conduct different chemical reaction and mechanism involved in petroleum industry	S2	Lectures and Laboratory	Final , mid-term, and practical exams.
2.2	Classification of different petroleum products based on separation by fractional distillation and solvent extraction	S3	Lectures and Laboratory	Final , mid-term, and practical exams.
2.3	Perform experiments for petroleum products quality	S1	Laboratory	Practical Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Relate the learned petroleum chemistry knowledge and skills to future career and Plan for further professional training as a chemist.	V1	Web-based study Library visits	Class and laboratory discussion. Assignment activities

C. Course Content

No	List of Topics	Contact Hours

1.	Definition of Petroleum and it origin formation and traps	2
2.	Methods of exploration and Petroleum Classification	2
3.	Chemical Composition of Petroleum	2
4.	Field separation of crude oil (Desalting, water treatment, gas treatment)	4
5.	Refining operations and Fractional Distillation of crude oil	4
6.	Crude oil Distillation products: light distillates (natural Gas, gasoline and naphtha) - Mild distillates (kerosene, heating oil and jet fuel and diesel fuel) - heavy distillates (lubricates oil and waxes, asphalt and coke oil).	2
7.	Chemical conversion processes of crude oil: Cracker processes (thermal cracking and catalytic cracking and hydrocracking) and Combining processes (polymerization and alkylation)	4
8.	Rearrangement processes (catalytic reforming and isomerization and improving the octane and cetane number) and Purification by hydrogen treatment (removing hydrogen sulfide compounds mercaptans and compounds of nitrogen. Etc.).	2
9.	Quality Standards of petroleum products (Control salt content compounds, Pensky Marten closed cup flash point, Control sulfur compound).	4
10	Quality Standards of petroleum products (Control Gas oil quality, Control lubricant oil kinematic viscosity, Control wax compounds).	4
Total		**30**

Experimental Part

Perform different quality standards test for different petroleum products including:

No	List of Topics	Contact Hours
1.	Safety requirements for petroleum lap experiments	3
2.	Introduction of Petroleum Chemistry experiments and techniques	3
3.	Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products ASTM D 287-92	6
4.	Standard Test for Refractive index of hydrocarbon liquids ASTM D1218-92 (re-approved 1998)	3
5.	Standard test method for distillation of petroleum products at atmospheric pressure (ASTM D 86-99a / IP 123/99)	3
6.	Standard test method for distillation of petroleum products at reduced pressure (ASTM D 1160-99)	3
7.	Standard test method for Calculating Viscosity Index from Kinematic Viscosity at 40 and 100 ^{o}C ASTM D 2270-93 / IP 226/91 (95)	3
8.	Standard Test Method for Smoke Point of Kerosene and Aviation Turbine Fuel ASTM 1322-97 / BS 2000: Part 57 1995/ IP 57/95	3
9.	Standard Test for Pour point of Petroleum Products ASTM D 5853-95 / IP 441/99 (95)	3
10.	Standard Test Method for Aniline point of Petroleum Products and hydrocarbon solvents ASTM D 611-82	3

11.	Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester (ASTM D 93-99c / IP 34/99)	3
12.	Standard Test for Water in Crude Oil by Distillation ASTM4006-81/ IP 368/97	3
13.	Standard Test Method for Sulfur in Petroleum Products (Lamp Method) ASTM D1266 -98	3
14.	Standard Test Method for Saybolt Color of Petroleum Product (Saybolt Chromometer Method) ASTM D156-94	3
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
15.	Homework or activities.	Over all weeks	10 %
16.	Practical Exam.	15	30 %
17.	Mid-term Exam.	7	20 %
18.	Final Exam.	16-17	40 %
	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	•J. G. Speight, The Chemistry and Technology of Petroleum, 5th ed. CRC Press, 2014, P. 953, ISBN: 9781439873892. •R. Curley, Fossil Fuels. Britannica, 2012, P. 160, ISBN 9781615305407. •M. A. Fahim, T. A. Alsahhaf, A. Elkilani, Fundamentals of Petroleum Refining, Elsevier, 2010, P. 496, ISBN 9780444527851.
Supportive References	•D. S. J. Jones, Peter R. Pujadó, Handbook of petroleum processing, Springer Dordrecht Netherlans, 2006.
Electronic Materials	PPT file containing the slides representing the course
Other Learning Materials	-

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms Laboratories
Technology equipment (projector, smart board, software)	Projector
Other equipment (depending on the nature of the specialty)	-

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect: Regular surveys to evaluate teaching effectiveness and course relevance. Direct: CLO' assessment
Effectiveness of Students' assessment	Faculty, Peer Review	Direct: Annual review of course content by faculty members and external experts
Quality of learning resources	Students	Indirect: Regular surveys to evaluate Quality of learning resources
The extent to which CLOs have been achieved	Peer Review	Direct: Annual review of course content by faculty members and external experts
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Graduation Project
Course Code:	CHM4602
Program:	Chemistry
Department:	Chemistry
College:	Science
Institution:	Umm Al-Qura University
Version:	1
Last Revision Date:	2025

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 h)					
2. Course type					
A.	☐University	☐College	☐Department	☒ Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8/4)					
4. Course general Description:					
Students will be introduced to scientific research methods, including writing and using the library for periodicals and scientific magazines. They will develop research skills, gain hands-on experience with laboratory instruments, and enhance their ability to conduct experiments, analyze results, and apply scientific knowledge effectively.					
5. Pre-requirements for this course (if any)**:**					
Cooperative Training (CHM4601)					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
This course aims to help students develop research skills and acquire knowledge that will benefit their academic and professional careers.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom		
2	E-learning		
3	Hybrid • Traditional classroom • E-learning	15	
4	Distance learning		
5	Other	30	

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**15**
2.	**Laboratory/Studio**	30
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		**45**

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	Students will apply chemistry concepts to solve chemical research problems.	K1	• Literature review. • Discussions. • Experiments.	• Evaluation of reports
1.2	Familiar with chemical nomenclature, processes, materials, techniques, and terminology.	K2	Experiments	• Evaluation of reports
...				
2.0	**Skills**			
2.1	Perform experiments, analyze, and interpret data for investigating complex problems in chemical research	S1	• Literature review. • Discussions. • Experiments.	• Evaluation of reports.
2.2	Design and develop sustainable solutions to major environmental/biological problems by applying appropriate chemistry tools based on scientific research	S2	• Literature review. • Discussions. • Experiments.	• Evaluation of reports.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Develop critical thinking to analysis and interpret experimental data.	S3	• Discussions. • Experiments.	• Evaluation of reports.
...				
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate learning skills to work as a team in a multidisciplinary environment and demonstrate effective writing, oral communication skills and using ICT tools	V2	• Assignments • Discussions	• Evaluation of reports
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Selected research project by the faculty member is assigned to the student upon agreement. State the objectives and the plans.	1
2.	Literature review: Now that the problem has been identified, the student must learn more about the topic under investigation. To do this, the student must review the literature related to the research problem. This step provides foundational knowledge about the problem area.	All through the term
3.	Attend a Workshop (organized by the Chemistry Department) for training in using software, how to review literature, how to write a report and present a seminar.	2
4.	Develop the instrumentation plan: the instrumentation plan serves as the road map for the entire study, specifying who will participate in the study; how, when, and where data will be collected.	All through the term
5.	Analyze the Data: The student will analyze the data according to the plan. The results of this analysis are then reviewed and summarized in a manner directly related to the research questions.	All through the term
6.	Writing scientific reports, plotting graphs and data analysis using different scientific software's.	All through the term
---		
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Attendance, supervisor evaluation	All through the term	20%
2.	Report and scientific contents	15	50%
3.	Presentation	15	20%
4.	Answers to questions	15	10%
5.	**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	1- C. Robson. How to do a Research Project: A Guide for Undergraduate Students. (2016), 2nd edition. Wiley.
Supportive References	1- Chemical journals, Books, Reviews
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	Other learning materials may be required depending on the nature of the research project.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	An adequate laboratory for experimental research projects
Technology equipment (projector, smart board, software)	NA
Other equipment (depending on the nature of the specialty)	Chemicals and glassware for experimental research projects.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer Reviewer	Direct
Effectiveness of student's assessment	Peer Reviewer	Direct

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Student	Indirect
The extent to which CLOs have been achieved	Program Leaders	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

2023
TP-155

Field Experience Specification

Course Title: **Cooperative Training**	
Course Code: **CHM4601**	
Program: **Chemistry**	
Department: **Chemistry**	
College: **Science**	
Institution: **Umm Al-Qura University**	
Field Experience Version Number: 1	
Last Revision Date: **2025**	

وزارة التعليم - جامعة أم القرى - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University
Jamoum University College - Chemistry Department

Table of Contents

A. Field Experience Details:

1. Credit hours: (6 h).		
2. Level/year at which Field Experience is offered: (7/4).		
3. Time allocated for Field Experience activities		
(15) Weeks	(75) Days	(600) Hours
4. Corequisite (or prerequisites if any) to join Field Experience		
Separation Methods and Thermal Analysis (CHMI3204)		
5. Mode of delivery		
☒ In-person/onsite	☐hybrid (onsite/online)	☐Online

B. Field Experience Course Learning Outcomes (CLOs), Training Activities and Assessment Methods

Code	Learning Outcomes	Aligned PLO Code	Training Activities	Assessment Methods	Assessment Responsibility
1.0	**Knowledge and understanding**				
1.1	Gain hands-on experience in chemical projects and material characterization	K2	• Attend seminars at stakeholder companies • Participate in practical work at stakeholder companies • Complete assignments	Evaluate student reports Assess PowerPoint presentations Conduct evaluation at the end of the training	Department
1.2					
…					
2.0	**Skills**				
2.1	Analyze and process data using a computer ▯ Write reports and present work in seminars	S3	Assignments	Evaluate student reports Assess PowerPoint presentations Conduct evaluation at the end of the training	Department

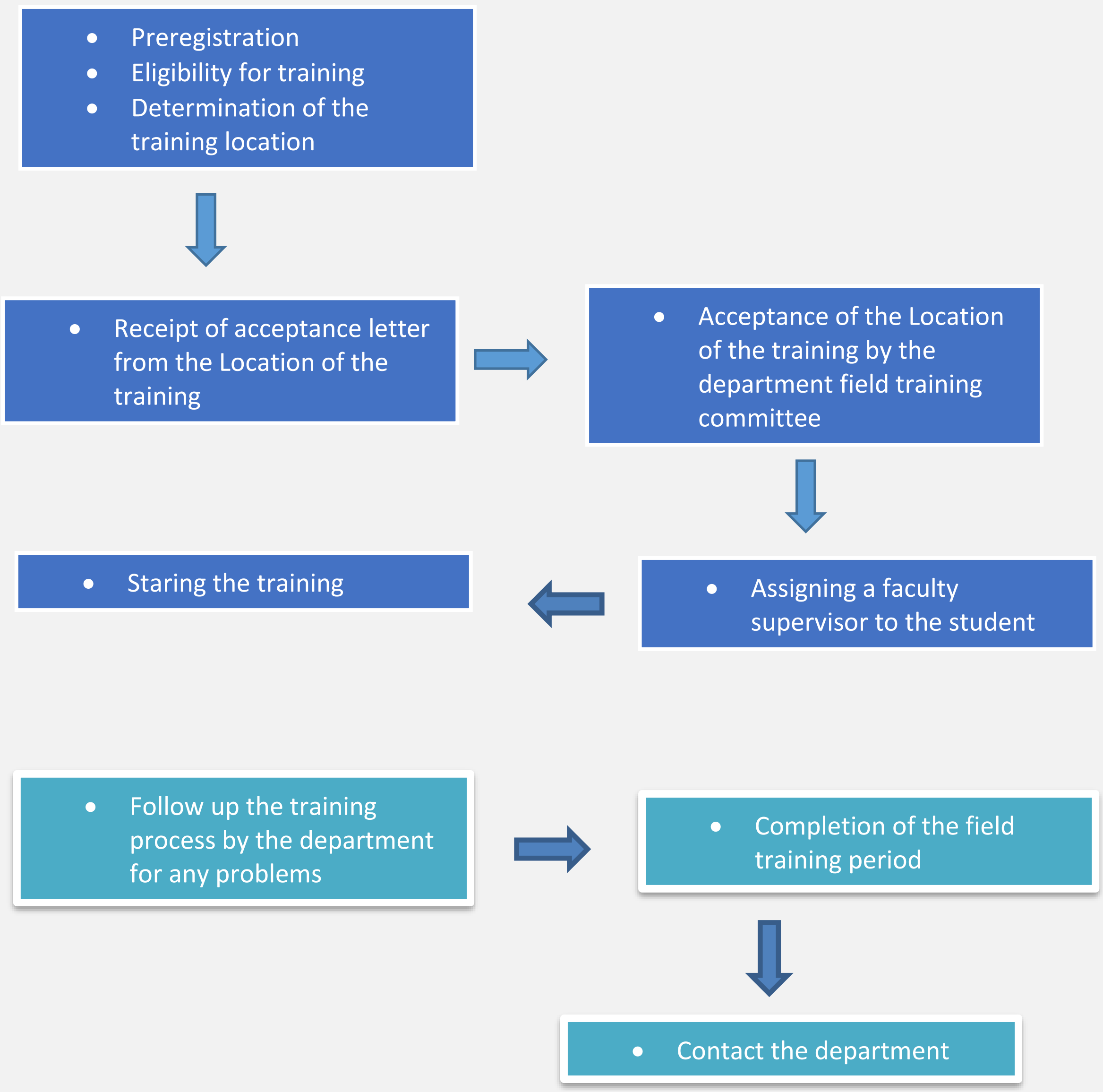
Code	Learning Outcomes	Aligned PLO Code	Training Activities	Assessment Methods	Assessment Responsibility
				committee at the end of the training.	
2.2	Write reports and present work in seminars	S2	Assignments	Evaluate student reports Assess PowerPoint presentations Conduct evaluation at the end of the training	
2.2	Analyse data and draw conclusions.	S1	Analyze data, write reports, and present in seminars.	Evaluation of the student reports and power point presentation at the end of the training.	Department
2.3	Gain analytical and technical skills to create a spirit of innovation.	S3	Analyze data, write reports, and present in seminars.	Evaluation of the student reports and power point presentation at the end of the training.	Department
3.0	**Values, autonomy, and responsibility**				
3.1	develop the skills required in the work environment including leadership responsibilities.	V1	• Assignments • Teamwork	Evaluation of the achievement by the staff supervisor at the stake holder company.	Department
3.2	Improve skills to work independently or with others.	V2	• Assignments • Teamwork	Evaluation of the achievement by the staff supervisor at the stake holder company.	Department
...					

*Assessment methods (i.e., practical test, field report, oral test, presentation, group project, essay, etc.).

C. Field Experience Administration

1. Field Experience Flowchart for Responsibility

Including units, departments, and committees responsible for field experience identifying by the interrelations.



2. Distribution of Responsibilities for Field Experience Activities

Activities	Department or College	Teaching Staff	Student	Training Organization	Field Supervisor
Selection of a field experience site	√		√	√	
Selection of supervisory staff	√				

Activities	Department or College	Teaching Staff	Student	Training Organization	Field Supervisor
Provision of the required equipment				√	√
Provision of learning resources	√	√			
Ensuring the safety of the site	√	√		√	√
Commuting to and from the field experience site			√		
Provision of support and guidance	√	√			
Implementation of training activities (duties, reports, projects ...)				√	√
Follow up on student training activities	√	√			√
Monitoring attendance and leave		√			√
Assessment of learning outcomes		√	√	√	√
Evaluating the quality of field experience	√	√	√		
Others (specify)					

3. Field Experience Location Requirements

Suggested Field Experience Locations	General Requirements*	Special Requirements**
Aramco	Equipment, laboratories	Chemical laboratories safety standards
Sabic	Equipment, laboratories	Chemical laboratories safety standards
Saudi standards metrology and quality organization	Equipment, laboratories	Chemical laboratories safety standards
Sipchem	Equipment, laboratories	Chemical laboratories safety standards
Sadara Chemical Company	Equipment, laboratories	Chemical laboratories safety standards

*E.g. provides information technology, equipment, laboratories, halls, housing, learning sources, clinics … etc.
** E.g. Criteria of the institution offering the training or those related to the specialization, such as safety standards, dealing with patients in medical specialties … etc.

4. Decision-Making Procedures for Identifying Appropriate Locations for Field Experience

The process of internship involves:
(a) a list of potential internship providers will be given to students.
(b) An application will be filled with by the student and sent to prospective internship providers by the College.
(c) acceptance letter by the internship provider will be given to students that receive an offer of an internship. Students may seek an internship in a workplace which is not listed in the provided list but should be approved by the Chemistry Department.
d) Once the acceptance letter of internship is received, it will be assessed by the training committee at the Department and the internship provider will be contacted to determine whether they agree to our terms and conditions.
e) The internship will then be either approved or rejected by the field training committee.
f) If the student accepts the offered and approved internship, he must enroll in the training course.

5. Safety and Risk Management

Potential Risks	Safety Actions	Risk Management Procedures
Chemical Laboratory Hazards and accidents that can Injury the trainee during field training	Follow up the safety rules and requirements of security and an agreement contract with the company.	The workplace of the internship must be compatible with the standards requirements of security.

D. Training Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Training and assessment	Students	Submitting comprehensive feedback about the company, the problem he faces, and his recommendations
Extent of achievement of course learning outcomes	Supervising staff in the field setting	Submitting comprehensive feedback about student's knowledge, skills and area of improvements.
Extent of achievement of course learning outcomes	Supervising faculty from the department	The faculty supervisor will provide feedback about organization, student's behavior, and recommendation to improve the field experience.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Quality of learning resources	Others— (e.g. graduates, independent evaluator, etc.)	Fill in a questionnaire to assess the Training

Evaluation areas (e.g., Effectiveness of Training and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Supervisory Staff, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

E. Specification Approval Data

Council /Committee	
Reference No.	
Date	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Coordination chemistry
Course Code:	CHM3303
Program:	Chemistry
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	First
Last Revision Date:	19/3/2025 *Pick Revision Date.*

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Jamoum University College-Chemistry Department
Ministry Of Education-Umm Al-Qura University

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3hrs)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (fifth level/ third year.)					
4. Course general Description:					
This course deals with the main subjects in coordination chemistry including importance, nomenclature, isomerism, geometry, preparation, electronic and IR spectra, and biological activity of the metal complexes as well as theories explaining bonding in coordination compounds.					
5. Pre-requirements for this course (if any)**:**					
Chemistry of Transition Elements (CHM2302)					
6. Pre-requirements for this course (if any)**:**					
None					

7. Course Main Objective(s):

By ending this course, students should be familiar with:

- **a. The importance, nomenclature, isomerism, geometry, preparation of metal complexes.**
- **b. The different theories explain the bonding in coordination compounds.**

The magnetic, biological, electronic and IR spectral properties of metal complexes.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	----	----
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	----	----

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	-----
4.	**Tutorial**	------
5.	**Others (specify)**	----
Total		75

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	Discuss the mode of bonding and geometries in coordination compounds using bonding theories.	K1	Lectures scientific discussion	Quiz. Mid-term exam. final exam.
1.2	Learning examples of. Possible types of symmetry for coordination complex	K2	Lectures scientific discussion	Quiz. Mid-term exam. final exam.
2.0	**Skills**			
2.1	Practice the chemical processes and techniques for synthesis and characterization of metal complexes.	**S1**	Lectures; Laboratory experiments	Regular evaluation during laboratory training course; final practical exam.
2.2	Employ the valence bond theory and crystal	**S2**	Lectures	Quiz.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	field theory to predict the geometrical structure and stability of metal complexes		scientific discussion	Mid-term exam. final exam.
2.3	Apply IT and communication technology in evaluating the biological importance.	**S3**	web based study.	Class discussion.
3.0	**Values, autonomy, and responsibility**			
3.1	Introduce a presentation belongs a report related to coordination chemistry topics.	**V1**	Web based study. Library visits	Class discussion.
3.2	Collaborative behavior of students was evaluated in lab or in classroom to manage the synthesis of coordination compounds.	**V2**	Lab work and classroom	Lab evaluation Final practical exam
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to the chemistry of coordination compounds - Werner theory of coordination compounds - Effective atomic number.	**6**
2.	Ligands – nomenclature of metal complexes – symmetry in metal complexes.	**3**
3.	Valence bond theory – coordination numbers and geometrical structures – inner and outer complexes.	**3**
4.	Stability of metal complexes; factors affecting the stability of metal complexes – ionic and ionization potential – geometrical arrangement of ligands around the central metal ion - metal chelates.	**6**
5.	Crystal field theory; ligand field in octahedral complexes – ligand field in tetrahedral complexes – ligand field in square planer complexes – Jahn-Teller effect (distortion from symmetrical arrangement) – crystal field stabilization energies.	**3**
6.	Preparation of coordination compounds (complexes); direct reactions – oxidation and reduction reactions – thermal decomposition reactions.	**3**
7.	Electronic spectrum of complexes - infrared spectra of metal complexes.	**3**
8.	Metal complexes of significant biological activities.	**3**

	Practical part	
	Preparation and characterization of some metal ion complexes	**45**
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	**---**	**10%**
2.	Midterm Exam.	**8**	**20%**
3.	Practical Exams.	**16**	**30%**
4.	Final Exam. (2 hours exam)	**17**	**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	Kazuo Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, John Wiley &Sons, 2009
Supportive References	• William L. Jolly, Modern Inorganic Chemistry; (2nd edition) McGraw-Hill, New York, 1991. • Geoffrey A. Lawrance, Introduction to Coordination Chemistry, John Wiley & Sons, 2009.
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com http://www.rsc.org
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	projector, smart board
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	Questionnaire evaluation of the course.
Effectiveness of Students assessment	Faculty member	Quarterly tests and participations
Quality of learning resources	Program/Department Instructor	Annual course report
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.
Other		

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

G. Specification Approval:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	General chemistry 2
Course Code:	CHM 1103
Program:	Chemistry program
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	first
Last Revision Date:	19/3/2025ck Revision Date.

جامعة أم القرى - وزارة التعليم • Ministry Of Education-Umm Al-Qura University
الكلية الجامعية بالجموم-قسم الكيمياء
Jamoum University College-Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 3 hours (2 theoretical + 1 practical)

2. Course type

A.	☐ University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (2nd level / 1st year)

4. Course general Description:

This course deals with the basic concepts of general chemistry including atomic construction, Lewis structures of compounds, theories of bonding, the principal quantum numbers, classification and properties of elements in the periodic table. The experimental part deals with basic experiments belonging to inorganic chemistry interest.

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

General chemistry 1 (CHM1101)

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

none

7. Course Main Objective(s):

By finishing this course, the students will be able to discuss and explain:

a. The atomic construction, atomic shells, their shapes and types of bonds
b. Electronic structure and Lewis structures of different chemical compounds.
c. The valence shell electron pairs repulsion theory, molecular orbital theory and valence bond theory.
d. The quantum numbers, classification of elements and properties of ionic and covalent compounds.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		**75**

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	Describe atomic construction, general properties of periodic table, types of bonds	**K1**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
1.2	Knowing the covalent bond theories	**K2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.0	**Skills**			
2.1	develop the students' activities in the laboratory during the conduction of practical work	**S1**	Experimental lectures in the lab	Experimental exam and periodic assessments
2.2	Apply the properties of the elements on groups and periods	**S2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.2	Develop the structures of covalent compounds	**S3**	Lecture and open discussion in classroom	Quiz periodic exams.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	according to the theories			final exam.
3.0	**Values, autonomy, and responsibility**			
3.1	Work individually to use the on-line libraries for searching and interpreting the course topics.	**V1**	Web research about the course topics	Assignments in blackboard
3.2	Demonstrate and then write constructive reports related to course topics.	**V2**	Library visits and training for collaborative work	Discussion report about a course item in blackboard
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Atomic construction and the quantum numbers	**4**
2.	Properties of elements and the periodic table – classification of elements into periods and groups.	**4**
3.	Comparison between some properties of the elements inside the period such as ionization energy, electron affinity, electronegativity and atomic size.	**6**
4	Chemical bonds; their types and theories – Lewis symbols and structures.	**6**
5	Valence bond theory, Hybridization and its types and Properties of ionic and covalent compounds.	**6**
6	Valence shell electron pairs repulsion theory, Molecular orbital theory – octet rule.	**4**
	Experimental part	
	Principles of inorganic investigations	**45**
	Total	**45+30= 75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities	--	10%
2.	Periodic Exam	7	20%
3.	Practical exam	16	30%
4.	Final Exam (2 hours exam)	17	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	H. B. Gray. Chemical Bonds: An Introduction to Atomic and Molecular Structure, University Science Books, 1994.
Supportive References	General Chemistry: The Essential Concepts 7th Edition by Raymond Chang Dr., Kenneth Goldsby Professor, 2013. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Wiley-Blackwell, 1998.
Electronic Materials	http://www.chemweb.com - http://www.sciencedirect.com - http://www.rsc.org
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories,
Technology equipment (projector, smart board, software)	projector, smart board
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students; Program Leaders	Questionnaire evaluation of the course (direct).

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students' assessment	Students; Faculty	Check marking of a sample of exam papers, or student work (direct).
Quality of learning resources	Faculty, Program Leaders	Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty (indirect)
The extent to which CLOs have been achieved	Program Leaders, Peer Reviewer	Annual course report (direct)
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Chemistry of Main Group Elements
Course Code:	CHM2301
Program:	Chemistry
Department:	Chemistry
College:	Faculty of science
Institution:	Umm Al-Qura University
Version:	first
Last Revision Date:	19/3/2025 *Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hours)					
2. Course type					
A.	☐ University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (3rd level / 2nd year)					
4. Course general Description:					
This course introduces the chemistry of main group elements (s- and p- block elements) including their structures, physical and chemical properties with comparative study of the elements across groups one to eight.					
5. Pre-requirements for this course (if any):					
General chemistry 2 (CHM1103)					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					
By finishing this course, the students will be able to discuss and explain: a. The general properties of the main group elements in the periodic table. b. The specific chemical properties of each group from group one to group eight in the main group elements. c. The existence and importance of their compounds and their significant uses.					

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 • 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)**	-
Total		**30**

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	Learning the physical and chemical properties of s-block elements	**K1**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
1.2	Understanding the physical and chemical properties of p-block elements	**K2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.0	**Skills**			
2.1	Apply the atomic size of elements with their ionization potential, electron affinity and electro-negativity and other properties	**S2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.2	Compere between group IA and IIA	**S2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Illustrate the chemical behavior of groups in p-block elements from comparative view	**S3**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
3.0	**Values, autonomy, and responsibility**			
3.1	Cooperate and work individually or with the group to use the on-line libraries for searching and interpreting the course topics.	V1	Web-based study	Assignments in blackboard
3.2	Demonstrate and then write constructive reports related to course topics.	V2	Library visits Web-based study	Discussion report about a course item in blackboard
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Comparison between some properties of the elements inside the period such as; ionization energy, electron affinity, electronegativity, and atomic size.	**4**
2.	Horizontal, perpendicular, and diagonal relationships in periodic table; Hydrogen and its position & properties, its isotopes, and chemical properties.	**2**
3.	s-block elements; electronic configuration, size, hardness, melting points – chemical properties; chemical reactivity with metals, nitrogen, acids, complexes formation – solubility and hydration – solubility in ammonia	**4**
4	Halides – some chemical properties of lithium and magnesium – diagonal relationship between lithium and magnesium elements.	**4**
5	Chemical properties of beryllium and differences between it and second group elements – diagonal relationship between beryllium and aluminum.	**4**
6	p-block elements; their electronic configuration, properties, and their compounds – properties of the first element in each group and compare it with the last element – inert pair effect –metallic and non-metallic properties of groups.	**4**
7	Independent study of the third, fourth and fifth groups.	**4**
8	Independent study of the sixth, seventh and inert gases groups.	**4**

Total	30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	**--**	**20%**
2.	Two Periodic Exams.	**6 and 11**	**30%**
3.	Final Exam (2 hours exam)	**17**	**50%**
...			

*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	A. G. Massey, Main Group Chemistry, 2nd Edition, Wiley, 2000.
Supportive References	F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, A comprehensive text, 1988, John Wiley & Sons. Das, Kumar V.G, Main Group Elements and their Compounds, Springer, 1996.
Electronic Materials	http://www.chemweb.com - http://www.sciencedirect.com - http://www.rsc.org
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories, exhibition rooms
Technology equipment (projector, smart board, software)	projector, smart board
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students; Program Leaders	Questionnaire evaluation of the course (direct).
Effectiveness of Students' assessment	Students; Faculty	Check marking of a sample of exam papers, or student work (direct).
Quality of learning resources	Faculty, Program Leaders	Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty (indirect)
The extent to which CLOs have been achieved	Program Leaders, Peer Reviewer	Annual course report (direct)
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification

(Bachelor)

Course Title:	Inorganic Reaction Mechanism and Spectra
Course Code:	CHM4306
Program:	Chemistry
Department:	Chemistry
College:	Faculty of science
Institution:	Umm Al-Qura University
Version:	First
Last Revision Date:	19/3/2025 *Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hours)					
2. Course type					
A.	☐ University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th level / 4th year)					
4. Course general Description:					
This course is focused on main principles of inorganic reaction mechanisms and spectra such as rate laws, labile and inert complexes, mechanism of substitution reactions, trans effect, mechanism for oxidation-reduction reactions. It also explores substitution reactions in different geometries of complexes and examines the electronic spectra of complexes with various geometries.					
5. Pre-requirements for this course (if any)**:**					
Organometallic chemistry (CHM3305)					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
2. Course Main Objective By the end of the study of this course students, will be aware fully with: a. The basic concepts of mechanism of inorganic reactions, including the substitution reactions of the ligands and some oxidation & reduction reactions. b. The basic concepts on the factors affecting inorganic reaction mechanism. **c.** Discussing the types of electronic transitions inside the metal ion complexes.					

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 • 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)**	-
Total		**30**

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	Outline the chemical behavior of inorganic compounds during chemical reactions.	**K1**	- Lectures using new techniques. - Meeting individual students and groups to solve their problems related to the course. - Assignments on E-learning.	- First Midterm Exam - Second Midterm Exam: - Activities and assignments on e-learning site: - Final Exam:
1.2	Recognize several concepts and principles related to inorganic reaction mechanisms such as complex formation.	**K2**		
2.0	**Skills**			
2.1	Apply the rate Laws for studying several inorganic chemistry reactions.	**S2**	Making connections between different concepts across the domains. - Using charts and concept maps. - Assigning research questions that can be	-Discussing and evaluating the topics that students learn from their textbooks and other sources. - Solving general chemistry problems related to qualitative
2.2	Compare between labile and inert complexes	**S3**		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Predict the mechanisms of substitution reactions in octahedral complexes - dissociation and association mechanisms.	**S3**	answered through collecting and analyzing data. - Summarizing the findings of the online research - Class discussions. - Using the Internet to create learning activities.	and quantitative information at the end of each topic. - Individual assignments or oral exam for developing/solving a task - Midterm Exams and Final examination at the end of semester.
3.0	**Values, autonomy, and responsibility**			
3.1	Work individually to use the on-line libraries for searching and interpreting the course topics.	**V1**	Using computer science in finishing reports and other related subjects - Group working. - Mini seminars prepared by the students to present their team projects or reports. - Visiting the University library and different websites to obtain some related subjects	Follow up the project progress - Evaluation of the duties associated with the appropriate use of communication skills - Assessments of student's assignments - evaluate solving the equations and problems related to subjects
3.2	Collaboration individually and in a team to predict the mechanism of inorganic reactions	**V2**		
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction on the basic concepts of inorganic reaction mechanism.	**2**
2.	The rate Laws for several inorganic chemistry reactions.	**2**
3.	Labile and inert complexes	**2**
4	Reaction mechanisms of ligand substitution.	**2**

5	Substitution reactions in square planar complexes, trans effect, and the theories for its explanation.	2
6	Reactions include the substitution of coordinating water.	4
7	Methods studying complexes reactions-octahedral & square- planar	4
8	Substitution reactions in octahedral complexes - dissociation and association mechanisms - equation reactions.	2
9	Aqueous ionic complexes, step wise complex formation, factors affecting the stability of complexes, acids, and bases.	2
10	Mechanism for oxidation-reduction reaction, inner sphere, and outer sphere reactions.	2
11	Basic of electronic transitions within the complexes	2
12	Electronic transitions within the octahedral and tetrahedral geometries	4
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	--	20%
2.	Two Periodic Exams.	6 and 11	30%
3.	Final Exam (2 hours exam)	17	50%
...			

*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	• Robert B. Jordan, Reaction mechanisms of inorganic and organometallic systems, 3rd, Oxford University press, 2007.
Supportive References	• Smiljko Asperger, Chemical kinetics and inorganic reaction mechanisms, 2ed, Kluwer Academic / Plenum Publisher 2003. • "Kinetics and Mechanisms of Reaction of Transition Metal Complexes," Ralph G. Wilkins, 2nd Thoroughly Revised Edition, VCH Publishers, 1992, ISBN 9783527282531 (Online book access at http://onlinelibrary.wiley.com/book/10.1002/3527600825) "Ligand Substitution Processes," C.H. Langford and H.B. Gray, W.A. Benjamin, Inc., 1966 (Online book access at
Electronic Materials	• ISIS draw and Chem draw and Chem office • -MS-Office Software • http://scholle.oc.uni-kiel.de/herges/modeling/gliederung.html

	http://phycomp.technion.ac.il/~ira/types.html
Other Learning Materials	**Nothing**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	projector, smart board, software
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Peer Reviewer	Checking selected exam papers, and student assignments.
Effectiveness of Students' assessment	Program Leaders	Reviewing of final exams and the student's degrees in different exams.
Quality of learning resources	Students	Periodically, completing the questionnaire evaluation of the course. Questionnaire evaluation of the course (direct).
The extent to which CLOs have been achieved	Program Leaders, Peer Reviewer	Annual course report (direct)
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Chemistry of Transition Elements
Course Code:	CHM2302
Program:	Chemistry
Department:	Chemistry
College:	Faculty of Science
Institution:	Umm Al-Qura University
Version:	First
Last Revision Date:	19/3/2025 *Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2h)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (4th Level/ 2nd year)

4. Course general Description:

The course introduces chemistry of the transition elements of d-block and f-block elements involving their general and chemical properties with comparative study of elements in their groups.

5. Pre-requirements for this course

Chemistry of Main Group Elements (CHM2301)

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

Nothing

7. Course Main Objective(s):

By the end of this course student should be familiar with:

a. The properties of the transition elements of d-block and f-block.

b. The chemical behaviour of the inner transition elements depending on the periodic properties in the periodic table in addition to a comparative study of the elements in their groups.

c. The spectroscopic and magnetic properties of the transition elements.

Comparative study for the chemical properties of transition elements as well as the lanthanides & actinides.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100 %
2	E-learning	--	--

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • 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)	--
Total		30

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	Learning the underlying principles explaining the main characteristics of the transition elements in their groups and in comparison, to s-block elements.	K1	Lectures scientific discussion	Quiz periodic exams. final exam.
1.2	Describe the transition elements and their compounds in their groups through studying their general and physical properties, chemical reactions, separation and extraction.	K2	Lectures scientific discussion	Quiz periodic exams. final exam.
2.0	Skills			
2.1	Compare between d-block or f-block elements and the main group elements	S2	Lectures scientific discussion	Quiz periodic exams. final exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	Applying the chemical methods used to solve complex problems concerning extraction the elements from their ores.	S2	Lectures scientific discussion	Quiz periodic exams. final exam.
2.3	Calculate the oxidation state of transition elements in their compounds	S3	Lectures scientific discussion	Quiz periodic exams. final exam.
3.0	Values, autonomy, and responsibility			
3.1	The ability to work individually to use the on-line libraries for searching and interpreting the course topics.	V1	Web based study	Assignments on the blackboard.
3.2	Responsibility of collaboratively and constructively for searching and interpreting up to dated aspects relating to the applications and uses of transition elements.	V2	Library visits Web-based study	Class discussion activities
...				

C. Course Content

No	List of Topics	Contact Hours
1.	The site of transition elements in the periodic table.	4
2.	General characteristics of the transition elements (d-block) in comparison to s-block elements.	4
3.	Study of the transition elements in their groups; scandium group, titanium group, vanadium group, chromium group, manganese group, iron, cobalt & nickel groups, copper group, and zinc group.	14
4.	Characteristics of f-block elements: lanthanide series (4f) and actinide series (5f).	4

5.	Studies of lanthanides and actinides in comparison with d-block elements in terms of electronic configuration, abundance, oxidation states and lanthanides contraction.	4
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	--	20 %
2.	Periodic Exam.	7	30 %
3.	Final Exam (2 hours exam)	17	50 %
...			

*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	Kazuo Nakamoto “Infrared and Raman Spectra of Inorganic and Coordination Compounds” **2009,** John Wiley &Sons.
Supportive References	R. Gopalan " *Textbook of Inorganic Chemistry 1st Edition”* **2011,** *CRC Press*. Eleanor Crabb, Elaine Moore, Lesley Smart” Concepts *in Transition Metal Chemistry” 2010, Royal Society of Chemistry”.*
Electronic Materials	- http://www.chemweb.com - http://www.sciencedirect.com http://www.rsc.org
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	projector, smart board

Items	Resources
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program Leaders	Questionnaire evaluation of the course
Effectiveness of Students' assessment	Students	Check marking of a sample of exam papers, or student work.
Quality of learning resources	Program/Department Instructor	Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty
The extent to which CLOs have been achieved	Peer Reviewer	Annual course report
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification

(Bachelor)

Course Title:	Organometallic Chemistry
Course Code:	CHM3305
Program:	Chemistry
Department:	Chemistry
College:	Faculty of science
Institution:	Umm Al-Qura University
Version:	First
Last Revision Date:	19/3/2025 *Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hours)					
2. Course type					
A.	☐ University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required			☐Elective	
3. Level/year at which this course is offered: (6th level/ 3rd year)					
4. Course general Description:					
The current course introduces the chemistry of organometallic compounds including their structures, nomenclature, classifications, reactions in addition to their applications in the field of catalysis.					
5. Pre-requirements for this course (if any):					
Solid state chemistry (CHM3304)					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					

By the end of studying of this course the student should fully understand:

a. The basic concepts of chemistry of organometallic compounds including their classifications and nomenclature.

The chemical and physical properties of organometallic compounds as well as their economic importance.

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 • 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)**	-
Total		**30 h**

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	Explain the mechanism of reactions involving the synthesis and applications of organometallic compounds.	K1	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
1.2	Illustrate the rules of nomenclature and preparation of complexes.	K2	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
1.3	Identify the eighteen-electron rule and oxidation numbers.	K2	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.0	**Skills**			
2.1	Apply the IUPAC rules for the nomenclature of compounds and the theories used to explain the stability.	S2	Lecture and open discussion in classroom	Quiz periodic exams. final exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	Solve the problems belong the organometallic compounds and eighteen-electron rule.	S2	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.4	Apply IT and communication technology in gathering and interpreting information and ideas concerning organometallic compounds and their importance.	S3	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
3.0	**Values, autonomy, and responsibility**			
3.1	Take responsibility to work with the group and introduce their presentation regarding the reports related to course topics.	V2	Web-site research about the course topics	Assignments in blackboard
...				

C. Course Content

No	List of Topics	Contact Hours
1.	History and nomenclature of σ-bonded and π-bonded complexes.	**2**
2.	Eighteen electron rule – oxidation number.	**2**
3.	Preparation of organometallic compounds: direct reactions between metals and alkyl halides.	**2**
4	Preparations involving organometallic compounds: reaction with organic halides, reaction with free metals and their compounds.	**4**
5	Substitution reactions: substitution of hydrogen with metal.	**2**
6	Addition reactions: addition of metallic compounds to multiple bonds and electrochemical methods.	**4**
7	Structure and bonding in organometallic compounds.	**4**

8	Application of organometallic compounds in organic reactions and organic synthesis.	**2**
9	Organometallic complexes of transition metals – unsaturated hydrocarbons.	**4**
10	Catalytic applications of organometallic compounds.	**4**
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	**--**	**20%**
2.	Two Periodic Exams.	**6 and 11**	**30%**
3.	Final Exam (2 hours exam)	**17**	**50%**
...			

*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	- B.D. Gupta, Anil J. Elias "***Basic Organometallic Chemistry: Concepts, Syntheses and Applications"*** 2013, Universities Press.
Supportive References	- R.H. Crabtree "**The Organometallic Chemistry of the Transition Metals**" 6th ed. 2014, Wiley puplisher. -Leah Renold**, *Applied Organometallic Chemistry and Catalysis,*** 2005, Oxford University Press.
Electronic Materials	**http://www.chemweb.com** **http://www.sciencedirect.com** **http://www.rsc.org**
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories

Items	Resources
Technology equipment (projector, smart board, software)	projector, smart board
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students; Program Leaders	Questionnaire evaluation of the course (direct).
Effectiveness of Students' assessment	Students; Faculty	Check marking of a sample of exam papers, or student work (direct).
Quality of learning resources	Faculty, Program Leaders	Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty (indirect)
The extent to which CLOs have been achieved	Program Leaders, Peer Reviewer	Annual course report (direct)
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Solid State Chemistry	
Course Code: CHM3304	
Program: Chemistry	
Department: Chemistry	
College: Faculty of science	
Institution: Umm Al-Qura University	
Version: First	
Last Revision Date: 19/3/2025 *Pick Revision Date.*	

جامعة أم القرى - وزارة التعليم - الكلية الجامعية بالجموم - قسم الكيمياء
Ministry Of Education - Umm Al-Qura University
Jamoum University College - Chemistry Department

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hours)					
2. Course type					
A.	☐ University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6th level/ 3rd year)					
4. Course general Description:					
This course reports the essential concepts of crystal structures properties such as crystal structures properties, symmetry operators, X- ray diffractions, Bragg's law, Miller indices, crystal defects and types of defects in solids.					
5. Pre-requirements for this course (if any)**:**					
Chemistry of transition elements CHM2302					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The main purpose for this course is to study: a. The bases of solid state chemistry. b. Crystallography and their kinds. c. The effect of X-ray on different crystals The crystallographic shapes and semiconductors.					

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 • 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)**	-
Total		**30h**

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	Knowing the crystal systems and their properties and how different between polymorphism and isomorphism.	**K1**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
1.2	Describe solid state chemistry and understand the basic principles of solid-state structures.	**K2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
1.4	Illustrate the crystal defects, types of defects (point, line, surface) and how to calculate the concentrations of the defects according to types of defects.	**K2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Calculate the concentrations of the defects according to types of defects.	**S2**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
2.2	Applies the Miller semantics, calculates the size of the unit, determines the power of the grid, and identifies the unit building structure.	**S3**	Lecture and open discussion in classroom	Quiz periodic exams. final exam.
3.0	**Values, autonomy, and responsibility**			
3.1	Take responsibility to communicate with his colleagues	**V1**	Web-site research about the course topics	Assignments in blackboard
3.2	Simulate crystalline structures using simulation models.	**V2**		

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to solid state chemistry	**2**
2.	Study the crystal structures properties, crystal lattice, type of crystals (covalent -ionic)-cubic centered face-cubic centered body.	**2**
3.	Learn Bravais lattices	**2**
4	Study the symmetry operators , elements and axis of rotation, symmetry and point group of molecules and point group of unit cells-point groups and space groups	**4**
5	Calculate the volume of the unit cell , atomic radius , number of molecules , close and square packing and the density.	**4**
6	X- ray diffractions and Bragg's law	**4**

7	Crystal structure of solids: Solid crystallography-X-Ray crystallography(interference phenomenon and diffraction method)	**2**
8	X-ray diffraction in the crystal structure-X-ray absorption- X-Ray spectrum-experimental crystal study(Lewis method-Rotatable crystal-powder diffraction) How to calculate Miller indices of directions and planes-calculate inter-planar d -spacing (dhkl)	**2**
9	Second midterm exam	**2**
10	The crystal binding in solid Material, lattice energy and ionic charge. How to detect the crystal defects and types of defects.	**2**
11	Effect of impurities on the properties of semiconductors (n-type and p-type semiconductor). Band theory of solids Selected Area Electron Diffraction (SAED)	**4**
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework or activities.	**--**	**20%**
2.	Two Periodic Exams.	**6 and 11**	**30%**
3.	Final Exam (2 hours exam)	**17**	**50%**
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*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	• Lesley E. Smart, Elaine A. Moore, Solid State Chemistry: An Introduction, 4^{th} , CRC press (Taylor & Frances) 2012
Supportive References	Lesley E.Smart , Elaine A.Moore , Solid State Chemistry ; An Introduction, 3^{rd}, Taylor & Francis Group, 2005 LLC • Lesley E. Smart, Elaine A. Moore, Solid State Chemistry: An Introduction, 4th , CRC press (Taylor & Frances) 2012
Electronic Materials	• http://www.mx.iucr.org/iucr-top/comm/cteach/pamphlets/13/node5.html

	• http://img.chem.ucl.ac.uk/sgp/mainmenu.htm • www.shef.ac.uk/.../solid-state-chemistry-applications-msc • www.simplybooks.in/solid-state-chemistry-its-anthony-r-book.. • www.infibeam.com/.../solid-state-chemistry-its-applications/9...
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	projector, smart board, software
Other equipment (depending on the nature of the specialty)	No other requirements.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students; Program Leaders	Questionnaire evaluation of the course (direct).
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Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

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