هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**General Chemistry 1**
Course Code:	**CHM 1101**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 5(4 Lectures, 0 Tutorial, 2 Lab)	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 1/Year 1	
4. Pre-requisites for this course (if any)**: None**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

This introductory and general chemistry course covers fundamental observations, laws, and theories of chemistry at the basic level. Topics include atoms/molecules, stoichiometry, acids/bases, solutions, equilibrium, gases, solids, liquids, thermodynamics, the periodic table, and chemical bonding. The chemistry lab is taken in parallel with the course and covers the following basic experiments: density, mass-mass relationship, limiting reactant, acid-base titrations, solubility product, reactions in aqueous solution, Calorimetry and redox reactions.

2. Course Main Objective: ***This course is entended:***

- Recognize atoms, molecules and ions, atomic theory, structure of the atom, isotopes, chemical formulas, naming compounds, stoichiometry, Avogadro's number, mass spectrometer, empirical formulas, chemical equations, limiting reagents and changes taking place.
- Describe chemical reactions in aqueous solutions and their general proprieties.
- Recall types of chemical reactions (precipitation, acid-base, oxidation-reduction).
- Solve ideal gas equation, stoichiometric data, partial pressures and the kinetic molecular theory of gases,
- Identify quantum theory, electronic structure, Bohr's theory, dual nature of electron, quantum mechanics, and electron configuration, periodic classification periodic variation in physical properties, ionization energy, and electron affinity.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To recognize the atomic theory and structure of the atom.**	K1, K3
1.2	**To describe different phenomena related to chemical reactions and its stoichiometry.**	K1
1.3	**To list gases laws and their physical properties.**	K1, K3
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	K4
2	**Skills :**	
2.1	**To differentiate between protons, neutrons and electrons.**	S1
2.2	**To calculate and balance chemical equations.**	S1
2.3	**To interpret the ideal gas laws and illustrate chemical calculations.**	S1,S3
2.4	**To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini reports, operate electronic mail and Network in communicating with others.**	S1, S2, S3
3	**Values:**	
3.1	**To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.**	V1;V2
3.2	**To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.**	V2

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**The Study of Change:** Science for the twenty-first century, the study of chemistry, the scientific method and hypothesis, a law and theory, matter and substance, mixture, physical means, elements and compounds, classification of matter, The three state of matter, Types of changes, Physical and chemical properties of matter, Extensive and Intensive properties, Measurement, handling numbers, Accuracy and precision	**6**
2	**Atoms, Molecules and Ions:** The atomic theory, Dalton’s atomic theory, Cathode ray tube, Millikan’s experiment, Types of radioactivity, Thomson’s model, Rutherford’s experiment, The structure of the atom, Atomic number, Masse number, Isotopes, The periodic table, Molecules and ions, Formulas and models, Chemical formulas, molecular formula, empirical formula, Formula of Ionic compounds, Chemical nomenclature, Naming compounds, Organic chemistry.	**6**
3	**Masse Relationships in chemical reactions (Stoichiometry):** The mole, Avogadro's number, Molar mass, Molecular mass, Formula mass, the mass spectrometer, Percent composition and empirical formula, Experimental determination of empirical formulas, Chemical reaction, Chemical equations, Balancing chemical equations, Amounts of reaction and reactants and products, Reaction Yield, Limiting reagents.	**10**
4	**Reaction in aqueous solutions:** General proprieties of aqueous solutions, Solution, solute, solvent, An electrolyte and nonelectrolyte, Precipitation reactions, Solubility, Properties of acids, Properties of bases, Arrhenius acid and base, Brønsted acid and base, Neutralization reaction. Oxidation-	**7**

	reduction reactions, Oxidation number, Types of oxidation-reduction reactions, Solution Stoichiometry, Concentration, dilution, indicators, Equivalence point, Gravimetric analysis, Acid base titrations, Redox titrations.	
5	**Gases:** Physical characteristics of gases, Units of pressure, Boyle's law, Charles' & Gay-Lussac's Law, Avogadro's law, and The gas laws. The ideal gas equation, Gas stoichiometry, Dalton's law of partial pressures, The kinetic molecular theory of gases, Molecular Speed Distribution, Gas diffusion, Gas effusion, Deviations from ideal behavior.	**8**
6	**Quantum Theory and the Electronic Structure of Atoms:** Properties of waves, Line emission spectrum, Bohr's model of the atom, The dual nature of the electron, Schrodinger Wave Equation, Quantum numbers, Atomic Orbitals, Aufbau principle, Hund's rule, Electron Configuration.	**7**
7	**The Periodic Table:** Development of the periodic table, ground state electron configurations of the elements, classification of the elements, electron configurations of cations and anions, isoelectronic, effective nuclear charge, atomic radii, ionization energy, electron affinity, diagonal relationships on the periodic table, properties of oxides across a period.	**4**
Total		**48**
Topics to be covered (Laboratories)		
1	Density of liquids & Density of regular and irregular solids	**2**
2	Stoichiometry: Mass-mass relationship	**2**
3	The chemical composition by mass percentage	**2**
4	Preparation of primary standard and dilution rule & titration	**2**
5	Determination of the empirical formula	**2**
6	Strong acid-strong base titration	**2**
7	Vinegar Analysis, Mass %	**2**
8	Reactions in Aqueous Solutions & Precipitation reaction & Limiting reactant	**2**
9	Redox titration of Fe^{2+}	**2**
10	Determination of the specific heat of metal	**2**
11	Revision	**4**
Total		**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the atomic theory and structure of the atom.**	Lecturing	Short quizzes
1.2	**To describe different phenomena related to chemical reactions and its stoichiometry.**	Solving problems, Homework and assignment	Homework and assignment marks and written exams
1.3	**To list gases laws and their physical properties.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0	**Skills**		
2.1	**To differentiate between protons, neutrons and electrons.**	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions
2.2	**To calculate and balance chemical equations.**	Lectures supported by laboratory experiments	Homework assignment, Examination and laboratory sheet
2.3	**To interpret the ideal gas laws and illustrate chemical calculations.**	Lecturing and oral discussion supported by laboratory experiments	Examination and laboratory report
2.4	**To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini reports, operate electronic mail and Network in communicating with others.**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks
3.2	**To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes, Attendance, Participation, Homework	All the semester	10 %
2	Laboratory	All the semester	30 %
3	Midterm Exam 1	Around 5th week	10 %
4	Midterm Exam 2	Around 8th week	10%
5	Final Exam	Around 13thweek	40 %
6	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Chemistry***, Raymond CHANG, Mc Graw Hill, 10th Education, 2010, ISBN 9780073511092.
Essential References Materials	• ***Chemistry,*** Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin, 7thEdition, 2006, ISBN: 061852844X • ***Laboratory Manual for Principles of General Chemistry***, J. A. Beran,, 7th Edition, John Wiley & Sons Inc., 2004.
Electronic Materials	• **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.** • **Each Laboratory should be equipped with maximum 25 seats** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers,**

Item	Resources
	measuring cyliders, curecibles, dishes, funnels, buchner, buchner flasks) • Appropriate chemicals and solvents (Sodium hydroxide, Barium Chloride, Hydrochloric acid, Sulphuric acid, phenolphthalein, methyl orange, ferric sulphate, ferrous sulphate, potassium permanganate, lead acetate) • Furnace Oven, Analytical balance (3 digits), Drying oven • Filter papers , clamps, stands

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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توصيف المقرر الدراسي

Course Title:	General Biology
Course Code:	BIO 1101
Program:	Bachelor of Science in Biology.
Department:	Biology
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	5 (4 Lectures + 2 Lab + 0 Tutorials).
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	Level 1 / First Year
4. Pre-requisites for this course (if any)**:** None.	
5. Co-requisites for this course (if any)**:** None.	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	72	100%
2	**Blended**	-	-
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other**	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	48
2	**Laboratory/Studio**	24
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	72

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course has titles which will introduce the basic concepts for all courses of biology in all educational levels. So, this course involves a tour in the cell, macromolecules, homeostasis, plant backgrounds, principles of genetics and biodiversity.

2. Course Main Objective

- To introduce students into the long-term key concepts in biology which represents general source for their continuing and completing education.
- To acquire the basic and fundamental knowledge of biological terms.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define basic concepts and principles of general biology.	K1.1
1.2	Outline the vast diversity of living things, their special adaptations to their environment, and their evolutionary and ecological relationships.	K1.1, K1.2
2	**Skills:**	

CLOs		Aligned PLOs
2.1	Summarize ideas as well as facts by requiring students to read material on ethical probes that have no easy answers.	S2.1
2.2	Create hypotheses from discovery-based activities by means of laboratories that emphasize observations and hands-on activities.	S2.1, S2.2
2.3	Analyze the obtained results from examinations and investigations.	S2.1, S2.2
3	**Values:**	
3.1	Show ability to communicate effectively with class mates and teaching staff.	V3.1, V3.2
3.2	Demonstrate dynamic work as a team member and being effective in sharing ideas and engaging in fruitful discussion.	V3.3
3.3	Appraise management of resources and time.	V3.2, V3.3

C. Course Content

No	List of Topics	Contact Hours
1	A tour in the cell	4
2	Cell membrane structure and function	4
3	Macromolecules: structure and function	4
4	Introduction to Genetics	4
5	The cell cycles. Mitosis, Meiosis.	4
6	Introduction to Animals and Plants Physiology.	4
7	Hemostasis and hormonal regulation	4
8	Cellular energy (Photosynthesis and Cellular respiration).	5
9	Animal tissues.	5
10	Plant structure, growth and development. Plant tissues. Plant diversity	5
11	Biodiversity: Bacteria and Archeae, Protista and fungi Introduction to animal diversity: Invertebrates, vertebrates	5
Total		48

Lab No.	Topics	Contact hours
Lab 01	Safety and Laboratory, Introduction to Measurement.	2
Lab 02	Structure and types of Microscopes.	2

Lab 03	Molecular Models, Structure of Animals and Plants Cells.	2
Lab 04	Animal and plant Tissue Slides.	2
Lab 05	Kingdom Fungi Slides, Kingdom Protista Slides, Kingdom Monera.	2
Lab 06	Cell Cycle and Mitosis& Meiosis.	2
Lab 07	Bacteria and Viruses.	2
Lab 08	DNA, Human Organs.	2
Lab 09	Osmosis and Diffusion.	2
Lab 10	Genetics I: Meiosis & Mendelian Genetics.	3
Lab 11	Genetics II: Human Genetics.	3
	Total	24

Topics to be covered (Laboratories)

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define basic concepts and principles of general biology.	Three hours weekly contain lectures.	Students will be evaluated on their ability to present complete solutions to problems.
1.2	Outline the vast diversity of living things, their special adaptations to their environment, and their evolutionary and ecological relationships.	Two hours weekly of Laboratory devoted to experiments. Self-Study including work on work sheets.	Performance must include class examinations and homework assignments
2.0	**Skills**		
2.1	Summarize ideas as well as facts by requiring students to read material on ethical probes that have no easy answers.	Self-study is an important method for students' learning.	Questions in Lectures.
2.2	Create hypotheses from discovery-based activities by means of laboratories that emphasize observations and hands-on activities.	Introduce some concepts by examples from real-life Problems (i.e. laboratory).	Participation through class work and Homework.
2.3	Analyze the obtained results from examinations and investigations.	Motivate students to work cooperatively with their class mates to develop individual skills.	Short Quizzes and Exams.
3.0	**Values**		
3.1	Show ability to communicate	Encourage the	Laboratory reports

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	effectively with class mates and teaching staff.	students to solve the exercises and problems on white board.	writing.
3.2	Demonstrate dynamic work as a team member and being effective in sharing ideas and engaging in fruitful discussion.	• Presentations. • Virtual labs.	Laboratory performance and reports.
3.3	Appraise management of resources and time.	Use microscope and laboratory instruments.	Laboratory performance and reports.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	Around 4th -5th week	15%
2	Midterm 2	Around 7th -8th week	15%
3	Quizzes, Attendance, Participation, Home works.	All the semester	10 %
4	Lab reports.	All the semester	5%
5	Lab Exam.	Around 9th week	15 %
6	Final Exam.	Around 13th week	40 %
7	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:
Personal office hour.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Campbell, A.,Reece, J.B –Pearson Biology 10th ed. (2013); international edition. ISBN-13: 978-0321775658 James W. Perry Laboratory Manual for General Biology 5th Edition, ISBN-13: 978-0534380250 (2006).
Essential References Materials	• Sadava et al. 2008. Life, the Science of Biology, 8th Edition. Freeman & Co. • Barnhart, M.C. and T.M. Tamme: Laboratory Manual for General Biology • Saudi Biological Sciences journal. Publications and magazine of biological and life sciences
Electronic Materials	https://www.dscc.edu
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Each classroom is equipped with PC and retro projector with a maximum of 30 students.
Technology Resources (AV, data show, Smart Board, software,	The computers are equipped with different software's. and connected to data show.

Item	Resources
etc.)	
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Specific laboratory equipment for this course including posters, models of different organisms, light microscopes, centrifuges, incubators, ovens and other glassware's.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
At the end of the course each student will complete an evaluation form which it will be used by the faculty to evaluate the course feedback and the instructor.	Students	Direct
At the end of each semester the course coordinator completes a report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.	Course coordinator	Direct
Reviewing the course reports submitted at the end of each semester.	Peer Reviewer	Indirect
Follow up of faculty members by specialized committees devoid of bias and criticism.	Specialized committees	Indirect
Check a sample of marking by independent faculty member.	Faculty	Indirect

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

H. Specification Approval Data

Council / Committee	Head of biology department
Reference No.	10
Date	November 16, 2022

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Course Specifications

Course Title:	**General Chemistry 2**
Course Code:	**CHM 1102**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 5(4 Lectures, 0 Tutorial, 2 Lab)	
2. Course type **a.** University ☐ College ☑ Department ☐ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 2/Year 1	
4. Pre-requisites for this course (if any)**: General Chemistry (1) – CHM 1101**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

This introductory and general chemistry course covers fundamental observations, laws, and theories of chemistry at the basic level. Topics include atoms/molecules, stoichiometry, acids/bases, solutions, equilibrium, gases, solids, liquids, thermodynamics, the periodic table, and chemical bonding. The chemistry lab is taken in parallel with the course and covers the following basic experiments: density, mass-mass relationship, limiting reactant, acid-base titrations, solubility product, reactions in aqueous solution, Calorimetry and redox reactions. The module includes topics in experimental general chemistry relevant to the course.

2. Course Main Objective: ***This course is entended:***

- To familiarize students with basic knowledge of chemistry needed for higher level courses.
- To improve the students' understanding of the properties of substances in the light of trends in the properties of elements across the periodic table.
- To develop the students' appreciation of chemistry as an experimental science supported by theory as an interpretive and predictive tool.
- To create an awareness of the relevance of chemistry to other areas of industrial importance, and environmental issues among the students'.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To recognize the basic concepts of physical, inorganic and analytical chemistry.**	**K1, K3**
1.2	**To name ionic and covalent compound using bonding concept and write Lewis structure of covalent compounds**.	**K1**
1.3	**To describe chemical experiments and define chemical equilibrium and factors affecting it.**	**K1, K2**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	**Skills :**	
2.1	**To calculate the amount of heat transferred during a reaction..**	**S1, S3**
2.2	**To prepare experimental set up to measure heat change and acid-base constants, and assemble different electrochemical cells, perform chemical experiments during laboratory classes and field tasks.**	**S1, S2**
2.3	**To explain the concepts of chemical equilibrium and factors affecting it.**	**S1, S3**
2.4	**To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.**	**S1, S3**
3	**Values:**	
3.1	To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	**V1;V2**
3.2	To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.	**V2**

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Thermochemistry**: First Law: State functions, change in enthalpy, work and heat, Enthalpy of chemical reactions, Calorimetry, Second Law: Entropy, Gibbs free energy, Free energy and chemical equilibrium.	**8**
2	**Entropy, free energy and equilibrium**: Spontaneous reactions, Entropy, State function, Entropy change of a system, Gibbs free energy, phase transition, Gibbs free energy and chemical equilibrium.	**8**
3	**Chemical equilibrium**: Chemical equilibrium, Law of mass action, Equilibrium constant, Equilibrium concentration, Le Chatelier's principal.	**6**
4	**Acid and Base**: Ion product of water, pH measurement, strong acid and base, weak acid and weak base, acid ionization constant, percent ionization, molecular structure and acid strength, acid-base properties of salts.	**6**
5	**Electrochemistry**: Redox reactions, Galvanic Cell, Standard reduction potential, spontaneities of Redox reactions, Cell Emf.	**4**
6	**Physical Properties of Solutions**: Type of solutions, A molecular view of the solution process, Concentration units, Effect of temperature on solubility, Effect of pressure on the solubility of gases.	**4**
7	**Chemical bonding**: Lewis Dot Symbols, The Ionic Bond, Lattice Energy of Ionic Compound, The Born-Haber Cycle for Determining Lattice Energies,	**8**

	The Covalent Bond, Electronegativity, Electronegativity and Oxidation Number, Writing Lewis Structures, Formal Charge and Lewis Structure, The Concept of Resonance, Exceptions to the Octet Rule, The Incomplete Octet, Odd-Electron Molecules, The Expanded Octet, Bond energy. Hybridization of Atomic Orbitals (sp3, sp2 & sp),	
8	**Nuclear Chemistry**: Balancing nuclear equations, Nuclear stability and radioactive decay.	**4**
Total		**48**
Topics to be covered (Laboratories)		
1	Safety and Laboratory equipment and measurements and How to make a report	**2**
2	Calorimeter calibration, Determination of heat of solution(endothermic-exothermic reaction)	**2**
3	Determination of specific heat of metals	**2**
4	Determination of heat of Neutralization & Determination of heat of Dilution	**2**
5	Chemical equilibrium: Effect of concentration & Effect of Temperature	**2**
6	Determination of acid pKa	**2**
7	Determination of iron by reaction with permanganate: Redox Titration	**2**
8	Daniel Cell	**2**
9	Determination of the reaction rate of sodium thiosulfate and hydrochloric acid	**2**
10	Factors affecting reaction rate	**2**
11, 12	Revison	**4**
Total		**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To identify the basic concepts of physical, inorganic and analytical chemistry.**	Lecturing	Short quizzes
1.2	**To name ionic and covalent compound using bonding concept and write Lewis structure of covalent compounds**.	Solving problems, Homework and assignment	Homework and assignment marks and written exams
1.3	**To describe chemical experiments and define chemical equilibrium and factors affecting it.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	**To calculate the amount of heat transferred during a reaction..**	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions
2.2	**To prepare experimental set up to measure heat change and acid-base constants, and assemble different electrochemical cells, perform chemical experiments during laboratory classes and field tasks.**	Lectures supported by laboratory experiments	Homework assignment, Examination and laboratory sheet
2.3	**To explain the concepts of chemical equilibrium and factors affecting it.**	Lecturing and oral discussion supported by laboratory experiments	Examination and laboratory report
2.4	**To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks
3.2	**To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homeworks**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm Exam 1**	**5th week**	**10 %**
4	**Midterm Exam 2**	**8th week**	**10%**
5	**Final Exam**	**13thweek**	**40 %**
6	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 2 office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Chemistry***, Raymond CHANG, Mc Graw Hill, 10th Education, 2010, ISBN 9780073511092.
Essential References Materials	• ***Chemistry,*** Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin, 7thEdition, 2006, ISBN: 061852844X • ***Laboratory Manual for Principles of General Chemistry***, J. A. Beran,, 7th Edition, John Wiley & Sons Inc., 2004.
Electronic Materials	• **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.** • **Each Laboratory should be equipped with maximum 25 seats** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**

Item	Resources
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cylinders, crucibles, dishes, funnels, buchner, buchner flasks)** • **Appropriate chemicals and solvents (Sodium hydroxide, Hydrochloric acid, Sulphuric acid, sodium tiosulphate, phenolphthalein, methyl orange, acetic acid)** • **Analytical balance (3 digits), Drying oven** • **Filter papers, clamps, stands, calorimeter and thermometer.**

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Calculus (1)
Course Code:	MAT 1101
Program:	Bachelor of Science in Applied Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 1 / Year 1**
4.Pre-requisites for this course (if any)**:**	**None**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	**Others** (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of limit, continuity, differentiation and its applications for functions with one variable. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

Understanding basics of differentiation and integration and their applications which are essential to proceed to next courses in all programs.

3. Course Learning Outcomes

	CLOs Upon successful completion of this course, students will be able to:	Aligned-PLOs
1	**Knowledge and Understanding**	
1.1	Identify various types of limits of functions of one variable (graphically, numerically and algebraically)	K1, K2
1.2	Describe different techniques of differentiation and its applications.	K1, K2

CLOs Upon successful completion of this course, students will be able to:		Aligned-PLOs
2	**Skills:**	
2.1	**Use differentiation and integration to solve real world problems such as rate of change, optimization, and area problems.**	**S1, S2**
2.2	**Demonstrate the connection between area and the definite integral through Fundamental theorem of Calculus.**	**S4**
2.3	**Draw graphs of functions handily and by using CAS and online solvers.**	**S5**
2.4	**State, clearly and precisely both orally and in writing, areas and definite integrals by Riemann sums**	**S3**
3	**Values:**	
3.1	**Work individually.**	**V1, V3**
3.2	**Develop personal values and attributes such as honesty, empathy and respect for others.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Preliminaries:** Solving Linear Equations and Inequalities, Absolute value, Solving Inequalities Containing an Absolute Value, Equations of lines, Quadratic Equations and Inequalities, Special Product Formulas, Polynomials, Factoring Polynomials; Functions: Domain, Range, and graphs of functions, Common Functions, Composition of functions, Inverse function; Trigonometry: Unit Circle, Angles and their Measurements, Solving Equations Involving Sines and Cosines, Important Trigonometric Identities, Trigonometric Functions (Sine, Cosine, and Tangent Function), Inverses Trigonometric Functions, Exponential and Logarithmic Functions, Laws of Exponents and Logarithms.	20
2	**Limits and Continuity:** The Concept of Limit, Formal definition of limit, Limit Theorems, Limits Involving Infinity, Asymptotes, The natural number e as a limit, Continuity of functions, Operations on continuous functions, Intermediate value theorem, The Bisection Method, Formal definition of the limit.	16
3	**Differentiation:** Tangent Lines and Velocity, The Derivative, Computation of Derivatives: The Power Rule, Higher Order Derivatives, The Product and Quotient Rules, The Chain rule, Derivatives of Trigonometric Functions and their inverses, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation, The Rule Theorem, The Mean Value Theorem.	18
4	**Applications of Differentiation:** Indeterminate Forms and L'Hopital's Rule, Maxima and minima values, Monotonic functions and the first derivative test, Concavity and the second derivative test, Graphing functions.	18
Total		72

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Identify various types of limits of functions of one variable**	**• 4 lecture hours\week**	**• Regular Exams**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	(graphically, numerically and algebraically)	• 2 tutorial hours\week • Self-study	• Assignments • Short Quizzes
1.2	Describe different techniques of differentiation and its applications.		
2.0	Skills		
2.1	Use differentiation and integration to solve real world problems such as rate of change, optimization, and area problems.	• Self-study • Real-life problems	• Participations • Short Quizzes
2.2	Demonstrate the connection between area and the definite integral through Fundamental theorem of Calculus.	Self-study	Participations
2.3	Draw graphs of functions handily and by using CAS and online solvers.	Real-life problems	Short Quizzes
2.4	State, clearly and precisely both orally and in writing, areas and definite integrals by Riemann sums	Self-study	Participations
3.0	Values		
3.1	To work individually.	Personal questions	Participation
3.2	Develop personal values and attributes such as honesty, empathy and respect for others.	Team work and class discussions.	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the term	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Calculus***, 4th Edition, R. T. Smith, R. B. Minton, McGraw-Hill, 2012. **(Main Reference)**
Essential References Materials	**1.** ***Calculus***; O. Swokowski, et al, PWS Pub. Co.; 6th Edition, 1994. **2.** ***Calculus: Early Transcendentals***, 7th Edition; C. Henry Edwards, David E. Penney, Pearson Prentice Hall, 2008.

	3. ***Essential Calculus with Application***; Richard A. Silverman, Dover Publications, 1989. 4. ***Schaum's Outline of Calculus***, 6th Edition; Frank Ayres, Elliott Mendelson, McGraw-Hill, 2013.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

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

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Mathematics**
Course Code:	**MAT 1103**
Program:	**Bachelor of Science in Chemistry**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 3 / Year 1**
4.Pre-requisites for this course (if any)**:**	**MAT 1101**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

Enhance and reinforce the knowledge of Calculus, gained by the Students in Calculus (1), with other topics which are essential to proceed to next courses in all programs. This course describes the most important ideas, theoretical results, and examples of definite integrals, infinite series, system of linear equations, matrices, determinants and ordinary differential equations. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

- **Enhance and reinforce the knowledge of Calculus, gained by the Students in Calculus (1).**
- **Introduce students to the subject of linear algebra.**

Introduce students to the subject of ordinary differential equations

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	Knowledge and Understanding	
1.1	To learn different techniques of integration and different test of convergence of series.	K1; S1
1.2	To know elementary matrices theory and solvability of ODEs.	S3
2	Skills:	
2.1	To develop techniques of problem solving.	S1
2.2	To communicate mathematics clearly and precisely both orally and in writing.	S1; S2
2.3	To use Internet in searching for scientific information	V2
2.4	To carry out calculations orally and mentally.	S1
3	Values:	
3.1	To work individually.	V1,V2
3.2	To work in groups.	V2

C. Course Content

No	List of Topics	Contact Hours
1	**Definite Integrals:** Review the Formulas and Techniques, Area between two curves, Substitution in Definite Integrals, Integration by Parts, Trigonometric Techniques of Integration, and Integration of Rational Functions using Partial Fractions.	19
2	**Infinite Series:** Infinite Series (Convergence and divergence) Integral test. P-series test, Comparison test, and Limit Comparison test. Alternating series, Absolute convergence, ratio test and root test. Power series.	19
3	**System of Linear Equations, Matrices and Determinants:** Solving linear systems, matrix notation, augmented matrix of a linear system, Reduced echelon form a matrix –Gaussian and Gauss Jordan Elimination, Algebra of matrices, Inverse of a square matrix and Determinants.	19
4	**Ordinary Differential Equations:** First order ordinary differential equations, separable equations and integrating factor. Second order ordinary differential equations	15
Total		72

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.1	To learn different techniques of integration and different test of convergence of series.	4 lecture hours\week	Regular Exams
1.2	To know elementary matrices theory and solvability of ODEs.	2 tutorial hours\week Self-study	Assignments Short Quizzes
2.0	Skills		
2.1	To develop techniques of problem solving.	Real-life problems	Lab Exam
2.2	To communicate mathematics clearly and precisely both orally and in writing.	Self-study	Participations
2.3	To use Internet in searching for scientific information	Real-life problems	Participations
2.4	To carry out calculations orally and mentally.	Self-study	Short Quizzes
3.0	Values		
3.1	To work individually.	Personal questions	Participation
3.2	To work in groups.	Team work	Homework and Mini-projects

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks, Quizzes, Mini-projects	During the semester	20%
2	First Midterm	Week 4-5	20%
3	Second Midterm	Week 7-8	20%
4	Final Exam	Week 13	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.
- All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***1. Calculus***, R. T. Smith and R. B. Minton, 4th Edition, McGraw-Hill, 2012. ISBN13: 9780077256968 (**Main Reference**). ***2. Linear Algebra***, 6th Edition, Gareth Williams Jones and Bartlett, 2008.
Essential References Materials	• ***Advanced Engineering Mathematics***, 5th Edition, Dennis G. Zill, Warren S. Wright, Jones & Bartlett Publishers, 2014. 1. **Linear Algebra**, Schaum's Outline, S. Lipschutz, M. Lipson, McGraw-Hill 3rd edition. 2000.

Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ Each class room should be equipped with a whiteboard and a projector. ▪ Laboratories should be equipped with computers and an internet connection.
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms should be equipped with data show and Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	During the semester and at the end of the course each student will complete two evaluation forms.
Extent of achievement of course learning outcomes, Quality of learning resources	Instructor	At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.

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

H. Specification Approval Data

Council / Committee	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
Reference No.	11/1444
Date	22/04/1444 (16/11/2022)

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Organic Chemistry (1)
Course Code:	CHM 1121
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours: **5 (4 Lectures, 0 Tutorials, 2 Lab)**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: **Level 3 / Year 1**	
4. Pre-requisites for this course (if any)**: CHM 1101**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course is an introduction to the chemistry of carbon. The concepts of bonding, structure, and classification of compounds by functional groups, as well as reactions of aliphatic hydrocarbons, alkyl halides, alcohols, and ethers are presented from a mechanistic viewpoint. Stereo-chemical principles are emphasized.

2. Course Main Objective

At the end of this course the student will be able to:

- **Determine the concepts of chemical bonding and hybridization for Organic Compounds.**
- **Name Aliphatic Organic Compounds and its derivatives according to IUPAC system.**
- **Describe preparation and reactions of Aliphatic Organic Compounds**
- **Recognize the types of organic reactions.**

- **Outline chemical behaviors of Aliphatic Organic Compounds.**
- **Recognize the Aromaticity System for Organic Compounds.**

Use glassware and equipment's in organic laboratory, and safely handle chemicals.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	**Knowledge and Understanding**	
1.1	**To state Organic Compound names according to IUPAC system.**	**K1, K3**
1.2	**To describe the chemical behavior and Stereochemistry of Aliphatic Organic Compounds.**	**K1,K2, S2**
1.3	**To define the basic reactions covered in the required basic organic chemistry course.**	**K3, S1**
2	**Skills :**	
2.1	**To differentiate between saturated and unsaturated organic compounds.**	**K1, K3, S1**
2.2	**To summarize chemical reactivity with chemical structure**	**S1, S2, S3**
2.3	**To evaluate synthesis and reactivity of aliphatic compounds**	**S1, S3**
2.4	**To Perform chemical experiments during Laboratory Classes field tasks and using Laboratory Instruments**	**K1; S2; S4: k4**
3	**Values:**	
3.1	**To demonstrate responsibility for their own learning and motivate for Team Work.**	**V1; V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Atomic Structure**: The nucleus, Orbitals, Electron Configurations, Development of chemical bonding theory, Valence bond Theory, sp3, sp2, sp Hybrid orbitals and the structure of Methane, Ethane, Ethylene and acetylene, The Nature of the chemical bonds, Drawing Chemical Structures.	**2**
2	**Covalent Bonds:** Acids and Bases. Polar Covalent Bonds, Formal Charges, Resonance, Rules of Resonance Forms, Drawing for Resonance Forms, Acids and bases, The Brønsted-Lowry definition, Acid base Strength, Predicting Acid – base Reactions from *pKa* Values, Organic Acids and Organic bases, The Lewis Definition, Molecular Models. Noncovalent Interaction.	**2**
3	**Alkanes and Their Stereochemistry**: Functional Groups, Alkane and Isomers, Naming Alkanes, Properties of Alkanes, Conformation of Ethane, Conformations of Other Alkane.	**5**
4	**Cyclolkanes and Their Steriochemistry**: Naming Cycloalkanes, *Cis-Trans* Isomerism in Cycloalkanes, Conformations of cycloalkanes, Axial and Equatorial bonds in cycloalkane, Conformational Monosubstituted Cycloalkanes, Conformational Disubstituted Cycloalkanes, Conformations of PolyCyclic cyclohexanes.**Group 18** elements (Noble Gas) :Introduction, Occurrence, extraction and uses, Physical properties, NMR active nuclei, Compounds of xenon, Fluorides, Chlorides, Oxides, Oxofluorides, Other compounds of xenon, Compounds of krypton and radon	**5**

5	**An Overview of Organic Reactions:** Kinds of organicreactions, How organic reaction occur, Mechanisms, Radical reactions, Polar reaction, Using curved Arrows in polar reactions Mechanisms, Describing a Reaction (Intermediates).	**3**
6	**Alkenes:** Structure and Reactivity, Industrial Preparation and Use of Alkenes, Calculating Degree of Unsaturation, Naming Alkenes, Sequence Rules: E, Z Designation Stability of Alkenes, Electrophilic Addation Reactions of Alkenes, Orintation of Electrophilic Additions: Markovnikov's rule, Carbocation Structure and Stability, The Hammond Postulate, Evidence for the Mechanism of Electrophilic Additions, Carbocations Rearrangements.	**4**
7	**Reactions and Synthesis of Alkenes**; Preparations of alkenes; A Preview of Elimination Reactions, Addition of Halogens to Alkenes, Addition of Hypohalous Acids of Alkenes. Addition of water to alkenes (Oxy-mercuration, hydroboration), Addition of Carbenes to alkenes, Reduction of Alkenes, Oxidation of Alkenes (Epoxidation, Cleavage to carbonyl Compounds), Radical Additions to Alkenes; Biological Addition of Radicals to alkenes.	**4**
8	**Alkynes**: Naming Alkynes, Preparation of alkynes, (Elimination Reactions of Dihalides); Reactions of Alkyne (Addition of HX and X2); Hydration of Alkynes); Reduction of Alkynes; Oxidative Cleavage of alkynes: Alkyne Acidity (Formation of Acetylide Anions); Alkylation of Acetylide Anions, An Introduction of Organic Synthesis.	**4**
9	**Organohalids**: Naming alkyl halides, Structure of Alkylhalides, Preparing of Alkyl Halides from Alkanes (Radical Halogenations), Preparation of Alkylhalides from Alkenes (Allylic Bromination), Stability of the Allyl Radicals, Preparaton of Alkyl Halidse from Alcohols, Reactions of Alkyl Halides (Grignard Reagents), Organometallic Coupling Reactions, Oxidation and Reduction inOrganic Chemistry.	**8**
10	**Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations:** The Discovery of Nucleophilic Substitution Reactions, The SN2 Reaction, Characteristics of the SN2 Reaction, The SN1 Reaction, Characteristics of the SN1 Reaction, Biological Substitution Reactions, Elimination Reactions: Zaitsev's Rule, The E2 Reaction and the Deuterium Isotope Effect, The E2 Reaction and Cyclohexane Conformation, The E1 and E1cB Reactions, Biological Elimination Reactions, A Summary of Reactivity: SN1, SN2, E1, E1cB, and E2.	**9**
11	**Revisions.**	**2**
Total		**48**
Topics to be covered (Laboratories)		
Lab 01	**Laboratory Instructions and Safety:** Laboratory instructions and The laboratory rules, Common Laboratory Techniques: Filtration, Decolonization, Drying and drying agents, Reflux, Reporting results,	**2**
Lab 02	Identification of Organic Compounds; Physical Character, Solubility, Melting Points, Boiling Points. (Physical Properties).	**2**
Lab 03	Re-crystallization.	**2**
Lab 04	Chromatography (Thin Layer Chromatography)	**2**

Lab.05	Distillation	**2**
Lab06	Classification of organic compounds, identification of Aromatic and aliphatic hydrocarbons	**2**
Lab 07	Identifications and differentiation of alcohol (primary, secondary, tertiary alcohols)	**2**
Lab 08	Identification and differentiation of Phenols	**2**
Lab 09	Identification and differentiation of aldehydes and ketones	**2**
Lab 010	Identification and differentiation of carboxylic acid as aromatic and aliphatic	**2**
Lab 11,12	Revision	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To state Organic Compound names according to IUPAC system.**	▪ Six hours are weekly containing lectures and laboratory activities. ▪ A Private study including home exam.	Short quizzes
1.2	**To describe the chemical behavior and Stereochemistry of Aliphatic Organic Compounds.**	▪ Six hours are weekly containing lectures, and group discussion ▪ Laboratory activities and discussion.	Homework and assignment marks and written exams
1.3	**To define the basic reactions covered in the required basic organic chemistry course.**	▪ Six hours are weekly for laboratory activities ▪ Think talk, and review the basic reactions in the organic chemistry course	Quizzes and MCQs, laboratory report
		▪	
2.0	**Skills:**		
2.1	**To differentiate between saturated and unsaturated organic compounds.**	▪ Introduce some solved and unsolved examples of differentiation between Saturated and Unsaturated Organic Compounds	Short quizzes and Multiples Choice Questions

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.2	**To summarize chemical reactivity with chemical structure**	▪ Group Discussions and Laboratory Experiments	Homework assignment, Examination and laboratory sheet
2.3	**To evaluate synthesis and reactivity of aliphatic compounds**	▪ Lectures and Oral Discussions. ▪ Brain storming Exercises	Examination and laboratory report
2.4	**To Perform chemical experiments during Laboratory Classes field tasks and using Laboratory Instruments**	▪	• Oral tests and lab performance, reports and sheets Marks Assignments and homework marks
3.0	**Values**		
3.1	**To demonstrate responsibility for their own learning and motivate for Team Work.**	▪ Brain Storms Exercises ▪ Group Discussion	• Oral Discussion. • Group Discussion and Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm 1**	**5th week**	**10 %**
3	**Midterm 2**	**8th week**	**10 %**
4	**Final Exam**	**Around 13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Organic Chemistry, John E. McMurry, Mary Finch (Cengage Group), 8ed (2012), ISBN-10: 0495118370 | ISBN-13: 978-0495118374.***
Essential References Materials	• ***Organic Chemistry. Paula YurkanisBruice,*** 2nd Ed, PRENTICE HALL, Upper saddle River New Jersey 07458), 1998, ISBN-10: 0321803221. • ***Organic Chemistry, Morrison, R. T.; Boyd, R. N. "",*** 6th edition, Prentice Hall of India, (1996), ISBN-10: 0136436692. • ***U N D E R S TA N D I N G T H E PRINCIPLES OF ORGANIC CHEMISTRY: A LABORATORY COURSE.*** Steven F. Pedersen and Arlyn M. Myers. Brooks/Cole, Cengage Learning, (2011), Library of Congress Control Number: 2009939414, ISBN-13: 978-0-495-82993-5, ISBN-10: 0-495-82993-5. • ***Macroscale and Microscale Organic Experiments,*** Williamson, K. A. & Masters, K. M. 6th Edition. Cengage Learning, (2010), ISBN-10 : 0538733330, ISBN-13 : 978-0538733335
Electronic Materials	• **Blackboard** • **http://www.chemweb.com** • **http://www.chemistry.com** • **http://www.orgsyn.org**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.** • **Each Laboratory should be equipped with maximum 25 seats** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders, dishes, funnels)**

Item	Resources
	• **Requested chemicals (ethanol, butanol, tert-butanol, cyclohexene, acetone, acetophenone, phenol, aniline, acetaldehyde,benzaldehyde, 2,4-dinitophenylhydrazine, ulphuric acid, hydrochloric acid .)** • **Analytical balance (3 digits), Drying oven, water bath** • **Filter papers, clamps, stands,** Melting Point apparatus.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

Course Specifications

Course Title:	**General Chemistry 2**
Course Code:	**CHM 1102**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: **5(4 Lectures, 0 Tutorial, 2 Lab)**	
2. Course type	
a. University ☐ College ☑ Department ☐ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: **Level 2/Year 1**	
4. Pre-requisites for this course (if any): **General Chemistry (1) – CHM 1101**	
5. Co-requisites for this course (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

This introductory and general chemistry course covers fundamental observations, laws, and theories of chemistry at the basic level. Topics include atoms/molecules, stoichiometry, acids/bases, solutions, equilibrium, gases, solids, liquids, thermodynamics, the periodic table, and chemical bonding. The chemistry lab is taken in parallel with the course and covers the following basic experiments: density, mass-mass relationship, limiting reactant, acid-base titrations, solubility product, reactions in aqueous solution, Calorimetry and redox reactions. The module includes topics in experimental general chemistry relevant to the course.

2. Course Main Objective: ***This course is entended:***

- To familiarize students with basic knowledge of chemistry needed for higher level courses.
- To improve the students' understanding of the properties of substances in the light of trends in the properties of elements across the periodic table.
- To develop the students' appreciation of chemistry as an experimental science supported by theory as an interpretive and predictive tool.
- To create an awareness of the relevance of chemistry to other areas of industrial importance, and environmental issues among the students'.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To recognize the basic concepts of physical, inorganic and analytical chemistry.**	**K1, K3**
1.2	**To name ionic and covalent compound using bonding concept and write Lewis structure of covalent compounds**.	**K1**
1.3	**To describe chemical experiments and define chemical equilibrium and factors affecting it.**	**K1, K2**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	**Skills :**	
2.1	**To calculate the amount of heat transferred during a reaction..**	**S1, S3**
2.2	**To prepare experimental set up to measure heat change and acid-base constants, and assemble different electrochemical cells, perform chemical experiments during laboratory classes and field tasks.**	**S1, S2**
2.3	**To explain the concepts of chemical equilibrium and factors affecting it.**	**S1, S3**
2.4	**To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.**	**S1, S3**
3	**Values:**	
3.1	To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	**V1;V2**
3.2	To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.	**V2**

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Thermochemistry**: First Law: State functions, change in enthalpy, work and heat, Enthalpy of chemical reactions, Calorimetry, Second Law: Entropy, Gibbs free energy, Free energy and chemical equilibrium.	**8**
2	**Entropy, free energy and equilibrium**: Spontaneous reactions, Entropy, State function, Entropy change of a system, Gibbs free energy, phase transition, Gibbs free energy and chemical equilibrium.	**8**
3	**Chemical equilibrium**: Chemical equilibrium, Law of mass action, Equilibrium constant, Equilibrium concentration, Le Chatelier's principal.	**6**
4	**Acid and Base**: Ion product of water, pH measurement, strong acid and base, weak acid and weak base, acid ionization constant, percent ionization, molecular structure and acid strength, acid-base properties of salts.	**6**
5	**Electrochemistry**: Redox reactions, Galvanic Cell, Standard reduction potential, spontaneities of Redox reactions, Cell Emf.	**4**
6	**Physical Properties of Solutions**: Type of solutions, A molecular view of the solution process, Concentration units, Effect of temperature on solubility, Effect of pressure on the solubility of gases.	**4**
7	**Chemical bonding**: Lewis Dot Symbols, The Ionic Bond, Lattice Energy of Ionic Compound, The Born-Haber Cycle for Determining Lattice Energies,	**8**

	The Covalent Bond, Electronegativity, Electronegativity and Oxidation Number, Writing Lewis Structures, Formal Charge and Lewis Structure, The Concept of Resonance, Exceptions to the Octet Rule, The Incomplete Octet, Odd-Electron Molecules, The Expanded Octet, Bond energy. Hybridization of Atomic Orbitals (sp3, sp2 & sp),	
8	**Nuclear Chemistry**: Balancing nuclear equations, Nuclear stability and radioactive decay.	**4**
Total		**48**
Topics to be covered (Laboratories)		
1	Safety and Laboratory equipment and measurements and How to make a report	**2**
2	Calorimeter calibration, Determination of heat of solution(endothermic-exothermic reaction)	**2**
3	Determination of specific heat of metals	**2**
4	Determination of heat of Neutralization & Determination of heat of Dilution	**2**
5	Chemical equilibrium: Effect of concentration & Effect of Temperature	**2**
6	Determination of acid pKa	**2**
7	Determination of iron by reaction with permanganate: Redox Titration	**2**
8	Daniel Cell	**2**
9	Determination of the reaction rate of sodium thiosulfate and hydrochloric acid	**2**
10	Factors affecting reaction rate	**2**
11, 12	Revison	**4**
Total		**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic concepts of physical, inorganic and analytical chemistry.**	Lecturing	Short quizzes
1.2	**To name ionic and covalent compound using bonding concept and write Lewis structure of covalent compounds**.	Solving problems, Homework and assignment	Homework and assignment marks and written exams
1.3	**To describe chemical experiments and define chemical equilibrium and factors affecting it.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	To calculate the amount of heat transferred during a reaction..	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions
2.2	To prepare experimental set up to measure heat change and acid-base constants, and assemble different electrochemical cells, perform chemical experiments during laboratory classes and field tasks.	Lectures supported by laboratory experiments	Homework assignment, Examination and laboratory sheet
2.3	To explain the concepts of chemical equilibrium and factors affecting it.	Lecturing and oral discussion supported by laboratory experiments	Examination and laboratory report
2.4	To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	To illustrate contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks
3.2	To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes, Attendance, Participation, Homeworks	All the semester	10 %
2	Laboratory	All the semester	30 %
3	Midterm Exam 1	5th week	10 %
4	Midterm Exam 2	8th week	10%
5	Final Exam	13th week	40 %
6	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 2 office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Chemistry***, Raymond CHANG, Mc Graw Hill, 10thEducation, 2010, ISBN 9780073511092.
Essential References Materials	• ***Chemistry,*** Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin, 7thEdition, 2006, ISBN: 061852844X • ***Laboratory Manual for Principles of General Chemistry***, J. A. Beran,, 7th Edition, John Wiley & Sons Inc., 2004.
Electronic Materials	• **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.** • **Each Laboratory should be equipped with maximum 25 seats** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**

Item	Resources
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cylinders, crucibles, dishes, funnels, buchner, buchner flasks)** • **Appropriate chemicals and solvents (Sodium hydroxide, Hydrochloric acid, Sulphuric acid, sodium tiosulphate, phenolphthalein, methyl orange, acetic acid)** • **Analytical balance (3 digits), Drying oven** • **Filter papers, clamps, stands, calorimeter and thermometer.**

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

Course Specifications

Course Title:	General Physics
Course Code:	PHY 1101
Program:	Bachelor of Science in Physics. Bachelor of Science in Applied Mathematics. Bachelor of Science in Chemistry. Bachelor of Science in Biology.
Department:	Physics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**5 (3 Lectures, 2 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☑ Department ☐ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 1/Year 1**
4.Pre-requisites for this course (if any)**:**	**None**
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	84	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	24
3	Tutorial	24
4	Others (specify)	0
	Total	84

B. Course Objectives and Learning Outcomes

1. Course Description

Physics 1101 is an introductory physics course for non-science majors. This course focuses on basic physics concepts and connections to everyday life. Course topics include Motion in one dimension, Vectors, laws of motion, Work and kinetic energy, Potential energy and conservation of energy. Overall goals of this course include students' gaining an appreciation for the physical world, improved critical thinking and reasoning skills, and improved scientific literacy for a better-informed public that can make intelligent voting decision. Furthermore, the course provides an introduction to laboratory techniques and experimental methods of physics with emphasis on linking the understanding of physics concepts with "Real-Life" situations. Every class will have a short lecture introducing the procedures, concepts, formulas and instructions relevant to the experiment. The lecture will also cover what is expected in the lab-report; don't be late. Attendance and participation is mandatory. Experiments will usually be performed in groups, but each student will turn in an individual lab report.

2. Course MainObjective

- Provide the basic concepts and build a strong foundation in the principles of classical mechanics.
- Analyze different physical situations and phenomena in terms of the fundamental laws of classical mechanics.
- Understand how these principles are applied in the world around us.
- Gain an understanding of the classical laws of physics and how they are applied to real world problems.
- Observe and analyze physical data relevant to some of the experiments in Mechanics.
- Develop critical thinking and analytical problem-solving skills.

3. Course Learning Outcomes

	CLOs After successful completion of the course, students will able to:	Aligned PLOs
1	Knowledge and Understanding	
1.1	Describe the concepts and principles in introductory study of physics.	K1, K2
1.2	Recognize the underlying physical principles behind various daily life phenomena.	K1, K2
1.3	Describe physical phenomena using proper physical laws and theories in mechanics.	K1, K2
1.4	Define simple mathematical techniques for quantitative analysis in solving physics problems.	K1, K2
2	Skills:	
2.1	Explain and summarize the basic knowledge gained from studying mechanics.	S1, S2
2.2	Develop the students ability to solve and analyze problems in physics related the topics covered by the course.	S2, S3
2.3	Explain and use information from the output of experiment to draw conclusions.	S2; S3
2.4	Summarize conclusions and write reports.	S3; S4
2.5	Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.	S4, S5
3	Values:	
3.1	Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.	V1, V2, V3

C. Course Content

No	List of Topics	Contact Hours
1	**Motion in one dimension:** Displacement, velocity and acceleration, onedimensional motion with constant acceleration, freely falling objects.	**13**
2	**Vectors:** Vector and scalar quantities, some properties of vectors, components of a vector and unit vectors	**8**
3	**The laws of motion:** The concept of force, Newton's first law, Newton'ssecond law, the force of gravity and weight, Newton's third law, someapplications of Newton's laws, forces of friction.	**13**
4	**Work and kinetic energy:** The scalar product of two vectors, work done bya constant force, kinetic energy and the work-kinetic energy theorem.	**13**
5	**Potential energy and conservation of energy:** Potential energy, conservative and non conservative forces, conservative forces andpotential energy, conservation of mechanical energy, work done by non-conservative forces, Power.	**13**
	List of Topics *(Laboratory)*	
1	**Introduction**	**2**
2	**Experiment 1:** Measurements and uncertainties. Virtual experience.	**2**
3	**Experiment 2:** Free fall.	**2**
4	**Experiment 3:** Forces in equilibrium.	**2**
5	**Experiment 4:** Simple pendulum.	**2**
6	**Experiment 5:** Constant Spring.	**2**
7	**Experiment 6:** Simple harmonic motion.	**2**
8	**Experiment 7:** Free fall: Conservation of mechanical energy of a uniformly accelerated mass.	**2**
9	**Experiment 8:** Describe the movement of an object moving at a constant speed and constant acceleration.	**2**
10	**Experiment 9:** Friction and Newton's second law.	**2**
11	**Experiment 10:** Ohm's Law.	**2**
12	**Revision**	**2**
	Total	**84**

Lab. content

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Describe the concepts and principles in introductory study of physics.**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Recognize the underlying physical principles behind various daily life phenomena.**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe physical phenomena using proper physical laws and theories in mechanics.**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.4	**Define simple mathematical techniques for quantitative analysis in solving physics problems.**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**		
2.1	**Explain and summarize the basic knowledge gained from studying mechanics.**	• Lectures. • Class discussions. • Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	• Problem classes and group tutorial. • Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. ▪ Homework.
2.3	**Explain and use information from the output of experiment to draw conclusions.**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Compare with standard results. ▪ Feedback and explanations.
2.4	**Summarize conclusions and write reports.**	• Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites).	▪ Compare with standard results. ▪ Feedback and explanations.
2.5	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	• Lectures. • Class discussions. • Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Exams. ▪ Participation and activities of students in the course community and blackboard. ▪ Homework.
3.0	**Values**		
3.1	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Participation. ▪ Homework. ▪ Mini-project(s).

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Class Activities (class quizzes, homework, solving problems, etc.....)	weekly	10 %
2	Laboratory	All the semester	30 %
3	Midterm Exam 1	5th week	10 %
4	Midterm Exam 2	9th week	10 %
5	Final Exam	13th week	40 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **Students will be assigned an academic advisor to give them the appropriate academic counseling and support.**
- **The lecturer will allocate 6 office hours per week. The assigned times will be advertised on the office door and reserved by the instructor as part of his teaching schedule.**
- **Students are able to get individual consultation appointment with teaching staff via email, phone calls and department website.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Serway R.A. and Jewett J.W., ***Physics for Scientists and Engineers with Modern Physics,*** 9th Edition, Brooks/Cole, Belmont, CA, USA (2014).
Essential References Materials	Halliday D. and Resnick R., ***Physics***, 9th Edition, John Wiley and sons (2011).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	- Laboratory Manual supplied by the Department of Physics. - Laboratory Manual is available at the website of the Department of Physics.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector.**
Technology Resources (AV, data show, Smart Board, software, etc.)	• **Classroomsare equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	• **Students** • **Second assessor**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	• **Instructor** • **Second assessor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

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

H. Specification Approval Data

Council / Committee	**Quality Unit-Physics Department**
Reference No.	**Department council No. 11**
Date	**16/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Inorganic Chemistry (1)**
Course Code:	**CHM 1211**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 5 (4 Lectures, 0 Tutorials, 2 Lab)							
2. Course type							
a.	University	☐	College	☐	Department	✓	Others ☐
b.	Required	✓	Elective	☐			
3. Level/year at which this course is offered: Level 4 / Year 2							
4. Pre-requisites for this course: General Chemistry (2) CHM 1102							
5. Co-requisites for this course (if any): None							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
QA	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

In this module students will study the elements of the periodic table in their different groups, alkali metals, halogens, s and p-block, inert gases, relation of properties with the position in the periodic table. The experimental part of this module deals with the identification of some anions and cations.

2. Course Main Objective

At the end of the course, Students should be able to:

- Gain knowledge of the basic information of s and p block elements and inert gases.
- Acquire methods of preparation of s and p block elements and their uses.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To outline groups of elements.**	**K1; K3**
1.2	**To define the properties and to describe the methods of preparation of elements and compounds of groups I-VIIA.**	**K1; K3**
1.3	**To list different uses and applications of inorganic compounds.**	**K1; K2**
1.4	**To name the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	**Skills :**	
2.1	**To explain the specific properties of elements according to their position in the periodic table.**	**K1; S1**
2.2	**To summarize groups of elements and their respective compounds.**	**S3; S2**
2.3	**To evaluate the components of ionic compounds.**	**S1; S3**
2.4	**To illustrate experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S2; S3; S4;**
3	**Values:**	
3.1	**To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.**	**V1;V2**
3.2	**To show effective awareness to maintain scientific integrity during different assessments, projects, and mini reports**	**V2**

C. Course Content

No	List of Topics	Contact Hours
1	• **Review on The elements** and their compounds: Periodic trends, Valence electron configurations, • **Hydrogen**: The hydrogen ion (proton), The hydride ion, Isotopes of hydrogen, protonium and deuterium, Deuterated compounds, Tritium, Dihydrogen. • **Group 1**: The alkali metals and their compounds: Introduction, Occurrence, extraction and uses, Extraction, Major uses of the alkali metals and their compounds, Physical properties and General properties. • **Group 2**: The alkali earth metals and their compounds: Introduction, Occurrence, extraction and uses, Major uses of the group 2 metals and their compounds, Physical properties and General properties.	**16**
2	• **Group 13**: elements and their compounds: Introduction, Occurrence, extraction and uses, Major uses of the group 13 elements and their compounds, Physical properties, Electronic configurations and oxidation states. • **Group 14**: elements and their compounds: Introduction, Occurrence, extraction and uses, Occurrence, Extraction and manufacture, Uses, Physical properties, Ionization energies and cation formation, Some energetic and bonding considerations,	**10**

	Allotropes of carbon, Graphite and diamond: structure and properties.	
3	• **Group 15**: elements and their compounds: Introduction, Occurrence, extraction and uses, Physical properties, Bonding considerations, Nitrogen, Phosphorus, Arsenic, antimony and bismuth. • **Group 16**: elements (Chalcogen) and their compounds: Introduction, Occurrence, extraction and uses, Physical properties and bonding considerations.	**10**
4	• **Group 17** elements (Halogens) and their compounds: the Introduction, Fluorine, chlorine, bromine and iodine, Astatine, Occurrence, extraction and uses, Physical properties and bonding considerations, NMR active nuclei and isotopes as tracers, The elements, Difluorine, Dichlorine, dibromine and diiodine,, Hypofluorous acid, Oxoacids of chlorine, bromine and iodine and their aqueous solution chemistry • **Group 18** elements (Noble Gas) :Introduction, Occurrence, extraction and uses, Physical properties, NMR active nuclei, Compounds of xenon, Fluorides, Chlorides, Oxides, Oxofluorides, Other compounds of xenon, Compounds of krypton and radon	**12**
Total		**48**

Topics to be covered (Laboratories)		
Lab 01	**Safety and Laboratory equipment's and measurements and How to make a report**	**2**
Lab 02	**Qualitative Analysis of HCl Group (CO_3^{-2}, HCO_3^-, S^{-}_2, $S_2O_3^{-2}$, NO_2^- and SO_3^{-2})**	**2**
Lab 03	**Qualitative Analysis of H_2SO_4 Group, (Cl^-, Br^-, I^- and NO_3^-)**	**2**
Lab 04	**Qualitative Analysis of Miscellaneous Group, (SO_4^{-2}, $B_4O_7^{-2}$ and PO_4^{-3})**	**2**
Lab 05	**Qualitative Analysis of Group I (Pb^{2+}, Hg+ and Ag^+)**	**2**
Lab 06	**Qualitative Analysis of Group IIA (Cu^{2+}, Hg^{2+} , Cd^{2+} and Bi^{3+})**	**2**
Lab 07	**Qualitative Analysis of Group IIB (Sn^{2+}, Sb^{3+} , Sb^{5+} , As^{3+} and As^{5+})**	**2**
Lab 08	**Qualitative Analysis of Group III, Al^{3+}, (Fe^{2+}, Mn^{2+}), (Co^{2+}, Ni^{2+}) and (Zn^{2+}& Cr^{3+})**	**2**
Lab 09	**Qualitative Analysis of Group IV (Ba^{2+}, Ca^{2+} and Sr^{2+})**	**2**
Lab 10	**Qualitative Analysis of Group V (Mg^{2+}, K^+ and Na^+)**	**2**
LAB 11,12	**Revision**	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To outline groups of elements.**	Lectures	quizzes
1.2	**To define the properties and to describe the methods of**	▪ Lectures and group discussion	▪ Homework Exams and laboratory reports

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	preparation of elements and compounds of groups I-VIIA.	Lectures and laboratory experiments	
1.3	**To list different uses and applications of inorganic compounds.**	Lectures and laboratory experiments	▪ Quizzes and homework ▪ Group discussions
1.4	**To name the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Lectures , laboratory experiments Group discussions	▪ Quizzes and homework ▪ Group discussions
2.0	**Skills**		
2.1	**To explain the specific properties of elements according to their position in the periodic table.**	• Group discussions • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks • Oral tests and lab sheets • Assessments and homework • Laboratory performance • Laboratory reports and sheet
2.2	**To summarize groups of elements and their respective compounds.**	Group discussions and laboratory experiments	Oral questions marks and laboratory reports
2.3	**To evaluate the components of ionic compounds.**	Brain storming	MCQs
2.4	**To illustrate experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	▪ Group discussion and assignments ▪ Demonstrations and laboratory manuals ▪ Presentations, demonstrations and virtual labs. ▪ Encourage studens to use electronic mail to submit homeworks and assignments	▪ Oral tests and assignments marks ▪ Laboratory performance ▪ Laboratory performance and reports ▪ Assignments and homework
3.0	**Values**		
3.1	**To appraise teamwork, and adapt to the work environment culture as well as link theoretical study with practical reality.**	• **Group discussions** • **Homework** • **Mini reports**	• **Presentation marks** • **Oral tests** • **Assessments and homework**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.2	To show effective awareness to maintain scientific integrity during different assessments, projects, and mini reports	• Group discussions • Homework • Mini reports	• Presentation marks • Oral tests • Assessments and homework

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Exam 1	5th week	10 %
2	Midterm Exam 2	8th week	10%
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems. • Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Inorganic Chemistry***, Catherine E. Housecroft and Alan G. Sharpe,. 2nd ED. Pearson Education Limited, Essex CM20 2JE, England, 2005 (ISBN: 0130-39913-2).
Essential References Materials	• ***Inorganic Chemistry***, Atkins, P., and Overton, T., Rourke, J., Weller, M., Armstrong, F. and Hagerman, M. 5th Ed. New York, NY: W.H. Freeman and Company, 2010 (ISBN: 978-1-42-921820-7). • ***Laboratory Manual for Principles of General Chemistry***, J. A. Beran,, 9th Edition, John Wiley & Sons Inc., 2004. (ISBN:9780470647899).

Electronic Materials	▪ **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (pipets, conical flasks, beakers, measuring cyliders, dishes, funnels, Buchner, Buchner flasks)** • **Appropriate fine chemicals and solvents (carbonate salts, sulphides salt, nitrate salts, chloride salts, bromide salts, iodide salts, sulphate salts, lead salts, mercury salts, silver salts, hydrochloric acid, sulfuric acid, silver nitrate, lead acetate)** • **Analytical balance (3 digits), Drying oven** • **Filter papers , clamps, stands**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Indirect: External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Fundamentals of Analytical Chemistry**
Course Code:	**CHM 1235**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: **5(4 Lectures, 0 Tutorial, 2 Lab)**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: **Level 4/Year 2**	
4. Pre-requisites for this course (if any)**:** **General Chemistry 2 – CHM 1102**	
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

This course is an introduction to the theory, principles, and practices of quantitative analytical chemistry. The course covers the fundamentals of analytical chemistry: concentration units, statistical data analysis, Chemical Equilibrium, Acids-Bases Equilibria and Fundamentals of Electrochemistry.

2. Course Main Objective: ***This course is intended:***

- To provide a basic knowledge and understanding of essential principles of analytical chemistry.
- To express the concentration of substances in different forms.
- To verify the correctness of the analytical measurements using statistical concepts.
- To provide a knowledge of Chemical equilibria and Acids-Bases Equilibria.
- To introduce the Fundamentals of Electrochemistry.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To list the main principles of analytical chemistry.**	K1
1.2	**To state formula related to statistics and the effect of different errors on the analytical results**	K2
1.3	**To outline some of the analytical chemistry methods and types of concentration expressions.**	K1, K3
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	K4
2	Skills:	
2.1	**To summarize the types of statistical errors and predict results obtained from chemical analysis statistically.**	S1, S3
2.2	**To develop accurate chemical analysis through accurate preparation of standards and reagents.**	S1, S3
2.3	**To demonstrate the experimental set-up, operate different laboratory instruments during laboratory classes and evaluate statistical data to justify analytical measurements. To demonstrate ability to use mail and Network to communicating with others**	S4, S3
2.4	**To show oral communication skills by presenting seminars before his class mates and teaching staff, to write reports about real pollution cases in his community and operate electronic mail and Network skills in communicating with others.**	S2, S3
3	Values:	
3.1	**To demonstrate self-confidence attitudes through single and teamwork practical sessions, presentations, and discussions. Avoid over consumption of materials and chemicals and keep the lab instruments and equipment clean and safe.**	V1, V2
3.2	**To Appraise collaborative work skill**	V2

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Review the basic calculations of analytical chemistry (chemical concentrations and stoichiometry relationship):** Relationship between Analytical Chemistry and other branches of science, General steps in chemical analysis, Measurements, Fundamental SI units, Derived SI units, other units, Conversion to SI units, Prefixes, Chemical concentrations, Molarity, Molality, Percentage composition, ppm and ppb, Preparing Solutions, Dilution, Stoichiometry Calculations.	**10**
2	**Statistics and data analysis in analytical chemistry:** Experimental Errors, Significant Figures, Significant Figures in arithmetic, Addition and Subtraction, Multiplication and Division. Graphs, logarithms and antilogarithms, Types of Errors, Systematic and Random Errors, Precision and Accuracy, Absolute and Relative Uncertainty, Propagation of Uncertainty from random errors	**10**
3	**Chemical equilibria:** The equilibrium constant, A System at Equilibrium, Manipulations of equilibrium constant, Homogeneous & Heterogeneous Equilibria, Le chatelie principle, solubility products. Common ion effect. Complex formation protic acids and bases.	**10**

4	**Acids-Bases Equilibria:** Electrolytes and Nonelectrolytes, Acids & Bases, Bronosted concept, salts, conjugate acids and bases. Autoprotolysis, pH: A Measure of Acidity, strength of acids and bases. Weak acids and bases, Polyprotic acids and bases, relation between Ka and Kb, Buffer Solution, Solving equilibrium problems.	**10**
5	**Fundamentals of Electrochemistry:** Redox Reactions, oxidizing agent, reducing agent, Rules for Assigning Oxidation Number. Electrochemical Cells: galvanic cell, Electrodes, salt bridge, electrode potential, standard electrode potential, The Nernst Equation, Free Energy and Cell Potential.	**8**
Total		**48**
Topics to be covered (Laboratories)		
1	Sampling Techniques of Different Materials.	**2**
2	Preparing Chemical Solutions by Physical Methods (w/v%, g/L, ppm) Making a standard solution using solid reagents.	**2**
3	Preparation and standardization of solutions by Chemical method [Molarity, Normality and molality].	**2**
4	Dilution of Solutions by different methods.	**2**
5, 6	Quality Control and Assurance of Weight Measurements. (A) Statistical Evaluation of Measurements (Panadol Tablets). (B) Quality Control Chart	**4**
7	Chemical equilibrium: The Iron-Thiocyanate Equilibrium	**2**
8	Solubility Product Constant and Common-Ion Effect.	**2**
9	Preparation of Buffers: [Preparation of buffer pH= 9.5, Preparation of buffer pH= 5], buffer capacity and range.	**2**
10	Electrochemistry – Galvanic Cell.	**2**
11,12	Review.	**4**
Total		**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**		
1.1	**To list the main principles of analytical chemistry.**	lecturing	Short quizzes
1.2	**To state formula related to statistics and the effect of different errors on the analytical results**	Lecturing, solving problems, group discussions, Homework and assignment	Homework and assignment marks and written exams
1.3	**To outline some of the analytical chemistry methods and types of concentration expressions.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory reports
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Lecturing, solving problems, group discussions, Homework and assignment	Homework and assignment marks and written exams

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0	**Skills**		
2.1	**To summarize the types of statistical errors and predict results obtained from chemical analysis statistically.**	Lecturing, oral discussion and laboratory experiments	Short quizzes Exams, Homework assignment and laboratory reports
2.2	**To develop accurate chemical analysis through accurate preparation of standards and reagents.**	Lecturing and oral discussion supported by laboratory experiments	Homework assignment, Examination and laboratory report
2.3	**To demonstrate the experimental set-up, operate different laboratory instruments during laboratory classes and evaluate statistical data to justify analytical measurements. To demonstrate ability to use mail and Network to communicating with others**	• Provide student with manual and instructions. • Group discussions and virtual labs. • Use network and computer's software Use blackboard to submit homework	• Laboratory performance evaluation • Laboratory reports and sheet • Oral tests and assignments marks Assignments and homework
2.4	**To show oral communication skills by presenting seminars before his class mates and teaching staff, to write reports about real pollution cases in his community and operate electronic mail and Network skills in communicating with others.**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To demonstrate self-confidence attitudes through single and teamwork practical sessions, presentations, and discussions. Avoid over consumption of materials and chemicals and keep the lab instruments and equipment clean and safe.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks
3.2	**To Appraise collaborative work skill**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homework**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	Midterm Exam 1	Around 5th week	10 %
4	Midterm Exam2	Around 8th week	10%
5	Final Exam	Around 13th week	40 %
6	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• Gary D. Christian, Purnendu K. (Sandy) Dasgupta, Kevin A. Schug. ***Analytical Chemistry***, 7th Edition. ISBN: 978-0-470-88757-8.
Essential References Materials	• Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. ***Fundamentals of analytical chemistry***, 9th Edition. ISBN-13: 978-0-495-55828-6. • Daniel C. Harris. ***Quantitative Chemical Analysis,*** 8th edition,2010, W. H. Freeman & Co., New York, ISBN: 9781429218153.
Electronic Materials	
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.** • **Each Laboratory should be equipped with maximum 25 seats** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.**

Item	Resources
	• Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cylinders) • Appropriate fine chemicals and solvents (Iron-Thiocyanate, potassium permanganate, sodium hydroxide, hydrochloric acid, sulphuric acid, phosohoric acid, calcium oxide, potassium carbonate) • Analytical balance (3 digits), Drying oven, Galvanic Cell, pH meter. • Filter papers , clamps, stands

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Computer Applications in Chemistry**
Course Code:	**CHM 1251**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 2 (0 Lectures, 0 Tutorials, 4 Lab)	
2. Course type a. University ☐ College ☐ Department ☑ Others ☐ b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 4 / Year 2	
4. Pre-requisites for this course (if any): CHM 1101	
5. Co-requisites for this course (if any): None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	48	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	0
2	Laboratory/Studio	48
3	Tutorial	0
4	Others (specify)	0
	Total	48

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers the all required knowledge and information for appropriate software that will be apply in his labs and courses. The course will provide sufficient information and application to do search and download scientific papers and books.

2. Course Main Objective

At the end of this course the student will be able to:

- Use the computer software such as Excel to present his data graphically and obtain constants.
- Download lectures, refrences, books and research articles that .
- Wtite his home work, mini-projects and graduation project using Microsoft Word.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	To identify the importance of software chemistry	K1; K2; S1
1.2	To list of applications of software chemistry	K1; K2; S1
1.3	To recognize scientific journals and database.	K1; K2; S1
2	Skills:	
2.1	To illustrate a simple mechanism using appropriate software program	K1; K3; S1; S2
2.2	To compare between the software programs	S1; S2; S3
2.3	To use Computer, software in, Perform Calculations, and chemical drawing.	K1; S2
3	Values:	
3.1	To show self-confidence attitudes through single and team work practical sessions, presentations, and discussions.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	The Evolution of Computers in Chemistry Computing and Communications in Chemistry Education	4
2	**Microsoft Word:** format copy, page layout: margins, orientation, size, columns, breaks: pages, columns, text wrapping, next page, continuous, even and odd pages, line numbers, review: track changes, show comments, accept and reject, insert: cover pages, pictures, tables, shapes, charts, hyperlink, bookmark, comment, header, footer, page number, text box, word art, symbol, object, design: themes, colors, fonts, watermark, page color, page borders, references: table of contents, insert footnote, insert endnote, insert citation, view: read mode, print layout, web layout, outline, draft, ruler, gridlines, navigation pane, zoom, one page, multiple pages, page width, table design: header row, total row, first column, last column, plain tables, grid tables, styles, shading, borders styles, layout: select, view grids, draw table, erase, delete, insert (above, below, left, right), split (cells, tables), auto fit, alignment, sort, convert to text, pictures properties, word to pdf	7
3	**Microsoft Excel: home:** clipboard, font, alignment, number, styles, cells, editing, insert: tables, illustrations, charts, hyperlinks, text, symbol, page layout: themes, page setup, scat to fit, sheet options, arrange, formulas: function library, data: data tools, outline, review: proofing, language, comments, changes, view: workbook view, show, zoom, windows.	5
4	**Libreoffice :** format copy, page layout: margins, orientation, size, columns, breaks: pages, columns, text wrapping, next page, continuous, even and odd pages, line numbers, review: track changes, show comments, accept and reject, insert: cover pages, pictures, tables, shapes, charts, hyperlink, bookmark, comment, header, footer, page number, text box, word art, symbol, object, design: themes, colors, fonts, watermark, page color, page borders, references: table of contents, insert footnote, insert endnote, insert citation, view: read mode, print layout, web layout, outline, draft, ruler, gridlines, navigation pane, zoom, one page, multiple pages, page width, table design: header row, total row, first column, last column, plain tables, grid tables,	7

	styles, shading, borders styles, layout: select, view grids, draw table, erase, delete, insert (above, below, left, right), split (cells, tables), auto fit, alignment, sort, convert to text, pictures properties, word to pdf	
5	**ChemOffice:** Chemical Drawing Software	**6**
6	**ChemScetch:** Chemical Drawing Software,	**6**
7	**Bibliographic Databases** using Endnote, Mendeley, Chemical Abstracts, Journals, Conferences, Reports, Patents	**7**
8	**Chemistry link collections:** Major chemistry resources, Specialist resources, chemistry web search sites, ... etc.	**6**
Total		**48**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To identify the importance of software chemistry**	• three hours are weekly containing Laboratory activities and Oral Discussion. • A Private study including work on writing report.	• Laboratory Reports. • Oral Discussion marks • Participation.
1.2	**To list of applications of software chemistry**	• three hours are weekly containing Laboratory activities with group discussion. • Think and discuss about Required Software chemistry	• Lab. Reports. • Oral Discussions.
1.3	**To recognize scientific journals and database.**	• three hours are weekly containing Laboratory activities with group discussion. • Think and write about the chemical equation by appropriate software	• Laboratory Reports • Oral Discussions.
2.0	**Skills**		
2.1	**To illustrate a simple mechanism using appropriate software program**	• Laboratory activities • Think and write about the chemical equation by	• Questions in labs. • Participation through Laboratories

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		appropriate software	• Oral Discussion,
2.2	**To compare between the software programs**	• Encourage students to communicate their logic chemical thinking, and to work and discuss cooperatively with their peers to develop individual skills.	• Questions in labs. • Participation through Laboratories • Oral discussion
2.3	**To use Computer, software in, Perform Calculations, and chemical drawing.**	• Encourage the students to use the Chemicals Glass wares and Instruments with caring and safety	• Oral Discussion. • Discussion marks • Giving marks for participation in the lab.
3.0	**Values**		
3.1	**To show self-confidence attitudes through single and team work practical sessions, presentations, and discussions.**	• labs and Group discussion • Have the ability to ask and answer questions as they arise • Brain storming Exercises	• Questions in labs. • Participation through Laboratories • Oral discussion.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Lab. Reports**	**All the semester**	**20 %**
2	**Midterm Exam**	**Around 5th week**	**20 %**
3	**Midterm Exam**	**Around 8th week**	**20 %**
4	**Final Exam**	**Around 13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ **Computer Software Applications in Chemistry, Peter C. Jurs, 2nd Edition. ISBN: 978-0-471-10587-9**
Essential References Materials	
Electronic Materials	• **Blackboard** • **http://www.acdlabs**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each Laboratory should be equipped with maximum 20 seats**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**Software: Chem Draw, office (Words, Excel), ACD labs** **Computers**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
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2020

Course Specifications

Course Title:	**Laboratory safety & management**
Course Code:	**CHM 1252**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 2 (1 Lectures, 0 Tutorials, 2 Lab)	
2. Course type a. University ☐ College ☐ Department ☑ Others ☐ b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 4 / Year 2	
4. Pre-requisites for this course (if any): CHM 1101	
5. Co-requisites for this course (if any): None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	12
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers an understanding of laboratory principles safety and management. The students will be able to more readily identify laboratory hazards and implement effective control measures and become aware of good design, management and laboratory practices. The course will introduce understand the process of assessing and reducing the risks within laboratories

2. Course Main Objective

The objective of this course

- To establish the foundation for a comprehensive laboratory safety management plan (LSM)
- To recognize procedure & guidelines have been established to safely control those hazards associated with the operation of teaching and research labs.
- To ensure the achievement of safety regulations.

- To manage the available resources and adequate for the possible job.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	To define the principles of safety	K1; K2; S1
1.2	To list of emergency responses and the routes of exposures to hazards	K1; K2; S1
1.3	To state the minimization, controlling and managing hazards	K1; K2
1.4	To recognize the toxicity of chemical compounds through simple mechanism based chemical reactivity of functional groups.	K1; K2
2	Skills:	
2.1	To prepare the safety reports periodically and compare between hazards and non-hazards treatment.	K1; K3; S1; S2; S4
2.2	To demonstrate skills to participate in class by asking questions and giving answers.	S1; S2; S3
2.3	To show effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.	K1; S2
2.4	To use mail and Network in communicating with the others effectively.	S1; S2; S3
3	Values:	
3.1	To demonstrate responsibility for their own learning and motivate for Team Work.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	**PRINCIPLES, ETHICS, AND PRACTICES:** THE FOUR PRINCIPLES OF SAFETY, WHAT IS GREEN CHEMISTRY? RETHINKING SAFETY: LEARNING FROM LAB INCIDENTS, GREEN CHEMISTRY IN THE ORGANIC CURRICULUM, FOSTERING A SAFETY CULTURE, EMPLOYERS' EXPECTATIONS OF SAFETY SKILLS FOR NEW CHEMISTS LAWS AND REGULATIONS PERTAINING TO SAFETY GREEN CHEMISTRY—THE BIG PICTURE	2
2	**EMERGENCY RESPONSE** : RESPONDING TO LABORATORY EMERGENCIES, FIRE EMERGENCIES IN INTRODUCTORY COURSES, CHEMICAL SPILLS: ON YOU AND IN THE LABORATORY, FIRST AID IN CHEMISTRY LABORATORIES, FIRE EMERGENCIES IN ORGANIC AND ADVANCED COURSES, CHEMICAL SPILLS: CONTAINMENT AND CLEANUP	1
3	**UNDERSTANDING AND COMMUNICATING ABOUT LABORATORY HAZARDS**: ROUTES OF EXPOSURES TO HAZARDS, LEARNING THE LANGUAGE OF SAFETY: SIGNS, SYMBOLS, AND LABELS, FINDING HAZARD INFORMATION: MATERIAL SAFETY DATA SHEETS (MSDSS), THE GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING, OF CHEMICALS (GHS) INFORMATION RESOURCES ABOUT LABORATORY HAZARDS AND SAFETY, INTERPRETING MSDS INFORMATION, CHEMICAL HYGIENE PLANS	1

4	RECOGNIZING LABORATORY HAZARDS: TOXIC SUBSTANCES AND BIOLOGICAL AGENTS: INTRODUCTION TO TOXICOLOGY, ACUTE TOXICITY, CHRONIC TOXICITY CARCINOGENS, BIOTRANS-FORMATION , BIOACCUMULATION, AND ELIMINATION OF TOXICANTS, BIOLOGICAL HAZARDS AND BIOSAFETY	2
5	RECOGNIZING LABORATORY HAZARDS: PHYSICAL HAZARDS: CORROSIVE HAZARDS IN INTRODUCTORY CHEMISTRY LABORATORIES FLAMMABLES—CHEMICALS WITH BURNING PASSION,CORROSIVES IN ADVANCED LABORATORIES, THE CHEMISTRY OF FIRE AND EXPLOSIONS INCOMPATIBLES—A CLASH OF VIOLENT PROPORTIONS, GAS CYLINDERS AND CRYOGENIC LIQUID TANKS, PEROXIDES, POTENTIALLY EXPLOSIVE HAZARDS, REACTIVE AND UNSTABLE LABORATORY CHEMICALS, HAZARDS FROM LOW- OR HIGH-PRESSURE SYSTEMS ELECTRICAL HAZARDS,HOUSEKEEPING IN THE RESEARC, LABORATORY—THE DANGERS OF MESSY LABS, NONIONIZING RADIATION AND ELECTRIC AND MAGNETIC FIELDS, AN ARRAY OF RAYS—IONIZING RADIATION HAZARDS IN THE LABORATORY, CRYOGENIC HAZARDS—A CHILLING EXPERIENCE, RUNAWAY REACTIONS, HAZARDS OF CATALYSTS	2
6	MINIMIZING, CONTROLLING, AND MANAGING HAZARDS : MANAGING RISK—MAKING DECISIONS ABOUT SAFETY, LABORATORY EYE PROTECTION, PROTECTING YOUR SKIN—CLOTHES, GLOVES, AND TOOLS, CHEMICAL HOODS IN INTRODUCTORY LABORATORIES, MORE ABOUT EYE AND FACE PROTECTION, PROTECTING YOUR SKIN IN ADVANCED LABORATORIES, CONTAINMENT AND VENTILATION IN ADVANCED LABORATORIES, SAFETY MEASURES FOR COMMON LABORATORY OPERATIONS, RADIATION SAFETY, LASER SAFETY, BIOLOGICAL SAFETY CABINETS, PROTECTIVE CLOTHING AND RESPIRATORS SAFETY IN THE RESEARCH LABORATORY, PROCESS SAFETY FOR CHEMICAL OPERATIONS	2
7	CHEMICAL MANAGEMENT: INSPECTIONS, STORAGE, WASTES, AND SECURITY, INTRODUCTION TO HANDLING CHEMICAL WASTES, STORING FLAMMABLE AND CORROSIVE LIQUIDS DOING YOUR OWN LABORATORY SAFETY INSPECTION, MANAGING CHEMICALS IN YOUR LABORATORY, CHEMICAL, INVENTORIES AND STORAGE, HANDLING HAZARDOUS LABORATORY WASTE, CHEMICAL SECURITY	2
Total		**12**
Lab. 1	General Lab safety principles	**2**
Lab. 2	Principles of Safety of green chemistry	**2**
Lab. 3	Principles of safety and management of organic chemistry Lab	**2**
Lab. 4	Principles of safety and management of inorganic chemistry Lab	**2**
Lab. 5	Principles of safety and management of physical chemistry Lab	**2**
Lab. 6	Principles of safety and management of analytical chemistry Lab	**2**
Lab. 7	Principles of safety and management of Biochemistry Lab	**2**
Lab. 8	Principles of safety and management of chemicals storehouse	**2**
Lab. 9	Principles of safety and management of research Lab	**2**
Lab. 10	Handling of hazardous laboratory waste. CHEMICAL SECURITY	**2**
Lab. 11	Principles of chemical security	**2**
Lab. 12	Revision	**2**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To define the principles of safety**	• three hours are weekly containing lectures and labs, and Oral Discussion. • A Private study including work on the home exam. • Students are encouraged to make regular visits during office hours where they can ask any question about the course.	• Quizzes • Assignments. • Oral Discussion marks • MCQs
1.2	**To list of emergency responses and the routes of exposures to hazards**	• three hours are weekly containing lectures, with group discussion.	• Quizzes • Assignments. • Oral Discussion marks • MCQs
1.3	**To state the minimization, controlling and managing hazards**	• three hours are weekly containing lectures with group discussion. • A Private study including work on home exam. • Group Discussion	• Midterms. • MCQs • Oral Discussions.
1.4	**To recognize the toxicity of chemical compounds through simple mechanism based chemical reactivity of functional groups.**	• Two hours are weekly containing lectures with group discussion. • A Private study including work on home exam. • Group Discussion • Think and talk about the influences of toxicity on environment	• Midterms. • Assignments • Oral Discussions. • Quizzes. • Final exam.
2.0	**Skills**		
2.1	**To prepare the safety reports periodically and compare between hazards and non-hazards treatment.**	• Lectures activity • Think and talk about the safety and management	• Questions in Lectures. • Assays • Short Quizzes and Exams. •

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.2	**To demonstrate skills to participate in class by asking questions and giving answers.**	• Motivate students to ask questions and to give a response.	• Oral Discussion. • Participation marks • Homework assignments, Quizzes and Exams. • Giving marks for participation in the class.
2.3	**To show effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	• Motivate the students to Group discussions, seminars.	• Oral Discussion. • Presentation marks •
2.4	**To use mail and Network in communicating with the others effectively.**	• Encourage the students to use blackboard and computer network skills in submitting homework assignments.	• Homework assignments.
3.0	**Values**		
3.1	**To demonstrate responsibility for their own learning and motivate for Team Work.**	• labs and Group discussion • Have the ability to ask and answer questions as they arise • Brain storming Exercises	• Questions in labs. • Participation through Laboratories • Oral discussion.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Lab. Reports**	**All the semester**	**20 %**
2	**Midterm Exam**	**Around 5th week**	**20 %**
3	**Midterm Exam**	**Around 8th week**	**20 %**
4	**Final Exam**	**Around 13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

• There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems. • Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ LABORATORY SAFETYFOR CHEMISTRY STUDENTS, Hill, R. Jr., Finster, D. C., 2ED, Wiley, 2012, ISBN-10: 0470344288
Essential References Materials	
Electronic Materials	• Blackboard • http://www.acdlabs
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Each classroom is equipped with PC and retro projector with a maximum of 25 students. • Each Laboratory should be equipped with maximum 25 seats • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
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T4
2020

Course Specifications

Course Title:	Introduction to Probability & Statistics
Course Code:	STA 1111
Program:	Bachelor of Science in Chemistry
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 5 / Year 2**
4.Pre-requisites for this course (if any)**:**	**MAT 1101**
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	24
4	Others (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of descriptive statistics, counting, random variables, probability distributions, simple linear regression and sampling distribution. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned. The use of statistical packages is essential during first and seventh chapters.

2. Course Main Objective

- **Describe discrete data graphically and compute measures of centrality and dispersion**
- **Compute probabilities by modeling sample spaces and applying rules of permutations and combinations, additive and multiplicative laws and conditional probability**
- **Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance.**
- **Compute probabilities based on practical situations using the binomial and normal distributions.**

Be familiar with statistics and random samples, sampling experiments, the sampling distribution for a sample mean, and the sampling distribution of a sample proportion.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	Knowledge and Understanding	
1.1	**To apply several techniques of counting to calculate probabilities, mean, variance.**	
1.2	**To recognize some special probability distributions and apply their specific formulas.**	
2	**Skills:**	
2.1	**To develop techniques of problem solving.**	
2.2	**To communicate mathematics clearly and precisely both orally and in writing.**	
2.3	**To use Internet in searching for scientific information**	
2.4	**To carry out calculations orally and mentally.**	
3	**Values:**	
3.1	**To work individually.**	
3.2	**To work in groups.**	

C. Course Content

No	List of Topics	Contact Hours
1	**Descriptive Statistics:** Definitions, Need of Statistics & Statistical Problem Solving Methodology & Introduction to Data Collection, Data Organization and Frequency Distributions, Graphic Presentations of Frequency Distributions, Computing Measures of Central Tendency, Computing Measures of Dispersion and Relative Position, Using Technology.	**7**
2	**Probability:** Some Basic Considerations, Events, Counting Sample Points. Interpretations of Probability, Addition Rules, Conditional Probability, Multiplication and Total Probability Rules, Independence, Bayes' Theorem.	**11**

3	**Random Variables and Probability Distribution:** Concept of Random Variable, Discrete Random Variables and Probability Distributions, Continuous Random Variables and Probability Distributions.	**6**
4	**Mathematical Expectation:** Mean of Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear combinations of Random Variables.	**6**
5	**Some Discrete Probability Distributions:** Bernoulli & Binomial Distribution, Hypergeometric Distribution, Geometric and Negative Binomial Distributions, Poisson Distribution.	**7**
6	**Some Continuous Probability Distributions:** Continuous Uniform Distribution, Gamma and Exponential Distribution, Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial.	**6**
7	**Simple Linear Regression and Correlation:** Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model.	**7**
8	**Fundamental Sampling Distribution:** Random Sampling, Some Important Statistics. Sampling Distribution. Sampling Distribution of Means and the Central Limit Theorem, Sampling Distribution of S^2, t-Distribution, F-Distribution	**9**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To apply several techniques of counting to calculate probabilities, mean, variance.**	**3 lecture hours\week**	**Regular Exams**
1.2	**To recognize some special probability distributions and apply their specific formulas.**	**2 tutorial hours\week** **Self-study**	**Assignments** **Short Quizzes**
2.0	**Skills**		
2.1	**To develop techniques of problem solving.**	**Real-life problems**	**Short Quizzes**
2.2	**To communicate mathematics clearly and precisely both orally and in writing.**	**Self-study**	**Participations**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	**To use Internet in searching for scientific information**	**Real-life problems**	**Short Quizzes**
2.4	**To carry out calculations orally and mentally.**	**Self-study**	**Participations**
3.0	Values		
3.1	**To work individually.**	**Personal questions**	**Participation**
3.2	**To work in groups.**	**Team work**	**Homework and Mini-projects**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homeworks, Quizzes, Mini-projects**	**During the semester**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Probability & Statistics for Engineers & Scientists***, 9th Edition, R. Walpole, R. Myers, S. Myers, K. Ye, Pearson Education International, 2012. ISBN 9780321629111. **(Main Reference).**
Essential References Materials	▪ ***Introduction to Probability and Statistics;*** 14th Edition, W. Mendenhall, R. J. Beaver, Barbara M. Beaver, Duxbury Press, 2013. ISBN-13: 9781133103752. ▪ ***Probability and Statistics in Engineering***, 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003. ISBN: 9780471240877. ▪ ***Data Analysis with Microsoft Excel,*** 3rd Edition, Kenneth N. Berk, Patrick Carey, Duxbury Press, 2010. ISBN: 9780538494670.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms should be equipped with data show and Smart Board.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	**Organic Chemistry (2)**
Course Code:	**CHM 1221**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. **Credit hours:**	**5 (4 Lectures, 0 Tutorials, 2Lab)**
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. **Level/year at which this course is offered:**	**Level 5 / Year 2**
4. **Pre-requisites for this course** (if any)**:**	**Organic chemistry (1) –CHM 1121**
5. **Co-requisites for this course** (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers an introduction to Steriochemistry, the Electrophilic Aromatic Substitution, Organic Functional Groups of Alcohols, Aldehydes, Ketones, Ethers, Epoxides, Carboxylic Acids, Carboxylic Acid Derivatives, Amines, Biomolecules as Amino Acids, Protein and Lipids will be included. A mechanistic Approach to Reactions will be in Short cut. The Chemistry Laboratory is taken simultaneously with the course and cover the following experiments which is in direct relation with the course.

2. Course Main Objective

At the end of this course the student will be able to:

- **To define the Aromaticity of Aromatic Systems.**
- **To list of Chemical Behavior of Aromatic Systems to a variety of reagents.**
- **To outline the Functional Groups of Organic Compounds.**

- To state the Reactivity of Functional Groups.
- To recognize the potential importance of the Organic Chemistry in biomolecules
- To name Organic Compounds according to IUPAC system.
- Use glassware and equipment's in Organic Laboratory, and safely handle chemicals.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	To define the Aromaticity of Aromatic Systems, and its Chemical Behavior to a variety of reagents.	K1; K3;
1.2	To outline the Functional Groups of Organic Compounds and their reactivity.	K1; K3; S2
1.3	To list the Potential importance of the Organic Chemistry in Biomolecules	K3; S1
2	Skills :	
2.1	To evaluate the Functional Groups in terms of the reactivity and structures.	K1; K3; S1; S2
2.2	To summarize the behavior of Functional Group towards Chemical Reaction.	S1; S2; S3
2.3	To illustrate a simple mechanism based Chemical Reactivity of Functional Group.	S1; S3
2.4	To perform chemical experiments during Laboratory Classes field tasks, and using Laboratory Instruments	K1; S2; S4; K4
3	Values:	
3.1	To demonstrate responsibility for their own learning and motivate for Team Work.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	**Benzene and aromaticity**: Names of aromatic hydrocarbons, Disubstituted benzenes, Structure and stability of benzene, Molecular orbital description of benzene, Aromaticity and Huckel 4n+2 rule, Aromatic heterocycles	3
2	**Chemistry of Benzene**: Brominating of Aromatic Rings, Other Aromatic Substitutions, and Alkylation of Aromatic Rings: The Friedel–Crafts Reaction, Acylation of Aromatic Rings, Substituent Effects in Aromatic Rings, An Explanation of Substituent Effects. Tri-substituted Benzenes: Additivity of Effects, Nucleophilic Aromatic Substitution, Benzene, Oxidation of Aromatic Compounds, Reduction of Aromatic Compounds, Synthesis Strategies.	8
3	**Alcohols and Phenols:** Naming Alcohols, Properties of Alcohols and Phenols: Hydrogen Bonding, Properties of Alcohols and Phenols: Acidity and Basicity, Preparation of Alcohols: an Overview, Alcohols from Reduction of Carbonyl Compounds, Alcohols from Reaction of Carbonyl Compounds with Grignard Reagents, Some Reactions of Alcohols, Oxidation of Alcohols, Protection of Alcohols, Preparation and Uses of Phenols, Reactions of Phenols, Spectroscopy of Alcohols and Phenols.	8

4	**Ethers and Epoxides; Thiols and Sulfides**: Naming Ethers, Structure, Properties, and Sources of Ethers, The Williamson Ether Synthesis, Alkoxy-mercuration of Alkenes, Reactions of Ethers: Acidic Cleavage, Reactions of Ethers: Claisen Rearrangement, Cyclic Ethers: Epoxides, Ring-Opening Reactions of Epoxides, Crown Ethers, Thiols and Sulfides,	3
5	**Aldehydes and Ketones**: Naming Aldehydes and Ketones, Preparation of Aldehydes and Ketones, Oxidation of Aldehydes and Ketones, Nucleophilic Addition Reactions of Aldehydes and Ketones, Relative Reactivity of Aldehydes and Ketones, Hydration, Cyanohydrin Formation, Imine and Enamine Formation, Nucleophilic Addition of Hydrazine: The Wolff–Kishner Reaction, Nucleophilic Addition of Alcohols: Acetal Formation.	4
6	**Carboxylic Acids and Nitriles**: The Importance of Carboxylic Acids (RCO_2H), Naming Carboxylic Acids and Nitriles, Structure and Physical Properties of Carboxylic Acids, Dissociation of Carboxylic Acids, Substituent Effects on Acidity, Substituent Effects in Substituted Benzoic Acids, Substituent Effects in Substituted Benzoic Acids, Preparation of Carboxylic Acids, Reactions of Carboxylic Acids: An Overview, Reduction of Carboxylic Acids, Chemistry of Nitriles, Preparation of Nitriles by Dehydration, Hydrolysis: Conversion of Nitriles into Carboxylic Acids.	4
7	**Carboxylic Acid Derivatives and Nucleophilic Acyl Substitution Reactions**: Naming Carboxylic Acid Derivatives, Nucleophilic Acyl Substitution, Nucleophilic Acyl Substitution Reactions of Carboxylic Acids, Chemistry of Acid Halides, Chemistry of Acid Anhydrides, Chemistry of Esters, Chemistry of Amides, Thioesters and Acyl Phosphates: Biological Carboxylic Acid Derivatives, Polyamides and Polyesters: Step-Growth Polymers, Spectroscopy of Carboxylic Acid Derivatives.	4
8	**Amines**: Naming Amines, Structure and Bonding in Amines, Properties and Sources of Amines, Basicity of Amines, Basicity of Substituted Arylamines, Synthesis of Amines, Reactions of Arylamines, Tetraalkylammonium Salts as Phase-Transfer Catalysts,	6
9	**Stereochemistry:** Enantiomers and the Tetrahedral Carbon, The Reason for Handedness in Molecules (Chirality Optical Activity) Pasteur's discovery of Enantiomers, Sequence Rule for Specifying Configuration, Diastereomers, Meso-Compounds, Racemic Mixtures and the Resolution of Enantiomers, Stereochemistry of Reactions: addition of H_2O to an Achiral Alkene, Sterochemistry of Reactions: addition of H_2O to an a chiral Alkene, Chirality at nitrogen, phosphorus and Sulfur, Chirality in Nature and Chiral Environments.	8
	Total	**48**
	Topics to be covered (Laboratories)	
Lab 01	**Nitration of Aromatic Compounds: Preparation of nitrobenzaldehyde).**	**2**
Lab 02	**Sulfonation of Aromatic Compounds**	**2**
Lab 03	**Nucleophilic Substitution Reactions of Alkyl Halides**	**2**
Lab 04	**Reactivity of aldehyde with ketone in the presence of base, Aldol Condensation**	**2**
Lab 05	**Preparation of Asprine**	**2**

Lab.0 6	Oxidation of Benzaldehyde-Green Chemistry	2
Lab07	Synthesis of oximes: Reaction of carbonyl compounds with hydroxylamine	2
Lab 08	Mannich Reaction: The acid-catalyzed reaction of an enolizable aldehyde or ketone with an imminium ion, followed by a base to give a β-aminoaldehyde of a β-aminoketone	2
Lab 09	Shiff base: Reaction of N-nucleophiles with aldehyde	2
Lab 010	Synthesis of acetanilidine; Reaction of aniline with acetic anhydride	2
Lab 11,12	Revision	4
	Total	**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To define the Aromaticity of Aromatic Systems, and its Chemical Behavior to a variety of reagents.**	▪ six hours are weekly containing lectures and laboratory activities. ▪ A Private study including home exam.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation.
1.2	**To outline the Functional Groups of Organic Compounds and their reactivity.**	▪ six hours are weekly containing lectures, and group discussion ▪ Laboratory activities and discussion.	▪ Quizzes Assignments. • Oral Discussion marks • Laboratory Reports
1.3	**To list the Potential importance of the Organic Chemistry in Biomolecules**	▪ six hours are weekly for laboratory activities ▪ Think talk, and review Organic Chemistry in Biomolecules	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
2.0	**Skills :**		
2.1	**To evaluate the Functional Groups in terms of the reactivity and structures.**	▪ Introduce some solved and unsolved examples of Comparison between Functional Groups of Organic Compounds	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Laboratory Reports ▪ Home Exam.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.2	**To summarize the behavior of Functional Group towards Chemical Reaction.**	▪ Group Discussions and Laboratory Experiments	• Questions in Lectures. • Laboratory Reports • Short Quizzes and Exams. • Oral Discussion
2.3	**To illustrate a simple mechanism based Chemical Reactivity of Functional Group.**	▪ Lectures and Oral Discussions. ▪ Brain storming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams.
2.4	**To perform chemical experiments during Laboratory Classes field tasks, and using Laboratory Instruments**	▪ Encourage the students to use the Chemicals Glass wares and Instruments with caring and safety	▪ Assignments and Laboratory Report.
3.0	**Values:**		
3.1	**To demonstrate responsibility for their own learning and motivate for Team Work.**	▪ Brain Storms Exercises ▪ Group Discussion	• Oral Discussion. ▪ Group Discussion and Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm 1**	**5th week**	**10 %**
4	**Midterm 2**	**8th week**	**10 %**
5	**Final Exam**	**13th week**	**40 %**
65	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Organic Chemistry, John E. McMurry. Mary Finch (Cengage Group),*** 8th ed (2012), ISBN-10: 0495118370 | ISBN-13: 978-0495118374. 2012
Essential References Materials	• ***Organic Chemistry. Paula YurkanisBruice,*** 2Ed, PRENTICE HALL, Upper saddle River New Jersey 07458), 1998, ISBN-10: 0321803221. • ***Organic Chemistry, Morrison, R. T.; Boyd, R. N.*** "", 6th edition, Prentice Hall of India, (1996), ISBN-10: 0136436692. • ***U N D E R S TA N D I N G T H E PRINCIPLES OF ORGANIC CHEMISTRY: A LABORATORY COURSE. Brooks/Cole, Cengage Learning, (2011),*** Library of Congress Control Number: 2009939414, ISBN-13: 978-0-495-82993-5, ISBN-10: 0-495-82993-5. • ***Williamson, K. A. & Masters, K. M. Macroscale and Microscale Organic Experiments,*** 6th Edition. Cengage Learning, (2010), ISBN-10 : 0538733330, ISBN-13 : 978-0538733335
Electronic Materials	• **Blackboard** • **http://www.chemweb.com** • **http://www.chemistry.com** • **http://www.orgsyn.org**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **Each Laboratory should be equipped with maximum 25 seats**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, dishes, funnels, Buchner, Buchner flasks, condensers)** • **Appropriate fine chemicals and solvents (benzaldehyde, toluene, nitric acid, suphuric acid, acetone, tert butyl bromide, methyl bromide, salicylaldehyde, hydroxyl amine hydrochloride, aniline, acetic anhydride, acetyl chloride, ethanol, dichloromethane, pet. Ether, diethyl ether)** • **Analytical balance (3 digits), Drying oven** • **Filter papers , clamps, stands**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	Physical Chemistry (1)
Course Code:	CHM 1241
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. **Credit hours:** **5 (4 Lectures, 0 Tutorials, 2 Lab)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. **Level/year at which this course is offered:** **Level 5 / Year 2**
4. **Pre-requisites for this course:** **General Chemistry (2) CHM 1102**
5. **Co-requisites for this course** (if any)**:** **None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	**Others** (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

Topics covered in the course include the properties of ideal gas and some laws related to them and the real gas properties. First, second and third laws of thermodynamics, the equilibrium states, Application of the Gibbs function and the Planck function to some phase changes.

2. Course Main Objective

At the end of the course, Students should be able:

- To improve the students' knowledge of the laws of classical thermodynamics.
- To recognize the properties of gases, liquids, and solids and their solutions.
- To correlate the kinetic theory to gas laws.

- Describe the basic principles of chemical equilibria and relationships with thermodynamic function and pH of solutions.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To define the concept of standard state and thermodynamic functions of pure substances due to change of temperature and state main gas laws and their applications.**	**K1; K2; K3**
1.2	**To describe the change of vapour pressure of pure liquids and solids due to change in temperature**	**K1**
1.3	**To list the thermodynamic concept of phase equilibrium, chemical equilibrium, entropy, and Gibb's free energy.**	**K1; K3**
2	**Skills :**	
2.1	**To summarize the heat of reaction from tabulated bond energy values and evaluate the elevation in boiling point and depression in freezing point of solutions due to salt addition**	**S1; S2; S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1; S2; S3**
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**
2.4	**To illustrate and diagram experimental data during laboratory classes, demonstrate technical writing and oral communication skills, and operate electronic mail and network in communication with classmates and teachers.**	**S4; S3, k4**
3	**Values:**	
3.1	**To show effective contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.**	**V1;V2**

C. Course Content

No	List of Topics	Contact Hours
1	• Nature of physical chemistry: Classical mechanics and Properties of Gases:The Perfect Gas – States of gases. Gas laws, Individual Gases, Boyle's Law, Charles's and Gay-Lussac's law, Avogadro's Principle, Graham's law, Perfect (Ideal) Gas Equation, Mixtures of Gases. Dalton's Law, Mole Fractions, Real Gases, Molecular Interactions, Compression factor Boyle's Temperature, Critical Constants, van der Waals Equations. Kinetic Model of Gases. The Barometric Distribution Law, The Maxwell Distribution of Molecular Speeds and Translational Energies,	**12**
2	• Introduction to Thermodynamics: Basic Concepts (Work, Heat and Energy), ZERO'th Law. The First Law of Thermodynamics - Conservation of Energy. Enthalpy, Definition of Enthalpy, Measurement of Enthalpy, Variation of Enthalpy with Temperature, Relation Between Heat Capacities, Adiabatic Change, Work of Adiabatic Change,	**12**

3	• The second law of thermodynamics: Carnot Cycle and entropy: Entropy, Thermodynamic definition, Entropy as a State Function, The Clausius Inequality. Entropy of Phase Transition at the Transition Temperature, Expansion of the Perfect Gas, Variation of Entropy with Temperature, Measurement of Entropy, Entropy Changes in Reversible Processes, Entropy Changes in Irreversible Processest. Third Law of Thermodynamics, Nernst Heat Theorem, Third-Law Entropies, Helmholtz Energy, Maximum Work, Gibbs Energy. The Gibbs Function and Chemical Reactions, Pressure and Temperature. Helmholtz Functions. Chemical equilibrium in systems of variable composition.	**11**
4	• Simple Mixtures: Thermodynamic Description of Mixtures, Partial Molar Quantities, Partial Molar Volume, Partial Molar Gibbs Energies. Application of the Gibbs function to chemical changes.	**13**
Total		**48**
Topics to be covered (Laboratories)		
Lab 01	Safety and Laboratory equipment and measurements and reports Boyle and Mariette's law (P, V), Amontons' law (P,T)	**2**
Lab 02	Gay-Lussac's law (V, T), Avogadro' s law (V, n)	**2**
Lab 03	•Determination of heat of solution from solubility Thermal equation of state and critical point	**2**
Lab 04	•Calibration of a calorimeter and Determination of the specific heat capacity of an Unknown Metal	**2**
Lab 5	•Determination of the calorific value for heating oil and the gross calorific value for olive oil	**2**
Lab 6	•Determination of the heat of formation for water	**2**
Lab 7	•Determination of the enthalpy of vaporization of liquids	**2**
Lab 8	•Enthalpy of Reaction - Hess's Law •Equilibrium and Le Châtelier's Principle	**2**
Lab 9	•Part I: Determination of the Effect of Various Influences on the Position of Equilibrium	**2**
Lab 10	•Part II: Determination of the Effect of Various Influences on the Position of Equilibrium	**2**
Lab 11, 12	Review	**4**
Tota		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To define the concept of standard state and thermodynamic functions of pure substances due to change of temperature and state**	**Lectures**	**Short quizzes and exams**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	main gas laws and their applications.		
1.2	To describe the change of vapour pressure of pure liquids and solids due to change in temperature	Lectures	MCQs and quizzes
1.3	To list the thermodynamic concept of phase equilibrium, chemical equilibrium, entropy, and Gibb's free energy.	Numerical examples and laboratory experiments	Laboratory reports Numerical problem solution grades
2.0	**Skills**		
2.1	To summarize the heat of reaction from tabulated bond energy values and evaluate the elevation in boiling point and depression in freezing point of solutions due to salt addition	Lectures and laboratory experiments	Solved problem marks Short quizzes and Laboratory reports Numerical problem
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Brain storming and self-study	Work portfolio and homework
2.3	To demonstrate skills to participate in class by asking questions and giving answers.	Motivate students to ask questions and to give response.	Participation marks
2.4	To illustrate and diagram experimental data during laboratory classes, demonstrate technical writing and oral communication skills, and operate electronic mail and network in communication with classmates and teachers.	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	To show effective contribution in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	• Group discussion and assignments • homework • Lab-reports • Virtual labs and demonstrations	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5thweek	10%
	Midterm 2	8th week	10%
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• **Physical Chemistry,** K. J. Laidler, J. H. Meiser, B. C. Sanctuary, 4th Ed, 2003,Houghton Mifflin Company [ISBN: 0618123415] • **Advanced Physical Chemistry Experiments,** J. N Gurtu, Amit Gurtu (2008) Meerut, India, Pragati Prakashan, ISBN:978-81-8398-527-7
Essential References Materials	• **Chemical Thermodynamics Basic Concepts and Methods,** Irving M. Klotz, Robert M. Rosenberg, - 7th edition-Wiley (2008). ISBN-10: 471780154 • **Physical Chemistry, P.**W Atkins, and J. de Paula 8th Ed. 2001, New York, NY: W.H. Freeman and Company, ISBN: 9780716735397
Electronic Materials	• **Blackboard** **www. Elesevier.com**
Other Learning Materials	• **Physical Chemistry**, R.Silbey, R. Alberty, and M. Bawendi. 4th ed. 2004, New York, NY: John Wiley & Sons, ISBN: 9780471215042.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.**

Item	Resources
	• In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders) • Appropriate fine chemicals and solvents (distilled Water ammonium nitrate) • Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer • Filter papers , clamps, stands

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T4
2020

Course Specifications

Course Title:	**Chemistry of Volumetric and Gravimetric Analysis**
Course Code:	**CHM 1236**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 5 (4 Lectures, 0 Tutoril, 2 Lab)	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 6/Year 2	
4. Pre-requisites for this course (if any)**: Fundamentals of Analytical Chemistry – CHM 1235**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

This course is an introduction to principles, and practices of classical quantitative analytical methods. The course covers the fundamentals of volumetric analysis such as acid – base, complexometric, redox and precipitation titrations. The basic principles and steps of gravimetric analysis will be covered in details.

2. Course Main Objective: ***This course is intended:***

- To understand the basic concepts and principles of volumetry and gravimetry.
- To gain the required theoretical and practical concepts and skills to conduct titrimetric analysis.
- To practice preparing, standardizing solutions for quantitative chemical analysis.
- To introduce the basic analytical techniques and practical aspects of volumetric analysis.
- To solve problems related to titrimetric analysis and interpret analytical results.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To define the main principles of analytical chemistry.**	K1
1.2	**To state formula related to statistics and the effect of different errors on the analytical results**	K2
1.3	**To outline some of the analytical chemistry methods and types of concentration expressions.**	K1, K3
1.4	**To list the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	K4
2	Skills:	
2.1	**To evaluate the types of statistical errors and predict results obtained from chemical analysis statistically.**	S1, S3
2.2	**To use accurate chemical analysis through accurate preparation of standards and reagents.**	S1, S3
2.3	**To demonstrate the experimental set-up, different laboratory instruments, and evaluate statistical data**	S4, S3
2.4	**To show oral communication skills by presenting seminars, writing reports, and operating electronic mail and Network skills in communicating results with others.**	S2, S3
3	Values:	
3.1	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	V1, V2
3.2	**To show effective awareness to maintain scientific integrity during different assessments, projects, and mini reports**	V2

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Introduction to titration:** Volumetric Titirimetry, Standard solutions, Standardization &Titration, Indicators, titration error, Types of titrations, Percent Purity Calculations.	**4**
2	**Acid/Base Titrations: Titration:** methods of end point determination, acid – base titrations, titration of strong acid with strong base, regions of equivalence point, before, at and after equivalence point, the titration curves, finding the end point with indicators, choosing an indicator.	**9**
3	**Complexometric Titrations:** EDTA titrations, metal chelate complexes, acid-base properties of EDTA, EDTA complexes, EDTA titration curves, regions of equivalence point, before, at and after equivalence point, titration calculations, metal ion indicators, EDTA titrations techniques, direct, indirect, displacement and back titrations, water hardness, masking.	**10**
5	**Oxidation/Reduction Titrations:** Basic concepts of Redox reactions, Redox titrations. The shape of redox titration curves, regions of equivalence point, before, at and after equivalence point, finding the end, Redox indicators.	**10**
6	**Precipitation Titrations:** Precipitation titration curve, Methods of Precipitation Titrations: Mohr's method, Volhard's Method, Fajan's method. Calculations.	**10**
6	**Gravimetric Analysis:** A successful Gravimetric Analysis: Preparation of the solution, The Precipitation, Digest the Precipitate, Washing and Filtering, Drying or Igniting, Gravimetric Calculations.	**5**

Total		48
Topics to be covered (Laboratories)		
1		2
2	Determination of the citric acidic content in lemon juice (Direct titration).	2
3	Determination of calcium carbonate (back titration).	2
4	Potentiometric Titrations: Calibration of PH-meter, and the PH Titration Curves of Weak Acid and strong bases.	2
5	Complexometric Titrations: Determination of calcium by EDTA using EBT (back titration).	4
6	Precipitation Titration: Standardization of Silver Nitrate Solution, and determination of Chloride by the Mohr Method.	2
7	Preparation of triodide solution (I^{3-}). Iodimetric titration of Vitamin C tablets.	2
8	Iodometric titration: Determination of Copper (II) using sodium thiosulfate.	2
9	Gravimetric analysis: Determination of Nickel in Steel.	2
10	Gravimetric analysis: Determination of calcium using Oxalate ion.	2
11	Review.	2
Total		24

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	**To define the main principles of analytical chemistry.**	lecturing	Short quizzes
1.2	**To state formula related to statistics and the effect of different errors on the analytical results**	Lecturing, solving problems, group discussions, Homework and assignment	Homework and assignment marks and written exams
1.3	**To outline some of the analytical chemistry methods and types of concentration expressions.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory reports
1.4	**To list the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory reports
2.0	Skills		
2.1	**To evaluate the types of statistical errors and predict results obtained from chemical analysis statistically.**	Lecturing, oral discussion and laboratory experiments	Short quizzes Exams, Homework assignment and laboratory reports
2.2	**To use accurate chemical analysis through accurate preparation of standards and reagents.**	Lecturing and oral discussion supported by laboratory experiments	Homework assignment, Examination and laboratory report

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	**To demonstrate the experimental set-up, different laboratory instruments, and evaluate statistical data**	• Provide student with manual and instructions. • Group discussions and virtual labs. • Use network and computer's software Use blackboard to submit homework	• Laboratory performance evaluation • Laboratory reports and sheet • Oral tests and assignments marks Assignments and homework
2.4	**To show oral communication skills by presenting seminars, writing reports, and operating electronic mail and Network skills in communicating results with others.**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks
3.2	**To show effective awareness to maintain scientific integrity during different assessments, projects, and mini reports**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homework**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm Exam 1**	**Around 5th week**	**10 %**
4	**Midterm Exam 2**	**Around 8th week**	**10%**
5	**Final Exam**	**Around 13thweek**	**40 %**
6	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• Gary D. Christian, Purnendu K. (Sandy) Dasgupta, Kevin A. Schug. ***Analytical Chemistry***, 7th Edition. ISBN: 978-0-470-88757-8.
Essential References Materials	• Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. ***Fundamentals of analytical chemistry***, 9th Edition. ISBN-13: 978-0-495-55828-6. • Daniel C. Harris. ***Quantitative Chemical Analysis,*** 8th edition,2010, W. H. Freeman & Co., New York, ISBN: 9781429218153.
Electronic Materials	• **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cylinders, crucibles, dishes, funnels, buchner, buchner flasks)** • **Appropriate fine chemicals and solvents (Calcium Carbonate, Carbonate ore, Silver Nitrate, sodium thiosulfate., oxalate salt, sodium tri-iodate, EDTA, potassium iodide, iodine, EBT, ammonium oxalate)**

Item	Resources
	• **pH meter, Analytical balance (3 digits), Drying oven, furnace oven.** • **Filter papers , clamps, stands**

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Physical Chemistry (2)**
Course Code:	**CHM 1242**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 5 (4 Lectures, 0 Tutorialsc, 2 Lab)								
2. Course type								
a.	University	☐	College	☐	Department	✓	Others	☐
b.	Required	✓	Elective	☐				
3. Level/year at which this course is offered: Level 6 / Year 2								
4. Pre-requisites for this course: Physical Chemistry (1) –CHM 1241								
5. Co-requisites for this course (if any): None								

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

Topics covered in the course include the description of the laws of phase transformations of pure substances followed by applications. Derivation and applications of phase rules on Two-Component Systems, vapor Pressure Diagrams. The Lever Rule. Temperature-Composition Diagrams. Distillation of Mixtures, Azeotropes, Immiscible Liquids. Distillation of Partially Miscible Liquids, Liquid-Solid Phase Diagrams, Eutectics. Chemical Equilibrium, The Description of Equilibrium, Perfect gas equilibria,
Dilute solutions of nonelectrolytes, Determination of nonelectrolyte activities

2. Course Main Objective

At the end of the course, Students should be able to:

- Improve the students' knowledge of the laws of phase transformations of pure substances followed by applications

- Use the typical phase diagrams of gases, liquids, and solids as well as to determine the azeotropic mixtures solutions point.
- Describe the properties of Dilute solutions of nonelectrolytes.
- Determination of nonelectrolyte activities and excess Gibbs functions from experimental data.
- Describe the activity, activity coefficients, and osmotic coefficients of strong electrolytes.
- operate laboratory instruments.
- diagram and illustrate experimentally obtained data.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To define phase transformations laws**	**K1; K2; K3;**
1.2	**To describe the basic principles of chemical equilibria related to thermodynamic functions**	**K1; K2; K3;**
1.3	**To state the Phase Rule**	**K1; K3**
2	**Skills :**	
2.1	**To evaluate the equilibrium constant from experimental data, and contrast kinetic data with Mathematical equations.**	**S1; S2; S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1; S2; S3**
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**
2.4	**To illustrate and diagram experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S2; S4; V3, K4**
3	**Values:**	
3.1	**To show effective awareness to maintain scientific integrity during different assessments, projects, and mini reports**	**V1;V2**

C. Course Content

No	List of Topics	Contact Hours
1	• Physical Transformations of Pure Substances, Phase Diagrams, Three Typical Phase Diagrams, Phase Stability, Location of Phase Boundaries, Ehrenfest Classification of Phase Transitions Phase Transitions, Ehrenfest Classification of Phase Transitions. Physical Liquid Surface, Surface Tension. Curved Surfaces.	**12**
2	• Phase Transformations: The Phase Rule, Two-Component Systems, vapor Pressure Diagrams. The Lever Rule. Temperature-Composition Diagrams. Distillation of Mixtures, Azeotropes, Immiscible Liquids. Distillation of Partially Miscible Liquids, Liquid-Solid Phase diagrams, Eutectics.	**16**
3	• Dilute solutions of nonelectrolytes: Henry's Law, Nernst's distribution Law,Raoult's Law,Van't Hoff's Law of osmotic pressure. Van't Hoff's Law of Freezing-Point Depression and Boiling-Point Elevation.Activities, excess Gibbs functions, and standard states for nonelectrolytes. Determination of nonelectrolyte activities and excess Gibbs functions from experimental data: Activity from Measurements of Vapor Pressure. Excess Gibbs Function from	**10**

	Measurement of Vapor Pressure. Activity of a Solute from Distribution between two Immiscible Solvents.	
4	• Activity, activity coefficients, and osmotic coefficients of strong electrolytes. Definitions and Standard states for Dissolved Electrolytes. Determination of Activities of Strong Electrolytes. Activity Coefficients of Some Strong Electrolytes. Changes in Gibbs function for processes in solutions.	**10**
	Total	**48**
Topics to be covered (Laboratories)		
Lab 01	Introduction and Safety	**2**
Lab 02	The Variation of Miscibility with temperature	**2**
Lab 03	Water-Phenol Miscibility Diagram (two components system)	**2**
Lab 04	The melting point of a binary system (Eutectic mixture)	**2**
Lab 05	Determination of the distribution coefficient of acetic acid between water and butanol or (water and diethyl ether)	**2**
Lab 06	Boiling point elevation Freezing point depression	**2**
Lab 07	Molecular Weight Determination by Freezing Point Depression Determining the Molecular Mass of liquid	**2**
Lab 08	Partial Molar Volume Determination	**2**
Lab 09	A study of the ternary system:benzene-aceticacid-water	**2**
Lab 10	To find out the equilibrium constant for the tri-iodide formation, 1_2 + 1-= I_3	**2**
Lab 11	To find the formula of complex cupper ammonium ion or study the complex formation between $CuSO_4$ and NH_3 solution.	**2**
Lab12	Revision	**2**
	Total	**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To define phase transformations laws**	**Lecture**	**Short quizzes**
1.2	**To describe the basic principles of chemical equilibria related to thermodynamic functions**	**Lecture and laboratory experiments**	**Exams and lab reports**
1.3	**To state the Phase Rule**	**Lecture, homework, Group discussions and laboratory experiments**	**Homework assignment marks, Oral test and lab reports**
2.0	**Skills**		
2.1	**To evaluate the equilibrium constant from experimental data, and contrast kinetic data with Mathematical equations.**	**Lectures and laboratory experiments**	**Solved problem marks** **Short quizzes and Laboratory reports** **Numerical problem**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Brain storming and self-study	Work portfolio and homework
2.3	To demonstrate skills to participate in class by asking questions and giving answers.	Motivate students to ask questions and to give response.	Participation marks
2.4	To illustrate and diagram experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.	• Seminars • Group discussions and lab experiment • Encourage students to use electronic mailand blackboard to submit works and assessments.	• Presentation marks • Oral tests and lab sheets • Assignments and homework • Laboratory performance • Laboratory reports and sheet
3.0	**Values**		
3.1	To show effective awareness to maintain scientific integrity during different assessments, projects, and mini reports	• Group discussions • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks • Oral tests Assessments and homework • Laboratory reports and sheet

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	10 %
	Midterm 2	8th week	10 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13thweek	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Physical Chemistry***, K. J. Laidler, J. H. Meiser, B. C. Sanctuary, 4th Ed, 2003,Houghton Mifflin Company [ISBN: 0618123415.
Essential References Materials	1. ***Physical Chemistry***, Ira N. Levine, 5th Edition, McGraw-Hill (ISBN: 0-07-231808-2). 2. ***Physical Chemistry***, R.Silbey, R. Alberty, and M. Bawendi. 4th ed. 2004, New York, NY: John Wiley & Sons, ISBN: 9780471215042. 3. ***Advanced Physical Chemistry Experiments,*** *J*. N Gurtu, Amit Gurtu (2008) Meerut, India, Pragati Prakashan, ISBN:978-81-8398-527-7
Electronic Materials	• **Blackboard** • **www. Elesevier.com**
Other Learning Materials	Chemical Thermodynamics Basic Concepts and Methods, Irving M. Klotz, Robert M. Rosenberg, - 7th edition-Wiley (2008). ISBN-10: 471780154.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (large test tubes, conical flasks, beakers, measuring cylinders, dishes, funnels)**

Item	Resources
	• **Appropriate fine chemicals and solvents (Phenol, Biphenyl, naphthalene, glacial acetic acid, absolut ethanol, chloroform, sodium chloride, diethyl ether, benzene, potassium iodide, iodine, copper sulphate, ammonia solution)** • **Analytical balance (3 digits), thermometer, water path, separating funnel, density flusk.** • **Filter papers , clamps, stands**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**Council of Chemistry Department**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Biochemistry**
Course Code:	**CHM1271**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. **Credit hours:** **3 (2 Lectures, 2 Lab, 0 Tutorials)**	
2. **Course type**	
a. University ☐ College ☐ Department √ Others ☐	
b. Required √ Elective ☐	
3. **Level/year at which this course is offered:** **Level 3 / Year 7**	
4. **Pre-requisites for this course** (if any): **CHM 1221 – BIO 1101**	
5. **Co-requisites for this course** (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**48**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**24**
2	**Laboratory/Studio**	**24**
3	**Tutorial**	**0**
4	**Others** (specify)	**0**
	Total	**48**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is an introduction to the basic principles of biochemistry, the chemistry of living organisms, providing the necessary knowledge and background that a chemist should have about all chemical reactions occur in a living cell. The course introduces the student to the biomolecules (including protein, carbohydrate, lipid, DNA and RNA) function, structure, synthesis, and their metabolism.

2. Course Main Objective

1. **The students should be able to:**
2. **Know basic cellular structure.**
3. **Know the main role of water, PH, buffers in biological systems.**
4. **Recognize the biomolecules and the difference between them with knowing their role.**
5. **Learn the properties, structures, and functions of the biomolecules.**

6. Study in details the chemistry of macromolecules (protein, carbohydrate, lipid, and DNA and RNA), and the micromolecules (amino acids, fatty acids, mono- and di-saccharide, and nucleic acids, which are the building blocks of the macromolecules.
7. Explaining all the pathways that occur in a living organism and the metabolism (anabolism and catabolism).
8. Be familiar with basic biochemistry techniques and experiments.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and understanding	
1.1	To define the fundamentals of biochemistry	K1, K3
1.2	To State biochemistry terminology	K1, S2
1.3	To outline the biological molecules and the difference between them	K1, K3, S2
1.4	To list the chemistry inside living organisms	K1, K3
2	Skills:	
2.1	To summarize the differences of biomolecules	S1, K3
2.2	To explain the most important techniques in biochemistry laboratory	K3, S3, S4, V3
2.3	To use the biochemistry field with other chemistry field (e.g., Organic, and inorganic chemistry)	K1, K3, K4
3	Values:	
3.1	To appraise a moral value toward acquiring knowledge and dealing with others	V1, V2
3.2	To show self-esteem, self-discipline, confidence, and other skills	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to biochemistry:** what is biochemistry? procaryotic and eucaryotic cells, cell structures, water, PH, buffer, ionic equilibrium	4
3	**Protein:** amino acids, structure of protein, globular and fibrous protein, enzymes	4
2	**Bioenergetics:** role of ATP, biologic oxidation, respiratory chain and oxidative phosphorylation	4
4	**Carbohydrates and the metabolism of carbohydrates:** introduction to carbohydrates, glycolysis, TCA cycle, gluconeogenesis, glycogen metabolism, pentose phosphate pathway, glycosaminoglycans and glycoproteins	4
5	**Lipid and the metabolism of lipid:** introduction to lipid, fatty acid and triacylglycerol metabolism, complex lipid metabolism, lipid transport and storage, cholesterol and steroid metabolism	4

6	**Nucleic acid:** nucleotides, DNA structure, replication, and organization, RNA structure, synthesis, and translation, protein synthesis and genetic code	4
Total		24
Laboratory selected topics		
1	Biochemistry laboratory instructions: Lab guideline, safety, equipment, glassware, chemicals, how to write a scientific report	2
2	Buffer solutions: definition, preparing buffer solutions, calculating PH, buffer capacity	2
3	Amino acids: Solubility of amino acids, Ninhydrin test, Xanthoprotein test, millon test, Sakaguchi test, sulfur test	2
4	Protein: The Lowry, Bradford, BCA assays and/or Biuret assays	2
5	Protein: affecting of salt on protein, precipitation by acids, precipitation by high temperature, precipitation by salt and heavy metals	2
6	Protein: Enzyme assay	2
7	Carbohydrates: Molisch test, benedict's test, barfoed's test, bial's test, seliwanoff's test, hydrolysis of sucrose test, Iodine/potassium iodide test,	2
8	Lipid: Lipid solubility test, saponification test, testing the separation of soap from solution by salt, test formation insoluble fatty acids salt	2
9	Lipid: Copper acetate test, Burchard test, Acrolein test, unsaturated fatty acid test	2
10	DNA: DNA extraction and characterization	2
11, 12	Revision	4
Total		24

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	To define the fundamentals of biochemistry	Lectures (PowerPoint slides) supported by laboratory experiments, homework and assignments, and discussion.	Quizzes, lab reports, class questioning, exams (midterms and finals)
1.2	To State biochemistry terminology		
1.3	To outline the biological molecules and the difference between them		
1.4	To define the fundamentals of biochemistry		
2.0	**Skills**		
2.1	To summarize the differences of biomolecules	Lectures supported by laboratory	Quizzes, lab reports, class

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To explain the most important techniques in biochemistry laboratory	experiments, homework and assignments or discussion.	questioning, exams (midterms and finals)
2.3	To use the biochemistry field with other chemistry field (e.g., Organic, and inorganic chemistry)		
3.0	Values		
3.1	To appraise a moral value toward acquiring knowledge and dealing with others	Lectures supported by laboratory experiments, homework and assignments or discussion.	group learning, group discussion, experimental collaboration
3.2	To show self-esteem, self-discipline, confidence, and other skills		Electronic learning, class participation, and group discussion

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes, Attendance, Participation, Homework	All the semester	10 %
2	Laboratory	All the semester	30 %
3	Midterm Exam1	Around 5th -6th week	10 %
4	Midterm Exam1	Around 8th -9th week	10 %
5	Final Exam	Around 13th week	40 %
6	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: Each faculty member has ~2 office hours on their weekly schedule for their students to solve problems and provide extra explanation of the course if needed.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Lippincott's Illustrated Reviews Biochemistry,** 7th edition, by Pamela C. Champe, Richard A. Harvey, and Denise R. Ferrier.
Essential References Materials	**Harper's Illustrated Biochemistry,** 31st edition, international edition, by Victor W. Roadwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, and P. Anthony Weil.

Electronic Materials	**1- Oxford journal of Biochemistry. 0TUhttp://jb.oxfordjournals.org/U0T** **2- American journal of Biochemistry.** **3- 0TUhttp://www.sapub.org/journal/aimsandscope.aspx?journalid=1012U0T.** **4- www.biology.arizona.edu/default.htmlU0T** **5-** http://mcb.harvard.edu/BioLinks.htmlU0T**.** **0TU**
Other Learning Materials	**NONE**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	• The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cylinders, crucibles, dishes, funnels, Buchner, Buchner flasks) • Appropriate fine chemicals and solvents (carbohydrates, amino acids, peptides, Molisch test, benedict's test, barfoed's test, bial's test, seliwanoff's test, hydrolysis of sucrose test, Iodine/potassium iodide test, ethanol, ether, pet.ether, hexane, dicholoromethane) • Analytical balance (3 digits), Drying oven, Automatic Pipette, Magnetic stirrer, spectrophotometer, vortex • Filter papers , clamps, stands

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	students	Evaluation survey •

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	Faculty	Course e. portfolio • Grade analysis •
	peers	Questionnaire •
Extent of achievement of course learning outcomes	Faculty member and program leader	Direct: Academic assessment • Indirect: Course Evaluation Survey •
Quality of learning resources	Student/ Faculty member/ program leader	Course evaluation survey • Course report •
Lab Performance		Lab report • Course e. portfolio •

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

H. Specification Approval Data

Council / Committee	Council of Chemistry Department
Reference No.	10 (NO. 1/10)
Date	21/04/1444- 15/11/2022

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Inorganic Chemistry (2)**
Course Code:	**CHM 1311**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 5 (4Lectures, 0 Tutorial, 2 Lab)							
2. Course type							
a.	University		College		Department	✓	Others	
b.	Required	✓	Elective				
3. Level/year at which this course is offered: Level 7 / Year 3							
4. Pre-requisites for this course: Inorganic Chemistry (1) - CHM 1211							
5. Co-requisites for this course (if any)**:** None							

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

Topics covered in the course include Coordination Compounds and their magnetic properties, theories regarding complexes geometries with their electronic configuration, types of ligands and properties. The course will be provide the students with Basic information for transition metals including methods of preparation, uses of elements and compounds.

2. Course Main Objective

At the end of the course, Students should be able to:

- Understanding Coordination compounds, their magnetic properties, theories regarding complexes geometries and their electronic configuration,
- Understanding ligands, their types and properties.

- Basic information about transition metals and analytical chemistry including methods of preparation, uses of elements and compounds.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To list the general characteristics of transition elements and identify a number industrial and metallurgical process.**	**K1; K2; K3**
1.2	**To describe the Crystal Field Theory and the Molecular orbital theory**	**K1**
1.3	**To name complexes made of a central atoms and ligands and to recognize the origin of metals magnetism**	**K1; K3**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	**Skills :**	
2.1	**To differentiate between paramagnetic, diamagnetic and ferromagnetic and anti- ferromagnetic compounds and to summarize the common physical and chemical properties of s and d elements.**	**S1; S3**
2.2	**To develop the electronic structures of transition metal complexes and to interpret electronic absorption spectra of complexes**	**S1; S2 and S3**
2.3	**To prepare standard solution using different laboratory equipment's**	**S2; S3**
2.4	**To illustrate and diagram experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S2; S3; S4**
3	**Values:**	
3.1	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works.**	**V1;V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Werner's Coordination Theory**, ligand classification, Nomenclature of Coordination Compounds Complex formation, Variable oxidation states, Electroneutrality principle **Isomerism in d-block metal complexes**: Structural isomerism: ionization isomers, Structural isomerism: hydration isomers, Structural isomerism: coordination isomerism, Structural isomerism: linkage isomerism, Structural isomerism: polymerization isomerism, Stereoisomerism: geometrical isomers, Stereoisomerism: optical isomers. Coordination numbers, Factors Affecting Coordination Number, The Kepert model, Coordination number 2-7 , stability of complexes, Preparation of coordination complexes, Detection of complexes.	**11**
2	**d-Block chemistry:** general considerations: Topic overview, Ground state electronic configurations, d-Block metals versus transition elements, Electronic configurations, Physical properties, The reactivity of the metals, Characteristic properties: a general perspective, Colour and Paramagnetism.	**9**
3	**Scandium group:** characterization, oxidation states, extraction, compounds, chemical reactions, oxidation states, extraction, compounds, separation, Titanium group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Vanadium Group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Chromium group: characterization, oxidation states, extraction, compounds, chemical reactions,	**17**

	separation, Manganese group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Iron group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Cobalt group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Nickel group, characterization, oxidation states, extraction, compounds, chemical reactions, separation, Copper group: characterization, oxidation states, extraction, compounds, chemical reactions, separation, Zinc group: characterization, oxidation states, extraction, compounds, chemical reactions, separation.	
4	**The f-block metals:** lanthanoids and actinoids: Introduction, f -Orbitals and oxidation states, Atom and ion sizes, The lanthanoid contraction, Coordination numbers, Sources of the lanthanoids and actinoids, occurrence and separation of the lanthanoids, The actinoids, Lanthanoid metals, Inorganic compounds and coordination complexes of the lanthanoids, Halides, Hydroxides and oxides, Complexes of Ln(III), The actinoid metals, Inorganic compounds and coordination complexes of thorium, uranium and plutonium, Thorium, Uranium, Plutonium.	**11**
Total		**48**
Topics to be covered (Laboratories)		
Lab 01	Determine M & S for Mg^{2+}, Zn^{2+} and Pb^{2+}.	**2**
Lab 02	Determine M & S for Cu^{2+}, Ni^{2+} and Ca^{2+} & Determine M & S for $Co^{2+}$and Zn^{2+}	**2**
Lab 03	Determine M & S for Al^{3+}, Ni^{2+} and Mg^{2+}	**2**
Lab 04	Determine M & S for Fe^{3+} and Zn^{2+}	**2**
Lab 05	Analysis of Mg^{2+} + Zn^{2+} and Mg^{2+} + Ni^{2+} mixtures & Analysis of Mg^{2+} + Zn^{2+} and Mg^{2+} + Zn^{2+} + Cu^{2+} mixtures	**2**
Lab 06	Preparation of chloropentammine cobalt(III) chloride	**2**
Lab 07	I basic cations Separation of group & II basic cations separation of group	**2**
Lab 08	III basic cations Separation of group	**2**
Lab 09	IV basic cations Separation of group	**2**
Lab 10	V basic cations Separation of group	**2**
Lab 11, 12	Revision	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To list the general characteristics of transition elements and identify a**	**Lectures**	**Quizzes**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	number industrial and metallurgical process.		
1.2	To describe the Crystal Field Theory and the Molecular orbital theory	Group discussion and laboratory experiments	• Homework • laboratory reports
1.3	To name complexes made of a central atoms and ligands and to recognize the origin of metals magnetism	Lectures	Exams
1.4	To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.	• Tutorials Group discussion	• Homework ▪ Quizzes
2.0	**Skills**		
2.1	To differentiate between paramagnetic, diamagnetic and ferromagnetic and anti-ferromagnetic compounds and to summarize the common physical and chemical properties of s and d elements.	Lecturing and group discussion	• Quizzes • oral exercises • Exam
2.2	To develop the electronic structures of transition metal complexes and to interpret electronic absorption spectra of complexes	• Tutorials Group discussion	• Homework • Oral tests
2.3	To prepare standard solution using different laboratory equipment's	Lab experiments	Lab reports
2.4	To illustrate and diagram experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.	• Group discussion and assignments • Demonstrations and laboratory manuals • Presentations, demonstrations and virtual labs. • Encourage students to use electronic mail and blackboard to submit homeworks and assignments	▪ Oral tests and assignments marks ▪ Laboratory performance ▪ Laboratory performance and reports ▪ Assignments and homework
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	To Appraise effectively the collaboration and inter-professionalism in class discussions or team works	• Group discussions • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks • Oral tests and lab sheets • Assessments and homework • Laboratory performance • Laboratory reports and sheet

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Exam 1	5th week	10 %
2	Midterm Exam 2	8th week	10 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems. • Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Inorganic Chemistry***, Gary L. Miessleand Donald A. Tarr. 4th Edition, 2010, Publisher: Prentic Hall:, 2010 ISBN-10:0136128661 • ***Advanced Inorganic Chemistry: A Comprehensive Text***,F. A. Cotton, S. G. Wilkinson 3rd Edition, 1972. Published by John Wiley & Sons Inc. ISBN 13: 9780471175605
Essential References Materials	• ***Advanced Inorganic Chemistry: A Comprehensive Text***, F. A. Cotton, & G. Wilkinson, 3rd Edition, Published by New York: Interscience Publishers Inc., New York.

	• ***Quantitative Chemical Analysis,*** Daniel C., Harris, 8th Edition, 2010. W. H. Freeman;: ISBN-10: 1429218150
Electronic Materials	▪ **Blackboard** • **www. Elesevier.com**
Other Learning Materials	**Comprehensive Inorganic Chemistry**. Sulekh Chandra, New Age International Limited Publishers, New Delhi, 2004 Descriptive inorganic chemistry, Rayner-Canham, Geoff., Publisher: W.H. Freeman, New York, 2006

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, test tubes, centrifuge tubes)** • **Appropriate chemicals such as different salts of several metals as Ni, Mg, Cu, Ca, Zn, Fe, Pb and solvents** • **Analytical balance (3 digits), centrifuge apparatus.** • **Filter papers , clamps, stands**

G. Course Quality Evaluation

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

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**ORGANOMETALLIC CHEMISTRY**
Course Code:	**CHM 1313**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 3(3 Lectures, 0 Tutorial, 0 Lab)	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 8/Year 3	
4. Pre-requisites for this course (if any): **Inorganic Chemistry 2 – CHM 1311**	
5. Co-requisites for this course (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

C. Course Objectives and Learning Outcomes

1. Course Description:
This course provides students with an introduction to Organometallic Chemistry, definitions, historical developments, Coordination theories, and also the 18-electron rule. The course will cover the Organometallics of Group.1 and Group.2, as well the transition metals. The Organometallic reactions and catalysis, and its application will be included.

2. Course Main Objective: ***This course is intended:***

- To improve the student's knowledge of the basic information about Organometallic Chemistry.
- To outline Organometallic Reactions and Catalysis,
- To recall the applications of organometallic compounds (catalytic processes, organic synthesis, therapeutics, biocides, qualitative and quantitative analysis, metallurgical operations and polymers).

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To describe the basic concepts of organometallic chemistry, and its nomenclature and to recall the concept of effective atomic number and molecular orbital diagrams of organometallic compounds,**	**K1; K2**
1.2	**To outline the bonding and bridging modes for organic ligands structure**	**K1**
1.3	**To recognize synthetic methods of organometallic compounds with different applications in catalytic processes.**	**K1; K2**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	Skills :	
2.1	**To evaluate Organometallic Compounds and the relationship among organic ligands structure for Organometallic Chemistry applications**	**S1; S2; S3**
2.2	**To develop routes for Organometallic Compounds synthesis.**	**K2; S1; S2; S3**
2.3	**To analyze spectral data of organometallic compounds and to explain the reactivity of Organometallic Compounds as a catalyst.**	**K2; S1; S2; S3**
2.4	**To demonstrate oral and network communication and technical writing skills.**	**S2; S3**
3	Values:	
3.1	**To show confident attitudes through single and teamwork, and effective awareness to maintain scientific integrity during different assessments, projects, and mini reports**	**V1, V2**

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Introduction**: Definition of organometallic compounds, Organic ligands and nomenclature Historical developments, types of organometallic compounds, preparation of organometallic compounds, Grignard Reagents, Properties of organometallic compounds.	**7**
2	**Coordination Theories**: Valence Bond Theory, Limitations of Valence Bond Theory, Ligand Field Theory, ligand field splitting, Octahedral Fields, Tetrahedral, Tetragonal, and Square Planar Fields, tetragonal distortion, Factors Affecting Δ, Ligand Field Stabilization Energy, Jahn-Teller Distortion, Limitations of Crystal Field Theory, Molecular Orbital Theory	**3**
3	**The 18-electron rule**, Exceptions to 18-electron rule, Hapticity, Metallocenes	**4**
4	**Bonding between Metal atoms and Organic π Systems**, Linear systems, π-Ethylene complexes, π-Allyl complexes, other linear π systems, cyclic π Systems, cyclopentadienyl (Cp) complexes, Ferrocene, (η^5 -$C_5H_5)_2Fe$, complexes containing cyclopentadienyl and CO ligands.	**4**
5	**Organometallics of Group 1 and 2**: preparations, reactions and applications, Organoelement Compounds of the Carbon Group (Group 14) (preparations, reactions and applications), Organometallics of group 12 (preparations, reactions and applications)	**7**
6	**Organometallic Reactions and Catalysis**: Reactions involving gain or loss of ligands, Ligand dissociation and substitution, Oxidative addition, Reductive elimination, Nucleophilic displacement, Reactions involving modification of ligands, Insertion, Carbonyl insertion (alkyl migration, Hydride elimination,	**5**

	Abstraction, Cyclometallations, Nucleophilic Displacement, Catalytic Deuteration, Hydroformylation, Monsanto Acetic Acid Process, Wacker (Smidt) Process, Hydrogenation (Wilkinson's catalyst), Olefin Metathesis.	
7	**Applications of Organometallics**: Zieglear- Natta catalysis and Wilkinson catalysis, Organic synthesis, Therapeutics, Biocides, Qualitative analysis, Quantitative analysis, Metallurgical operations, Polymers.	**3**
8	**Revisions.**	**3**
Total		**36**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To describe the basic concepts of organometallic chemistry, and its nomenclature and to recall the concept of effective atomic number and molecular orbital diagrams of organometallic compounds,**	lecturing	Short quizzes
1.2	**To outline the bonding and bridging modes for organic ligands structure**	Lecturing, group discussions, Homework and assignment	Oral test, Homework and assignment marks and written exams
1.3	**To recognize synthetic methods of organometallic compounds with different applications in catalytic processes.**	Lecturing, group discussions, Homework and assignment	Participation, Quizzes and MCQs,
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	group discussions, Homework and assignment	
2.0	**Skills :.**		
2.1	**To evaluate Organometallic Compounds and the relationship among organic ligands structure for Organometallic Chemistry applications**	• Lectures activity • Think and talk about the reactivity of Organometallic Compounds • Introduce some solved and unsolved examples of Organometallic Compounds Synthesis and Reactivity achieving	• Questions in Lectures. • Short Quizzes and Exams. • Participation through Class work and Homework.
2.2	**To develop routes for Organometallic Compounds synthesis.**	Encourage students to communicate their logic chemical thinking, and to work and discuss cooperatively with their	• Questions in Lectures. • Short Quizzes and Exams.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		peers to develop individual skills.	
2.3	**To analyze spectral data of organometallic compounds and to explain the reactivity of Organometallic Compounds as a catalyst.**	• Lectures and Group discussion Have the ability to ask and answer questions as they arise	• Questions in Lectures. • Short Quizzes and Exams. • Oral Presentation
2.4	**To demonstrate oral and network communication and technical writing skills.**	• Oral participation • Group discussions • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To show confident attitudes through single and teamwork, and effective awareness to maintain scientific integrity during different assessments, projects, and mini reports**	Group discussion, assignments and homework	• Oral tests, sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homework**	**All the semester**	**20 %**
2	**Midterm Exam 1**	**Around 5th week**	**20 %**
3	**Midterm Exam 2**	**Around 8th week**	**20%**
4	**Final Exam**	**Around 13thweek**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Organometallic Chemistry***, G. S. Sodhi, 2009, Ane Books Pvt. Ltd. ISBN: 8180521982
Essential References Materials	• ***Inorganic Chemistry***, Catherine E. Housecroft and Alan G. Sharpe, 2nd Ed. 2005, Publisher: Pearson Education Limited, ISBN 0130-39913-2.

	• ***Inorganic Chemistry,*** Gary L. Miessler and Donald A. Tarr, 4th Ed. 2010, Prentice Hall ISBN 10:0136128661. • ***The organometallic chemistry of the transition metals***, Robert H. Crabtree, 4th Ed, 2005, John Wiley & Sons, Inc., ,10 9 8 7 6 5 4 3 2 1.
Electronic Materials	• **Blackboard** • **http://home.cc.umanitoba.ca/~budzelaa/CHEM4680/CHEM4680_lectures.html** • **http://chem-faculty.lsu.edu/stanley/webpub/4571-chap5-hydrides.pdf**
Other Learning Materials	***Comprehensive Inorganic Chemistry***. Sulekh Chandra, New Age International Limited Publishers, New Delhi, 2004 Descriptive inorganic chemistry, Rayner-Canham, Geoff., Publisher: W.H. Freeman, New York, 2006

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Heterocyclic Chemistry**
Course Code:	**CHM 1321**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**5 (4 Lectures, 2 Lab, 0 Tutorials)**
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 7 / Year 3**
4. Pre-requisites for this course (if any)**:**	**Organic chemistry (2) –CHM 1221**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides students with an introduction to heterocyclic chemistry, methods, reactivity and application of heterocyclic compounds in medicinal chemistry and industry. Topics covered in the course include a structure of heterocycles, Heterocycles with three members with one heteroatom, Structure of Five-membered Rings with One Heteroatom, Structure of Five-membered Rings with Two or More Heteroatoms, Structure of Six-membered Rings with One Heteroatom, Heterocycles with Six members with Two or More Heteroatoms, biologically important heterocycles. The experimental part of this course deals to provide students with experience in single-step and multi-step synthesis, purifications and characterization of organic molecules with hands-on access to available instruments and techniques.

2. Course Main Objective

At the end of this course the student will be able to:

- To know the basis of heterocyclic chemistry and its importance and to recognize the relationship between the molecular structure and properties of heterocyclic compounds.
- To interpret synthetic methods of heterocyclic compounds from their reaction mechanism and to rationalize the reactivity of heteroaromatic compounds.
- To provide students with the knowledge and skills necessary to understand and to be familiar with heterocyclic chemistry, synthesis and reactivity.
- To develop hands-on skills of using laboratory tools and be able to overcome synthetic problems.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	**To recognize the structures of important classes of Heterocyclic Aromatic Compounds and to memorize the Synthetic methods of Organic Compounds**	**K1; K3;**
1.2	**To define sequences of Heterocyclic Compounds Synthesis in different reaction conditions.**	**K1; K3; S1; S3**
1.3	**To state electron deficient or electron rich in Heterocyclic Compounds in terms of reactivity and to write the appropriate the reaction mechanism used for synthesis**	**K1; K3; S1; S3**
2	**Skills :**	
2.1	**To explain the reactivity of Heterocyclic Compounds towards a series of reagents**	**K1; K3; S1; S3**
2.2	**To summarize Heterocyclic Compounds synthesis providing by appropriate reaction mechanism.**	**K1; K3; S1; S3**
2.3	**To evaluate the reactivity of Heterocyclic Compounds according to heteroatoms and functional groups attached.**	**K1; K3; S1; S3**
2.4	**To Demonstrate Laboratory Instruments, Oral Communication, and writing of mini- Reports, using electronic mail and Networks in communicating with others.**	**K1, S2; S3; S4;K4**
3	**Values:**	
3.1	**To show responsibility for their own learning and motivate for Team Work.**	**V1; V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Structure of Heterocycles:** Introduction, Relationship of Heterocyclic and Carbocyclic Aromatic Compounds, Systematic Nomenclature, The Relation between Benzene Ring and the Heterocyclic Rings, Aromaticity Rules, Nomenclature of Heterocyclic Compounds of Five and Six Member-ring with Two Heteroatom's, Fused with Benzene Ring, Fused Heterocyclic Ring Systems,	**10**
2	**Heterocycles with three members with one heteroatom:** Different Methods for the Preparation of Oxirane, Formation of Aziridines using	

	Haloamines, Methylene Insertion Reactions. Some Examples of Nucleophilic and Electrophilic Ring Openings.	**5**
3	**Structure of Five-membered Rings with One Heteroatom:** Reactivity of Five-membered Rings with One Heteroatom, Electrophilic attack, Nucleophilic attack, Nucleophilic Attack at Nitrogen Heteroatom, Nucleophilic Attack at Hydrogen Attached to Ring Carbon or Ring Nitrogen, Benzo derivatives of Five-membered Heterocycles with One Heteroatom.	**7**
4	**Structure of Five-membered Rings with Two or More Heteroatoms:** Azoles with Heteroatoms in the 1,2-positions, Azoles with Heteroatoms in the 1,3-positions, Reactivity of Five-membered Rings with Two or More Heteroatoms	**4**
5	**Structure of Six-membered Rings with One Heteroatom:** Reactivity of Six-membered Rings with One Heteroatom (Pyran, Thiopyran, Pyridine), Electrophilic attack, Nucleophilic attack, Nucleophilic Attack at Nitrogen Heteroatom, Nucleophilic Attack at Hydrogen Attached to Ring Carbon or Ring Nitrogen, Benzo derivatives of Six-membered heterocycles with one heteroatom.	**9**
6	**Heterocycles with Six-members with Two or More Heteroatoms:** Structure and Reactivity of Aromatic Six-Membered Systems with two or More Heteroatoms, Synthesis and Reactivity of 1,2- and 1,4- and 1,3-Diazines such as Pyrimidines; Six-membered Ring Systems with Three and More Heteroatoms: Triazines, Tetrazines, Oxadiazines and Oxathiazines.	**8**
7	**Biologically important heterocycles:** Pyrimidines, and Purines, structure, synthesis, Nucleic acids and enzymes, the Biological Processes	**3**
8	**Revisions.**	**2**
Total		**48**
Lab. 1	Synthesis of 2,5-Dimethyl pyrrole: Pyrrole can be prepared from 1,4-Diketone in the Presence of Ammonium Carbonate.	**2**
Lab. 2	Synthesis of Hexahydro-1,3,5-tri-*p*-tolyl-*s*-triazine. Hexa hydro-1,3,5-tri-*p*-tolyl-*s*-triazine can be prepared by the reaction of *p*-toluidine with formaldehyde at room temperature.	**2**
Lab. 3	Synthesis of 2,3-diphenylquinoxaline 2,3-diphenylquinoxaline can be prepared by the reaction of benzil with *o*-phenylenediamine.	**2**
Lab. 4	Synthesis of 5,5-Diphenylhydantoin 5,5-Diphenylhydantoin can be prepared by the reaction of benzil with urea in the presence of a base.	**2**
Lab. 5	Synthesis of benzimidazole Benzimidazole can be prepared by the reaction of *o*-phenylenediamine with formic acid under refluxing.	**2**
Lab. 6	Synthesis of Benzotriazole Benzotriazole can be prepared by the reaction of *o*-phenylenediamine with nitrous acid.	**2**
Lab. 7	Synthesis of 3-Methyl-1-phenyl-5-pyrazolone 3-Methyl-1-phenyl-5-pyrazolone can be prepared by the reaction of ethyl acetoacetate with phenylhydrazine.	**2**
Lab. 8	a-Synthesis of Pyrano pyrazole:3-Methyl-1-phenyl-5-pyrazolone can be reacted with α,β-unsaturated nitriles affording fused pyrazole b- Synthesis of Pyridine Derivatives: Pyridine derivatives can be prepared from chalcones and active methylene comounds	**2**
Lab. 9	Synthesis of Barbituric Acid Barbituric acid can be prepared by the reaction of diethylmalonate with urea in the presence of sodium ethoxide.	**2**

Lab. 10	Synthesis of Hexahydro-1,3,5-tri-*p*-tolyl-*s*-triazine. Hexahydro-1,3,5-tri-*p*-tolyl-*s*-triazine can be prepared by the reaction of p-toluidine with formaldehyde at room temperature.	
Lab. 11	Synthesis of 2,3-diphenylquinoxaline 2,3-diphenylquinoxaline can be prepared by the reaction of benzil with *o*-phenylenediamine.	**2**
Lab 12	Revision	**2**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the structures of important classes of Heterocyclic Aromatic Compounds and to memorize the Synthetic methods of Organic Compounds**	▪ Four hours are weekly containing lectures and Group Discussion ▪ A Private study including home exam.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation. ▪ Lab reports
1.2	**To define sequences of Heterocyclic Compounds Synthesis in different reaction conditions.**	▪ Four hours are weekly containing lectures, and group discussion	▪ Quizzes Assignments. • Oral Discussion marks
1.3	**To state electron deficient or electron rich in Heterocyclic Compounds in terms of reactivity and to write the appropriate the reaction mechanism used for synthesis**	▪ Four hours are weekly for lectures, and group discussion ▪ Think and talk about reactivity of heterocyclic compounds	• Midterms. • Assignments • Oral Discussions. • Quizzes. ▪ Lab reports
2.0	**Skills :**		
2.1	**To explain the reactivity of Heterocyclic Compounds towards a series of reagents**	▪ Lectures activity ▪ Think and talk about the reactivity of heterocyclic Compounds	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Home Exam. ▪ Lab reports
2.2	**To summarize Heterocyclic Compounds synthesis providing by appropriate reaction mechanism.**	▪ Encourage students to communicate their logic chemical thinking, and to work and discuss cooperatively with their peers to	• Questions in Lectures. • Participation through Oral Discussion • Short Quizzes and Exams.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		develop individual skills.	
2.3	**To evaluate the reactivity of Heterocyclic Compounds according to heteroatoms and functional groups attached.**	▪ Lectures and Oral Discussions. ▪ Brain storming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams.
2.4	**To Demonstrate Laboratory Instruments, Oral Communication, and writing of mini- Reports, using electronic mail and Networks in communicating with others.**	▪ Group Discussion and Assignments ▪ Introduce several reports on Synthesis and Reactivity of Heterocyclic Compounds for reading, writing, and oral presentation. ▪ Encourage students to use electronic mail to submit Home Exams and Assignments	▪ Oral Discussion, Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. ▪ Marks given for Assignments
3.0	**Values**		
3.1	**To show responsibility for their own learning and motivate for Team Work..**	▪ Brain Storms Exercises ▪ Group Discussion	• Oral Discussion. ▪ Group Discussion and Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Midterm 1**	**5th week**	**10 %**
2	**Midterm 2**	**8th week**	**10%**
3	**Quizzes, Home Works, class participation, and mini projects**	**During the semester**	**10 %**
	Laboratory	**All the semester**	**30 %**
	Final Exam	**13th week**	**40 %**
3	**Total**		**100 %**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
• **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Heterocyclic Chemistry***, Joule, John A., Mills. K., Wiley-Blackwell, 5th Ed. (2010), ISBN: 978-1-4051-3300-5. • ***Handbook of Heterocyclic Chemistry***, Katritzky, A. R.; Pozharskii, A. F.; 2nd Ed. (2000); Pergamon: Oxford. ISBN: 978-0-08-095843-9
Essential References Materials	***1. Heterocyclic Chemistry*** Gilchrist, T. L.; Addison Wesley Longman: Edinburgh Gate, 3rd Ed. (1997), ISBN-10: 0582278430 ***2. Vogel's' Textbook of Practical Organic Chemistry,*** Vogel, A.I., Tatchell, A.R. , Furnis, B.S , Smith, P.W.G , Longman Group UK Limited, (5th Ed.), 1989 ISBN 978-0-582-46236-6 ***3. Heterocyclic chemistry;*** Gilchrist, T. L. (3rd Ed.), Prentice Hall:, 1979, ISBN:9780582278431.
Electronic Materials	• **Blackboard** • **http://www.sigmaldrich.com**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, , dishes, funnels, Buchner, Buchner flasks, condensers, round bottom flasks)** • **Appropriate fine chemicals and solvents (1,4-Diketone Ammonium Carbonate., p-toluidine, formaldehyde, benzil, o-phenylenediamine, ethyl acetoacetate**

Item	Resources
	phenylhydrazine. Diethylmalonate, urea sodium metal, absolute ethanol, dichloromethane, ether, hexane) • Analytical balance (3 digits), Drying oven, hot plates, water bath, shaker, magnetic stirrer with hotplate • Filter papers , clamps, stands

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-Syllabus review- Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	Organic Compounds Spectroscopy
Course Code:	CHM 1322
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. **Credit hours:** **3 (3 Lectures, 0 Lab, 0 Tutorials)**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. **Level/year at which this course is offered:** **Level 7 / Year 3**	
4. **Pre-requisites for this course** (if any): **Organic chemistry (2) –CHM 1221**	
5. **Co-requisites for this course** (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides students with an Introduction for Organic Compounds Spectroscopy, which covers all techniques: UV-vis spectroscopy, infrared spectroscopy, ^{1}H and ^{13}C NMR spectroscopy, with practice problems

2. Course Main Objective

At the end of this course the student will be able to:

- To recognize the basic spectroscopy of Organic Compounds
- To describe the spectroscopic data of Organic Compounds by determination the Functional Group and number of protons and carbons.
- To outline scientific methods for identifying and elucidating organic compounds.
- To interpret the structure of organic compounds from spectroscopic data.
- To define factors influence the chemical structure

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	To recognize the basic spectroscopy of organic compounds.	K1; K3;
1.2	To describe the spectroscopic data of organic compounds by determination the functional group and number of protons and carbons.	K1; K3; S2; C2
1.3	To outline the structure of Organic Compounds from spectroscopic data with defining factors influence the chemical structure	K3; S1
2	Skills:	
2.1	To analyze information related to applied organic chemistry.	K1; K3; S1; S3
2.2	To interpret data and results through analytical logical thinking.	S1; S3
2.3	To Summarize concepts of elucidation of chemical structures leading to logic thinking, followed by evaluation gained information.	S1; S3
2.4	To Demonstrate Oral Communication and writing of mini- Reports regarding the Structure Elucidation of organic compounds using electronic mail and Networks in communicating with others.	S2; S3
3	Values:	
3.1	To appraise teamwork, decision-making in unpredictable work, and management of resources and time.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	**UV/VIS:** Introduction, Theory and instrumentation, Absorption laws, Solvents, Characteristic Absorption of Organic Molecules (Saturated hydrocarbons, Alkenes, Alkynes, Carbonyl compounds, Aromatic Compounds).	5
2	**Infrared Spectrometry:** Introduction, short notes about theory and Instrumentation, Interpretation of spectra, Characteristic Absorption of Organic Molecule (Normal Alkanes, branched Alkanes, Cyclic Alkanes, Alkenes, Mononuclear Aromatic Hydrocarbons, Alcohols and Phenols, Ethers, Epoxides and Peroxides, Ketones, Aldehydes, Esters and Lactones, Acid Halides, Amides and Lactams, Carboxylic acids, Amines, Amine Salts, Amino Acids and its Salts, Isonitrile, Organic Sulphur Compounds, Organic Halogen Compounds, Silicon Compounds, Phosphorus Compounds, Hetero aromatic Compounds, Heteroaromatic Compound).	7
3	**Proton NMR Spectroscopy:** Introduction, Short notes about Theory and Instrumentation,Chemical Shift, Spin Coupling; Multiples; Spin System, Proton on Oxygen; Nitrogen; Sulphur Atoms, Exchangeable Protons, Simple Introduction for Chemical Shift Equivalence with examples, Magnetic Equivalent (Spin-Coupling Equivalence), AMX, ABX, and ABC Rigid System with Three Coupling Constants, Chirality, Vicinal and Giminal coupling, Low-Range Coupling.	13
4	**Carbon ^{13}NMR Spectrometry:** Introduction, Theory (Decoupling Techniques, Chemical Shift Scale and Range, Solvents), Interpretation of simple 13C spectra, Chemical Shift Equivalence, Chemical Classes and Chemical Shifts	8

	(Alkanes, Alkenes, Alkynes, Aromatic Compounds, Alcohols, Ethers,Acetals and Epoxides, Halides, Amines, Thiols, Functional Groups Containing Carbon)..	
5	**REVIEW:** includes simple oral presentation by the students for some selected organic compounds with open discussion about strategy to solve the problems	**3**
Total		**36**
Topics to be covered (Laboratories)		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic spectroscopy of organic compounds.**	▪ Three hours are weekly containing lectures ▪ A Private study including home exam.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation.
1.2	**To describe the spectroscopic data of organic compounds by determination the functional group and number of protons and carbons.**	▪ Three hours are weekly containing lectures, and group discussion	▪ Quizzes Assignments. • Oral Discussion marks
1.3	**To outline the structure of Organic Compounds from spectroscopic data with defining factors influence the chemical structure**	▪ Three hours are weekly for lectures ▪ Think and talk about elucidating of organic compounds spectro-scopically.	• Midterms. • Assignments • Oral Discussions. • Quizzes.
2.0	**Skills:**		
2.1	**To analyze information related to applied organic chemistry.**	▪ Lectures activity ▪ Think and talk about structures and functional groups of organic compounds	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Home Exam.
2.2	**To interpret data and results through analytical logical thinking.**	▪ Encourage students to communicate their logic chemical thinking, and to work and discuss cooperatively with their peers to develop individual skills.	• Questions in Lectures. • Participation through Oral Discussion • Short Quizzes and Exams.
2.3	**To Summarize concepts of elucidation of chemical structures**	▪ Lectures and Oral Discussions. ▪ Brain storming	▪ Questions in Lectures. ▪ Short Quizzes and

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	leading to logic thinking, followed by evaluation gained information.	Exercises	Exams.
2.4	To Demonstrate Oral Communication and writing of mini-Reports regarding the Structure Elucidation of organic compounds using electronic mail and Networks in communicating with others.	▪ Brain Storms Exercises ▪ Group Discussion	• Oral Discussion. ▪ Group Discussion and Assignments
3.0	Values		
3.1	To appraise teamwork, decision-making in unpredictable work, and management of resources and time. .	• Group discussions and assignments	• Group discussion marks. • Group worksheet assignments.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes, Attendance, Participation, Home Exams	All the semester	20 %
2	Midterm Exam 1	Around 5th week	20 %
3	Midterm Exam 2	Around 8th week	20 %
4	Final Exam	Around 13th week	40 %
5	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.
- Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• *Spectrometric Identification of Organic Compounds*, Robert M. Silverstein; Wiley: New York,7th ed.,2005, ISBN-10: 0471393622.
Essential References Materials	• *The Systematic Identification of Organic Compounds*; Ralph L. Shriner, Christine K. F. Hermann, Terence C. Morrill, David Y. Curtin, Reynold C. Fuson, Wiley: New York.8th ed. 2004. ISBN-10: 0471215031

	• ***Introduction to Spectroscopy***, Donald L. Pavia, Gary M. Lampman, George S. Kriz, James A. Vyvyan., Brooks/Cole, Gerage Learning, 4th Ed., 2009; ISBN-10: 0495114782
Electronic Materials	• **Blackboard** • **http://www.sigmaldrich.com**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio.
	Course Responsible	**Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)

Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	**Instrumental Analysis**
Course Code:	**CHM 1332**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 5(4 Lectures, 0 Turorial, 2 Lab)	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 8/Year 3	
4. Pre-requisites for this course (if any): **Chemistry of Volumetric and Gravimetric Analysis – CHM 1236**	
5. Co-requisites for this course (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

The topics taught in this course include Electromagnetic spectrum and its properties, spectrometers, Ultra violet and visible, infrared and Raman, atomic absorption and atomic emission, molecular emission. To study the basic principle of electrochemical techniques such as potentiometry, cyclic voltammetry, and Polarography.

2. Course Main Objective: ***This course is intended:***

- To improve students' knowledge of instrumental analysis by providing them with basic concepts, functionality of different instrumental techniques.
- To develop their hand on skills to use the different instruments and obtain results using appropriate techniques.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and understanding**	
1.1	**To list the basic principles of instrumental analytical techniques.**	**K1, K2**
1.2	**To recognize the components and the role of instruments in solving problems in the physical, chemical and biological samples.**	**K2, K3**
1.3	**To outline absorbance, transmittance and concentrations.**	**K2**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	**Skills** :	
2.1	**To summarize main instrumental analysis devices and explain the complexity of each instrument, its strength and limitation.**	**S1**
2.2	**To develop the measuring of different variable using spectroscopic lab instruments and differentiate between various types of instruments in terms of parts and functions.**	**S1**
2.3	**To prepare standard solutions using different laboratory equipment with calibrating to present data in graphs**	**S1; S4**
2.4	**To demonstrate Oral Communication and writing of mini- Reports regarding the instrumental analysis applications using electronic mail and Networks in communicating with others.**	**S2, S3**
3	**Values:**	
3.1	**To appraise teamwork, decision-making in unpredictable work, and management of resources and time.**	**V1, V2**

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Introduction to Spectroscopy:** Electromagnetic spectrum, relationships between frequency, wavelength and E, components of an optical spectrometer	**5**
2	**Molecular Absorption Spectroscopy:** Ultraviolet and visible spectroscopy, electronic levels and electronic transitions, instrumentation. Beer' -Lambert law, transmittance and absorbance, relation. Infrared spectroscopy Dipole moment, molecular stretching and bending vibrations, instrumentation, Raman spectroscopy.	**9**
3	**Molecular Emission Spectroscopy:** Molecular orbitals, absorption and emission, singlet and triplet states, fluorescence, phosphorescence	**5**
4	**Atomic Absorption Spectroscopy:** Energy levels, selection rules, instrumentation. Sample atomization, flame and graphite furnace. Fuel, oxidants and interferences.	**10**
5	**Atomic Emission Spectroscopy:** Emission of radiation, ground and excited states, flame photometer, instruments, Inductively Coupled Plasma (ICP), comparison with flame photometry.	**10**
6	**Electrochemical analysis:** Nernst equation, pH meter and ion-selective electrodes, potentiometry, cyclic voltammeter, Polarography.	**9**
	Total	**48**

Topics to be covered (Laboratories)

1	Introduction to UV-Vis spectrometer and its operation. Single and double beam. The Maximum Wavelength of Absorbance (λ_{max}).	**2**
2	Verification of transmittance-absorbance relation (A= - Log T).	**2**
3	Standard Calibration Curve and Beer's - Lambert's law.	**2**
4	Determination of Iron (III) in an unknown sample using the standard addition method.	**2**
5	Plotting the Absorption Spectrum of Iron (II) Complex with 1,10-Phenanthroline.	**2**
6	Determination of alkali metal concentrations using flame photometer (1)	**2**
7	Determination of alkali metal concentrations using flame photometer (2)	**2**
8	Determination of an Infrared (IR) spectrum of some liquid and solid organic compounds.	**2**
9	Titration of an acid and a base using pH meter.	**2**
10	Determination of elemental content of a sample by Inductively Coupled Plasma (ICP).	**2**
11, 12	Revision	**4**
Total		**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To list the basic principles of instrumental analytical techniques.**	lecturing	Short quizzes
1.2	**To recognize the components and the role of instruments in solving problems in the physical, chemical and biological samples.**	Lecturing, group discussions, Homework and assignment	Oral test, Homework and assignment marks and written exams
1.3	**To outline absorbance, transmittance and concentrations.**	lecturing , laboratory experiments.	Participation, Quizzes and MCQs, laboratory reports
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	lecturing , laboratory experiments.	Participation, Quizzes and MCQs, laboratory reports
2.0	**SKILLS**		
2.1	**To summarize main instrumental analysis devices and explain the complexity of each instrument, its strength and limitation.**	Lecturing, group discussion and laboratory experiments	Short quizzes Exams, Homework assignment and laboratory reports

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	**To develop the measuring of different variable using spectroscopic lab instruments and differentiate between various types of instruments in terms of parts and functions.**	Lectures and laboratory sessions	Quizzes
2.3	**To prepare standard solutions using different laboratory equipment with calibrating to present data in graphs**	Lecturing and oral discussion supported by laboratory experiments	Homework assignment, Examination and laboratory report
2.4	**To demonstrate Oral Communication and writing of mini- Reports regarding the instrumental analysis applications using electronic mail and Networks in communicating with others.**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To appraise teamwork, decision-making in unpredictable work, and management of resources and time.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homework**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm Exam 1**	**Around 5th week**	**10 %**
4	**Midterm Exam 2**	**Around 8th week**	**10%**
5	**Final Exam**	**Around 13thweek**	**40 %**
6	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

G. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• Gary D. Christian, Purnendu K. (Sandy) Dasgupta, Kevin A. Schug. ***Analytical Chemistry***, 7th Edition. ISBN: 978-0-470-88757-8.
Essential References Materials	• Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch. ***Fundamentals of analytical chemistry***, 9th Edition. ISBN-13: 978-0-495-55828-6. • Daniel C. Harris. ***Quantitative Chemical Analysis,*** 8th edition,2010, W. H. Freeman & Co., New York, ISBN: 9781429218153.
Electronic Materials	• Blackboard • http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true • http://www.chem1.com/acad/webtext/virtualtextbook.html • http://www.shodor.org/UNChem/index.html
Other Learning Materials	**Internal server: www. Elesevier.com**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, dishes, funnels)** • **Appropriate fine chemicals and solvents (ferric sulphate, ferrous sulphate or chloride, sodium chloride, potassium chloride, HCl, NaOH)** • **UV-Vis spectrometer, flame photometer , Analytical balance (3 digits), Drying oven, Inductively Coupled Plasma (ICP).** • **Filter papers , clamps, stands**

H. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

I. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Quantum Chemistry**
Course Code:	**CHM 1341**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 3 (3 Lectures, 0 Lab, 0Tutorials)							
2. Course type							
a.	University		College		Department	✓	Others
b.	Required	✓	Elective				
3. Level/year at which this course is offered: Level 10 / Year 4							
4. Pre-requisites for this course: MAT 1103– CHM 1242							
5. Co-requisites for this course (if any)**:** None							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (Mini-reports, Midterm, Final Exam)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course deals with classical and quantum mechanics, black body radiation, atomic models and spectra, Schrodinger equation, operators, postulates of quantum mechanics, wave functions, particle in 1-D box, rigid rotor and harmonic oscillator.

2. Course Main Objective

At the end of the course, Students should be able:

- To provide students with the basic principles of quantum chemistry.
- To acquaint them with some concept of quantum chemistry in contrast with classical mechanics.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To describe the failure of classical mechanics in contrast to quantum mechanical phenomena.**	**K1; K2; K3;**
1.2	**To define concepts relevant to quantum mechanics such as photoelectric effect, wave-particle duality.**	**K1; K2; K3;**
1.3	**To recognize the principles of the translational motion, particle in a box.**	**K1**
1.4	**To outline the Structure and spectra of hydrogen atomic orbitals and energies of shells and sub shells.**	**K1; K3**
2	**Skills :**	
2.1	**To calculate adsorption parameters using problems and their solutions, and estimate kinetic, physical and optical parameters of colloidal systems.**	**S1; S2; S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1; S2; S3**
2.3	**To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.**	**S3**
3	**Values:**	
3.1	**To appraise working in groups.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Classical Mechanics**: dawn of quantum mechanics, Black-Body radiation, Photo electric effect, dual nature of light, the uncertainty principle, Bohr model of the atom, spectral series, Rydberg formula for hydrogen spectrum.	**11**
2	**Derivation of Schrodinger equation**: Operators and their properties, eigenfunctions and eigenvalues, postulates of quantum mechanics, Particle in 1-D box and Harmonic oscillator.	**12**
3	**Rigid-rotor model**: hydrogen atoms and hydrogen like atoms wave function, Normalized and orthogonal wave functions, translational motion. Classical and quantum mechanical treatment.	**13**
	Total	**36**
Topics to be covered (Laboratories)		
	None	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	To describe the failure of classical mechanics in contrast to quantum mechanical phenomena.	Lecture	Short quizzes
1.2	To define concepts relevant to quantum mechanics such as photoelectric effect, wave-particle duality.	Lecture and group discussions	Oral tests and MCQs, Homework
1.3	To recognize the principles of the translational motion, particle in a box.	Lecture and group discussions	Short quizzes oral tests, Homework
1.4	To outline the Structure and spectra of hydrogen atomic orbitals and energies of shells and sub shells.	Lecture and group discussions	Oral tests and MCQs
2.0	Skills :		
2.1	To calculate adsorption parameters using problems and their solutions, and estimate kinetic, physical and optical parameters of colloidal systems.	Lecture and oral discussions	Solved problem marks Short quizzes and homework assignment
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Brain storming and self-study	Work portfolio and homework
2.3	To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.	Motivate students to ask questions and to give response.	Participation marks
3.0	Values		
3.1	To Appraise working in groups.	• Seminars • Group discussion and assignments • Homeworks • Mini reports	• Presentation marks • Oral tests • Assignments and homeworks • Mini reports assignment

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5^{th}/ 6^{th} week	20 %
2	Midterm 2	8-9^{th}	20%
3	Quizzes, Home Works, class participation, and mini projects	During the semester	30 %
4	Final Exam	13^{th}week	40 %
5	Total	All weeks	100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Physical Chemistry,*** Atkins, P. W., and J. de Paula. 8th ed. 2001, Freeman and Company, New York, NY: W.H. (ISBN: 9780716735397)
Essential References Materials	• ***Physical Chemistry,*** Sanctuary, K. J. Laidler, J. H. Meiser, B. C., 4th Ed 2003, Houghton Mifflin CompanyISBN: 81-239-0645-5. • ***Physical Chemistry.*** Silbey, R., R. Alberty, and M. Bawendi. 4th ed, 2004,: John Wiley & Sons, New York, NY. ISBN: 9780471215042 • ***Physical Chemistry,*** *Ira N. Levine, 5th Edition, McGraw-Hill (ISBN: 0-07-231808-2)*
Electronic Materials	• Blackboard • http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true • http://www.chem1.com/acad/webtext/virtualtextbook.html • http://www.shodor.org/UNChem/index.html
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each classroom is equipped with PC and retro projector with a maximum of 25 students.**

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-Syllabus review- Accreditation review.

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

H. Specification Approval Data

Council / Committee	COUNCIL OF DEPARTEMENT OF CHEMISTRY
Reference No.	10 (NO. 1/10)
Date	21/04/1444- 15/11/2022

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Electrochemistry and Corrosion**
Course Code:	**CHM 1343**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. **Credit hours:** **5 (4 Lectures, 0 Tutorials, 2 Lab)**	
2. **Course type**	
a. University ☐ College ☐ Department ✓ Others ☐	
b. Required ✓ Elective ☐	
3. **Level/year at which this course is offered:** **Level 8 / Year 3**	
4. **Pre-requisites for this course:** **Physical Chemistry (2) –CHM 1241**	
5. **Co-requisites for this course** (if any): **None**	

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

B. Course Objectives and Learning Outcomes

1. Course Description

Topics covered in the course include the fundamentals of electrochemistry, cells, batteries and their standard potentials, Nernst equation, potentiometry and voltammetry methods, electrolytic conductance, corrosion.

2. Course Main Objective

At the end of the course, Students should be able to:

- To provide students with basics of electrochemical processes under standard and non-standard conditions.
- To familiarize students with the principles of some electrochemical techniques.
- To introduce corrosion and wear occurring to metals under different conditions.
- To give summary of different technologies are used to prevent or minimize corrosion.
- Solve mathematical problems to calculate cells potentials, amounts of metal deposited in electrolysis, conductivity, resistivity and current values.
- Carry out experiments, collect data and derive relations and conclusions.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To recognize some principles of electrochemistry.**	**K1; K2; K3**
1.2	**To state Nernst equation for a galvanic cell potential due to change of redox system.**	**K1; K2; K3**
1.3	**To name laws of conductivity, resistivity and related phenomena.**	**K1**
1.4	**To define corrosion and its impact upon metal integrity, and list methods of corrosion prevention**	**K1; K3; K4**
2	**Skills :**	
2.1	**To evaluate the equilibrium constant from experimental data, and contrast kinetic data with Mathematical equations.**	**S1; S2; S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1; S2; S3**
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**
2.4	**To interpret experimentally obtained data and present orally, and writing of mini- Reports using electronic mail and Networks in communicating with others**	**S2; S4, K4**
3	**Values:**	
3.1	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	• Introduction / Fundamental Concepts: Electrochemistry and Redox, Redox Review. Balancing Redox Reactions, Types of cells, Common Components, Electrolytic cells, Voltaic (Galvanic) Cells, Cell Potential. STANDARD POTENTIALS, Standard Reduction Potentials, E0cell and ΔG0, Calculating E0 cell, Nernst equation, Concentration Cells. Batteries, Fuel Cells, Electrolysis, Stoichiometry, Faraday constant (F).	**10**
2	• Practical Considerations: Electrochemical Cell, electroanalytical measurement, Potentiometric Technique, Potentiostatic Technique, voltammogram. Thermodynamics and Potentials. Ion-selective electrodes (ISE), glass electrodes, liquid membrane electrodes, solid-state electrodes, applications of ISEs. Steps in simple reactions, steps in complex reactions, electrode reaction pathway, reactions controlled by mass transport.	**10**
3	• Potentiometry: Potential step experiments, potential sweep experiments. Reactions controlled by rate of electron transfer, electrical double layer. Reactions & Interfacial Properties:Cyclic voltammetry, Reversible Systems, Irreversible Systems, Quasi-reversible Systems, Applications, spectroelectrochemistry, electrochemiluminescence (ecl), scanning probe microscopy.	**10**
4	• Electrode scanning tunneling microscopy (stm), atomic force microscopy (afm), scanning electrochemical microscopy (secm), electrochemical quartz crystal, microbalance (eqcm), impedance spectroscopy. Controlled potential techniques: Controlled potential, chronoamperometry, chronocoulometry,	**10**

	polarography, the ilkovic equation, pulse voltammetry, ac voltammetry, stripping analysis, flow analysis.	
5	• Chemical Corrosion: Electrochemical Corrosion, the Electrode Potential in Electrochemical Cells. Types of Electrochemical Corrosion, Protection Against Electrochemical Corrosion.	**8**
Total		**48**

Topics to be covered (Laboratories)		
Lab 01	Electrolysis of Water	**2**
Lab 02	Electrochemical Studies on Different Galvanic Cells	**2**
Lab 03	Electrochemical Studies on Concentration Cells.	**2**
Lab 04	Electroplating.	**2**
Lab 05	Determination Of Cell Constant.	**2**
Lab 06	Part1: Determination of Equivalent Conductance of a Strong Electrolyte. Part2: Dissociation Constant of Weak Acid.	**2**
Lab 07	Part1: Solubility product Ksp by conductivity method Part2: Determination of ΔG, ΔH and ΔS by solubility product method	**2**
Lab 08	Calculate the equilibrium constant electrochemically	**2**
Lab 09	Corrosion rate (weight loss), Corrosion Inhibition Corrosion rate (corrosion current)	**2**
Lab 10	Potentiometric Titration of a Bromide-Iodide Mixture	**2**
Lab 11, 12	Revision	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize some principles of electrochemistry.**	**Lecture**	**Short quizzes**
1.2	**To state Nernst equation for a galvanic cell potential due to change of redox system.**	**Lecture and laboratory experiments**	**Exams and lab reports**
1.3	**To name laws of conductivity, resistivity and related phenomena.**	**Group discussions and laboratory experiments**	**Oral test and lab reports**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.4	To define corrosion and its impact upon metal integrity, and list methods of corrosion prevention	Lecture, homework and laboratory experiments	Homework assignment marks and lab reports
2.0	**Skills :**		
2.1	To evaluate the equilibrium constant from experimental data, and contrast kinetic data with Mathematical equations.	Lectures and laboratory experiments	Solved problem marks Short quizzes and Laboratory reports Numerical problem
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	, Brain storming and self-study	Work portfolio and homework
2.3	To demonstrate skills to participate in class by asking questions and giving answers.	Motivate students to ask questions and to give response.	Participation marks
2.4	To interpret experimentally obtained data and present orally, and writing of mini- Reports using electronic mail and Networks in communicating with others	• Seminars • Group discussions and lab experiment • Group discussion and assignments • Encourage students to use electronic mail to submit works and assignements. • Virtual labs and demonstrations	• Presentation marks • Oral tests and lab sheets • Oral test and assignments marks • Assignments and homework • Laboratory performance • Laboratory reports and sheet
3.0	**Values**		
3.1	To appraise effectively the collaboration and inter-professionalism in class discussions or team works.	• Group discussions and lab experiment • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks. • Oral tests and lab sheets • Assessments and homework • Laboratory reports and sheet

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th/ 6th week	10%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
	Midterm 2	8-9th	10%
3	Quizzes, Homeworks, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Analytical Electrochemistry***, Joseph Wang, 3rd Ed., 2006, John Wiley & Sons, New Jersy, ISBN: 978-0-471-67879-3.
Essential References Materials	• ***Electrochemical Methods: Fundamentals and Applications***, A. J. Bard and L. R. Faulkner, 2nd Ed., 2001, John Wiley & Sons, New York, ISBN: 0-471-04372-9. • ***The Science and Engineering of Materials,*** *Donald R. Askeland – Pradeep P. Phulé, , 4th ed. (req. for corrosion part, Chapter 22)* • ***Experimental Electrochemistry: A Laboratory Textbook,*** *R. Holze 1st Ed., (2009), Wiley-VCH. ISBN-13: 978-3527310982*
Electronic Materials	• **Blackboard** • **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** • **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (conicals, beakers, measuring cyliders) • Appropriate fine chemicals and solvents (acetic acid, sodium chloride, some organic and inorganic inhibitors, hydrochloric acid, nitric acid, sulphuric acid) • Galvanic cell, metal electrodes, power supply, pH meter, Analytical balance (3 digits), Drying oven

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Chemical Kinetics**
Course Code:	**CHM 1348**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 4 (3 Lectures, 0 Tutorials, 2 Lab)							
2. Course type							
a.	University		College		Department	✓	Others
b.	Required	✓	Elective				
3. Level/year at which this course is offered: Level 9 / Year 3							
4. Pre-requisites for this course: CHM 1241							
5. Co-requisites for this course (if any)**: None**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

Topics covered in the course include the description of the Response of Chemical Equilibria to Conditions, Quantitative chemical kinetics, Kinetics of complex multistep reactions.

2. Course Main Objective

At the end of the course, Students should be able to:

- To provide students with vocabulary and concepts of chemical kinetics and an introduction to catalysis.
- This includes definitions, types and rates of reactions, and methods for the determination of the their partial and global orders, initiation to catalysis specifically acid-base and enzymatic catalysis .
- The course is designed to provide theoretical, practical, methodological and technical knowledge of kinetic in solution chemistry and physical chemistry.
- determine reaction rate laws and constants along with the factor effecting them.

- operate laboratory instruments.
- diagram and illustrate experimentally obtained data.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	**To define the dependence of Rates on Concentration First-Order Second-Order, Zero-Order, N^{th}-Order Reactions**	**K1; K2; K3;**
1.2	**To describe the Third-Order Reactions. Parallel Reactions. Series First-Order Reactions. Series Reactions with Two Intermediates. Reversible Reactions. Autocatalysis Effect of Temperature.**	**K1; K2; K3;**
1.3	**To state the factors affecting reaction rate and the laws of chemical kinetics**	**K1; K3; K4**
2	Skills :	
2.1	**To evaluate Rate Constants**	**S1; S2; S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1; S2; S3**
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**
2.4	**To illustrate and diagram experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S2; S4**
3	Values:	
3.1	**To appraise collaborative work skill**	**V1; V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Rates of Reactions,** Dependence of Rates on Concentration First-Order Second-Order, Zero-Order, Nth-Order Reactions, Cautions on Treating Kinetic Data, Effect of Temperature, Some Common Reaction Mechanisms, Direct Combination, Chain Mechanisms, Substitution Reactions	**9**
2	**Second-Order Reaction**, First-Order in Two Components. Third-Order Reactions. Parallel Reactions. Series First-Order Reactions. Series Reactions with Two Intermediates. Reversible Reactions. Autocatalysis Effect of Temperature.	**9**
3	**Calculating Rate Constants**, The Method of Half-Lives, Initial Rates, Using Large Excess of a Reactant (Flooding), The Logarithmic Method Effects of Pressure, Flow Techniques, Relaxation Techniques, Tracer Methods, Kinetic Isotope Effects. Collision Theory. The Potential Energy Surface, Transition State Theory, Unimolecular Decomposition of Gases, Free Radical or Chain Mechanisms, Adsorption of Gases on Solids, Langmuir Adsorption Isotherm, B–E–T Isotherm. **Catalyst and catalysis, Types of catalysis, Classification of catalysis.**	**9**
4	**Characteristics of catalytic reactions,** Catalytic promoters, Catalytic poisons. Theories of catalysis. Biochemical or enzyme catalysis. Acid-	**9**

	base catalysis. Heterogeneous Catalysis. Industrial applications of catalysts	
Total		**36**
Topics to be covered (Laboratories)		
Lab 01	Safety and Laboratory equipment's and measurements and reports	**2**
Lab 02	Factors affecting reaction rate. Part I (Concentration), Factors affecting reaction rate. Part II (Temperature), Factors affecting reaction rate.	**2**
Lab 03	Part III (Catalyst), Factors affecting reaction rate. Part III (Surface area),	**2**
Lab 04	Determination of the Rate Law for the Iodination of Acetone in Acidic Solution,	**2**
Lab 05,6	Chemical kinetics: second order reaction iodination of aniline, ,	**4**
Lab 07	The Iodine Clock Reaction	**2**
Lab 08	Hydrolysis of ethyl acetate ester in acidic medium,	**2**
Lab 09	Hydrolysis of ethyl acetate ester in basic medium,	**2**
Lab 10	Determination of the activation energy of a reaction	**2**
Lab11, 12	Review	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To define the dependence of Rates on Concentration First-Order Second-Order, Zero-Order, N^{th}-Order Reactions**	**Lecture**	**Short quizzes**
1.2	**To describe the Third-Order Reactions. Parallel Reactions. Series First-Order Reactions. Series Reactions with Two Intermediates. Reversible Reactions. Autocatalysis Effect of Temperature.**	**Lecture and laboratory experiments**	**Exams and lab reports**
1.3	**To state the factors affecting reaction rate and the laws of chemical kinetics**	**Lecture, homework, Group discussions and laboratory experiments**	**Homework assignment marks, Oral test and lab reports**
2.0	**Skills :**		
2.1	**To evaluate Rate Constants**	**Lectures and laboratory experiments**	**Solved problem marks** **Short quizzes and Laboratory reports** **Numerical problem**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Brain storming and self-study	Work portfolio and homework
2.3	To demonstrate skills to participate in class by asking questions and giving answers.	Motivate students to ask questions and to give response.	Participation marks
2.4	To illustrate and diagram experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.	• Seminars • Group discussions and lab experiment • Encourage students to use electronic mailand blackboard to submit works and assessments.	• Presentation marks • Oral tests and lab sheets • Assignments and homework • Laboratory performance • Laboratory reports and sheet
3.0	**Values**		
3.1	To Appraise collaborative work skill	• Group discussions • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks • Oral tests Assessments and homework • Laboratory reports and sheet

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	10 %
2	Midterm 2	8th week	10%
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.
- Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Principles of Chemical Kinetics,*** James E. House, Academic Academic Press; 2nd edition, ASIN : B0018C7KS4
Essential References Materials	• ***Chemical Kinetics and Reaction Dynamics***, Santosh K. Upadhyay, Co-published by Springer 233 Spring Street, New York 10013, USA with Anamaya Publishers, New Delhi, India (2006) • ***Chemical Kinetics and Catalysis,*** R. A. van Santen and J. W. Niemantsverdriet, Springer Science + Business Media, LLC, ISBN-10 1475796455, ISBN-13 : 978-1475796452
Electronic Materials	• **Blackboard** • **www. Elesevier.com**
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (burette, pipits, conical flasks, beakers, measuring cyliders) • Appropriate fine chemicals and solvents (aceton, iodine, sodium thiosulphate, potassium persulphate, ethyl acetate, hydrogen peroxide, potassium permanganate).

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Solid State Chemistry**
Course Code:	**CHM 1411**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 3(3 Lectures, 0 Tutorials, 0 Lab)							
2. Course type							
a.	University		College		Department	✓	Others	
b.	Required	✓	Elective				
3. Level/year at which this course is offered: Level 11 / Year 4							
4. Pre-requisites for this course: Inorganic Chemistry (2) CHM 1311							
5. Co-requisites for this course (if any)**: None**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

The topics covered in this course include: Introduction to solid-state chemistry, periodicity of the elements, atomic structure, bonding, reactions kinetics and mechanisms, semiconductors, band gap, crystal structures, diffraction, amorphous solids, Chemical equilibrium, chemistry of carbon, polymers.

2. Course Main Objective

1. *What is the main purpose for this course?*

By the completion of this course, students will be expected to:

- Predict basic physical properties of materials based on knowledge of their atomic composition and chemical bonding.
- Readily describe the structure of crystalline materials using the nomenclature of Bravais lattices and Miller Indices.

- Use a binary phase diagram to quantitatively describe the compositions, phases and microstructures developed during heat treatments of binary solid systems.
- Use the principles of nucleation theory and solid state diffusion to solve problems involving kinetics of phase transformations in metal alloy systems.
- Use of computer teaching processes especially materials that require it.
- Create Website for course communication with student to provide them with homework assignments and teaching materials.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	To recognize the basic physical properties of materials based on knowledge of their atomic composition and chemical bonding.	K1; K3
1.2	To describe the structure of crystalline materials using the nomenclature of Bravais lattices and Miller Indices.	K1; K3; S2
1.3	To define the binary phase diagram, to outline the compositions, phases and microstructures developed during heat treatments of binary solid systems.	K1; S1
1.4	To recall the principles of nucleation theory and solid state diffusion to solve problems involving kinetics of phase transformations in metal alloy systems	K1, K2
2	**Skills :**	
2.1	To predict the crystalline structures from Bravais lattices and Miller Indices data.	K1; S1
2.2	To develop cubic crystal systems and determines the planes and Miller indices.	S3
2.3	To evaluate the optical and thermal properties of materials.	S1; S3
2.4	To differentiate between the various crystalline structure.	S2; S3; S4
3	**Values:**	
3.1	To appraise teamwork, and create awareness to maintain scientific integrity during different assessments.	V1;V2

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to solid-state and materials science (Classifications of Materials and types of Solids).	10
2	The atomic structure and the electron configurations and the wave- particle Duality	7
3	Crystal Structures, the 14 Baravis Lattice, the closed packing systems, the crowding and coordination numbers of solid crystals, the crystal axes, planes and Miller indexes.	7
4	X- ray Diffraction and Braggs' equation.	3
5	Band theory of solids, band gaps and the electrical and thermal conductivity of metals, semiconductors and insulators, magnetic and optical properties of solids, crystal Imperfections, types of crystal defects..	9

Total	**36**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic physical properties of materials based on knowledge of their atomic composition and chemical bonding.**	Lectures	Quizzes
1.2	**To describe the structure of crystalline materials using the nomenclature of Bravais lattices and Miller Indices.**	▪ Lectures and group discussion Lectures and laboratory experiments	▪ Homework Exams and laboratory reports
1.3	**To define the binary phase diagram, to outline the compositions, phases and microstructures developed during heat treatments of binary solid systems.**	Lectures	▪ Quizzes and homework
1.4	**To recall the principles of nucleation theory and solid state diffusion to solve problems involving kinetics of phase transformations in metal alloy systems**	Lectures	▪ Quizzes and homework ▪ exams
2	**Skills**		
2.1	**To predict the crystalline structures from Bravais lattices and Miller Indices data.**	Lectures	Quizzes and homework
2.2	**To develop cubic crystal systems and determines the planes and Miller indices.**	Group discussions and laboratory experiments	Oral questions marks and laboratory reports
2.3	**To evaluate the optical and thermal properties of materials.**	Brain storming	MCQs
2.4	**To differentiate between the various crystalline structure.**	▪ Group discussion and assignments • homeworks	▪ Oral tests and assignments marks • homework
3.0	Values		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	**To appraise teamwork, and create awareness to maintain scientific integrity during different assessments.**	• Group discussions • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks • Oral tests and lab sheets • Assessments and homework • Laboratory performance • Laboratory reports and sheet

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Exam 1	5^{th} week	20 %
2	Midterm Exam 2	8^{th} week	20%
3	Quizzes, Home Works, class participation, and mini projects	During the semester	20 %
4	Final Exam	13^{th}week	40 %
5	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Introduction to Solid-State Chemistry*** 2009, Pearson Custom Publishing (ISBN 10: 0-558-36407-1),
Essential References Materials	• ***Solid State Chemistry: An Introduction***, Lesley E. Smart, Elaine A. Moore, 4th Edition, 2012 by CRC Press, ISBN 9781439847909.
Electronic Materials	▪ **Blackboard** • **Class room** • **Internal server: \\10.10.70.70\ScienceShareFolder**

	• http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true • http://www.chem1.com/acad/webtext/virtualtextbook.html • http://www.shodor.org/UNChem/index.html
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Each classroom is equipped with PC and retro projector with a maximum of 25 students. • Each Laboratory should be equipped with maximum 25 seats
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Chemistry of Natural Products**
Course Code:	**CHM 1421**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**2(2 Lectures, 0 Lab, 0 Tutorials)**
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 10 / Year 4**
4. Pre-requisites for this course (if any)**:**	**CHM 1321**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	24	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	24
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	24

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers introduction to natural product chemistry; classification of natural products, isolation techniques and physiochemical data, the acetate pathway (fatty acids and polyketides), the shikimate pathway (aromatic amino acids and phenylpropanoids), the mevalonate (terpenoid and steroids), alkaloids, proteins and amino acid derivatives, lipids and fatty acids, and carbohydrates.

2. Course Main Objective

At the end of this course the student will be able to:

- To study of carbohydrates and natural products in point of view from many disciplines.
- To Promote understanding of the significance of natural products in terms of their biosynthesis, and biological activity and in life.
- To outline the occurrence, the isolation, and structure elucidation

- To develop hands-on skills of using laboratory tools and be able to isolate and elucidate the chemical structure of isolated batural products.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	**Knowledge and Understanding**	
1.1	**To recall functional groups of organic chemistry and their importance in the biosynthesis.**	**K1; K3;**
1.2	**To recognize the structure and molecular classification of a representative number of compounds belonging to the main classes of natural products.**	**K1; K3; S2**
1.3	**To list relevance of selected natural compounds and some chemical elaboration and outline the structure activity relationship.**	**K3; S1**
2	**Skills:**	
2.1	**To explain different synthetic strategies pathways in natural products biosynthesis**	**K1, K3, S1, S2**
2.2	**To predict the bioactivity, properties and chemical structure of some natural products.**	**S1, S2, S3**
2.3	**To summarize different situations and problems in isolation of specific natural products group**	**S1, S3**
3	**Values:**	
3.1	**To show intellectual and scientific integrity during assignments and projects**	**V1; V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction:** Occurrence, origin, main groups of natural products, impact of natural products in medicine.	**2**
2	**Alkaloides:** Introduction, Hagnauer system of classification, Physicochemical properties of alkaloids, Methods of isolation, Biosynthesis of alkaloids.	**3**
3	**Terpenes and Terpinoids:** Introduction, Isoprene rule, Carbon-carbon bond formation in terpene biosynthesis, Classification of Terpenes, Heme Biosynthesis, some examples of terpenes synthesis.	**5**
4	**Flavonides:** Purpose and delivery of Favonides in plants, Types of Flavonides, Flavonides biosynthesis, Chemical analysis of Flavonides, Legnin, Complexation and Reduction/Oxidation Reactions of Selected Flavonoids with Iron and Iron Complexes.	**5**
5	**Glycosides and Tannines:** Nomenclature, Anthracene glycosides, Anthracene and anthranols, Structure of Saponines, Coumarin glycosides.	**3**
6	**Protein and amino acids:** Classification of Amino Acids, Stereochemistry of Amino Acids, Acid-Base Behavior of Amino Acids, Synthesis and Reactions of Amino Acids, Peptides, Peptide Bond Formation. Insulin, Solid-Phase Peptide Synthesis.	**2**
7	**Lipids and Fatty acids:** Introduction, Structures, Biological Functions of Lipids, Fatty Acid Naming Systems, Trans Fatty Acids, Wax, Major	**2**

	Types of Lipids, Phosphatidylcholine, Ether Lipids, Sialic Acid, Saponification and Methylation.	
8	**Carbohydrates:** Introduction, Monosaccharides, Nomenclature of Monosaccharides, Amino sugars, Modified Monosaccharides, Ketoses, Structure and stereochemistry of glucose, Cyclic structure of monosaccharides, Reactions of monosaccharides, Formation of Osazones, Relative Sweetness of Some Carbohydrate and Artificial Sweeteners, Cellulose, Heparin with other examples.	**2**
	Total	**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recall functional groups of organic chemistry and their importance in the biosynthesis.**	• Two hours are weekly containing lectures, , and Oral Discussion. • A Private study including home exam.	• Quizzes Assignments • Oral Discussion • Participation.
1.2	**To recognize the structure and molecular classification of a representative number of compounds belonging to the main classes of natural products.**	▪ Two hours are weekly containing lectures, and group discussion ▪ Discussion activities	▪ Quizzes Assignments. • Oral Discussion marks
1.3	**To list relevance of selected natural compounds and some chemical elaboration and outline the structure activity relationship.**	▪ Two hours are weekly for lectures activities ▪ Think and talk about Natural Products Chemistry	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
2.0	**Skills**		
2.1	**To explain different synthetic strategies pathways in natural products biosynthesis**	• Lectures activity, • Think and talk about Biosynthesis of natural products	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Home Exam.
2.2	**To predict the bioactivity, properties and chemical structure of some natural products.**	▪ Introduce some examples on the bioactivity properties of some natural products	• Questions in Lectures. • Short Quizzes and Exams.
2.3	**To summarize different situations and problems in isolation of specific natural products group**	• Lectures, and Group discussion ▪ Brainstorming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
3.0	Values		
3.1	**To show intellectual and scientific integrity during assignments, projects, and reports**	▪ Group Discussion and Assignments.	▪ Oral Tests and Assignments Marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**5th week**	**20 %**
2	**Midterm Exam 1**	**8th week**	**20 %**
3	**Midterm Exam 2**	**During the semester**	**20 %**
4	**Final Exam**	**13thweek**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	▪ ***Chemistry of Natural Products***, Bhat, Sujata V., Nagasampagi, Bhimsen A., Sivakumar, Meenakshi Jointly published with Narosa Publishing House 2005, XXX., ISBN: 978-3-540-40669-3 • ***The Chemistry of Natural Products***, Thomson, R.H. Springer, 2nd ed. 1993, **ISBN-10:** 9401049505
Essential References Materials	• ***Medicinal Natural Products: A Biosynthetic Approach***, Dewick, Paul M., Wiley India Pvt Ltd; Third edition, 2011. **ISBN-10:** 8126532963.
Electronic Materials	• **Blackboard**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Organic Reactions Mechanism**
Course Code:	**CHM 1422**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. **Credit hours:**	**3 (3 Lectures, 0 Lab, 0 Tutorials)**
2. **Course type**	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. **Level/year at which this course is offered:**	**Level 11 / Year 4**
4. **Pre-requisites for this course** (if any):	**CHM 1321**
5. **Co-requisites for this course** (if any):	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides students with an Introduction for Organic Reactions Mechanism, which covers all aspects; kinetic and physical methods to determine organic reaction mechanism; classifications of reaction mechanism; Substitution; Addition; Elimination; Radical Addition Reaction and Rearrangement.

2. Course Main Objective

At the end of this course the student will be able to:

- Recall knowledge of core organic chemistry.
- Describe advanced organic chemistry topics including reaction mechanism, advanced synthetic procedures and strategy.
- Reproduce knowledge of quantitative understanding of reactions and proposing potential improvements to existing processes in organic chemistry.
- Recognize appropriate mechanism in organic synthesis.
- Define factors influencing the chemical reaction mechanism

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	**To recall knowledge of core organic chemistry.**	**K1; K3;**
1.2	**To describe advanced organic chemistry topics including reaction mechanism advanced synthetic procedures and strategy.**	**K1; K3; S1; S3**
1.3	**To recognize appropriate mechanism and factors influence the organic synthesis.**	**K1; K3; S1; S3**
2	Skills:	
2.1	**To Evaluate knowledge and understanding of essential facts, concepts and principles of physical organic chemistry.**	**K1; K3; S1; S3**
2.2	**To analyze problems and plan strategies for their solution, critically review different approaches to problems and demonstrate good research design.**	**K1; K3; S1; S3; S4**
2.3	**To Summarize concepts of reaction mechanism leading to logic thinking, followed by evaluation gained information.**	**K1; K3; S1; S3; S4**
2.4	**To demonstrate oral Communication to carry out Chemical Reactions Sequence orally and propose a reaction mechanism and writing of mini- Reports, with operating electronic mail and Network in communicating with others.**	**S1, S4**
3	Values:	
3.1	**To show responsibility for their own learning and motivate for team work**	**V1;V2**

C. Course Content

No	List of Topics	Contact Hours
1	**An Overview of Organic Reactions**: Understanding Organic Reaction, kinds of organic reactions, How Organic Reactions occur: Mechanisms, Steps in Mechanisms, Types of Steps in Reaction Mechanisms, Energy diagram of any Reaction, Kinetics of the Reaction, Hybridization, Conjugation, Aromaticity, Inductive Effect, Mesomeric Effect	**4**
2	**Nucleophilic Substitution**: Relation of Kinetics to mechanism, Effect of solvent, Effect of structure, Stereochemical implications of mechanism, Stability of Carbocatios, *SN*1 Mechanism, Sources of Carbocations Stability, Effect of Entering and Leaving Groups, *SN2* Mechanism Inversion of Configuration, Determination of Relative Configuration, Effect of Entering and Leaving Groups, Other Nucleophilic Displacements	**6**
3	**Electrophilic Aromatic Substitution**:Electrophilic Attack on Benzene (π,σ complexes), Nitration, Halogenations, Sulphonation, Friedle- Crafts Reactions (Alkylation, Acylation), Diazo Coupling, Electrophilic Attack on C_6H_5Y (Y= $+NR_3$, CCl_3, NO_2, CHO, COOH etc., Y= OCOR, NHCOR, OR, OH, NH_2, NR_2, Partial Rate Factors and Selectivity, *O,P* Ratios, Electrophilic Substitution of Other Aromatic.	**6**
4	**Electrophilic and Nucleophilic Addition Reaction:** Electrophilic and Nucleophilic Addition Reaction to C=C,Addition of Halogens, Effect of Substitutions on Rate of Addition, Orientation of Addition, Other Addition Reactions (Further Halogen Derivatives, Hydration, Carbocations, Hydroxylation, Hydrogenation, Ozonolysis), Addition to Conjugated Dienes (Electrophilic addition, Diels- Alder Reaction	**6**

5	**Elimination Reaction:** 1,2-(β-) Elimination, E1 Mechanism, E1Cb Mechanism, E2 Mechanism (Stereoselectivity in E2, Orientation in E2 Saytzev v. Hoffmann), Elimination v. Substitution, Effect of activating groups, Other 1,2-Elimination, 1,2-(α-) Elimination, Pyrolytic Syn Elimination.	**3**
6	**Reaction Intermediate:** Carbocation, Carboanion and Free Radical Formation, Carbene Formation and Reaction, Nitrene Formation and reactions, Arene-benzyne Formation and Reaction	**3**
7	**Radical Addition Reactions, Radical and Radicals Reaction and its application in biology**: Production of Radicals, Reaction of Radicals, Homolytic Bond Dissociation, Reaction of Alkanes with Halogen, Chlorination of Methane, Radicals in Biology, Superoxide SOD and Antioxidant, Drugs based on Radicals.	**4**
8	**Rearrangement and Fragmentation Reaction:** Cationic Rearrangement, Anionic Rearrangement, Radical Rearrangement, Factors Influence these Rearrangements.	**4**
Total		**36**
Topics to be covered (Laboratories)		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recall knowledge of core organic chemistry.**	• **Lectures and Group Discussion** • **A Private study including home exam.**	• **Quizzes Assignments** ▪ **Discussions.** ▪ **Oral Discussion** ▪ **Participation.**
1.2	**To describe advanced organic chemistry topics including reaction mechanism advanced synthetic procedures and strategy.**	• **Lectures, and group discussion**	• **Quizzes Assignments.** • **Oral Discussion marks**
1.3	**To recognize appropriate mechanism and factors influence the organic synthesis.**	▪ **Lectures, and group discussion** ▪ **Think and talk about reactivity of heterocyclic compounds**	• **Midterms.** • **Assignments** • **Oral Discussions.** • **Quizzes.**
2.0	**Skills**		
2.1	**To Evaluate knowledge and understanding of essential facts, concepts and principles of physical organic chemistry.**	▪ Lectures activity ▪ Think and talk about the reactivity of Organic Compounds and functional groups.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Home Exam.
2.2	**To analyze problems and plan strategies for their solution, critically review different**	• Introduce some examples of Organic Reactions from	• Questions in Lectures. • Participation

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	approaches to problems and demonstrate good research design.	Previous courses achieving Brainstorming.	through Oral Discussion • Short Quizzes and Exams.
2.3	**To Summarize concepts of reaction mechanism leading to logic thinking, followed by evaluation gained information.**	• Lectures and Oral Discussions. • Brain storming Exercises	• Questions in Lectures. • Short Quizzes and Exams.
2.4	**To demonstrate oral Communication to carry out Chemical Reactions Sequence orally and mentally, and propose a simple reaction mechanism improving technical writing skills through writing of mini- Reports, with operating electronic mail and Network in communicating with others.**	• Group Discussion and Assignments • Introduce several reports about examples of reaction mechanism in English, which will require reading, writing, and oral presentation. ▪ Encourage students to use electronic mail to submit Home Exams and Assignments	▪ Oral Discussion, Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. ▪ Marks given for Assignments
3.0	**Values**		
3.1	**To show responsibility for their own learning and motivate for Team Work.**	• Brain Storms Exercises • Group Discussion	• Oral Discussion. • Group Discussion and Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**All the semester**	**20 %**
2	**Midterm Exam 1**	**Around 5th week**	**20 %**
3	**Midterm Exam 2**	**Around 8 th week**	**20 %**
4	**Final Exam**	**Around 13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***A Guidebook to Mechanism in Organic Chemistry, Peter Sykes, Pearson; 6 edition 6th Ed., 1996 | ISBN-10: 0582446953***
Essential References Materials	• ***Arrow-Pushing in Organic Chemistry: An Easy Approach to Understanding Reaction***, John Wiley & Sons, Inc., 2011, ISBN10: 978-1-118-21045-1 • ***MARCH'S Advanced Organic Chemistry, Reactions, Mechanisms, and Structure***, Michael B. Smith, Jerry March, John Wiley & Sons, Inc., 7th Ed., 2007. ISBN: 978-0-470-46259-1
Electronic Materials	• **Blackboard** • **Journal of Organic Chemistry, ACS** • **Organic Letters, ACS** • **Tetrahedron** • **Tetrahedron Letters** • **Organic and Biomolecules Chemistry, RSC** • **European Journal Of Organic Chemistry** • **http://www.sigmaldrich.com**
Other Learning Materials	• ***A Guidebook to Mechanism in Organic Chemistry***, Peter Sykes, Pearson; 6 Edition 6th Ed., 1996, | ISBN-10: 0582446953.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

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

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Indirect: Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-Syllabus review- Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Polymers and Petrochemicals**
Course Code:	**CHM 1428**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: **3 (3 Lectures, 0 Lab, 0 Tutorials)**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: **Level 10/ Year 4**	
4. Pre-requisites for this course (if any): **CHM 1321**	
5. Co-requisites for this course (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides students with an introduction to Polymers Chemistry and Petrochemicals, methods of preparation, physical properties and application as well extended to Petrochemicals Process and Chemistry.

Topics covered in the course include An Introduction to Polymer Chemistry, main synthetic methods including mechanism of Polymer, Reactions of Polymers, Distillation, Application in Petroleum Chemistry and Petrochemical Process.

2. Course Main Objective

At the end of this course the student will be able to:

- Know the fundamentals of Polymer's Chemistry and Petrochemicals
- Understand the importance of the subject to pursue their career in academia or industry.
- Describe the physical properties of different polymers will be one of the outcome, and combination with industrial process.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	To recognize the basic concepts of Polymer Chemistry.	K1; K3;
1.2	To outline Polymers types Chemically, physically and of Polymerization Process.	K1; K3; S2;
1.3	To describe the Petrochemical Process in Petroleum Chemistry	K3;S1
2	Skills:	
2.1	To explain Polymerization Mechanisms and Petrochemical Separation Methods.	K1; K3; S1; S3
2.2	To summarize the Polymerization Process according to their physical properties required.	S1; S3
2.3	To plan multistep Synthesis of Polymer to improve its conversion percent.	S1; S3
2.4	To demonstrate Oral Communication to outline Polymers types, Polymerization Process, and the Petrochemical Process in Petroleum Chemistry orally and mentally, with improving technical writing skills through writing of mini- Reports, with operating electronic mail and Network in communicating with others.	S2, S3, S4
3	Values:	
3.1	To show the responsibility for their own learning and motivate for Team Work.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	**An Introduction to Polymer Chemistry:** Types of Polymers and Polymerizations, Nomenclature of Polymers, Linear, Branched, and Crosslinked Polymers, Molecular Weight, Physical State, Applications of Polymers	5
2	**Step Polymerization (Condensation Polymerization):** Reactivity of Functional Groups, Step Polymerizations Other than Polyesterification, Catalyzed versus Uncatalyzed, Molecular Weight Control in Linear Polymerization, Molecular Weight Distribution in Linear Polymerization , Process Conditions, Multi chain Polymerization, Crosslinking, Molecular Weight Distributions in Nonlinear Polymerizations, Crosslinking Technology, Polyesters, Unsaturated Polyesters, and Alkyds, Phenolic Polymers, Amino Plastics, Epoxy Resins, Polyurethanes, Step Copolymerization, Types of Copolymers, Methods of Synthesizing Copolymers, Block Copolymers, Utility of Copolymerization, High-Performance Polymers, Enzymatic Polymerizations	10
3	**Radical Chain Polymerization:** Nature of Radical Chain Polymerization, Structural Arrangement of Monomer Units, Experimental Determination of Rp, Initiation, Thermal Decomposition of Initiators, Redox Initiation, Molecular Weight, Chain Transfer, Inhibition and Retardation, Rate of Polymerization, Degree of Polymerization, Auto acceleration, Course of Polymerization, Molecular Weight Distribution, Polyethylene, Polystyrene, Vinyl Family, Poly(vinyl chloride), Polymerization of Dienes	7

4	**Reactions of Polymers:** Other Reactions, Graft Copolymers, Radical Graft Polymerization, Vinyl Macro monomers, Chain Transfer and Copolymerization, Ionizing Radiation, Redox Initiation, Living Radical Polymerization, Anionic Graft Polymerization, Cationic Graft Polymerization, Other Approaches to Graft Copolymers, Block Copolymers	7
5	**Distillation, Application in PetroChemistry and Petrochemical Process:** Distillation and Distillation Categories, Processing Mode, Processing Sequence, System Types, Reactions, How Oil Formed, Oil Refining, Oil Production, Oil Process, Chemistry of Petrochemical Process	7
Total		**36**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1	**Knowledge and Understanding**		
1.1	**To recognize the basic concepts of Polymer Chemistry.**	• Lectures and Group Discussion • A Private study including home exam.	• Quizzes • Discussion • Participation
1.2	**To outline Polymers types Chemically, physically and of Polymerization Process.**	• Lectures with group discussion. • Think, talk and discuss about Polymers types, Polymerization and Reactions process.	• Oral Discussion marks
1.3	**To describe the Petrochemical Process in Petroleum Chemistry**	• Lectures with group discussion. • Think, talk discuss about Petrochemical Process in Petrochemicals and industry	• Quizzes • Home exam • Oral discussions.
2	**Skills:**		
2.1	**To explain Polymerization Mechanisms and Petrochemical Separation Methods.**	▪ Lectures activity ▪ Think and talk about the reactivity of heterocyclic Compounds	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, • Laboratory Reports • Home Exam.
2.2	**To summarize the Polymerization Process according to their physical properties required.**	• Encourage students to communicate their logic chemical thinking, and to work and discuss	• Short Quizzes and Exams. • Oral Discussion

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		cooperatively with their peers to develop individual skills.	
2.3	**To plan multistep Synthesis of Polymer to improve its conversion percent.**	• Lectures and Oral Discussions. • Brain storming Exercises	• Questions in Lectures. • Short Quizzes and Exams.
2.4	**To demonstrate Oral Communication to outline Polymers types, Polymerization Process, and the Petrochemical Process in Petroleum Chemistry orally and mentally, with improving technical writing skills through writing of mini- Reports, with operating electronic mail and Network in communicating with others.**	• Group Discussion and Assignments • Introduce several reports in Polymers and petrochemicals which will require reading, writing, and oral presentation • Encourage students to use electronic mail to submit Home Exams and Assignments	• Oral Discussion, Quizzes, and Exams. • Giving marks for Oral Discussion in Lectures. • Marks given for Assignments
3	**Values:**		
3.1	**To show the responsibility for their own learning and motivate for Team Work.**	• Brain Storms Exercises • Group Discussion	• Oral Discussion. • Group Discussion and Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**All the semester**	**20 %**
2	**Midterm Exam 1**	**Around 5th -6th week**	**20 %**
3	**Midterm Exam 2**	**Around 8th -9th week**	**20 %**
4	**Final Exam**	**Around 13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Principles of Polymerization*** , George Odian, John Wiley and sons Inc. Wiley Interscience, 4 th Edition, 2004. ISBN 0-471-27400-3.
Essential References Materials	• ***Textbook of Polymer Science,*** Fred W. Billmeyer, Wiley-Interscience, 3rded, 1984, , ISBN: 978-0-471-03196-3 • ***Polymer Science and Technology,*** Joel R. Fried, Prentice-Hall , 2nd ed., 2003, ISBN-10: 0137039557
Electronic Materials	• **Blackboard** • **http://www.sigmaldrich.com**
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Chemical Separation Methods**
Course Code:	**CHM 1438**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 5(4Lectures, 0Tutorials, 2 Labs)	
2. Course type a. University ☐ College ☐ Department ☑ Others ☐ b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 11/Year 4	
4. Pre-requisites for this course (if any): Chemistry of Volumetric and Gravimetric Analysis – CHM 1236	
5. Co-requisites for this course (if any): None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	72	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	48
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	72

C. Course Objectives and Learning Outcomes

1. Course Description:

Classical separation methods, extraction, chromatography (TLC, GC, HPLC, Column chromatography), detectors, ion exchange and electrophoresis.

2. Course Main Objective: ***This course is intended:***

- The main objective of this course is to familiarize students with the fundamental of separation processes used in analytical chemistry such as various extraction techniques, gas and liquid chromatography, size and ion chromatography and electrophoresis.
- By completion of this course, students, are expected to gain independent laboratory skills in certain separation techniques and will have the ability to interpret data from analytical separation methods.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	**To outline principles of chemical separations and construction of relevant instrumentation.**	**K1, K2, K3**
1.2	**To name factors that affect performance of chemical separation methods especially GC and HPLC and optimize respective operating conditions.**	**K2, K3**
1.3	**To describe experimental methods to separate plant extract components**	**K1, K2**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	Skills :	
2.1	**To operate and calibrate separative techniques and use the appropriate types of detectors such as ECD, FID, NPD, Diode-Array and mass-spectrometer.**	**S1**
2.2	**To differentiate the scientific separation methods employed in multidisciplinary fields such as environmental and pharmaceutical analysis.**	**S1, S3**
2.3	**To design experimental setup for separation of compounds with different properties such as polarity and solubility.**	**S1; S4**
2.4	**To demonstrate oral communication skills by presenting seminars before his class mates and teaching staff, to write reports about real pollution cases in his community and operate electronic mail and Network skills in communicating with others.**	**S2, S3**
3	Values:	
3.1	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	**V1, V2**

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Introduction to separation:** Pre-concentration, quantification, purity and role of separation**,** Classification of separation methods depending on the basis of separation**,** Classical separation methods, distillation, re-crystallization, filtration, decantation, and centrifugation, Introduction to the developed method of separation, requirements and specifications	9
2	**Extraction techniques**: theory and applications in liquid-liquid, liquid–solid, soild-pahse micro extractions and stir-bar sorptive extraction techniques, Comparison of the efficiency of various techniques, and methods improvement, Applications in various fields	5
3	**Chromatographic theory**: history of chromatography, classification of chromatographic methods, mechanism of separation, column efficiency, Band broadening and resolution, (HETP)theoretical plates, open column and chromatogram, layer chromatography (TLC) and paper chromatography and their applications	5
4	**Gas chromatography**: instrumental design, gas type selection, methods of sample introducing or injection (split, splitless , split-splitless and purge and trap, Types of detectors, (ECD, FID, NPD, PID) and connection to MS Columns(capillary and packed) , chemically bonded and	8

	comparing the efficiency, Temperature programmed (oven) and quantitative analysis (applications)	
5	**High performance Liquid Chromatography**(HPLC): theory of operation, instrumental design , function of various parts of the machine , solvent delivery(pumps), types of pumps and requirements, Column specification and polarity, column selection, detectors (UV-Vis., Fluorescence , RI, Diode array,,) and connectivity to MS Operational modes of HPLC(Reverse and Normal phase) quantitative analysis and applications	10
6	**Ion chromatography, cation and anion exchange**: resin, and size exclusion chromatography, Electrophoresis, its principle and capillary electrophoresis.	7
7	**Mass spectrometer:** instrumental design, theory of operation, basic specifications, advantages and disadvantages as chromatography detector.	4
	Total	**48**
	Topics to be covered (Laboratories)	
1	Separation of a Solid Mixture	**2**
2	Determination of distribution coefficient	**2**
3	Single and Multiple extraction	**2**
4	Separation of organic mixture by acid-base extraction	**2**
5	TLC	**2**
6	Paper chromatography	**2**
7	Column chromatography:	**2**
8	Cation exchange chromatography	**2**
9	HPLC: Separation and quantification of pharmaceutical mixture	**2**
10	Gas chromatographic separation of organic mixture	**2**
11, 12	Revision	**4**
	Total	**24**

Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To outline principles of chemical separations and construction of relevant instrumentation.**	lecturing	Short quizzes
1.2	**To name factors that affect performance of chemical separation methods especially GC and HPLC and optimize respective operating conditions.**	Lecturing, group discussions, Homework and assignment	Oral test, Homework and assignment marks and written exams
1.3	**To describe experimental methods to separate plant extract components**	laboratory experiments.	Participation, Quizzes and MCQs, laboratory reports

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.4	To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.	laboratory experiments.	Participation, Quizzes and MCQs, laboratory reports
2.0	Skills :		
2.1	To operate and calibrate separative techniques and use the appropriate types of detectors such as ECD, FID, NPD, Diode-Array and mass-spectrometer.	Lecturing, group discussion and laboratory experiments	Short quizzes Exams, Homework assignment and laboratory reports
2.2	To differentiate the scientific separation methods employed in multidisciplinary fields such as environmental and pharmaceutical analysis.	Lectures and laboratory sessions	Quizzes
2.3	To design experimental setup for separation of compounds with different properties such as polarity and solubility.	Lecturing and oral discussion supported by laboratory experiments	Homework assignment, Examination and laboratory report
2.4	To demonstrate oral communication skills by presenting seminars before his class mates and teaching staff, to write reports about real pollution cases in his community and operate electronic mail and Network skills in communicating with others.	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	Values		
3.1	To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes, Attendance, Participation, Homework	All the semester	10 %
2	Laboratory	All the semester	30 %
3	Midterm Exam 1	Around 5th week	10 %
4	Midterm Exam 2	Around 8th week	10%
5	Final Exam	Around 13th week	40 %
6	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • **There are two office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• ***Quantitative Chemical Analysis***, Daniel C. Harris, 8th Ed., 2010, W. H. Freeman & Co., New York, ISBN: 9781429218153.
Essential References Materials	• ***Modern Analytical Chemistry***, David Harvey, McGraw-Hill, 1st Ed, 2000, ISBN: 0–07–237547–7 • ***Chemical Analysis: Modern Instrumentation Methods and Techniques***, Francis Rouessac, Annick Rouessac, John Wiley & Sons, 2nd, 2007.ISBN: 0470859040, 9780470859049. • ***Principles of Instrumental Analysis***, D. A. Skoog, F. J. Holler, S.R. Crouch, Brooks Cole; sixth edition (2006), ISBN: 0495012017, 978-0495012016. • ***Chromatography: Fundamentals and applications of chromatography and related differential migration methods***, Heftmann، E , 6th Ed, Elsevier Science, 2004., ISBN: 0444511067, 978-0444511065.
Electronic Materials	• Blackboard • http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true • http://www.chem1.com/acad/webtext/virtualtextbook.html • http://www.shodor.org/UNChem/index.html
Other Learning Materials	**Journal of chromatography. Encyclopedia of chemistry**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, dishes, funnels)** • **Appropriate fine chemicals and solvents (raw materials to isolate active materials,,diethyl ether, copper sulphate, HCl, NaOH)** • **Separating funnul, TLC, Paper chromatography, Column chromatography, Cation exchange chromatography, HPLC.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct :** Questionnaire. **Indirect :** Eternal assessorat report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Catalysis and Surface chemistry**
Course Code:	**CHM 1446**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 3 (3 Lectures, 0 Lab, 0Tutorials)							
2. Course type							
a.	University	☐	College	☐	Department	✓	Others ☐
b.	Required	✓	Elective	☐			
3. Level/year at which this course is offered: Level 10 / Year 4							
4. Pre-requisites for this course: Physical Chemistry2 - CHM 1242							
5. Co-requisites for this course (if any)**:** None							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (Mini-reports, Midterm, Final Exam)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description **This course describes the definitions and types of homogeneous and heterogeneous catalysts, extending to the preparation methods and characterization. This course designed to provide with the concepts of heterogeneous catalysis, theoretical, methodological and technical knowledge of the catalysts and catalytic cycle. The course will cover surface Chemistry: Solid surfaces and their characterization; Adsorption on solid surfaces: technique for measurement of adsorption.**
2. Course Main Objective ▪ The student will gain information about surface Chemistry: Solid surfaces and their characterization; Adsorption on solid surfaces: technique for measurement of adsorption from gas phase and solution; Langmuir, Freundlich and BET adsorption isotherm: Enthalpy of adsorption; Adsorption on liquid surface. Gibb's adsorption equation; Surface film; Electro-capillary phenomena. ▪ This includes initiation to catalysis specifically acid-base and enzymatic catalysis**.**

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To list the main concepts and applications of homogeneous and heterogeneous catalysis.**	**K1; K2; K3**
1.2	**To recognize the concept of acid-base catalysis and proton transfer and describe the acid-base cycle and its industrial application.**	**K1; K2; K3**
1.3	**To define surface chemistry and adsorption-desorption process, and list techniques for measurement of adsorption and surface area.**	**K1; K3**
2	**Skills :**	
2.1	**To differentiate homogenous and heterogeneous catalysis mechanisms, and estimate the kinetics and thermodynamic parameters of catalytic reactions and to calculate the adsorption parameters.**	**S1; S2; S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1; S2; S3**
2.3	**To demonstrate ability to participate in class by asking questions and giving answers.**	**S3**
2.4	**To show technical writing and oral communication skills through writing and oral presentation of mini-reports and operate electronic mail and Network in communicating with others.**	**S2; S3; k4**
3	**Values:**	
3.1	**To appraise collaborative work skill**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction, Bulk, surface, Adsorption, adsorbate, adsorbent, Desorption, absorption, Physisorption, Chemisorption, surface area.**	**5**

2	Adsorption at Solid Liquid interface. Adsorption at Solid Gas interface, specific surface area.	6
3	Adsorption isotherm, Henry's equation, Freundlich isotherm, Langmuir isotherm, Potential theory of adsorption, Dubinin-Radushkevich.	7
4	Catalyst and catalysis, Types of catalysis, Classification of catalysis.	5
5	Characteristics of catalytic reactions, Catalytic promoters, Catalytic poisons.	5
6	Theories of catalysis. Biochemical or enzyme catalysis. Acid-base catalysis. Heterogeneous Catalysis. Industrial applications of catalysts	8
Total		36
Topics to be covered (Laboratories)		
None		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	To list the main concepts and applications of homogeneous and heterogeneous catalysis.	Lecture	Homework assignment marks and lab reports
1.2	To recognize the concept of acid-base catalysis and proton transfer and describe the acid-base cycle and its industrial application.	Lecture	Short quizzes
1.3	To define surface chemistry and adsorption-desorption process, and list techniques for measurement of adsorption and surface area.	Lecture and group discussions	Oral tests and MCQs, Homework
2.0	**Skills :**		
2.1	To differentiate homogenous and heterogeneous catalysis mechanisms, and estimate the kinetics and thermodynamic parameters of catalytic reactions and to calculate the adsorption parameters.	Lecture and oral discussions	Solved problem marks Short quizzes and homework assignment
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Tutorial, Brain storming and self-study	Work portfolio and homework
2.3	To demonstrate ability to participate in class by asking questions and giving answers.	Motivate students to ask questions and to give response.	Participation marks
2.4	To show technical writing and oral communication skills through writing and oral presentation of	• Seminars	• Oral tests and presentation marks

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	mini-reports and operate electronic mail and Network in communicating with others.	• Group discussion and assignments Encourage students to use electronic mail to submit homework and assignments.	• Assignments and homework marks Group competitions
3.0	Values		
3.1	To appraise collaborative work skill	• Group discussions and assignment. • Homework • Mini-reports	• Oral presentation marks. • Assessments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	20 %
2	Midterm 2	8th week	20 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	20 %
4	Final Exam	13th week	40 %
5	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Principle of Colloids and Surface Chemistry.*** 4th Edition, Duncan J. Shaw, esc, PhD, FRS, Liverpool Polytechnic, (ISBN 07506 11820)
Essential References Materials	• ***Principle of Colloids and Surface Chemistry.*** 3rd Edition Hiemenz and Raj Rajagopalan, CRC (1997). • ***Chemical Kinetics and Catalysis,*** R. A. van Santen and J. W. Niemantsverdriet, Springer Science + Business Media, LLC

Electronic Materials	• **Blackboard** • **Elsevier**
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each classroom is equipped with PC and retro projector with a maximum of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T5
2019

Field Experience Specifications

Course Title:	**Field Training**
Course Code:	**CHM 1497**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Field Experience Identification

1. Credit hours: 4	
2. Level/year at which this course is offered:	12/4 (last term of the program).
3. Dates and times allocation of field experience activities. • Number of weeks: (**12**) week • Number of days: (**36**) day • Number of hours:(**180)** hour	
4. Pre-requisites to join field experience (if any)**:** **Student must have completed a minimum number of 160 Hours Credit**	

B. Learning Outcomes, and Training and Assessment Methods

1. Field Experience Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	To perform knowledge of the context of the professional career joined with her/his program of Chemistry before graduation	K1, K4, S2
1.2	To recognize a range of professional interests in related fields of her/his academic program on Chemistry	K2,K3, S3
1.3	To outline all opportunities for learning, development, applying the gained knowledge and mentoring throughout the duration of the training.	K1, K2, K4
2	**Skills:**	
2.1	To summarize the obtained knowledge and information in classroom and laboratories to real-world situations and labour market	K2, S1, S4,
2.2	To rate new skills by becoming accustomed to critical and innovative for problem solving, thinking analysis and making practical decisions with confidence and rigor.	S1, S3
2.3	To plan efficient use of their time during the field exercise	S3, S4, V2
2.4	To demonstrate collaboration skills with other professionals	S4, V2
2.5	To show the communication skills through oral, written and technological methods with persons inside and outside the training organization in a manner that reflects advanced professional practice.	S4, V2
3	**Values:**	
3.1	To demonstrate discipline, self and social responsibility	V1, V2
3.2	To show integrity and honesty and applying ethic principles of the profession	V1, V2

2.Alignment of Learning Outcomes with Training Activities and Assessment Methods

Code	Learning Outcomes	Training Methods/Activities	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	To perform knowledge of the context of the professional career joined with her/his program of Chemistry before graduation	participation with the field supervisor at work place.	Discussion Specific rubric

Code	Learning Outcomes	Training Methods/Activities	Assessment Methods
1.2	To recognize a range of professional interests in related fields of her/his academic program on Chemistry	Subject-based study essays written-short answer/long answer/report	Rubric of evaluation
1.3	To outline all opportunities for learning, development, applying the gained knowledge and mentoring throughout the duration of the training.	Oral test Presentation Written report	Evaluate student's Discussion
2.0	**Skills:**		
2.1	To summarize the obtained knowledge and information in classroom and laboratories to real-world situations and labour market	workplace performance; Oral Presentations	• Portfolio • Student's diary/journal.
2.2	To rate new skills by becoming accustomed to critical and innovative for problem solving, thinking analysis and making practical decisions with confidence and rigor.	Written research questions/ Reflection	Student portfolio
2.3	To plan efficient use of their time during the field exercise	Tasks with deadline	Portfolio, and score of attendance.
2.4	To demonstrate collaboration skills with other professionals	group tasks	Portfolio Specific rubric Direct observation
2.5	To show the communication skills through oral, written and technological methods with persons inside and outside the training organization in a manner that reflects advanced professional practice.	Written tasks Discussion	Evaluation of Report Direct observation
3.0	**Values**		
3.1	To demonstrate discipline, self and social responsibility	Discussion, behavior	Portfolio and direct observation
3.2	To show integrity and honesty and applying ethic principles of the profession	Discussion, behavior	Portfolio and direct observation

3. Field Experience Learning Outcomes Assessment

a. Students Assessment Timetable

#	Assessment task*	Assessment timing (Week)	Percentage of Total Assessment Score
1	**Orientation session attendance.**	**First week**	**5% by the teaching staff advisor.**
2	**Site Visit**	**About Week 4 & week 8**	**10% by the teaching staff advisor.**
3	**Appreciation on student's performance (using supervisor's reports and student's weekly)**	**During the 12 weeks of the training.**	**10% by the teaching staff advisor.**

#	Assessment task*	Assessment timing (Week)	Percentage of Total Assessment Score
4	**Week log of activities**	**Weekly**	**10% by the teaching staff advisor and 5% by training advisor.**
5	**Demonstrate Learning Outcomes.**	**During the 12 weeks of the training.**	**50% by training advisor.**
6	**Student Field Performance Appraisal**	**Between Week 12 and week 13.**	**10% by student.**

***Assessment task** (i.e., Practical test, oral test, presentation, group project, essay, etc.)

b. Assessment Responsibilities

م	Category	Assessment Responsibility
1	**Teaching Staff**	The teaching staff supervisor assesses: • the attendance and participation of the student in the orientation session, • the performance during the field visit, • student's performance by using supervisor's reports and student's weekly, which express the application of student's knowledge to actual practice.
2	**Field Supervisor**	The field supervisor assesses overall performance and progress of the student during the training.
3	**Others** (specify)	**N.A.**

C. Field Experience Administration

1. Field Experience Locations

a. Field Experience Locations Requirements

Suggested Field Experience Locations	General Requirements*	Special Requirements**
List of potential companies and institutions (public/private sectors) such as Maaden Saudi Aramco KACST SABIC Standards and Specifications Authority Pharmaceutical factories Detergent factories Petroleum companies	The workplace is registered and approved by the competent Saudi instances. legal status as determined by the law in Saudi Arabia. Efficiency and safety	The field experience location activities must appropriate and consistent with the mission of Imam university and the requirements for field experience learning outcomes

*Ex: provides information technology ,equipment ,laboratories ,halls ,housing ,learning sources ,clinics etc.

**Ex: Criteria of the training institution or related to the specialization, such as: safety standards, dealing with patients in medical specialties, etc.

b. Decision-making procedures for identifying appropriate locations for field experience

Before starting the process for field experience, the college should state a range of partnerships with potential training organizations that may provide high-level training opportunities.
The list of partnerships should be available in college of science website. These partnerships should be based on requirements listed above. The college should communicate the present document (including qualifications and responsibilities) to the training organization to ensure skills requirements to determine an appropriate field supervisor.

2. Supervisory Staff

a. Selection of Supervisory Staff

Selection Items	Field Supervisor	Teaching Staff
Qualifications	A permanent member of the training organization.	A member of the teaching staff at the department of Chemistry is assigned authority and responsibility of supervising and evaluating the overall components of the field experience according the present specifications document.
Selection Criteria	depending to the training organization criteria.	• Ability to supervise a team, to establish priorities and manage competing deadlines for self and others. • Experience in the supervision and leadership of staff. • Well-developed oral and written communication skills. • Ability to build and maintain effective working relationships and act with diplomacy and discretion when dealing with sensitive and confidential issues • Ability to develop effective social and professional networks.

b. Qualification and Training of Supervisory Staff

(Including the procedures and activities used to qualify and train the supervisory staff on supervising operations, implementing training activities, the follow-up and evaluation of students, etc.)

3. Responsibilities

a. Field Experience Flowchart for Responsibility

including units, departments, and committees responsible for field experience, as evidenced by the relations between them.

b. Distribution of Responsibilities for Field Experience Activities

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

Activity	Department or College	Teaching Staff	Student	Training Organization	Field Supervisor
Selection of supervisory staff	√				
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		√			√
Adjusting attendance and leave		√			√
Assessment of learning outcomes		√			√
Evaluating the quality of field experience	√	√	√	√	√
Others (specify)					

4. Field Experience Implementation

a. Supervision and Follow-up Mechanism

The mechanism used for supervision and follow-up student is essentially based on:

- ✓ follow-up forms
- ✓ Interview follow-up
- ✓ Student portfolio
- ✓ Daily attendance record.
- ✓ Evaluation rubric

b. Student Support and Guidance Activities

- ✓ Session of orientation, necessary documentations (forms and rubrics, and guide manual).
- ✓ The workplace is expected to provide documents for student training (including internal policy manuals, electronic sources).

✓ The workspace is expected to provide also appropriate desk gadgets including printer/internet access with appropriate electronic devices and software.

5. Safety and Risk Management

Potential Risks	Safety Actions	Risk Management Procedures
Potential Risks depend on the workspace and production activities of the training organization. Potential sources of harm and hazards should be identified. This issue should be discussed with Training Organization before starting the training	Basic safety rules and tips that need to be followed at the worksite. Safety guidelines must be established and maintained: safety procedures for laboratory investigations and field trips should be implemented.	• Respecting the last updated version of the booklet "Implementation of Risk Management and Safety Culture" published by The Ministry of Labor and Social development. • providing an understanding of how to deal with different types of work-training in order to help reduce exposure risks. • Offering short risk management training at the beginning of training.

G. Training Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student performance, effectiveness and efficiency	Field Supervisor,	Direct and Indirect
Quality of learning resources Effectiveness of Training and assessment. Student performance	Teaching staff	Indirect
Evaluation of the field Experience (workspace, Quality of learning resources, supervisory, achievements, skills, behavior, time)	Student	Indirect

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	**Council of Chemistry Department**
Reference No.	**10 (1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Graduation Project
Course Code:	CHM 1499
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours: 4 (1 Lectures, 6 Lab, 0Tutorials)	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 12 / Year 4	
4. Pre-requisites for this course (if any): Research project course starts in the last semester of the program study, with 160 Credit Hours	
5. Co-requisites for this course (if any): None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	84	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	12
2	Laboratory/Studio	72
3	Library	0
4	Others (Mini-reports, Midterm, Final Exam)	0
	Total	84

B. Course Objectives and Learning Outcomes

1. Course Description

Graduation Project is an independent task to be carried out by each student individually and accomplished according to a specific timetable duration. Students should achieve the project within one semester. Graduation project is a solo act based on one major department topics and is supervised by one of the staff members. The department assigns a scientific committee with the project supervisor to evaluate and discuss the project in a pre-stated date before the final exam. The student is given freedom to a great extent in choosing the graduation project title; the selected topic will focus on, and follow with the aid of the supervising professor

2. Course Main Objective
After completing the project, the student is supposed to acquire the necessary skills in the following: • Be able to carry out a guided graduation project independently. • Be able to attend and practice his obtained knowledge and information during his chemistry program appropriately. • Be able to search and communicate with the faculty member scientifically. • Be able to develop his intellectual abilities in scientific research.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge:	
1.1	To recall basic concepts and knowledge to initiate the graduation project	K1, K2, K3
1.2	To list the scientific approach for interpreting the obtained data, to describe the obtained results in appropriate form, to outline in-depth knowledge of currently active research areas in Chemistry	K1, K3
1.3	To state the scientific report supported with obtained results and conclusion	S2, K3
2	Skills:	
2.1	To develop experience in searching and assessing current literature.	S1, S3
2.2	To analyze obtained data independently with supervisor guidance and to explain obtained results through scientifically logic thinking, with evaluation of the gained information.	S1, S3, S4;K4
2.3	To interpret the different results taken from various techniques used.	S1, S3, S4
3	Values	
3.1	To illustrate the active participation by oral discussion, to demonstrate creative and innovative approaches to his (her) research project subject.	S1, V1, V2
3.2	To show ability to communicate effectively with the supervisor, to revise and improve written and visual content and use appropriate technology to achieve desired outcomes, to comprehend information accessed through reading and discussion.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	Collection a background and literature review on the suggested work.	10
2	The student carries out a guided independent study with review of research background and literatures in selected topic in chemistry. The project can be done with laboratory work.	72

3	**Discussion by oral presentation**	**2**
Total		**48**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recall basic concepts and knowledge to initiate the graduation project**	• Four hours are weekly containing literature survey with supervisor guidance. • Students are encouraged to make regular visits during office hours where they can ask any question about the course.	• Continuous evaluation of the research supervisor • Written the collected the literature survey • Oral Discussion
1.2	**To list the scientific approach for interpreting the obtained data, to describe the obtained results in appropriate form, to outline in-depth knowledge of currently active research areas in Chemistry**	• Four hours are weekly containing laboratory activities under supervisor guidance. • Think and talk to interpret the obtained results.	• Continuous evaluation of the research supervisor • Self-interpreting check with the supervisor • Oral Discussion
1.3	**To state the scientific report supported with obtained results and conclusion**	Practice the scientific writing of the project with aid of the supervisor.	• Self- Written report • Oral Discussion
2.0	**Skills:**		
2.1	**To develop experience in searching and assessing current literature.**	Independent developing under the guidance of the research supervisor through under discussion weekly.	• Continuous evaluation of the research supervisor • Written report • Oral discussion
2.2	**To analyze obtained data independently with supervisor guidance and to explain obtained results through scientifically logic thinking, with evaluation of the gained information.**	Independent data analysis under the guidance of the research supervisor including further discussion.	• Continuous evaluation of the research supervisor • Written report • Oral discussion
2.3	**To interpret the different results taken from various techniques used.**	Laboratory experiments and self-study	• Laboratory reports • Oral discussion
3.0	**Values**		
3.1	**To illustrate the active participation by oral discussion, to demonstrate**	• Motivate students to discuss the	Oral Discussion.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	creative and innovative approaches to his (her) research project subject.	graduation project topic. • Oral discussions	Continuous evaluation of the research supervisor Oral presentation marks
3.2	**To show ability to communicate effectively with the supervisor, to revise and improve written and visual content and use appropriate technology to achieve desired outcomes, to comprehend information accessed through reading and discussion.**	• Independent study under the guidance of the research supervisor with further discussion with supervisor weekly. • Simulation of presentation monitored by the supervisor.	Oral Discussion. Continuous evaluation of the research supervisor Written report.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**First continuous evaluation (reported by the supervisor)**	**4th week**	**20%**
2	**Second continuous evaluation (reported by the supervisor)**	**9th week**	**30%**
3	**Written report in English (20-35 pages)**	**During the semester**	**20%**
4	**Short talk in English language (oral presentation 15 minutes)**	**13th week**	**30%**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **Each student admitted to the bachelor program will be assigned an academic advisor to give him the appropriate academic counselling and support.**
- **The lecturer for each course will allocate 6 office hours per week, these times will be advertised on the office door, and reserved by the instructor as part of his teaching schedule to help the students on any academic problems/difficulties.**
- **The student is able to get individual consultation and academic advice appointment with teaching staff via e-mail or phone calls.**

- A list of teaching staff members with their room numbers, their phone numbers and their e-mail addresses is given in the BSc. Chemistry Handbook and Department website.

F. Learning Resources and Facilities

Students will be guided by study notes, books, research articles and original sources (or English translations where necessary), which are provided. The students will need to master the appropriate chemistry and ultimately present his /her work in the form of a final presentation. Other appropriate learning resources are possible related to the nature of the research project.

1.Learning Resources

Required Textbooks	**Depending on Graduation Project Subject**
Essential References Materials	**Depending on Graduation Project Subject**
Electronic Materials	-
Other Learning Materials	-

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**Depending on Graduation Project Subject**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist- Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist- Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist- Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Industrial Inorganic Chemistry**
Course Code:	**CHM 1312**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

A. Table of Contents

B. Course Identification

1. Credit hours: 3(2 Lectures, 0 Tutorial, 2 Lab)	
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑	
3. Level/year at which this course is offered: Level 9/Year 3	
4. Pre-requisites for this course (if any)**: Organometallic Chemistry(1) - CHM 1313**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	48	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	24
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	48

C. Course Objectives and Learning Outcomes

1. Course Description:

Topics covered in the course include the introduction on the Ceramics, in terms of classification, the raw materials, and advanced process in the ceramic industries. The course will extend the Cement industry, Glasses and the Manufacturing procedure. Metallurgical Processes and Metals is one of the topics that will cover in this course.

2. Course Main Objective: ***This course is entended:***

- To enrich the student's knowledge of the basic information for industrial requirements and methods of preparation relevant to inorganic chemistry industries.
- To develop awareness on the contributions of chemistry to industry KSA.
- To disclose on the range and scope of the Saudi chemical industry relevant to provision of Silicate products, construction materials, oxide ceramics, and related industries

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To recognize the basic information of inorganic industrial chemistry.**	**K1, K3**
1.2	**To list the types of ceramics, glass, cements and metallurgy**	**K1, K2, K3**
1.3	**To outline environmentally harmful substances and materials.**	**K1, K2**
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	**K4**
2	**Skills :**	
2.1	**To differentiate between different industries using inorganic compounds and explain methods of preparation of industrial inorganic commodities.**	**S1, S2**
2.2	**To interpret the correct equations for synthesis of the different industrial compounds.**	**S1, S3**
2.3	**To evaluate the wastes of water by different treatment methods.**	**S1, S3**
2.4	**To diagram and illustrate experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	**S1,S2, S3, S4**
3	**Values:**	
3.1	**To appraise teamwork, and create awareness to maintain scientific integrity during different assessments, projects, and mini reports.**	**V1, V2**

D. Course Content

No	List of Topics	Contact Hours
	Topics to be covered (Lectures and Tutorial)	
1	**Primary Inorganic Materials, Water: Water:** Economic Importance, Production of Potable Water, Filtration, Production of Soft or Deionized Water, Water Hardness and its treatment Nitrogen, Phosphorus, and Potash: Nitrogen-Containing Fertilizers: Economic Importance, General Information Importance of Ammonium Sulfate, Importance of Ammonium Nitrate, Importance of Urea, Manufacture of Nitrogen-Containing Fertilizers. Phosphorus and its Compounds, Phosphorus and Inorganic Phosphorus Compounds, Products, Phosphoric Acid, Phosphoric Acid Salts, Phosphorus. Potassium-Containing Fertilizers: Occurrence of Potassium Salts, Economic Importance of Potassium-Containing Fertilizers, Manufacture of Potassium-Containing Fertilizers N-P-K fertilizer: sources and forms of fertilizers.	6
2	**Sulfur and Sulfur Compounds:** Sulfur and Sulfur Compounds: Sulfur, Economic Importance, Applications, Sulfuric Acid, Starting Materials for Sulfuric Acid Manufacture, Sulfuric Acid from Sulfur Dioxide Alkalis and Related Products: Lime and gypsum Burning. Portland Cement, Cement phases, Manufacture, hydration, types, factors affecting on the hydration. Soda Ash, Caustic Soda, The Chloralkali Industry. The Halogens: The Chlorine, Chlorofluorocarbons. Oxides and Oxoacids of Chlorine. Fluorine and Fluorine Compounds. Bromine and Iodine, Extraction, Uses and Hazards of Bromine.	6
3	**Ceramics and Glass:** Ceramics, Classification of Ceramics, Traditional Ceramics, Advanced Ceramics, Ceramics Raw Materials, Ceramic Manufacturing Processes, Advanced Processes. Glass, Composition of glass, Different varieties of glass, Special glasses, Properties of glass, Glass Raw materials, Chemical reactions of the formation, Manufacturing procedure.	6

4	**Extractive Metallurgy:** Extractive Metallurgy: Gravity and Flotation Methods of Ore Concentration, Hydrometallurgical Concentration and Separation, Separations Utilizing Special Properties, Electrolytic Reduction of Concentrate, Chemical Reduction of Concentrate, Pyrometallurgy of Oxides. Iron Production, Steelmaking. Pyrometallurgy of Halides and Sulfides. Titanium and Titanium Dioxide. Silicon. Metal Sulfides. Copper, Extraction.	**6**
Total		**24**
Topics to be covered (Laboratories)		
1	Introduction: Analysis of calcium Carbonate Minerals	**2**
2	Analysis of calcium Carbonate Minerals: Determination of the percentage of loss on ignition	**2**
3	Determination of the Impure silica or acid insoluble matter	**2**
4	Determination of the amount of combined oxides impurities in carbonate ore	**2**
5	Determination of the amount of calcium in limestone	**2**
6	Determination of the water contents in cements: Determination of total water content, (Wt) & Determination of chemically combined water, (Wn):	**2**
7	Determination of Free water, (We):	**2**
8	Determination of available lime or free CaO in Cement	**2**
9	Preparation of glass and coloured glass & Colouring of glass sheet	**2**
10	Characterization and physical properties of glass & Determination of the durability of glass	**2**
11, 12	Revision	**4**
Total		**24**

E. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic information of inorganic industrial chemistry.**	Lecturing	Short quizzes
1.2	**To list the types of ceramics, glass, cements and metallurgy**	Lecturing and oral discussion	Homework and assignment marks and written exams
1.3	**To outline environmentally harmful substances and materials.**	Discussions, Laboratory classes	Quizzes and MCQs, laboratory report
1.4	**To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.**	Lecturing and oral discussion Laboratory classes	
2.0	**Skills**		
2.1	**To differentiate between different industries using inorganic compounds and explain methods of preparation of industrial inorganic commodities.**	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	**To interpret the correct equations for synthesis of the different industrial compounds.**	Lectures supported by laboratory experiments	Homework assignment, Examination and laboratory sheet
2.3	**To evaluate the wastes of water by different treatment methods.**	Lecturing and oral discussion supported by laboratory experiments	Examination and laboratory report
2.4	**To diagram and illustrate experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.**	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values**		
3.1	**To appraise teamwork, and create awareness to maintain scientific integrity during different assessments, projects, and mini reports.**	• Group discussion, assignments and homework • Lab-reports • Virtual labs and demonstrations	• Oral tests, lab performance, Lab-reports and sheets Marks • Assignments and homework marks

2. **Assessment Tasks for Students**

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Homeworks**	**All the semester**	**10 %**
2	**Laboratory**	**All the semester**	**30 %**
3	**Midterm Exam 1**	**5th week**	**10 %**
4	**Midterm Exam 2**	**8th week**	**10%**
5	**Final Exam**	**13thweek**	**40 %**
6	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

F. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : • **There are 2 office hours per week reserved by each staff member, planned on his timetable, to help the students to solve their problems.** • **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counselling.**

Learning Resources and Facilities

1. **Learning Resources**

Required Textbooks	• ***Industrial Inorganic Chemistry*** , Karl H. Buchel, Hans H. Moretto and Peter Woditsch, , 2nd Ed. WILEY-VCH Verlag, CmbH. D-

	69469 Weinheim (Federal Republic of Germany), 2000 ,(ISBN: 3-527-29849-5
Essential References Materials	• ***Applied Chemistry, Theory and Practice***, O.P. Vermani, A.K. Narula, 2nd ed., 1995, New Age International (P) Ltd., Publishers Published by New Age International (P) Ltd., Publishers, ISBN (13) : 978-81-224-2494-2
Electronic Materials	• Blackboard • http://www.chemistrylecturenotes.com/html/electrochemistry.html
Other Learning Materials	**Non**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cyliders, curecibles, dishes, funnels, buchner, buchner flasks)** • **Appropriate fine chemicals and solvents (Calcium Carbonate, Silica. Carbonate ore, Cement)** • **Furnace Oven, Analytical balance (3 digits), Drying oven** • **Filter papers , clamps, stands**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Indirect: External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review- Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Medicinal Chemistry
Course Code:	CHM 1323
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours: 3 (3 Lectures, 0 Lab, 0 Tutorials)	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☐ Elective ☑	
3. Level/year at which this course is offered: Level 9 / Year 3	
4. Pre-requisites for this course (if any)**:** Heterocyclic Chemistry - CHM 1321	
5. Co-requisites for this course (if any)**:** None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides students with an introduction to chemical principles that are required to understand the action and behavior of drug compounds and hence the relationship between the structure of a compound and its chemical and therapeutic properties, and thus the chemical considerations in drug design. Methods of drug discovery will be described and will include Drug-Target Interactions, Review of Organic Functional Groups and Acid-Base Concepts, Fundamentals of Neurochemistry, Enzymes as Drug Targets, Receptors as Drug Targets, and Selected Examples of Drug Action at some Common Target Areas.

2. Course Main Objective

- To introduce the structure and properties of medicinal agents with a short cut about its metabolites.
- To provide the basic knowledge of the relationship between different classes of organic compounds based on their chemical structures and their activities.

- To become more familiar with drug-receptor interaction, types of chemical functions involved in drug-receptor interaction.
- To rationalize the structure-activity relationship (SAR), in terms of chemistry structures and the mode of action on the target.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	**Knowledge and Understanding**	
1.1	**To recognize the principles of medicinal chemistry and drug discovery**	**K1; K3;**
1.2	**To outline pharmacological activity of several major groups of drugs**	**K1; K3; S2**
1.3	**To state all aspects of the drug discovery process, from lead compound discovery to the optimization of biological activity**	**K3; S1**
1.4	**To list important human diseases and assess current therapeutic approaches.**	**K3; S1**
2	**Skills:**	
2.1	**To evaluate the chemical structures information and pharmacological activity relations**	**K1, K3, S1, S2**
2.2	**To predict the pharmacological activity based on chemical function group**	**S1, S2, S3**
2.3	**To interpret the mode of action of organic compounds**	**S1, S3**
2.4	**To summarize different approaches for target lead compounds**	**S1; S3; S4**
3	**Values:**	
3.1	**To show intellectual and scientific integrity during assignments, projects, and reports**	**V1; V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Course Introduction and Importance of Medicinal Chemistry:** Understanding Drug Action, Drug Discovery and Development process, List of physico-chemical properties related to drug	**3**
2	**Target Interactions:** Structural Effects on Biological Action, Role and Types of Chemical Bonding Interactions between Drug and Target, Binding of Neurotransmitters to Their Receptors.	**7**
3	**Review of Organic Functional Groups and Acid-Base Concepts:** Chemical bonding, Functional groups, Electron donating and withdrawing groups, Acids and bases, Henderson-Hasselbach equation; Estimating, pKa and pKb; Heterocycles	**4**
4	**Fundamentals of Neurochemistry:** Structures, Chemical Properties, Metabolism, and Actions of Select Neurochemicals Including Acetylcholine, Epinephrine, Norepinephrine, Dopamine, Serotonin, Glutamate, GABA, and Nitric Oxide) and of Nicotine**.**	**4**

5	**Enzymes as Drug Targets:** brief review of amino acids, protein structure, enzyme classes, Mode of Action: theory of enzyme catalysis, Regulation Kinetics: Multisubstrate mechanisms Inhibitors: Reversible, Irreversible inhibitors, Pharmaceutical Concerns: Ki and IC50.	**4**
6	**Oligonucleotides as Drug Targets:** Nucleic Acids: brief review of DNA/RNA structure/function, Oligonucleotide Recognition: base pairing, electrostatics, intercalation, groove binding, Interference with Nucleic Acid Synthesis and Function.	**7**
7	**Selected Examples of Drug Action at some Common Target Areas:** Examples of drugs that disrupt cell membranes and walls Antifungal agent, Antibacterial apents , Ionophoric antibiotic action ,Cell wall synthesis inhibition, Drugs that target enzymes, Reversible inhibihors, Irreversible inhibition, Transition state inhibitors, Drugs that target receptors Agonists , Antagonists, Partial agonists, Drugs that target nucleic acids, Antimetabolites, Enzyme inhibitors, Intercalation agents, Alkylating agents, Antisense drugs, Chain cleaving agents Antiviral drugs.	**7**
Total		**36**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the principles of medicinal chemistry and drug discovery**	• Three hours are weekly containing lectures. • A Private study including work on the home exam. • Students are encouraged to make regular visits during office hours where they can ask any question about the course.	• Quizzes Assignments • Oral Discussion • Participation.
1.2	**To outline pharmacological activity of several major groups of drugs**	• Three hours are weekly containing lectures with group discussion. • A Private study including work on the homework. ▪	• Assignments. • Quizzes. • Final exam. •

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.3	**To state all aspects of the drug discovery process, from lead compound discovery to the optimization of biological activity**	• Three hours are weekly containing lectures with group discussion. • A Private study including work on the homework. ▪ Think and talk about Lead Drug Discovery approach and biological optimizations.	• Midterms. • Assignments. • Oral test • Quizzes. • Final exam.
1.4	**To list important human diseases and assess current therapeutic approaches.**	• Three hours are weekly containing lectures with group discussion. ▪ Think, talk and discuss about therapeutic treatment of human diseases.	• Midterms. • Assignments • Oral Discussions. • Quizzes. ▪ Final exam.
2.0	**Skills**		
2.1	**To evaluate the chemical structures information and pharmacological activity relations**	• Lectures activity • Think and talk about the chemical structures and pharmacological activity	• Questions in Lectures. • Short Quizzes and Exams. ▪ Participation through Class work and Homework.
2.2	**To predict the pharmacological activity based on chemical function group**	▪ Introduce some concepts of Structure activity relationship	• Questions in Lectures. • Short Quizzes and Exams. • Participation through Oral Discussion and Homework.
2.3	**To interpret the mode of action of organic compounds**	▪ Encourage students to exchange their chemical thinking, and to work and discuss cooperatively with their peers to develop individual skills.	• Questions in Lectures. • Short Quizzes and Exams. ▪ Participation through Oral Discussion and Homework.
2.4	**To summarize different approaches for target lead compounds**	▪ Could ask and answer questions as they arise.	• Questions in Lectures. • Short Quizzes and Exams. • Oral Presentation

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
			• Participation through Oral Discussion and Homework.
3.0	**Values**		
3.1	**To show intellectual and scientific integrity during assignments, projects, and reports**	▪ Group Discussion and Assignments.	▪ Oral Tests and Assignments Marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**All the semester**	**20 %**
2	**Midterm Exam 1**	**5th week**	**20 %**
3	**Midterm Exam 2**	**8th week**	**20 %**
4	**Final Exam**	**13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**1.** ***Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry*****, Beale** Jr.,John M., Block, John, LWW; 12 edition (March 2, 2010), ISBN10: 0781779294 **2.** ***Textbook of Drug Design and Discovery*****,** Stromgaard, K, Krogsgaard-Larsen, P., Madsen, U, CRC Press; 4 edition, 2009, ISBN-10: 1420063227
Essential References Materials	***Essential of Pharmaceutical Chemistry,*** Cairns, D., Pharmaceutical Press; 3rdRevised edition, 2008, ISBN-10: 0853697450
Electronic Materials	• **Blackboard** • **Journal of Medicinal Chemistry, ACS** • **Organic Letters, ACS** • **Organic and Biomolecules Chemistry, RSC** • **European Journal Of Medicinal Chemistry**

	• http://www.sigmaldrich.com • European Journal Of Pharmaceutical Chemistry • ACS Medicinal Chemistry Letters
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Food Chemistry**
Course Code:	**CHM 1326**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: **3 (3 Lectures, 0 Lab, 0 Tutorials)**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☐ Elective ☑	
3. Level/year at which this course is offered: **Level 9 / Year 3**	
4. Pre-requisites for this course (if any)**: Heterocyclic Chemistry - CHM 1321**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

In this module, the students will study the following topics: Water and water quality, carbohydrates, amino acids and proteins, lipids and oils, minerals and vitamins, food quality control.

2. Course Main Objective

At the end of this course the student will be able to:

- The aim of the course is to give students information dealing with main analytical approaches useful to assess purity and quality of selected foods, namely waters, fats and oils, dairy products and honey.
- Practical exercised will be performed ,too and each student will individually carry out some analytical evaluation on authenticfood samples.
- The course prepares students to compete in jobs related to food industry.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	To recognize the basic principles of food analysis	K1; K3;
1.2	To list the components of food and their experimental determinination procedures.	K1; K3; S2
1.3	To describe ways of food contamination and ways of its detection.	K3; S1
2	Skills:	
2.1	To develop ways to avoid food contamination.	K1, K3, S1, S2
2.2	To differentiate between saturated and unsaturated fat	S1, S2, S3
2.3	To analyze reports about a real cases of food pollution	S1; S3
3	Values:	
3.1	To show intellectual and scientific integrity during assignments, projects, and reports	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	Source, functions of food – food groups – food guide – basic five food groups.	3
2	Water: Purification processes – Ion exchangers, reverse osmosis, activated charcoal treatment. Use of chlorination, ozone, and UV light disinfection. Specification of drinking water.	3
3	Proteins: amino acids – peptides – proteins animal and plant sources, Analysis of proteins – principles in the determination of moisture content, ash content, nitrogen content. Milk: Composition and effectiveness as a diet. Fat content in milk.	4
4	Classification, structure and reactions of monosaccharides, sucrose and starch.	3
5	Lipids: nomenclature and classification. Emulsions and emulsifiers, rancidity of fats – chemistry of fat and oil processing – function and storage of fats. heat treatment on the nutritive value of oilseeds, nuts and oil-seed meals.	3
6	Minerals and vitamins: Sources, functions, bioavailability and deficiency of the following minerals (calcium, iron, iodine, fluorine, sodium and potassium (elementary treatment). Vitamins - classification, sources, functions and deficiencies of fat- soluble vitamins – A, D, E and K, water-soluble vitamins – C.	7
7	Beverages: Soft drinks, fruit juices, carbonation	3

8	**Food additives: Artificial sweeteners – saccharin– food flavours – esters. Antioxidants. Food colours.**	**3**
9	**Adulterants: Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals. Principles involved in the analysis of detection and prevention of food adulteration.**	**3**
10	**Quality control: Specifications and standards: PFA, FPO, FDA, drug license, WHO standards, ISI specifications, packing and label requirements, essential commodities act, consumer protection act. AGMARK**	**4**
Total		**36**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic principles of food analysis**	• Three hours are weekly containing lectures, and Oral Discussion. • A Private study including home exam.	• Quizzes Assignments • Oral Discussion • Participation.
1.2	**To list the components of food and their experimental determinination procedures.**	▪ Three hours are weekly containing lectures, and group discussion	▪ Quizzes Assignments. • Oral Discussion marks
1.3	**To describe ways of food contamination and ways of its detection.**	▪ Think and talk about food Chemistry	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
2.0	**Skills**		
2.1	**To develop ways to avoid food contamination.**	• Lectures activity , • Think and talk about Biosynthesis of natural products	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Home Exam.
2.2	**To differentiate between saturated and unsaturated fat**	▪ Introduce some examples on the bioactivity properties of some natural products	• Questions in Lectures. • Short Quizzes and Exams.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.3	To analyze reports about a real cases of food pollution	• Lectures, and Group discussion ▪ Brainstorming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams.
3.0	Values		
3.1	To show intellectual and scientific integrity during assignments, projects, and reports	▪ Group Discussion and Assignments.	▪ Oral Tests and Assignments Marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes, Attendance, Participation, Home Exams	All the semester	20 %
2	Midterm Exam 1	5th week	20 %
2	Midterm Exam 2	8th week	20 %
3	Final Exam	13th week	40 %
4	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: • There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems. • Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	*Food Analysis Laboratory Manual,* S. Suzanne Nielsen, 4th Edition, 2010. Springer Science &Business Media ISBN 978-1-4419-1477-4.
Essential References Materials	1. *Food science,* Norman N. Potter, 5th ed, 2007. CBS publishers and distributors, New Delhi. 1994 ISBN 10: 812390472X / ISBN 13: 9788123904726.

	2. ***Food Chemistry, Owen R Fennema***, 3rd Edition 1996, Marcel Decker Inc., New York. 1996. ISBN 10: 0824793463 / ISBN 13: 9780824793463
Electronic Materials	• **Blackboard**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA

T4

2020

Course Specifications

Course Title:	**Environmental Chemistry**
Course Code:	**CHM 1334**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**3(2 Lectures, 0 Tutorial, 2 Lab)**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Level 9 / Year 4**
4. Pre-requisites for this course (if any)**:**	**Instrumental Analysis - CHM 1332**
5. Co-requisites for this course (if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	48	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	24
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (specify)	0
	Total	48

B. Course Objectives and Learning Outcomes

1. Course Description

The objective of this course is to provide the student with an understanding of the fundamental chemical processes that are central to important environmental problems. On the other hand, students are encouraged to utilize this knowledge in making critical evaluations of these problems.

2. Course Main Objective

At the end of the course, students should be able to:

- Understand the fundamental concepts of environmental chemistry.
- Develop awareness of the impact of environmental problems and ways to reduce them.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	

	CLOs	AlignedPLOs
1.1	To list the components of the environment and recognize the chemistry of soil, air, and water and to outline the mechanisms by which pollutants can affect their qualities..	K1, K3
1.2	To name the important tropospheric processes, photochemical smog and acid precipitation	K1, K2
1.3	To state some scientific methods employed in environmental chemistry.	K2, K3
1.4	To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.	K4
2	Skills:	
2.1	To compare methods to determine the extent of environmental pollution and to summarize method of environment monitoring.	S1, S2, S3
2.2	To analyze the factors affecting the impact of industry and waste disposal upon the environment.	S2, S3
2.3	To interpret experimentally pollution products and reactivity, as well environmental fates of organic and inorganic toxins.	S2, S4
2.4	To evaluate oral communication skills by presenting seminars, and written reports about real pollution cases via electronic mail and Network skills with others	S2, S3
3	Values:	
3.1	To appraise coordination in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	**Environmental Chemistry of water:** Definition of the environment and its components - general introduction to environmental chemistry - properties and sources of water - aquatic chemistry - nitrogen oxides in atmosphere - metal ions and calcium- oxidation reduction - complexation and chelation.	3
2	**Water pollution:** Nature and types of water pollutants - elemental pollutants - heavy metals - metalloids - organic and inorganic species - acidity, alkalinity and salinity - oxygen, oxidants and reductants - pesticides, polychlorinated biphenyls and radionuclides in aquatic environment.	3
3	**Water treatment:** Water treatment and water use - municipal water treatment - treatment of water for industrial use - sewage water - industrial water treatment - removal of solids - removal of calcium and other metals - removal of dissolved organics and inorganics - sludge - water disinfection - water reuse and recycling.	3
4	**The atmosphere and atmospheric chemistry:** Atmosphere - chemistry of atmosphere - importance of atmosphere - physical characteristics of atmosphere - inversions and air pollution - chemical and photochemical reactions in the atmosphere - acid base reaction in the atmosphere - reactions of atmospheric oxygen - reactions of atmospheric nitrogen.	3
5	**Inorganic air pollutants**	2

	Carbon dioxide - sulfur dioxide sources and sulfur cycle - nitrogen oxides in atmosphere - acid rain - fluorine chlorine and their gaseous compounds**.**	
6	**Organic air pollutants and photochemical smog:** Pollutant hydrocarbons - photochemical smog - smog-forming automotive emission - smog-forming reactions of organic compounds in the atmosphere - mechanism of smog formation	**2**
7	**Soil environmental chemistry:** Nature and composition of soil - acid-base and ion exchange reactions in soils - nitrogen, phosphorus and potassium in soils - fertilizers - waste and pollutants in soil - preparation of waste for disposal.	**2**
8	**Toxicological chemistry:** Introduction to toxicology and toxicological chemistry - dose-response relationship - toxic elements and elemental forms - toxic inorganic compounds - toxicological chemistry of organic compounds - application of nanomaterials for toxins removal from water - The impact of environmental pollution on human health.	**2**
9	**Industrial Ecology, Resource and Energy:** Metal resource and ecology - world energy resource - energy conservation - petroleum, coal and natural gas - nuclear fission and fusion - the sun energy and energy from biomass	**2**
10	**Environmental analysis:** Introduction of environmental chemical analysis - analysis of water samples - classical methods of water analysis - instrumental methods of water analysis - analysis of waste and solids - atmospheric monitoring - environmental hazards assessment.	**2**
	Total	**24**

Topics to be covered (Laboratories)		
Lab 01	Sampling Techniques of solid and liquid Environmental samples	**2**
Lab 02	Alkalinity and Acidity of Water	**2**
Lab 03	Determination of Total Hardness in Water	**2**
Lab 04	Determination of Chloride Content in Soil, Tap and ground Water Samples by the Mohr Method	**2**
Lab 05	Spectrophotometry, Colorimetry and Absorption Spectra: Determining Iron in Natural Waters and Sediments	**2**
Lab 06	Chemical Oxygen Demand (COD)	**2**
Lab 07	Determination of Total Organic Matter in Soil, Sludge and Waste Water	**2**
Lab 08	Determination of Sodium Na and Potassium K Contents in Environmental Samples by Flame Atomic Emission Spectroscopy (FAES)	**2**
Lab 09	Analysis of Metals (Ca, Mg, Pb and Cu) by Flame Atomic Absorption Spectroscopy	**2**
Lab 10	Determination of dissolved oxygen in sea water by Winkler titration	**2**
Lab 11, 12	Revision	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.1	To list the components of the environment and recognize the chemistry of soil, air, and water and to outline the mechanisms by which pollutants can affect their qualities..	Lecture	Oral tests and MCQs Assays markets Quizzes and homework
1.2	To name the important tropospheric processes, photochemical smog and acid precipitation	Lecture and group discussions	Exams and lab reports
1.3	To state some scientific methods employed in environmental chemistry.	Lecture and group discussions	Oral tests and MCQs
1.4	To define the principles of safety, list of emergency responses and outline the routes of exposures to hazards, the minimization, and controlling and laboratory management.	Lecture and group discussions	Oral tests and MCQs
2.0	Skills:		
2.1	To compare methods to determine the extent of environmental pollution and to summarize method of environment monitoring.	• Lectures and group discussion • Brain storming and group discussion	Oral tests Assays and oral questions
2.2	To analyze the factors affecting the impact of industry and waste disposal upon the environment.	• Brain storming	Quizzes
2.3	To interpret experimentally pollution products and reactivity, as well environmental fates of organic and inorganic toxins.	• Group discussion and laboratory sessions	Lab reports
2.4	To evaluate oral communication skills by presenting seminars, and written reports about real pollution cases via electronic mail and Network skills with others	• Group discussion and laboratory sessionsLaboratory experiments	Lab reports
3.0	Values:		
3.1	To appraise coordination in teamwork and raise Knowledge during various evaluations, initiatives, and Lab-reports to uphold scientific integrity.	▪ Group Discussion and Assignments.	▪ Oral Tests and Assignments Marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	10 %
2	Midterm 2	8^{th} week	10%
3	Quizzes, Attendance, Participation and Home works	All the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13^{th} week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Environmental Chemistry***, Stanley A. Manahan, 7th ed., 2000, Boca Raton: CRC Press LLC: ISBN: 978-1-4398-3276-9. • ***CV: https://www.smashwords.com/profile/view/manahans***
Essential References Materials	• ***Elements of environmental chemistry,*** Donald and Hites, John Wiley & sons, Inc. New York, ISBN 978-0-471-99815-0 ISBN 978-0-471-99815-0 • **Cv:https://oneill.indiana.edu/faculty-research/directory/profiles/faculty/full-time/raff-jonathan.html** • ***Environmental soil and water chemistry, principles and applications*** V. P. Evangelou, John Wiley & Sons, Inc. New York. ISBN: 978-0-471-16515-6 • ***Cv:https://www.wiley.com/en-us/Environmental+Soil+and+Water+Chemistry:+Principles+and+Applications-p-9780471165156***
Electronic Materials	▪ Blackboard ▪ http://www.chemistry.college.hmco.com
Other Learning Materials	**NONE**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **Each Laboratory should be equipped with maximum 25 seats**

Item	Resources
	• In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	• The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (burrete, pipets, conical flasks, beakers, measuring cyliders, dishes, funnels) • Flame Atomic Emission Spectroscopy (FAES), Spectrophotometry, Chemical Oxygen Demand (COD) apparatus, Analytical balance (3 digits), Drying oven • Filter papers , clamps, stands

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Material Science**
Course Code:	**CHM 1344**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 3 (2 Lectures, 0 Tutorials, 2 Lab)							
2. Course type							
a.	University		College		Department	✓	Others
b.	Required		Elective	✓			
3. Level/year at which this course is offered: Level 9 / Year 3							
4. Pre-requisites for this course: Physical chemistry 2– CHM 1242							
5. Co-requisites for this course (if any): None							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	48	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	24
2	Laboratory/Studio	24
3	Tutorial	0
4	Others (Mini-reports, Midterm, Final Exam)	0
	Total	48

B. Course Objectives and Learning Outcomes

1. Course Description

The topics covered in this course include: Types of structural and functional materials, binary phase diagrams of metals and alloys, microstructure analysis, physical and mechanical properties of materials, heat treatment processes, welding of materials, materials inspections, destructive and nondestructive testing of materials, and applications of engineering materials.

2. Course Main Objective

1-Describe the classifications of different types of materials.

2-Explain the different fabrication methods of structural and functional materials.

3-Use the binary phase diagrams to explain the possibilities of formation of different types of alloys, intermetallic compounds and composites.

4-Understand how the microstructure effects on the materials properties and behavior.

5-Predict fundamentals physical and mechanical properties of materials based on knowledge of their crystal structure and microstructure.

6-To study the different heat treatment and welding methods of metallic materials.

7-Describe the destructive and nondestructive techniques of testing materials. 8-Explain the different applications of engineering materials.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	To recognize the basic physical properties of materials based on knowledge of their structure.	K1, K2, K3
1.2	To describe the binary phase diagrams of metals and alloys and its correlation with the microstructure and properties.	K1, K2, K3
1.3	To recall the fundamentals of the change in the microstructure by the heat treatment processes.	K1, K3
2	Skills	
2.1	To develop different samples of materials and determine the microstructure, evaluate the physical and mechanical properties of different types of materials.	S1, S2, S3
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	S1, S2, S3
2.3	To evaluate oral communication and technical writing skills, with the capability of using electronic mail, and Networks in communicating with others	S3
2.4	To interpret diagram and explain experimental data during laboratory classes, demonstrate technical writing and oral communication skills, and operate electronic mail and network in communication with classmates and teachers.	S1; S3; S4; k4
3	Values	
3.1	To appraise collaborative work skill.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	• Types of structural and functional materials	3
2	• Fabrication techniques of different types of materials	5
3	• Binary and Iron/Carbon phase diagrams	5
4	• Microstructure analysis	3
5	• Heat Treatments and welding of metals and alloys	2
6	• Physical and mechanical properties of materials	4
7	• Nondestructive and destructive testing of materials	2
	Total	24
Topics to be covered (Laboratories)		
Lab. 1	• Safety and Laboratory equipment's and measurements and how to make a report. • Fabrication of Al intermetallic and copper solid solutions by casting method.	2

Lab. 2	• Fabrication of metal and polymer matrix composites by vortex and powder Technology.	**2**
Lab. 3	• Determination of the density and porosity content of porous materials.	**2**
Lab. 4	• Fabrication and annealing of ferro and ferri magnetic materials. • Electroless deposition and consolidation of nanocomposite materials.	**2**
Lab. 5	• Electrodeposition of laminated composite materials.	**2**
Lab. 6	• Measuring and estimation of the electrical and thermal conductivity of metallic materials.	**2**
Lab. 7	• Annealing and tempering of steel alloys.	**2**
Lab. 8	• Welding of low melting point metals and its alloys.	**2**
Lab. 9	• Metallographic and Microstructure investigations of metallic materials.	**2**
Lab. 10	• Measuring of mechanical properties (compression, fracture strength and hardness) of ceramic and metallic materials.	**2**
Lab 11, 12	• Revision	**4**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic physical properties of materials based on knowledge of their structure.**	**Lecture**	**Short quizzes**
1.2	**To describe the binary phase diagrams of metals and alloys and its correlation with the microstructure and properties.**	**Lecture and group discussions**	**Oral tests and MCQs, Homework**
1.3	**To recall the fundamentals of the change in the microstructure by the heat treatment processes.**	**Lecture and group discussions**	**Homework assignment marks, Oral test and Short quizzes.**
2.0	**Skills**		
2.1	**To develop different samples of materials and determine the microstructure, evaluate the physical and mechanical properties of different types of materials.**	**Lectures and laboratory experiments**	**Solved problem marks** **Short quizzes and Laboratory reports** **Numerical problem**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**Brain storming and self-study**	**Work portfolio and homework**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	To evaluate oral communication and technical writing skills, with the capability of using electronic mail, and Networks in communicating with others	Motivate students to ask questions and to give response.	Participation marks
2.4	To interpret diagram and explain experimental data during laboratory classes, demonstrate technical writing and oral communication skills, and operate electronic mail and network in communication with classmates and teachers.	• Oral participation • Group discussions and lab experiment and reports • Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	Values		
3.1	To appraise collaborative work skill	• Group discussion and assignments • homework • Lab-reports • Virtual labs and demonstrations	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	10 %
2	Midterm 2	8th week	10 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.
- Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Materials Science and Engineering: An Introduction*** 10th Edition, by William D. Callister Jr., David G. Rethwisch, Wiley, 2020, ISBN 978-1119721772
Essential References Materials	***Powder Metallurgy & Particulate Materials Processing*** **,**Randall M German, Metal Powder Industry, 2005, ISBN 9780976205715
Electronic Materials	• **Blackboard** • **https://bcs.wiley.com/he-bcs/Books?action=contents&itemId=1119405491&bcsId=10952** • **https://www.wilhelmsen.com/globalassets/marine-products/welding/documents/wilhelmsen-ships-service---unitor-welding-handbook.pdf**
Other Learning Materials	Strength of Materials: Fundamentals and Applications, T.D. Gunneswara Rao and Mudimby Andal Cambridge University Press, 2018, ISBN 9781108454285

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.** • **Each Laboratory should be equipped with maximum 25 seats** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, dishes, funnels)** • **Requested chemicals (polymer, ferro and ferri magnetic materials, available metallic materials.)** • **Power supply, LCR bridge for electrical measurements, mechanical test machine for mechanical properties measurements apparatus, Analytical balance (3 digits), Drying oven**

Item	Resources
	• Filter papers , clamps, stands

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Nuclear and Radiation chemistry
Course Code:	CHM 1415
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours: **3 (3 Lectures, 0 Tutorials, 0 Lab)**							
2. Course type							
a.	University		College		Department	✓	Others	
b.	Required		Elective	✓			
3. Level/year at which this course is offered: **Level 10/ Year 4**							
4. Pre-requisites for this course: **Electrochemistry and Corrosion/ CHM 1343**							
5. Co-requisites for this course (if any): **None**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (Mini-reports, Midterm, Final Exam)	0
	Total	**36**

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers the following topics: introduction to nuclear chemistry, types of radiations, nuclear reactions, kinetics of nuclear decay, half-life, reactors, radiation detection, isotope separation and applications.

2. Course Main Objective

Students should be able to:

- Improve their knowledge of the basic information of Radiation and Nuclear chemistry; requirements, methods of preparation, uses of Radioelements.
- Be aware of the contributions of chemistry to society
- Improve their knowledge of types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy, relationships, nuclear reactions, rates of radioactive decay, interaction of radiation with matter.
- Improve their knowledge of instrumentation and Introduction to health – physical applications in nuclear and radiochemistry.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	To recognize the basic information of radioactive and nuclear chemistry and to identify instrumentation and health applications in nuclear and radiochemistry.	K1, K2, K3
1.2	To list types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy.	K1, K3
1.3	To define environmentally harmful nuclear materials and name some applications of radio-isotopes.	K1, K3
2	Skills :	
2.1	To differentiate between the different types of radioactive decay and predict nuclides stability and nuclear reaction products.	S2, S3
2.2	To calculate the mass defect and binding energy for fission and fusion reaction.	S1, S2
2.3	To estimate ages of materials using carbon and uranium dating.	S1, S2
2.4	To develop effective written and oral communication skills, ability to present data in graphs through electronic mail, and Network skills with others	S1, S3
3	Values:	
3.1	To demonstrate teamwork, make a decision, and create awareness to maintain scientific integrity during different assessments, projects, and mini-reports.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	• Introduction, Nuclear binding energy, Mass defect and binding energy, The average binding energy per nucleon.	4
2	• Radioactivity, Nuclear emissions, Nuclear transformations, The kinetics of radioactive decay, Units of radioactivity, Artificial isotopes, Bombardment of nuclei by high-energy a-particles and neutrons, Bombardment of nuclei by 'slow' neutrons.	7
3	• Nuclear fission, The fission of uranium, The production of energy by nuclear fission, Nuclear reprocessing, Syntheses of transuranium elements, The separation of radioactive isotopes.	7
4	• Chemical separation, The Szilard–Chalmers effect, Nuclear fusion, Applications of isotopes, Infrared (IR) spectroscopy, Kinetic isotope effects, Radiocarbon dating, Analytical applications, Sources of 2H and 13C, Deuterium: electrolytic separation of isotopes.	4
5	• Carbon-13: chemical enrichment, Multinuclear NMR spectroscopy in inorganic chemistry, Which nuclei are suitable for NMR spectroscopic studies?	7
6	Chemical shift ranges, Spin–spin coupling, Stereochemically non-rigid species, Exchange processes in solution, Mo¨ ssbauer spectroscopy in inorganic chemistry, The technique of Mo¨ ssbauer spectroscopy, What can isomer shift data tell us?	7

Total	36
Topics to be covered (Laboratories)	
None	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	To recognize the basic information of radioactive and nuclear chemistry and to identify instrumentation and health applications in nuclear and radiochemistry.	Lecture	Short quizzes
1.2	To list types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy.	Lecture and group discussions	Oral tests and MCQs, Homework
1.3	To define environmentally harmful nuclear materials and name some applications of radio-isotopes.	Lecture and group discussions	Short quizzes oral tests, Homework
2.0	**Skills**		
2.1	To differentiate between the different types of radioactive decay and predict nuclides stability and nuclear reaction products.	• Group discussion Lectures	• Exams Quizzes
2.2	To calculate the mass defect and binding energy for fission and fusion reaction.	Group discussion and pair thinking	Oral tests and homework
2.3	To estimate ages of materials using carbon and uranium dating.	Self-study	Assay marks
2.4	To develop effective written and oral communication skills, ability to present data in graphs through electronic mail, and Network skills with others	• Seminars • Group discussion and assignments Encourage students to use electronic mail to submit homework and assignments.	• Oral tests and presentation marks • Assignments and homework marks Group competitions
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	To demonstrate teamwork, make a decision, and create awareness to maintain scientific integrity during different assessments, projects, and mini-reports. .	• Group discussions and assignment. • Homework • Mini-reports	• Oral presentation marks. • Assessments and homework marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	20 %
2	Midterm	8th week	20%
3	Quizzes, Homeworks, class participation, and mini projects	During the semester	20 %
4	Final Exam	13th week	40 %
5	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.
- Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Inorganic Chemistry,*** Catherine E. Housecroft and Alan G. Sharpe, 2nd ED. Pearson Education Limited, Essex CM20 2JE, England, 2005 (ISBN: 0130-39913-2)
Essential References Materials	• ***Inorganic Chemistry,*** Atkins, P., and Overton, T., Rourke, J., Weller, M., Armstrong, F. and Hagerman, M. 5th Ed. New York, NY: W.H. Freeman and Company, 2010 (ISBN: 978-1-42-921820-7)
Electronic Materials	▪ **Blackboard** ▪ **http://highered.mcgrawhill.com/classware/ala.do?isbn=0073048518&alaid=ala_1136810&protected=true&showSelfStudyTree=true** ▪ **http://www.chem1.com/acad/webtext/virtualtextbook.html** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each classroom is equipped with PC and retro projector with a maximum of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

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هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Bioorganic Chemistry**
Course Code:	**CHM 1424**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. **Credit hours:** **3 (3 Lectures, 0 Lab, 0 Tutorials)**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☐ Elective ☑	
3. **Level/year at which this course is offered:** **Level 10 / Year 4**	
4. **Pre-requisites for this course** (if any): **Heterocyclic Chemistry CHM 1321**	
5. **Co-requisites for this course** (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide students with a basic understanding of the chemical nature of biomolecules and biomacromolecules. As part of this course, students will be introduced to Bioorganic Chemistry of Amino Acids and Polypeptides discussing Organic Reactions and Biochemical Transformations. The course will extend to cover Enzyme Chemistry as a biocatalysts including Multifunctional Catalysis and Simple Models. Throughout the course , practical examples and visual aids will be employed in order to emphasize the significance and ramifications of the subject matter.

2. Course Main Objective

At the end of this course the student will be able to:

- Identify, classify and name of biochemical compounds in the living systems.
- Apply the knowledge of amino acids, peptides, their biochemical and physical properties as catalyst in biochemical process.
- Recognize the link between synthetic organic chemistry and enzyme catalyzed reactions
- Use the vocabulary on organic chemicals and reactions in metabolism and other biochemical applications
- Be familiar with chemical reaction mechanisms of enzyme-catalyzed reactions

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	Knowledge and Understanding	
1.1	**To recall Chemistry of Amino Acids and Polypeptides and its role in living systems. catalytic effect of enzymes in organic media**	**K1; K3;**
1.2	**To outline the chemical reaction mechanism during enzymatic and co-enzymatic process as a catalyst**	**K1; K3; S2**
1.3	**To describe the role of enzymes in Metal Ions in Proteins and Biological Molecules**	**K3; S1**
2	Skills:	
2.1	**To explain the role and synthesis of Amino Acids and Polypeptides in living systems**	**K1, K3, S1, S2**
2.2	**To evaluate the chemical process during the catalytic period of enzymes and co-enzyme as Multifunctional Catalysis and Simple Models**	**S1, S2, S3**
2.3	**To summarize different situations and problems in isolation of specific natural products group**	**S1, S3**
2.4	**To justify the molecular Devices in its sounding applications**	**S1; S3; S4**
3	Values:	
3.1	**To show intellectual and scientific integrity during assignments, projects, and reports**	**V1; V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to Bioorganic Chemistry:** Basic Considerations, Proximity Effects in Organie Chemistry, Molecular Adaptation Molecular Recognition and the Supramolecular Level.	**3**
2	**Bioorganic Chemistry of Amino Acids and Polypeptides**: Chemistry of the Living Cells, Analogy Between Organie Reactions and Biochemical Transformations, Chemistry of the Peptide Bond, Nonribosomal Peptide Bond Formation, Asymmetrie Synthesis of a-Amino Acids, Asymmetrie Synthesis with Chiral Organometallic Catalysts, Antibodies as Enzymes, Chemieal Mutations, Molecular Recognition and Drug Design.	**4**
3	**Enzyme Chemistry:** Introduction to Catalysis, Introduction to Enzymes, Multifunctional Catalysis and Simple Models, a-Chymotrypsin, Other Hydrolytic Enzymes, Stereo electronic Control in Hydrolytic Reactions, Immobilized Enzymes and Enzyme Technology, Enzymes in Synthetic Organic Chemistry, Enzyme-Analog-Built Polymers, Design of Molecular Clefts	**7**
4	**Enzyme Models:** Host-Guest Complexation Chemistry, New Developments in Crown Ether Chemistry, Membrane Chemistry and Micelles, Polymers 5.5	**7**

	Cyclodextrins, Enzyme Design Using Steroid Template, Remote Functionalization Reactions, Biomimetic Polyene Cyclization's	
5	**Metal Ions:** Metal Ions in Proteins and Biological Molecules, Carboxypeptidase A and the Role of Zinc, Hydrolysis of Amino Acid Esters and Amides and Peptides, Iron and Oxygen Transport	**7**
6	**Coenzyme Chemistry:** Oxidoreduction, Pyridoxal Phosphate, Suicide Enzyme Inactivators and Affinity Labels, Thiamine Pyrophosphate Biotin.	**4**
7	**Molecular Devices:** Introduction to Self-Organization and Self-Assembly 8.2 General Overview of the Approach, Specific Examples	**4**
Total		**36**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge and Understanding**		
1.1	**To Recall Chemistry of Amino Acids and Polypeptides and its role in living systems. catalytic effect of enzymes in organic media**	• Three hours are weekly containing lectures, and Oral Discussion. • A Private study including home exam.	• Quizzes Assignments • Oral Discussion • Participation.
1.2	**To Outline the chemical reaction mechanism during enzymatic and co-enzymatic process as a catalyst**	▪ Three hours are weekly containing lectures, and group discussion	▪ Quizzes Assignments. • Oral Discussion marks
1.3	**To Describe the role of enzymes in Metal Ions in Proteins and Biological Molecules**	▪ Three are weekly for Lectures activities ▪ Think and talk about Bioorganic Chemistry	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
2.0	**Skills**		
2.1	**To explain the role and synthesis of Amino Acids and Polypeptides in living systems**	• Lectures activity • Think and talk about Biosynthesis of Bioorganic Molecules.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Home Exam.
2.2	**To evaluate the chemical process during the catalytic period of enzymes and co-enzyme as Multifunctional Catalysis and Simple Models**	▪ Introduce some examples on the bioactivity properties of some Biomolecules	• Questions in Lectures. • Short Quizzes and Exams.
2.3	**To summarize different situations and problems in isolation of specific natural products group**	• Lectures, and Group discussion ▪ Brainstorming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams.

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.4	**To justify the molecular Devices in its sounding applications**	▪ Encourage the students to outline the molecular devices applications	▪ Assignments
3.0	**Values**		
3.1	**To show intellectual and scientific integrity during assignments, projects, and reports**	▪ Group Discussion and Assignments.	▪ Oral Tests and Assignments Marks

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Quizzes, Attendance, Participation, Home Exams**	**All the semester**	**20 %**
2	**Midterm Exam 1**	**5th week**	**20 %**
3	**Midterm Exam 2**	**8th week**	**20 %**
4	**Final Exam**	**13th week**	**40 %**
5	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Bioorganic Chemistry: A Chemical Approach to Enzyme Action,*** Hermann Dugas Christopher Penney, Springer , 1996, US, ISBN-13 : 978-1468400977 ***Bio-organic Chemistry*****,** Harish K. Chopra, Anupama Parmar, Parmjit S. Panesar, Alpha Science, 2012, ISBN: 9781842657737
Essential References Materials	***Organic Chemistry of Enzyme-Catalyzed Reactions,*** Richard B. Silverman, 2nd Edition, Academic Press, 2002. ISBN : 9780126437317
Electronic Materials	• **Blackboard**

Other Learning Materials	• Bioorganic & Medicinal Chemistry Letters • Bioorganic & Medicinal Chemistry • Tetrahedron asymmetry • Bioorganic Chemistry. • Saudi Digital Library

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey-Observations- Syllabus review-Accreditation review.
Lab Performance	Students	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Renewable Energy
Course Code:	CHM 1442
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. **Credit hours: 3 (3 Lectures, 0 Lab, 0 Tutorials)**								
2. Course type								
a.	University	☐	College	☐	Department	✓	Others	☐
b.	Required	☐	Elective	✓				
3. **Level/year at which this course is offered: Level 10 / Year 4**								
4. **Pre-requisites for this course: Electrochemistry and Corrosion- CHM 1343**								
5. **Co-requisites for this course** (if any): **None**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (Mini-reports, Midterm, Final Exam)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

Renewable Energy, an overview, fundamental of Renewable Energy Supply. Utilization of passive solar technology, solar thermal heat utilization, solar thermal power plants. Photovoltaic power generation, wind power generation, renewable energy generation in power system. Impact of renewable energy on frequency control and reliability, frequency response service from renewable energy. Renewable energy and electricity market, future towards a sustainable electric supply system.

2. Course Main Objective

At the end of the course, Students should be able:

- To understand the concept of renewable energies (in the history of mankind renewable energies have for a long time been the primary possibility of generating energy).
- To be aware of environmental, climate-friendly and social acceptable, alternatives suitable to cover the energy demand has become increasingly important.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**To recognize the concept of renewable energies.**	**K1, K2, K3**
1.2	**To list the side effects of fossil fuel use.**	**K1, K2, K3**
1.3	**To describe environmental, climate-friendly and social acceptable, alternatives suitable to cover the energy demand has become increasingly important.**	**K1, K3, K4**
2	**Skills :**	
2.1	**To evaluate the benefits of renewable energy economically and environmentally.**	**S1, S2, S3**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**S1, S2, S3**
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**
2.4	**To develop oral and network communication and technical writing skills through writing and oral presentation of mini reports, and to operate electronic mail and Network in communicating with others.**	**S1; S3; S4**
3	**Values:**	
3.1	**To illustrate teamwork, and create awareness to maintain scientific integrity during different assessments, projects, and mini reports.**	**V1, V2**

C. Course Content

No	List of Topics	Contact Hours
1	**Renewable Energy, an overview, fundamental of Renewable Energy Supply.**	**5**
2	**Utilization of passive solar technology, solar thermal heat utilization, solar thermal power plants.**	**9**
3	**Photovoltaic power generation, wind power generation, renewable energy generation in power system.**	**9**
4	**Impact of renewable energy on frequency control and reliability, frequency response service from renewable energy.**	**7**
5	**Renewable energy and electricity market, future towards a sustainable electric supply system.**	**6**
Total		**36**
Topics to be covered (Laboratories)		
None		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	To recognize the concept of renewable energies.	Lecture	Short quizzes
1.2	To list the side effects of fossil fuel use.	Lecture and group discussions	Oral tests and MCQs, Homework
1.3	To describe environmental, climate-friendly and social acceptable, alternatives suitable to cover the energy demand has become increasingly important.	Lecture and group discussions	Homework assignment marks, Oral test and Short quizzes.
2.0	Skills		
2.1	To evaluate the benefits of renewable energy economically and environmentally.	Lecture and oral discussions	Short quizzes and oral tests
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Brain storming and self-study	Oral test and presentation marks
2.3	To demonstrate skills to participate in class by asking questions and giving answers.	Motivate students to ask questions and to give response.	Work portfolio and homework
2.4	To develop oral and network communication and technical writing skills through writing and oral presentation of mini reports, and to operate electronic mail and Network in communicating with others.	• Seminars • Group discussions Encourage students to use electronic mail and blackboard to submit works and assessments.	Oral test and presentations marks
3.0	Values		
3.1	To illustrate teamwork, and create awareness to maintain scientific integrity during different assessments, projects, and mini reports.	• Group discussions • Homework • Mini reports and demonstrations	• Presentation marks • Oral tests • Assessments and homework

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	20 %
2	Midterm 2	8th week	20 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	20 %
4	Final Exam	13th week	40 %

#	Assessment task*	Week Due	Percentage of Total Assessment Score
5	**Total**		**100 %**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Renewable Energy: Technology, Economics and Environments',*** Martin Kaltschmitt, Wolfgang Streicher, Andreas Wiese: Springer 2007. ISBN-13: 978-3540709473
Essential References Materials	• ***Renewable Energy in Power Systems',*** Leon Freris, David Infield: ', Wiley 2008. ISBN: 978-0-470-01749-4
Electronic Materials	• **Blackboard** • **Internal server: \\10.10.70.70\ScienceShareFolder** • **http://www.shodor.org/UNChem/index.html**
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Each classroom is equipped with PC and retro projector with a maximum of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Indirect: Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Chemistry of Colloids**
Course Code:	**CHM 1444**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: **3 (2 Lectures, 0 Tutorials, 2 Lab)**			
2. Course type			
a. University ☐	College ☐	Department ✓	Others ☐
b. Required ☐	Elective ✓		
3. Level/year at which this course is offered: **Level 10 / Year 4**			
4. Pre-requisites for this course: **Electrochemistry and Corrosion– CHM 1343**			
5. Co-requisites for this course (if any)**:** **None**			

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	48	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	24
2	Laboratory/Studio	24
3	Tutorial	0
4	**Others** (Mini-reports, Midterm, Final Exam)	0
	Total	48

B. Course Objectives and Learning Outcomes

1. Course Description

The course will give knowledge about Colloidal State of matter: Classification, preparation and physical properties, Electro kinetic phenomena; Colloidal electrolytes and their uses, Emulsion; preparation, properties, stability and use.

2. Course Main Objective

At the end of the course, Students should be able:

- The course will improve student's knowledge about Colloidal State of matter: Classification, preparation and physical properties, Electrokinetic phenomena; Collodial electrolytes and their uses, Emulsion; preparation, properties, stability and use .
- Analyze data and results through analytical thinking, with evaluation of the gained information.
- Operate laboratory instruments, and diagram and illustrate experimentally obtained data.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding	
1.1	To define classification, and physical properties of colloids.	K1; K2; K3;
1.2	To describe the basic principles of colloids preparation, purification, theory of stability, instability and main types of stabilization.	K1; K2; K3
1.3	To state outline the electro-kinetic and optical properties of colloids.	K1
1.4	To outline the ultracentrifuge, sedimentation-diffusion equilibrium, Charge effects, Colligative properties, Osmotic pressure, Van's Hoff's law, the Donnan membrane effect, and viscosity.	K1; K3; K4
2	Skills :	
2.1	To calculate the adsorption parameters using problems and their solutions, and estimate kinetic, physical and optical parameters of colloidal systems.	S1; S2; S3
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	S1; S2; S3
2.3	To evaluate oral and network communication, technical writing skills through writing, oral presentation of mini reports	S3
2.4	To diagram and explain experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.	S2; S4; K4
3	Values:	
3.1	To appraise coordination and raise knowledge during various evaluations, initiatives, and mini reports to uphold scientific integrity.	V1; V2

C. Course Content

No	List of Topics	Contact Hours
1	History, component, dispersed phase, dispersion medium, micelles, aggregation, classification, Lyophilic , Lyophobic properties, Tyndall effect, Brownian movement, Zeta potential, electrophoresis. Preparation, dispersion method, Bredig's Electric Arc, mechanical dispersion, Ultrasonic Dispersion, peptization dispersion, Condensation or Aggregation Methods, Preparation of colloidal sol. Purification, Dialysis, Electrodialysis, Ultra-filtration, Ultra-centrifugation; Application and chemical impact, Colloid Chemistry .	6
2	Brownian motion, random walk, Brownian displacement equation, Diffusion, Fick's first law, diffusion coefficient, Einstein's equation. Sedimentation: driving force, liquid resistance, frictional coefficient, Stoke's law, sedimentation rate.	4
3	Ultracentrifuge, sedimentation-diffusion equilibrium, Charge effects. Colligative properties, Osmotic pressure, Van's Hoff's law The Donnan membrane effect, viscosity.	4

4	Light scattering: Tyndall effect, turbidity, size and shape, Debye scattering, Rayleigh Scattering, Molar Masses, Doppler Broadening. Ultramicroscope. micro electrophoresis. Electronmicroscope, the resolving power, the limit of resolution .	**4**
5	Theory of stability, instability, main types of stabilization, DLVO Theory, Electrostatic stability, Electric double layer, conditions for colloid stability, thermodynamic and kinetic aspects.	**6**
Total		**24**
Topics to be covered (Laboratories)		
Lab 01	**Introduction & Safety**	**2**
Lab 02	**Preparation of A hydrophobic colloidal sol: red color sol of $Fe(OH)_3$,** **Preparation of a colloidal solution (sol) of starch,**	**2**
Lab 03	**Emulsion and emulsifying agent, Rheological characterization of concentrated emulsions (creams),**	**2**
Lab 04	**Determination of the critical micelle concentration of SDS.**	**2**
Lab 05	**Measurement of surface tension of solutions by Du Nouy tensiometer.**	**2**
Lab 06	**Polymer's relative molecular masses from viscosity measurements**	
Lab 07	**Determination of size distribution of a sedimenting suspension,**	**2**
Lab 08	**Zeta potential measurements of dyes by paper electrophoresis,.**	**2**
Lab 09	**Study of adsorption of Methylene blue from solution on charcoal – Verification of Freundlich and Langmuir adsorption models.**	**2**
Lab 10	**Study of adsorption of acetic acid from solution on charcoal – Verification of Freundlich and Langmuir adsorption models,**	**2**
Lab 11	**Analysis of the experimental data obtained in Labs 7 and Lab 8.**	**2**
Lab 12	**Review**	**2**
Total		**24**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.1	To define classification, and physical properties of colloids.	Lecture	Short quizzes
1.2	To describe the basic principles of colloids preparation, purification, theory of stability, instability and main types of stabilization.	Lecture and laboratory experiments	Exams and lab reports
1.3	To state outline the electro-kinetic and optical properties of colloids.	Group discussions and laboratory experiments	Oral test and lab reports
1.4	To outline the ultracentrifuge, sedimentation-diffusion equilibrium, Charge effects, Colligative properties, Osmotic pressure, Van's Hoff's law, the Donnan membrane effect, and viscosity.	Lecture, homework and laboratory experiments	Homework assignment marks and lab reports
2.0	**Skills**		
2.1	To calculate the adsorption parameters using problems and their solutions, and estimate kinetic, physical and optical parameters of colloidal systems.	Tutorials Lectures and laboratory experiments	Solved problem marks Short quizzes and Laboratory reports Numerical problem
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	Tutorial, Brain storming and self-study	Work portfolio and homework
2.3	To evaluate oral and network communication, technical writing skills through writing, oral presentation of mini reports	Motivate students to ask questions and to give response.	Participation marks
2.4	To diagram and explain experimentally obtained data during laboratory classes and field tasks, and to demonstrate oral and network communication and technical writing skills.	• Seminars • Group discussions and lab experiment • Encourage students to use electronic mailand blackboard to submit works and assessments.	• Presentation marks • Oral tests and lab sheets • Assignments and homework • Laboratory performance • Laboratory reports and sheet
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	To appraise coordination and raise knowledge during various evaluations, initiatives, and mini reports to uphold scientific integrity.	• Group discussions • Homework • Mini reports • Virtual labs and demonstrations	• Presentation marks • Oral tests and lab sheets • Assessments and homework • Laboratory reports and sheet

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	10 %
2	Midterm 2	8th week	10 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4	Laboratory	All the semester	30 %
5	Final Exam	13th week	40 %
6	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.
- Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• *Principle of Colloids and Surface Chemistry.* 4th Edition, Duncan J. Shaw, esc, PhD, FRS, Liverpool Polytechnic, (ISBN 07506 11820) • *Advanced Physical Chemistry Experiments,* J. N Gurtu, Amit Gurtu (2008) Meerut, India, Pragati Prakashan, ISBN:978-81-8398-527-7
Essential References Materials	• *Colloid Science: Principles, Methods and Applications,* Terence Cosgrove, Blackwell (2005) • *Principle of Colloids and Surface Chemistry*. 3rd Edition Hiemenz and Raj Rajagopalan, CRC (1997).
Electronic Materials	• Blackboard • http://www.funsci.com/fun3_en/exper2/exper2.htm

	• http://www.kt.dtu.dk/english/Education/Continuing_education/Business/Colloid_and_surface_chemistry.
Other Learning Materials	• None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Each classroom is equipped with PC and retro projector with a maximum of 25 students. • Each Laboratory should be equipped with maximum 25 seats • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs.
Technology Resources (AV, data show, Smart Board, software, etc.)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, dishes, funnels) • Requested chemicals (starch, sodium dodecyl sulphate, oil, polystyrene, dyes such as methylene blue, charcoal) • paper electrophoresis, Du Nouy tensiometer, conductometer, shaker.Analytical balance (3 digits), Drying oven, pH meter • Filter papers , clamps, stands

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
		Indirect: Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
Lab Performance	Students Course Responsible	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Photochemistry
Course Code:	CHM 1445
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University

Table of Contents

A. Course Identification

1. Credit hours: **3 (3 Lectures, 0 Lab, 0Tutorials)**							
2. Course type							
a.	University	☐	College	☐	Department	✓	Others ☐
b.	Required	☐	Elective	✓			
3. Level/year at which this course is offered: **Level 10/ Year 4**							
4. Pre-requisites for this course: **Quantum Chemistry /CHM 1341**							
5. Co-requisites for this course (if any)**:** **None**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (Mini-reports, Midterm, Final Exam)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

This course deals with Scientific concepts and Importance of photochemistry, Mechanisms of photochemical reactions, Types of energy transitions, Factors affecting electronic transitions in different photochemical systems, Homogeneous and heterogeneous photo degradation, Methods for measuring rate of photochemical reactions, life time, quantum yield, Quenching constant of photo luminescent compounds, Developing a photochemical system of appropriate design, Photo kinetic, impacts of photochemistry in environmental and industrial sectors.

2. Course Main Objective

At the end of the course, Students should be able to:

- **Describe the Scientific concepts and the importance of photochemistry.**
- **Recognize the Mechanisms of photochemical reactions.**
- **Define the types of energy transitions and the factors affecting electronic transitions in different photochemical systems.**

- Recognize homogeneous and heterogeneous photo degradation.
- Measure the rate of photochemical reactions, life time, quantum yield, quenching constant of photo luminescent compounds.
- Develop a photochemical system of appropriate design
- Define Photo kinetic and recent impacts of photochemistry in environmental and industrial sectors.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	To describe the Scientific concepts, the importance of photochemistry and the mechanisms of photochemical reactions	K1; K2; K3;
1.2	To define the types of energy transitions and the factors affecting electronic transitions in different photochemical systems	K1; K2; K3;
1.3	To recognize homogeneous and heterogeneous photo degradation.	K1
1.4	To outline photo kinetic and recent impacts of photochemistry in environmental and industrial sectors.	K1; K3
2	Skills :	
2.1	To calculate the rate of photochemical reactions, life time, quantum yield, quenching constant of photo luminescent compounds	S1; S2; S3
2.2	To choose a photochemical system for appropriate design.	S1; S2; S3
2.3	To evaluate oral communication and technical writing skills, with the capability of using electronic mail, and Networks in communicating with others.	S3
3	Values:	
3.1	To show the ability to integrate into teamwork, as well as individually with keeping scientific integrity identity during different assessments, projects, and mini reports	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	Scientific concepts in photochemistry	2
2	Importance of photochemistry	2
3	Mechanisms of photochemical reactions	2
4	Types of energy transitions	5
5	Factors affecting electronic transitions in different photochemical systems	2
6	Homogeneous and heterogeneous photo degradation	5
7	Methods for measuring rate of photochemical reactions, lifetime, quantum yield	5
8	Quenching constant of photo luminescent compounds	3
9	Develop a photochemical system of appropriate design	3
10	Photo kinetic	3
11, 12	Recent impacts of photochemistry in environmental and industrial sectors.	4
	Total	36

Topics to be covered (Laboratories)
None

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	To describe the Scientific concepts, the importance of photochemistry and the mechanisms of photochemical reactions	Lecture	Short quizzes
1.2	To define the types of energy transitions and the factors affecting electronic transitions in different photochemical systems	Lecture and group discussions	Oral tests and MCQs, Homework
1.3	To recognize homogeneous and heterogeneous photo degradation.	Lecture and group discussions	Short quizzes oral tests, Homework
1.4	To outline photo kinetic and recent impacts of photochemistry in environmental and industrial sectors.	Lecture and group discussions	Oral tests and MCQs
2.0	Skills		
2.1	To calculate the rate of photochemical reactions, life time, quantum yield, quenching constant of photo luminescent compounds	Lecture and oral discussions	Solved problem marks Short quizzes and homework assignment
2.2	To choose a photochemical system for appropriate design.	Brain storming and self-study	Work portfolio and homework
2.3	To evaluate oral communication and technical writing skills, with the capability of using electronic mail, and Networks in communicating with others.	Motivate students to ask questions and to give response.	Participation marks
3.0	Values		
3.1	To show the ability to integrate into teamwork, as well as individually with keeping scientific integrity identity during different assessments, projects, and mini reports	• Seminars • Group discussion and assignments • Homeworks • Mini reports	• Presentation marks • Oral tests • Assignments and homeworks • Mini reports assignment

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm 1	5th week	20 %
2	Midterm 2	8thweek	20 %
3	Quizzes, Home Works, class participation, and mini projects	During the semester	20 %
4	Final Exam	13thweek	40 %
5	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***Photochemistry,*** Carol E. Wayne and Richard P.Wayane, Oxford University Press Inc., illus.ISBN: 9780198558866
Essential References Materials	• **Journal-of-photochemistry-and-photobiology-a-chemistry.**
Electronic Materials	**None**
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each classroom is equipped with PC and retro projector with a maximum of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations-Syllabus review- Accreditation review.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Nanochemistry**
Course Code:	**CHM 1449**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours: 3 (3 Lectures, 0 Lab, 0Tutorials)							
2. Course type							
a.	University	☐	College ☐	Department	✓	Others	☐
b.	Required	☐	Elective	✓			
3. Level/year at which this course is offered: Level 10 / Year 4							
4. Pre-requisites for this course: Quantum chemistry / CHM 1341							
5. Co-requisites for this course (if any): None							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	100 %
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	36
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (Mini-reports, Midterm, Final Exam)	0
	Total	36

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers the following topics: Inorganic Materials Chemistry and Nanochemistry; Basics Nanomaterials, Nanoparticles: Types, compositions, and structures. The course will extend to Metal and semiconductor nanocrystals, Porous inorganic nanoparticles, Organic nanoparticles. It also designed to cover Optical characterization and structural characterization.

2. Course Main Objective

At the end of the course, Students should be able:

- To recognize the basic information of nanochemistry and nanomaterials concepts and their applications.
- To describe the concept of nanomaterials preparation
- To state the application of nanochemistry and nanotechnology in the industrial field.
- To outline the physical and chemical characterization of nanomaterials.
- To differentiate between the different types of nanomaterials.
- To predict the physical properties of nanomaterials.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	Knowledge and Understanding	
1.1	To recognize the basic information of nanochemistry and nanomaterials concepts and their applications.	K1; K2; K3
1.2	To describe the concept of nanomaterials preparation	K1; K2; K3
1.3	To state the application of nanochemistry and nanotechnology in the industrial field.	K1
1.4	To outline the physical and chemical characterization of nanomaterials.	K1; K3
2	Skills :	
2.1	To differentiate between the different types of nanomaterials, and summarize the nanomaterials synthesis.	S1, S2, S3,
2.2	To analyze data and results through analytical thinking, with evaluation of the gained information.	S1, S2, S3
2.3	To develop oral and network communication, technical writing skills through writing, oral presentation of mini reports	S3
3	Values:	
3.1	To illustrate teamwork, make a decision, and maintain scientific integrity during different assessments, projects, and mini-reports.	V1, V2

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to nanochemistry**: Inorganic Materials Chemistry and Nanochemistry; Basics Nanomaterials, Nanoparticles: Types, compositions, and structures.	6
2	**Metal and semiconductor nanocrystals**: Porous inorganic nanoparticles, Organic (latexes), Carbon-based nanoparticles (carbon nanotubes, grapheme), Porous inorganic nanoparticles, Organic (latexes) and carbon-based nanoparticles (carbon nanotubes, graphene), Nanoparticle synthesis: Basic synthesis and fabrication methods for nanomaterials (CVD, sol-gel, microemulsion, template, hydrothermal) , Classical Colloid Theory: Nucleation and growth, Ostwald ripening, Homogeneous vs. heterogeneous nucleation, Applications of nanomaterials, Anisotropic growth and shape control, Catalyzed (seeded) growth, Nanocrystal doping, solid solutions and Vegard's rule	15
3	**Optical characterization**: Absorption and photoluminescence (PL & PLE) spectroscopies, steady-state vs. fast spectroscopy, dynamic light scattering **Structural characterization**: XRD, TEM, AFM, Deviations between bulk and near-surface crystal structures **Chemistry of small surfaces**: Curvature and neighboring-charge effects on chemical reactivity and equilibria (pKa's, redox potentials) **Applications in structural materials**, imaging, lighting, energy conversion (Solar Cells), catalysis and Photocatalysis (Environmental remediation) and Nano-electronics/Nano-photonics Applications Environmental, safety, and ethical aspects of nanotechnology	15

Total	36
Topics to be covered (Laboratories)	
None	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To recognize the basic information of nanochemistry and nanomaterials concepts and their applications.**	**Lecture**	**Short quizzes**
1.2	**To describe the concept of nanomaterials preparation**	**Lecture and group discussions**	**Oral tests and MCQs, Homework**
1.3	**To state the application of nanochemistry and nanotechnology in the industrial field.**	**Lecture and group discussions**	**Short quizzes oral tests, Homework**
1.4	**To outline the physical and chemical characterization of nanomaterials.**	**Lecture and group discussions**	**Oral tests and MCQs**
2.0	**Skills**		
2.1	**To differentiate between the different types of nanomaterials, and summarize the nanomaterials synthesis.**	**Lecture and oral discussions**	**Solved problem marks** **Short quizzes and homework assignment**
2.2	**To analyze data and results through analytical thinking, with evaluation of the gained information.**	**Tutorial, Brain storming and self-study**	**Work portfolio and homework**
2.3	**To develop oral and network communication, technical writing skills through writing, oral presentation of mini reports**	**Motivate students to ask questions and to give response.** **Encourage students to use electronic mail and blackboard to submit works and assignments.**	**Participation marks**
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	**To illustrate teamwork, make a decision, and maintain scientific integrity during different assessments, projects, and mini-reports.**	• **Seminars** • **Group discussion and assignments** • **Homeworks** • **Mini reports**	• **Presentation marks** • **Oral tests** • **Assignments and homeworks** • **Mini reports assignment**

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Midterm 1**	**5th week**	**20 %**
2	**Midterm 2**	**8th week**	**20 %**
3	**Quizzes, Homeworks, class participation, and mini projects**	**During the semester**	**20 %**
4	**Final Exam**	**13th week**	**40 %**
5	**Total**		**100 %**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- **There are 2 office hours per week reserved by each staff member, planed on his timetable, to help the students to solve their problems.**
- **Each department has an academic advisor who will act as a mentor, providing academic and career advice and general counseling.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• ***Nanochemistry,*** G.B. Sergeev, K.J. Klabunde, Elsevier, 2013, ISBN: 978-0-444-59397-9
Essential References Materials	• ***Nanoscale Science and Technology,*** Robert Kelsall, Ian W. Hamley , Mark Geoghegan, Wiley | 2005-04-29 | ISBN: 0470850868 • ***Nanomaterials and Nanochemistry,*** C Brechignac, P Houdy, M Lahmani2011, Wiley, ISBN: 0444593977
Electronic Materials	• **Blackboard**
Other Learning Materials	• **None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Each classroom is equipped with PC and retro projector with a maximum of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Extent of achievement of course learning outcomes	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.

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

H. Specification Approval Data

Council / Committee	**COUNCIL OF DEPARTEMENT OF CHEMISTRY**
Reference No.	**10 (NO. 1/10)**
Date	**21/04/1444- 15/11/2022**