Course Specification
(Bachelor)

Course Title:	Environmental Chemistry
Course Code:	CHM 1334
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	2024 v1
Last Revision Date:	14 October 2024

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 2 (1, 0, 3)					
2 (1 Lectures, 0 Tutorials, 3 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: Level 5,6/ Third year					
4. Course general 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.					
5. Pre-requirements for this course (if any)**:**					
Volumetric and Gravimetric Analysis /CHM 1236					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
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.**					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**60**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**
4	Distance learning	**0**	**0**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**15**

2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		60

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

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
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**	▪ Four hours are weekly containing lectures and laboratory activities. ▪ A Private study including home exam.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation.
1.2	**To name the important tropospheric processes, photochemical smog and acid precipitation**	**K1, K2**	▪ Four hours are weekly containing lectures and Laboratory activities ▪ Group discussion.	▪ Quizzes Assignments. • Oral Discussion marks Laboratory Reports
1.3	**To state some scientific methods employed in environmental chemistry.**	**K2, K3**	▪ Four hours are weekly for laboratory activities ▪ Think talk, and review environmental chemistry methods to detect pollution	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
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**	**K4**	• Group discussions. • Laboratory activities	▪ Quizzes ▪ Assignments ▪ Discussions. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	laboratory management.			
2.0	**Skills**			
2.1	**To compare methods to determine the extent of environmental pollution and to summarize method of environment monitoring.**	**S1, S2, S3**	Introduce some examples of environmental pollution	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, ▪ Laboratory Reports ▪ Home Exam.
2.2	**To analyze the factors affecting the impact of industry and waste disposal upon the environment.**	**S2, S3**	• Group Discussions • Laboratory Experiments	• Questions in Lectures. • Laboratory Reports • Short Quizzes and Exams. • Oral Discussion
2.3	**To interpret experimentally pollution products and reactivity, as well environmental fates of organic and inorganic toxins.**	**S2, S4**	▪ Lectures and Oral Discussions. ▪ Brainstorming Exercises	▪ Questions in Lectures.Short ▪ Quizzes and Exams.
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**	• Encourage the students to use the Chemicals, Glasswares and Instruments with caring and safety	▪ Assignments ▪ Laboratory Report.
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise coordination in teamwork and raise Knowledge during various evaluations,**	**V1; V2**	▪ Group Discussion and Assignments.	▪ Oral Tests and Assignments Marks

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	initiatives, and Lab-reports to uphold scientific integrity.			

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.	**2**
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.	**2**
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.	**2**
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.	**2**
5	**Inorganic air pollutants** Carbon dioxide - sulfur dioxide sources and sulfur cycle - nitrogen oxides in atmosphere - acid rain - fluorine chlorine and their gaseous compounds**.**	**2**
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	**1**
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.	**1**
	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.	**1**

	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	**1**
	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.	**1**
Total		**15**

No	List of Experiments	Contact hours
1	Sampling Techniques of solid and liquid Environmental samples	**3**
2	Alkalinity and Acidity of Water	**3**
3	Determination of Total Hardness in Water	**3**
4	Determination of Chloride Content in Soil, Tap, and ground Water Samples by the Mohr Method	**3**
5	Spectrophotometry, Colorimetry and Absorption Spectra: Determining Iron in Natural Waters and Sediments	**3**
6	Chemical Oxygen Demand (COD)	**3**
7	Determination of Total Organic Matter in Soil, Sludge and Waste Water	**3**
8	Determination of Sodium Na and Potassium K Contents in Environmental Samples by Flame Atomic Emission Spectroscopy (FAES)	**3**
9	Analysis of Metals (Ca, Mg, Pb and Cu) by Flame Atomic Absorption Spectroscopy	**3**
10	Determination of dissolved oxygen in seawater by Winkler titration	**3**
11	Suspended and Dissolved Solids (SS and DS) in Water and Waste Water (1)	**4**
12	Total Dissolved Solids (TDS) Solids in Water and Waste Water (2)	**4**
13	Determination of Total Organic Matter in Soil, Sludge and Waste Water	**3**
14	Methods for Trace Metals Analysis in Plant, Food, and Organic Environmental Samples	**4**
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm 1**	**6th/ 7th week**	**10 %**
2.	**Midterm 2**	**11th/ 12th week**	**10 %**
3.	**Quizzes, Home Works, class participation, and mini projects**	**During the semester**	**10 %**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Laboratory	All the semester	30 %
5.	Final Exam	16-17th week	40 %
6.	Total	All weeks	100 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• **Environmental Chemistry**, Stanley A. Manahan, 7th ed., 2000, Boca Raton: CRC Press LLC: ISBN: 978-1-4398-3276-9.
Supportive References	• **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 • **Environmental soil and water chemistry, principles and applications** V. P. Evangelou, John Wiley & Sons, Inc. New York. ISBN: 978-0-471-16515-6
Electronic Materials	▪ Blackboard http://www.chemistry.college.hmco.com
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, 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

Items	Resources
	• 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 equipment (projector, smart board, software)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other equipment (depending on the nature of the specialty)	• 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

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
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.
The extent to which CLOs have been achieved	**Course Responsible**	Direct: Exams - Course e-Portfolio.

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**7 (NO. 2/3)**
DATE	**29/3/1446 - 2/10/2024**