Course Specification
(Bachelor)

Course Title:	**Environmental Chemical Analysis**
Course Code:	**CHM 1239**
Program:	**Bachelor of Science in Chemical Laboratories**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	2024- **1**
Last Revision Date:	15 September 2024

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3, 3, 0)					
4 (3 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 4/ Second year					
4. Course general Description:					
The course provides an insight into the Introduction to environmental analysis techniques on real samples and sampling of different test materials (including Air samples, Water samples, Soil and Sediment Sampling, Trace Organics, Contaminated Land Sites Sample storage, and sample preparation are discussed. The course is based on basic knowledge of analytical chemistry. It goes further in-depth to use other analytical techniques for environmental monitoring. The course is based on and uses active learning activities through teamwork, planning fieldwork, sampling, sample processing, chemical analysis, data interpretation, and reporting in the practical part.					
5. Pre-requirements for this course (if any)**:**					
Basics of Environmental Chemistry -CHM 1237					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The objectives of this course are as follows: ✓ To introduce the student to a basic knowledge of analytical technique to environmental samples including water, air, and soil. ✓ To illustrate the analyses of the major physical, chemical, and biological parameters for each of these environmental samples. ✓ To provide the student with a knowledge of data interpretation.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**90**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	**0**	**0**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		90

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 recognize the Environmental Sampling collection and Analysis**	**K1; K4**	• Five hours weekly, containing lectures and laboratory activities • A Private study, including a Homework	**Direct:** • exams, Quizzes • Homework Laboratory Reports • Participation
1.2	**To outline the methods of analysis such as Spectrophotometric Methods, Electrochemical Methods of Analysis, Chromatography, and Mass Spectrometry.**	**K2; K4**	• Three hours weekly, containing lectures • A Private study, including a Homework	**Direct:** •Oral tests •Homework and assignment marks, •Written exams

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.3	**To describe the analysis of different methods of soil and solids waste**	**K2; K4**	Lectures and laboratory experiments.	**Direct:** • Participation, • Quizzes and MCQs, • laboratory reports
1.4	**To define and describe the analysis methods of Air pollutant and biological materials:**	**K3; K4**	Lectures Group discussions laboratory experiments.	**Direct:** • Participation, • Quizzes and MCQs, • laboratory reports
2.0	**Skills**			
2.1	**To evaluate the different components of water**	**S1; S3**	Lecture and oral discussions	**Direct:** • Oral Disscussion • Short quizzes and homework assignments
2.2	**To Justify the proper analysis methods for air, water, soil, and biological materials**	**S1; S2**	Group Discussion Brainstorming and self-study	**Direct:** • Quizzes • laboratory reports • Homework
2.3	**To demonstrate skills to participate in class by asking questions and giving answers.**	**S3**	Motivate students to ask questions and to give responses.	**Direct:** • Participation marks • Oral Disscussion
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.**	**S1; S4**	• Seminars • Laboratory • Encourage students to use Blackboard and electronic mail to submit works and assignments.	**Direct:** • Lab reports • Assignments and homework

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise teamwork and create awareness to maintain scientific integrity during different assessments, projects, and mini-reports.**	**V2**	• Group discussion and assignments • homework	**Direct:** • Oral tests Assignments • homework marks
3.2	**Show personal values and attributes such as honesty, empathy and respect for others**	**V1, V2**	• Teamwork and class discussions	**Direct** • lab reports • Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Environmental Sampling and Analysis:** Introduction to environmental analysis, Sampling, Air Sample Collection and Analysis, Water Sample Collection and Analysis, Soil and Sediment Sampling, Sample Preparation for Trace Organics, Contaminated Land Sites and their analysis, EPA Methods, and Performance-Based Analyses.	9
2.	**Chemical analysis of water and wastewater:** General Aspects of Environmental Chemical Analysis, Error and Quality Control: detection limit, instrument detection limit, method detection limit, practical quantitation limit. Methods of analysis such as, Spectrophotometric Methods, Electrochemical Methods of Analysis, Chromatography, Mass Spectrometry. Sampling, sampling strategy, Shewhart chart for mean values and uncertainty., Water Sampling, Water Sample Preservation, Total Organic Carbon in Water, Measurement of Radioactivity in Water, Biological Toxins,.	9
3.	**Analysis of soil and solids waste:** Introduction, soil analysis: physical parameter as pH, texture, chemical parameter as organic matter, CEC, N, P, K, biological parameter, Sample digestions, Analyte isolation for organics analysis, Sample cleanups,	9

	Determination of chelating agents, Toxicity characteristic leaching Procedures.	
4.	**Analysis Air pollutant analysis:** Atmospheric Monitoring, Air Pollutants Measured, Sampling, Methods of Analysis, Determination of Sulfur Dioxide, Nitrogen Oxides, Analysis of Oxidants, Analysis of Carbon Monoxide, Determination of Hydrocarbons and Organics, Analysis of Particulate Matter, Direct Spectrophotometric Analysis of Gaseous Air Pollutants.	9
5.	**Analysis of biological material:** Introduction, Indicators of Exposure to Xenobiotics, Determination of Metals, Determination of Nonmetals and Inorganic Compounds, Determination of Parent Organic Compounds.	9

No	List of Topics- Practical	Contact Hours
1	Sampling Techniques of solid Environmental samples	3
2	Sampling and Testing of Environmental Water Samples	3
3	Alkalinity and Acidity of Water	3
4	Determination of Total Hardness in Water	3
5	Determination of Chloride Content in Soil, Tap, and ground Water Samples by the Mohr Method	3
6	Solids in Water and Waste Water (1)	3
7	Solids in Water and Waste Water (2)	3
8	Determination of Oil and Grease in Waste Water	3
9	Spectrophotometric Determination of Iron in a wastewater and other samples	3
10	Chemical Oxygen Demand (COD) 46	3
11	Determination of Total Organic Matter in Soil, Sludge and Waste Water	3
12	Detection of Lead (Pb) Pollution in Environmental Sample	3
13	Air quality: pH and acid content of Acid Rain Air Pollution: Sulphate(VI) Determination in Acid Rain	3
14	Determination of Sodium Na and Potassium K Contents in Environmental Samples by Flame Atomic Emission Spectroscopy (FAES)	3
15	Revision and Lab. Reports overview	3
	Total	90

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	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 6th -7th week	10%
4	Midterm Exam 2	Around 11th -12th week	10%
5	Final Exam	Around 15th – 16th week	40%
6	Total		100%

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

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Stanley Manahan, Stanley E. Manahan , **Environmental Chemistry**, CRC Press; 7th edition (December 29, 1999), ISBN-10 : 1566704928, ISBN-13 : 978-1566704922
Supportive References	• Gary D. Christian, Purnendu K. Dasgupta , Kevin A. Schug, **Analytical Chemistry**, Wiley; 7th edition (October 7, 2013), ISBN-10 : 0470887575, ISBN-13 : 978-0470887578 • Jonathan D. Raff, Ronald A. Hites, **Elements of Environmental Chemistry**, ASIN: B08CS91QCS, Wiley; 3rd edition (July 9, 2020). • V. P. Evangelou, **Environmental Soil and Water Chemistry: Principles and Applications**, Wiley-Interscience; 1st edition (October 12, 1998), ISBN-10 : 0471165158, ISBN-13 : 978-0471165156
Electronic Materials	• Internal server: \\10.10.70.70\ScienceShareFolder http://www.chemistry.college.hmco.com
Other Learning Materials	such as computer-based programs/CD, professional standards or regulations and software.

3. 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** • **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.

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

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.	**3 (NO. 1/3)**
DATE	**5/3/1446- 8/09/2024**