Course Specification

(Postgraduate Programs)

Course Title:	**Advanced Environmental Chemistry**
Course Code:	**CHM 6134**
Program:	**Master of science in chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3 (3 Lectures, 0 Lab, 0 Tutorials)				
2. Course type				
A.	☐University	☐College	☐Department	☐Track
B.	☐Required		☒Elective	
3. Level/year at which this course is offered: Level 2/Year 1				
4. Course General Description:				
This course describes fundamentals and advanced topics of Environmental Chemistry. The course covers the pollutants in the major components of the environment. Topics that deal with the hydrosphere such as Contaminant behavior in the aquatic environment, Water quality parameters, drinking water treatment methods, modern aspects of wastewater treatment are deeply covered in addition to air and soil pollution. The interaction of energy and the environment was covered with special emphasis on petroleum and petroleum industry pollutants in addition to renewable energy sources. Hazardous materials and toxicants and their impacts on the environment were outlined in the toxicological chemistry and ecotoxicology unit.				
5. Pre-requirements for this course (if any)**:**				
Advanced Analytical Chemistry - CHM 6131				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
• **Recognize the basic Principles of Contaminant behavior in the aquatic system and the fate of pollutants.** • **Outline and determine the drinking water parameters.** • **Recognize and describe the Drinking Water Treatment techniques and the waste water treatment methods.** • **Understand the nature and behavior of the soil and air contaminants.** • **Develop awareness of the relation and impact of the petroleum energy on the environment and to suggest renewable energy sources.** • **Specify the toxicants and hazards with serious influence on the environment.**				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**45**	**100 %**

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

3. Contact Hours: (based on the academic semester)

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

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To list the methods for the analysis of xenobiotic substances in environmental samples.**	**K1. Anal.; K2. Anal.; K4. Anal.**	▪ **Five hours/week lectures.** ▪ **Self-study Home-exam.**	▪ **Regular Exams** ▪ **Assignments** ▪ **Short Quizzes** ▪ **Oral Discussion Participation.**
1.2	**To outline Aquatic Chemistry Science and Water Pollution.**	**K2. Anal.; K4. Anal.**	**Five hours/week lectures. Think, to justify the aquatic chemistry science and water pollution, using available references (SDL) online.**	**Oral Discussion marks Literatures Survey Mini-seminar. Participation.**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			Open discussion..	
1.3	To state priority environmental contaminants such as selected heavy metals and dioxins.	K2. Anal.; K3. Anal.; K4. Anal.	Five hours/ week lectures. Open Discussion with mini-reports to justify priority environmental contaminants in KSA using available references (SDL) online.	Midterm. Assignments. Group Discussions. Literatures Survey Mini-seminar. Participation.
1.4	To define Water Quality Parameters and Toxicological Chemistry and Ecotoxicology.	K2. Anal.; K4. Anal.	Five hours/week lectures. Group Discussion using available references (SDL)	Assignments Open Discussions. Literatures Survey Mini-seminar. Participation.
2.0	Skills			
2.1	To summarize important chemical reactions and their mechanisms in the atmosphere and the Aquatic Environment causing Pollution.	S1. Anal.; S2. Anal.	Lectures activity Self-study. Think, and discuss in details important chemical reactions in environment.	Questions in Lectures. Short Quizzes and Exams. Open Discussions. Participation Mini -seminar.
2.2	To develop an experimental setup for analysis of various environmental samples solids or liquids.	S2. Anal.; S3. Anal.	Practice some examples for experimental setup for environmental analysis. Brainstorming. Self-study	Questions in Lectures. Participation Oral Discussion Short Quizzes.
2.3	To evaluate the nature and behavior of the soil and air contaminants.	S1. Anal.; S2. Anal.; S3. Anal.	Lectures Oral Discussions. Brainstorming. Self-study	Questions in Lectures. Short Quizzes and Exams. Oral Discussion. Participation.
2.4	To operate communication to	S1. Anal.; S3. Anal. S4. Anal.	Group Discussion and Assignments	Oral Discussion.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	different environmental analytical techniques and their applications, accompanying writing of mini-Reports, operating electronic mail, and Network in communicating with others.		Launch several examples of obtained results from different environmental analytical techniques used to study, which will require reading, writing, and oral presentation in groups. Encourage students to use electronic mail to submit Home Exams and Assignments	Quizzes, and Exams. Giving marks for Oral Discussion in Lectures. Marks given for Assignments.
3.0	Values, autonomy, and responsibility			
3.1	To perform a scientific presentation, research, and work independently and integrate with a collaborated group, Using IT to acquire, analyze, and communicate information.	V1. Anal.	Brainstorming. Exercises Group Discussion. Team work.	Oral Discussion. Group Discussion Assignments.
3.2	To demonstrate his ability to the effectively collaboration and inter-professionalism in class discussions or team works, as well as independently.	V1. Anal.; V2. Anal.	Small Group tasks Open discussion at classroom. Office hour guiding. Group Presentation of mini-projects	Participation Homework's Mini-project(s).
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	**Principles of Contaminant behavior in the aquatic environment:** The Behavior of Contaminants in Natural Waters, Important Properties of Pollutants, Important Properties of Water and Soil, The Fates of Different Pollutants, Processes That Remove Pollutants from Water, Transport Processes, Major Contaminant Groups and Their Natural Pathways for Removal from Water.	7
2.	**Water quality parameters:** pH and temperature, Oxidation-Reduction (Redox) Potential, Carbon Dioxide, Bicarbonate, and Carbonate, Acidity and Alkalinity, Total Hardness, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Total Nitrogen, Sulfide, Phosphorus, Metals in Water, Total, Suspended, and Dissolved solids (TSS and TDS).	7
3.	**Drinking Water Treatment methods:** Drinking Water Standards, Basic Drinking Water Treatment methods, Disinfection Byproducts and Disinfection Residuals, Strategies for Controlling Disinfection Byproducts, chlorine and related disinfection methods, Ozone Disinfection Treatment, Potassium Permanganate, Peroxone (Ozone + Hydrogen Peroxide), Ultraviolet (UV) Disinfection Treatment, Memberane Filtration Water Treatment.	5
4.	**Modern aspects of wastewater treatment:** Waste water Management, Hazardous and Biomedical Waste Management, Environmental Biotechnology. Wetlands- concept, classification, importance, uses and threats to the wetlands.	5
5.	**Air pollution:** Gaseous Inorganic and Organic Air Pollutants, Air and Gas Analysis, (emission of NOX gases), Particulate Materials in Air, Photochemical Smog.	5
6.	**Soil pollution:** Source, Soil analysis, Fertility of solid and effect of pollution on it, water binding capacity of the soil, Organic fertilizers and their long term effect on soil quality	6
7.	**Energy and the Environment:** General Characteristics of Petroleum, Petroleum Releases to the Subsurface, Formation of Petroleum Contamination Plumes, Renewable Energy, Nuclear Fission and Fusions Power.	5
8.	**Toxicological Chemistry and Ecotoxicology:** Environmental Chemistry of Hazardous Wastes, Toxicological Chemistry (Nature of Toxicants and Biochemical Transformations), Toxic Elements and Organic Compounds, Analysis of Chlorinated Organic Compounds in Fatty-Food, Analysis of Xenobiotic Substances in Environmental Samples, Industrial Waste Management and Treatments.	5
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)	weekly	30 %
2.	Midterm Exams	9th and week	30 %
3.	Final Exam	Around 12th–17th week	40 %
4.	Total		100%

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

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	***nvironmental Chemistry: A global perspective***, Vanloon, G. W.; Duffy, S. J., 3rd Edition, Oxford University Press, 2010. ISBN: 978-0199228867. ***Environmental Chemistry,*** Baird, C.; Cann, M., 5th Edition, W. H. Freeman, 2012.ISBN-13: 978-1429277044. ***Principles of Environmental Chemistry,*** Giard, J.E., 3rd Edition, Jones& Bartlett Learning, 2013, ISBN-13: 978-1449693527.
Supportive References	NONE
Electronic Materials	▪ Environmental Science & Technology ▪ Science of the Total Environment ▪ Environmental Toxicology and Chemistry, ▪ Journal of Atmospheric Chemistry. • Saudi Digital Library
Other Learning Materials	• Blackboard. • Multimedia associated with the text book and the relevant websites

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
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)	**None**

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-GCC)	**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.
The extent to which CLOs have been achieved	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Council of Chemistry Department**
REFERENCE NO.	**10 (No. 2/10)**
DATE	21/04/1444- 15/11/2022