



Course Specification

— (Bachelor)

Course Title: Graduation Project

Course Code: BIOE4102

Program: Environmental Sciences

Department: Biology

College: Science

Institution: Umm Al-Qura University

Version: Course Specification Version Number

Last Revision Date: 28/12/2024



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A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

A. University College Department Track Others

B. Required Elective

3. Level/year at which this course is offered: (8 – Fourth Year)

4. Course general Description:

By the end of this course, students should be able to evaluate the different approaches used and suggest future experiments or alternative strategies for addressing the problem. The student should be able to converse in writing a scientific report and presenting scientific data in a clear, accessible manner. The skills learned will be applicable to problem-solving exercises encountered in all types of employment.

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

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

7. Course Main Objective(s):

- Gain practical and/or theoretical knowledge about a particular area of environmental sciences.
- Work independently on the research project under the supervision of an academic staff member and should be able to design experiments to answer the particular question posed, as well as critically analyze the results. There will be scope for initiative in this element of the project.
- Be able to set the work in the context of work done by other experimentalists and provide a concise summary of relevant literature.
- Summarize and provide a concise summary of relevant literature.
- Displaying and organizing different types of data.
- Preparing and representing the data.
- Thinking about all new topics in the different fields of environmental sciences.
- Ability to design laboratory experiments and carry out most of the advanced techniques in the field of environmental sciences.



2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	54	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	9
2.	Laboratory/Studio	45
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		54

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Summarize relevant literature in environmental sciences.	K2, K3	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments.	Exams, Assignments, Course activities and Written analyses



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			3.Discussions	
1.2	Explain various data types relevant to environmental sciences.	K2, K3	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments. 3.Discussions 4. Handout of lecture notes for each topic	Exams, Assignments, Course activities and Written analyses
1.3	Discuss new research topics in the field of environmental sciences.	K2, K3	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments. 3.Discussions 4. Handout of lecture notes for each topic	Exams, Assignments, Course activities and Written analyses
1.4.	List potential and emerging research topic in environmental sciences.	K2, K3	1.In-class lecturing where the previous knowledge is linked to the	Exams, Assignments, Course activities and Written analyses



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			<p>current and future topics.</p> <p>2.Homework assignments.</p> <p>3.Discussions</p> <p>4. Handout of lecture notes for each topic</p>	
2.0	Skills			
2.1	Design laboratory experiments in environmental sciences.	S1, S2, S3, S4	<p>Students will receive credit for these activities based on their responses to the particular questions and assignments. These will include reading summaries, reflective questions, quizzes</p>	<p>Evaluation of the topics prepared by students according to the content, arrangement, and covering of the topic.</p> <p>Midterm and final exams.</p> <p>Checking the homework assignments.</p> <p>Course work reports</p>
2.2	Evaluate research literature for environmental topics	S1, S2, S3, S4	<p>Students will receive credit for these activities based on their responses to the particular questions and assignments. These will include reading summaries,</p>	<p>Evaluation of the topics prepared by students according to the content, arrangement, and covering of the topic.</p> <p>Midterm and final exams.</p> <p>Checking the homework assignments.</p> <p>Course work reports</p>





Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			reflective questions, quizzes	
3.0	Values, autonomy, and responsibility			
3.1	Design laboratory experiments in environmental sciences.	V1,V2, V3	Students will receive credit for these activities based on their responses to the particular questions and assignments. These will include reading summaries, reflective questions, quizzes	Evaluation of the topics prepared by students according to the content, arrangement, and covering of the topic. Midterm and final exams. Checking the homework assignments. Course work reports
3.2	Evaluate research literature for environmental topics.	V1,V2, V3		
3.3	Link between theoretical knowledge and practical experiments in environmental research.	V1,V2, V3		

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to research project	1
2.	Where and how I start?: Thinking of research ideas, Purpose of research, Research questions or hypothesis, Are these questions/hypothesis feasible to achieve?, Problems with research questions/hypothesis, research title.	6
3.	Project preparing: Project management, project timeline, project ethics	2
4.	The literature review: Primary and secondary sources, quality of sources, Your literature review should tell a story, how to make it a story?, Speed reading and taking notes, Critical awareness while reading, How to search for information, Managing references, Various style of referencing systems.	9





5.	Research methodology I: Research design, Research approach, building your way from research purpose, to question, to approach, to data gathering.	3
6.	Methodology II: Types of research methods: experimental, Case studies, Cross-sectional studies, Longitudinal studies, surveys, Comparative studies, How to structure and write up your methodology?	3
7.	Results analysis: Types of results, comparative analysis, statistical analysis, results presentation (tables, graphs, figures)	3
8.	Concluding and writing up: Writing a discussion, writing a conclusion, writing an abstract and finalizing the title, general points about writing a research/review article and presentation coda	3
9.	Set up a small project at (laboratory or field) parallel with theoretical lectures, for each student or a group of three students to begin to implement theoretical ideas on the ground (small training research point), collecting their own actual data, analyzing, representing the collected data, commenting, and critical discussing it and writing an essay about it. This essay will be revised by supervisor and critically discussed with the student/students group by examiners board (usually two departmental scientific staff members).	
Total		54 hours

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Reports, Discussion	4, 10	25%
2.	Presentation	6	25%
3.	Final report	16	50%

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

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	
Supportive References	<p>Writing Scientific Research Articles: Strategy and Steps. 2nd Edition. by Margaret Cargill , Patrick O'Connor, ISBN-13: 978-1118570708. 2013. Wiley-Black Well Press.</p> <p>Enjoy Writing Your Science Thesis or Dissertation: A Step by Step Guide to Planning and Writing a Thesis or Dissertation for</p>





	Undergraduate and Graduate Science Students. 2nd Edition by Elizabeth M Fisher, Richard C Thompson. ISBN-13: 978-1783264216. 2014. Imperial College Press.
Electronic Materials	www.columbia.edu/cu/biology/ug/research/paper.html https://www.youtube.com/watch?v=0oAFVHb21HM https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3474301/
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	data show, Smart Board
Other equipment (depending on the nature of the specialty)	Laboratory equipped with instruments.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect - Questionnaires
Effectiveness of Students assessment	Program committee. - Staff members. - Students.	Direct - Questionnaires. - Reports. - Meetings
Quality of learning resources	Program leaders. - Peer Reviewer.	Direct & Indirect - Questionnaires. - Reports. - Meetings
The extent to which CLOs have been achieved	- Peer Reviewers Students	Direct & Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	





DATE





Course Specification

— (Bachelor)

Course Title: **Natural Resource Management and Restoration**

Course Code: **BIOE4514**

Program: **Environmental Sciences**

Department: **Biology**

College: **Science**

Institution: **Umm Al-Qura University**

Version: **1**

Last Revision Date: **29/12/2024**



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A. General information about the course:

1. Course Identification

1. Credit hours: (.....)

2 hours

2. Course type

A. University College Department Track Others

B. Required Elective

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

4. Course general Description:

The *Natural Resource Management and Restoration* course provides a multidisciplinary approach to understanding the sustainable use, management, and restoration of natural resources such as water, soil, forests, and biodiversity. It emphasizes the importance of conserving resources for future generations while addressing the challenges of degradation, overexploitation, and climate change.

Students will gain theoretical knowledge and practical skills in sustainable resource management practices, ecosystem restoration techniques, and policy frameworks. The course also integrates innovative tools and technologies, such as GIS, remote sensing, and ecological modeling, to analyze and address resource management challenges. By fostering critical thinking, this course prepares participants to design and implement solutions for resource conservation and ecosystem recovery.

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

Plant Vegetation

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

7. Course Main Objective(s):

1. Understand the Importance of Natural Resources
 - Explore the role of natural resources in supporting ecosystems, economies, and human well-being.
2. Analyze Resource Degradation and Challenges
 - Identify the causes and consequences of resource degradation, including deforestation, soil erosion, and water pollution.
3. Learn Sustainable Resource Management Practices
 - Study approaches for the sustainable use and conservation of soil, water, forests, and biodiversity.
4. Master Ecosystem Restoration Techniques



- Gain knowledge of ecological restoration methods, including reforestation, wetland restoration, and soil rehabilitation.
- 5. Study Policy Frameworks and Legal Instruments
 - Understand global and national policies for resource management, such as the UN Sustainable Development Goals (SDGs).
- 6. Explore Community Engagement Strategies
 - Learn to involve local communities in resource management and restoration efforts through participatory approaches.
- 7. Apply Advanced Technologies
 - Use tools like GIS, remote sensing, and environmental modeling for resource monitoring and management.
- 8. Address Climate Change Impacts
 - Study the effects of climate change on natural resources and strategies for adaptation and mitigation.
- 9. Develop Critical Thinking and Problem-Solving Skills
 - Equip participants with the ability to assess and design practical solutions for resource conservation and restoration.
- 10. Promote Sustainable Development
 - Examine the integration of natural resource management with economic development and environmental sustainability.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

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





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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Understand the Fundamentals of Natural Resource Management and Restoration	K1	<p>Knowledge: Use the data show to explain the topics scheduled - Showing some documentaries that relate to course-identify. Lectures. Video tapes, CDs and DVDs (audiovisuals) .Assignments (essays and oral presentation).Tutorials. Accelerated learning (learning by fun). Mind maps.</p> <p>-The methodology includes a combination of lectures by the lecturer, seminar presentation by the students and web-interactions.</p> <p>- At the end of the programme, students will be divided into groups for seminar presentation on important areas of the course to assess their understanding</p>	<p>-Quarterly and final tests(objective tests and essay and oral).</p> <p>- Reports.</p> <p>- Projects.</p> <p>- Debates and questions.</p>
1.2	Recognize Ecosystem Fundamentals. Biodiversity and Its Importance. Soil Science and Management. Water Resources Management. And Forest Management	K2		
1.3	Describe Invasive Species Management. and Sustainable Agriculture and Land Use	K3		
1.4	Demonstrate the Policy, Legislation, and Economics in NRM. Community Involvement and Stakeholder Engagement. and Restoration Project Planning and Implementation	K4		





Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			<p>and comprehension of the course.</p> <ul style="list-style-type: none"> - All students will be involved in on-line learning process and each student is required to create an E-mail address to facilitate student web interactions. - Using images and movies - Encouraging students to collect the new information about what the new in Natural Resource Management and Restoration.. 	
2.0	Skills			
2.1	Apply broad theories, principles, and concepts in various contexts related to the environmental field. .	S1	<p>Cognitive skills: discussions and periodic tests during theoretical lectures - joint research work between students and doing some individual assignments - Practical studies. Browsing on the Internet. Self-studies to be used for exams. home work. Presentations by students. Lectures.</p>	<ul style="list-style-type: none"> - Periodic semester and final exams. - Evaluation of short research - Evaluation of offers. - Required activities and duties - Giving additional marks to students who have contributions, discussions, and answers to sudden
2.2	Use critical thinking and develop creative solutions to of Natural Resource Management and Restoration.	S2		
2.3	Acquire the skill to analyze and use standard and specialized digital technology, instruments, and materials that are advanced in	S3		





Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	analyzing environmental problems.		<p>Personal skills and responsibility: Participation in groups for research work. All students assigned to carry out tasks and duties during theoretical lessons.</p> <p>An oral presentation lecture about the project was given by the students and discussed with them after the students were distributed into groups to encourage group work. - A complete article about the project, teamwork. Numerical and communication skills: communicating via the Internet with the professor to present research and films. Use of laboratory equipment. Using different computer programs. Students must prepare and present a lecture on a topic related to the course using Power Point. Students are asked to write a</p>	<p>questions during the lecture.</p> <p>-Semi-regular exams and fruitful discussions.</p> <p>-Homework for students to evaluate and discuss.</p> <p>-Assessing research preparation skills.</p> <p>- Evaluating students in the indirect decision of the curriculum.</p>



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			<p>short essay on a topic related to the course, which encourages them to search for knowledge in appropriate references such as (scientific books, magazines, and websites).</p> <ul style="list-style-type: none"> - Lectures -Brainstorming -discussion. 	
3.0	Values, autonomy, and responsibility			
3.1	Demonstrate commitment to professional and academic values and ethics.	V1	<p>Always give students examples of the importance of these values and their role in strengthening relationships in scientific, practical, and societal life.</p> <p>Distributing students into groups and emphasizing that teamwork gives better payoff from individual work and promotes progress</p>	<p>Observing students during work and dealing with each other and tests.</p> <p>Observing students while working in theoretical groups.</p> <p>During my discussions with the students and their interest and understanding of the course</p>



C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Natural Resource Management and Restoration - Definition and scope of NRM and restoration ecology - Importance of NRM in sustainable development - Historical perspectives and evolution of NRM practices	2
2.	Ecosystem Fundamentals -Ecosystem structure and function -Energy flow and nutrient cycling -Biodiversity and ecosystem services.	2
3.	Biodiversity and Its Importance - Levels of biodiversity: genetic, species, and ecosystem - Threats to biodiversity - Conservation strategies	2
4.	Soil Science and Management - Soil properties and classification - Soil health and fertility - Sustainable soil management practices	2
5.	Water Resources Management - Hydrological cycle and water quality - Water scarcity and management challenges - Integrated Water Resources Management (IWRM)	2
6.	Forest Management - Forest ecosystems and their services - Sustainable forestry practices - Deforestation and reforestation strategies	2
7.	- Goals and ethics of ecological restoration - Restoration success criteria - Types of restoration projects	2
8.	Midterm exam	
9.	Invasive Species Management - Identification and impacts of invasive species - Prevention and control methods - Restoration post-invasive species removal	2
10.	Climate Change Impacts and Adaptation - Effects of climate change on natural resources - Adaptive management strategies - Mitigation and resilience building	2
11.	Sustainable Agriculture and Land Use - Principles of sustainable agriculture - Land use planning and management - Agroecology and permaculture practices	2
12	Policy, Legislation, and Economics in NRM	2





	- Key environmental laws and regulations - Economic instruments in resource management (e.g., taxes, subsidies) - Policy-making processes and stakeholders	
13	Community Involvement and Stakeholder Engagement - Importance of local communities in NRM - Strategies for effective stakeholder engagement - Social dimensions of restoration projects	2
14	Restoration Project Planning and Implementation - Project design and goal setting - Monitoring and evaluation techniques - Funding and resource allocation	2
15	Case Studies and Future Directions - Analysis of successful and unsuccessful restoration projects - Emerging trends and technologies in NRM - Future challenges and opportunities	2
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-term exam	8	30%
2.	Final-term exam	17	50%
3.	Periodically	12	20%

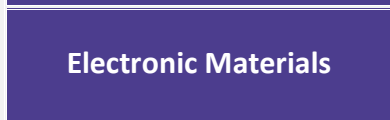
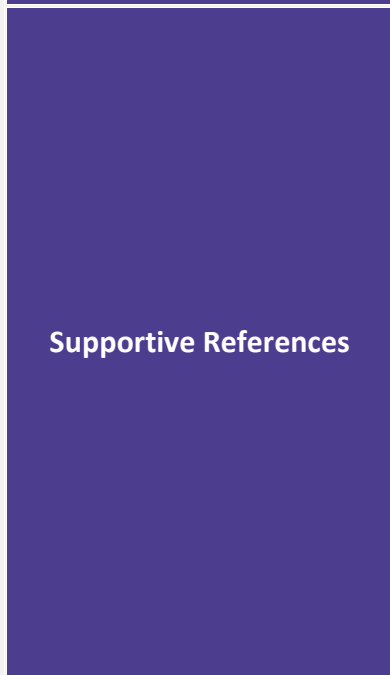
*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<p>1. Books and Textbooks</p> <ol style="list-style-type: none"> <i>Natural Resource Conservation: Management for a Sustainable Future</i> by Daniel D. Chiras and John P. Reganold Zerbe, S. (2023). Introduction to Restoration Ecology. In: Restoration of Ecosystems – Bridging Nature and Humans. Springer Spektrum, Berlin, Heidelberg. https://doi.org/10.1007/978-3-662-65658-7_1 Obaisi, A.I., Adegbeye, M.J., Elghandour, M.M.M.Y., Barbabosa-Pliego, A., Salem, A.Z.M. (2022). Natural Resource Management and Sustainable Agriculture. In: Lackner, M., Sajjadi, B., Chen, WY. (eds) Handbook of
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Climate Change Mitigation and Adaptation. Springer, Cham. https://doi.org/10.1007/978-3-030-72579-2_133

4. *Ecological Restoration: Principles, Values, and Structure of an Emerging Profession* by Andre Clewell and James Aronson
5. *Soil and Water Conservation for Sustainable Development* by Morgan, R.P.C.
6. *Restoration Ecology: The New Frontier* by Jelte van Andel and James Aronson

2. Research Articles and Journals

1. *Journal of Environmental Management*
2. *Ecological Restoration Journal*
3. *Conservation Biology*
4. *Restoration Ecology*

3. Technical Guidelines and Manuals

1. *UNEP Ecosystem Restoration Guidelines*
2. *FAO Guidelines for Sustainable Soil Management*
3. *Forest Landscape Restoration Handbook* by the International Union for Conservation of Nature (IUCN)

4. Web Resources and Databases

1. Global Restoration Initiative: www.wri.org
2. International Union for Conservation of Nature (IUCN): www.iucn.org
3. UNEP Nature-Based Solutions Hub: www.unep.org

1. Books and Textbooks

- *Ecosystem Services and Natural Capital* by Pushpam Kumar
- *The Restoration Economy* by Storm Cunningham
- *Principles of Ecological Landscape Design* by Travis Beck

2. Research Articles and Journals

- *Land Degradation and Development*
- *Environmental Research Letters*
- *Sustainability Science*

3. Technical Guides and Reports

- *World Resources Report: Managing Resources Sustainably* by WRI
- *Global Land Outlook* by UNCCD

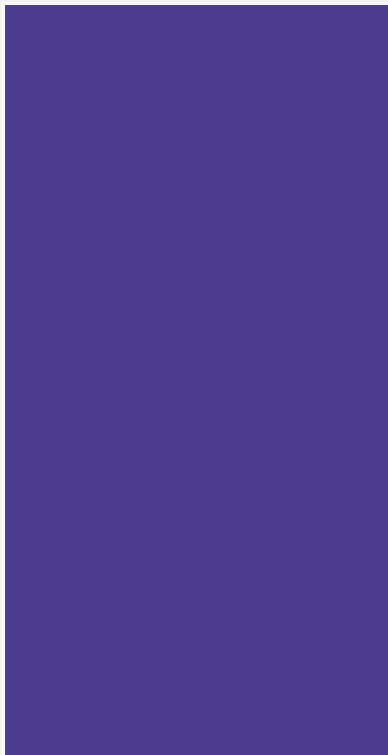
4. Web-Based Resources

- The Nature Conservancy: www.nature.org
- Conservation International: www.conservation.org

1. Online Courses and Tutorials

- *Natural Resource Management* on Coursera by the University of Minnesota





- *Ecosystem Restoration* by UNEP (free e-learning modules)
- 2. **E-Books and PDFs**
 - *The Economics of Ecosystem Restoration* by UNEP (PDF available online).
 - *Watershed Management Guide* by FAO (downloadable PDF).
- 3. **Videos and Webinars**
 - *National Geographic's Restore the Earth Series*: Videos on large-scale restoration projects.
 - *Webinars by the Society for Ecological Restoration (SER)*: Discussions on global restoration practices.
- 4. **Software and Apps**
 - **LandPKS (Land Potential Knowledge System)**: A tool for assessing land potential and monitoring restoration efforts.
 - **TerrSet Software**: Integrated GIS and remote sensing for monitoring land and ecosystem restoration.



- 1. **Field Visits and Demonstrations**
 - Visits to restoration sites, such as reclaimed mining areas or reforested landscapes.
 - Participation in community-led restoration projects.
- 2. **Workshops and Training Programs**
 - *Ecosystem Restoration Workshops* by the Society for Ecological Restoration (SER).
 - *Forest Management Training* by FAO or similar organizations.
- 3. **DIY Kits and Experimental Learning**
 - Soil quality testing kits to study degradation and recovery.
 - DIY reforestation kits for small-scale tree planting experiments.
- 4. **Case Studies and Reports**
 - *The Bonn Challenge*: A global initiative to restore 350 million hectares of degraded land.
 - *The Great Green Wall*: A case study of land restoration in Africa's Sahel region.

These resources provide a comprehensive guide to mastering natural resource management and restoration, equipping students and professionals with the skills to address real-world environmental challenges effectively.

2. Required Facilities and equipment





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

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	-Questionnaires -Open discussion in the classroom at the end of the lectures.
Effectiveness of Students' assessment	the Examination Results Evaluation Committee	monitoring the quality of the exam questions and their conformity to the required standards.
Quality of learning resources	Quality Committee in the Department	Checking the educational resources and lectures and their compatibility with the objectives and topics of the course
The extent to which CLOs have been achieved	Quality Committee in the Department	-Checking the course report prepared by the course instructor and his evaluation of the students' results. -students' evaluation of the course.
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	







Course Specification

— (Bachelor)

Course Title: **Environmental Monitoring and Assessment**

Course Code: **BIOE4515**

Program: **Environmental Sciences**

Department: **Biology**

College: **Science**

Institution: **Umm Al-Qura University**

Version: **1447**

Last Revision Date: **26 December 2024**



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A. General information about the course:

1. Course Identification

1. Credit hours: (3 hr)

2. Course type

A. University College Department Track Others

B. Required Elective

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

4. Course general Description:

This course provides an in-depth understanding of environmental monitoring and assessment, focusing on the principles, techniques, and applications of monitoring environmental parameters. Additionally, the course addresses environmental impact assessments (EIA) and risk analysis to evaluate human and industrial impacts on ecosystems.

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

Environmental Pollution (BIOE2503) 2nd Year / 3rd Level
Air and water pollution (BIOE2504) 2nd Year / 4th Level

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

7. Course Main Objective(s):

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

1. Understand the Fundamentals of Environmental Monitoring
 - Define key concepts and principles of environmental monitoring and assessment.
 - Explain the importance of monitoring environmental components such as air, water, and soil.
2. Develop Skills in Environmental Data Collection and Analysis
 - Apply appropriate sampling techniques for different environmental media.
 - Utilize analytical methods for detecting and quantifying pollutants.
 - Interpret environmental data using statistical and computational tools.
3. Assess Environmental Impacts and Risks
 - Understand methodologies for conducting environmental impact assessments (EIA).
 - Analyze risk factors and evaluate mitigation strategies for environmental hazards.



4. Use Modern Technologies in Environmental Monitoring

- Implement remote sensing and GIS techniques for environmental assessment.
- Explore the role of emerging technologies in environmental data management.

5. Promote Sustainable Environmental Management

- Evaluate the effectiveness of environmental policies and regulations.
- Develop strategies for sustainable environmental monitoring and pollution control.

6. Enhance Problem-Solving and Critical Thinking Skills

- Apply scientific methods to address environmental monitoring challenges.
- Develop solutions for real-world environmental issues based on monitoring data.

This course aims to equip students with the knowledge and technical expertise needed for careers in environmental science, regulatory agencies, and research institutions.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5h/week	100%
2	E-learning	-	-
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

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





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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Explain the fundamental principles of environmental monitoring and assessment, including key environmental parameters.	K1, K2	- Interactive lectures - Case studies - Group discussions	- Written exams - Assignments - Open-book exams - Quizzes
1.2	Identify and describe various environmental sampling techniques for air, water, and soil.	K1, K2	- Practical demonstrations - Field visits - Interactive lectures	- Practical reports - Written exams - Assignments - Quizzes
1.3	Describe the principles and applications of Environmental Impact Assessment (EIA) and risk analysis.	K2, K3	- Problem-based learning - Case studies - Guest lectures	- Project-based assessment - Written reports - Presentations
2.0	Skills			
2.1	Apply appropriate sampling and data collection techniques to monitor environmental pollutants and analyze the different features	S1, S2	- Fieldwork - Hands-on lab activities - Practical exercises	- Field reports - Lab reports - Practical assessments
2.2	Use statistical and computational tools to analyze environmental data.	S2, S3	- Computer-based workshops - Data analysis exercises	- Data interpretation assignments - Quizzes - Practical assessments
2.3	Critically evaluate environmental monitoring data and	S2, S3	- Case study analysis - Problem-	- Research papers - Presentation



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	propose mitigation strategies.		solving exercises	s - Group discussions
3.0	Values, autonomy, and responsibility			
3.1	Demonstrate ethical responsibility in environmental data collection and reporting.	V1	- Ethical discussions - Case studies	- Ethics-based assignments - Class discussions
3.2	Work effectively in teams to design and implement environmental monitoring programs.	V2, V3	- Group projects - Collaborative research	- Group-based assessments - Peer evaluations
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Environmental Monitoring and Assessment: Definitions, Importance, and Scope	2
2	Environmental Indicators and Parameters: Physical, Chemical, and Biological Aspects	2
3	Sampling Techniques for Air, Water, and Soil Monitoring	2
4	Laboratory and Field Methods in Environmental Monitoring	2
5	Analytical Techniques for Environmental Pollutants	2
6	Statistical and Computational Approaches in Environmental Data Analysis	2
7	Remote Sensing and GIS Applications in Environmental Monitoring	2
8	Environmental Impact Assessment (EIA): Principles and Methodologies	2
9	Risk Analysis and Management in Environmental Assessment	2
10	Water Quality Monitoring and Assessment	2
11	Air Quality Monitoring: Techniques and Standards	2
12	Soil Pollution and Contaminant Monitoring	2
13	Environmental Monitoring Programs: Design, Implementation, and Evaluation	2
14	Sustainable Environmental Management and Pollution Control Strategies	2
15	Ethical Considerations and Regulatory Frameworks in Environmental Monitoring	2
Total		30



Practical Component for "Environmental Monitoring and Assessment" (BIOE4515)

The practical part of this course is designed to provide hands-on experience in environmental monitoring techniques, data collection, and analysis. The laboratory sessions and fieldwork will complement the theoretical concepts taught in lectures.

1. Practical Learning Outcomes

By the end of the practical sessions, students should be able to:

1. Apply appropriate sampling techniques for air, water, and soil monitoring.
2. Use analytical instruments to detect and quantify environmental pollutants.
3. Interpret environmental data using statistical and computational tools.
4. Develop GIS-based maps for environmental monitoring.
5. Conduct environmental impact assessment (EIA) through case studies and real-world applications.
6. Implement risk analysis techniques for environmental hazards.

2. Practical Sessions and Activities

Week	Practical Topic	Learning Activities	Assessment Methods
1	Introduction to Environmental Monitoring	Safety guidelines, use of field and lab equipment, overview of sampling techniques	Attendance & participation
2	Air Sampling and Monitoring	Methods of air sampling (passive, active), particulate matter (PM) analysis, gas detection sensors	Lab report & quiz
3	Water Quality Assessment	Collection and analysis of water samples (pH, DO, BOD, COD, heavy metals)	Lab report & practical assessment
4	Soil Contamination and Analysis	Soil sampling techniques, chemical and biological contamination analysis	Soil sample report
5	Environmental Pollutants Detection	Spectrophotometry, chromatography (GC-MS, HPLC), heavy metals detection	Lab assessment
6	Statistical & Computational Data Analysis	Data processing in SPSS, R, or Excel for environmental assessment	Data interpretation exercise
7	GIS & Remote Sensing Applications	GIS mapping of pollution sources, remote sensing for land use changes	GIS mapping project



Week	Practical Topic	Learning Activities	Assessment Methods
8	Midterm Practical Exam	Practical assessment covering previous experiments	Midterm exam
9	Environmental Impact Assessment (EIA) Techniques	Case study analysis, field visit to industrial site for impact evaluation	Report & presentation
10	Risk Assessment & Hazard Mapping	Identifying environmental risks using GIS & statistical methods	Risk analysis report
11	Microbiological Monitoring of Water & Soil	Identification of microbial contamination, bacterial culture & biochemical tests	Microbial analysis report
12	Noise Pollution & Environmental Sound Analysis	Noise level monitoring using sound meters, evaluation of noise pollution in different environments	Noise pollution analysis report
13	Waste Management & Pollution Control Techniques	Waste characterization, recycling techniques, hazardous waste treatment	Waste assessment report
14	Designing an Environmental Monitoring Program	Students develop a monitoring program for a selected environmental issue	Final project submission
15	Final Practical Exam	Comprehensive lab-based assessment	Final practical exam

3. Required Laboratory Equipment and Software

- **Sampling Equipment:** Air samplers, water testing kits, soil augers, sample containers.
- **Analytical Instruments:** Spectrophotometer, Gas Chromatography-Mass Spectrometry (GC-MS), High-Performance Liquid Chromatography (HPLC), Atomic Absorption Spectroscopy (AAS).
- **GIS & Remote Sensing Tools:** ArcGIS, QGIS, Google Earth, satellite imagery software.
- **Data Analysis Software:** SPSS, R, MATLAB, Excel for statistical analysis.
- **Microbiological Analysis:** Incubators, autoclaves, culture media, microscopes.
- **Field Instruments:** pH meters, dissolved oxygen meters, turbidity meters, noise level meters.





D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, Project, Problem Sets	Throughout the semester	10%
2.	Midterm Exam (Lab)	Week 7	10%
3.	Exam Midterm (Lecture)	Week 7	20%
4.	Final Exam (Lab)	Week15	20%
5.	Final Exam (Lecture)	Week 16	40%
	Total		100

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

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<p>Reddy, N.T., Hemavathi, Manjunath, R. (2025). Environmental Applications and Emerging Pollutants: Monitoring and Remediation Techniques. In: Verma, P. (eds) Biotechnology for Environmental Sustainability. Interdisciplinary Biotechnological Advances. Springer, Singapore. https://doi.org/10.1007/978-981-97-7221-6_13</p> <p>- Younes, M. & Bartram, J. (2001). <i>Environmental Monitoring and Assessment: Principles and Practices</i>.</p> <p>- Chapman, D. (1996). <i>Water Quality Assessments: A Guide to the Use of Biota, Sediments, and Water in Environmental Monitoring</i>. 2nd Edition.</p>
Supportive References	<p>- <i>Environmental Monitoring and Assessment Journal</i></p> <p>- <i>Journal of Environmental Science and Pollution Research</i></p> <p>- <i>Environmental Impact Assessment Review</i></p>
Electronic Materials	<p>- <i>United Nations Environment Programme (UNEP) Reports:</i> https://www.unep.org</p> <p>- <i>US Environmental Protection Agency (EPA) Environmental Monitoring Resources:</i> https://www.epa.gov/monitoring</p> <p>- <i>NCBI – Environmental Health Articles:</i> https://www.ncbi.nlm.nih.gov/pmc</p>
Other Learning Materials	<p>- Course Handouts: Instructor-prepared lecture notes covering environmental monitoring techniques, methodologies, and case studies.</p>





- **Lab Manuals:** Detailed step-by-step guides for laboratory experiments and fieldwork related to environmental assessment.
- **Interactive Online Modules:** Simulations and training resources related to GIS applications, remote sensing, and data analysis in environmental monitoring.
- **Research Papers:** Recent studies on environmental impact assessments, pollution monitoring, and risk analysis.
- **Case Studies:** Documented real-world examples of environmental monitoring programs and mitigation strategies.

2. Required Facilities and equipment

Items	Resources
<p>facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)</p>	<ul style="list-style-type: none"> - Lecture room equipped for interactive learning - Laboratory for environmental analysis - Fieldwork access for sampling and monitoring studies
<p>Technology equipment (projector, smart board, software)</p>	<ul style="list-style-type: none"> - Computers with data analysis software (e.g., GIS, SPSS, R, MATLAB) - Internet access for research and online resources - Smart Board for interactive presentations - Projector for visual presentations
<p>Other equipment (depending on the nature of the specialty)</p>	<ul style="list-style-type: none"> - Display screen for data visualization - Whiteboard for discussions and problem-solving sessions - UV rays and spectrophotometer for pollutant and DNA analysis - Air and water quality monitoring sensors - Remote sensing tools for GIS-based environmental assessment

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Course Instructor	<ul style="list-style-type: none"> - Student feedback (course evaluations and surveys) - Peer evaluations



Assessment Areas/Issues	Assessor	Assessment Methods
		- Regular review of teaching strategies
Effectiveness of Students assessment	Students	- Written feedback - Satisfaction surveys - Peer evaluation of assignments and projects
Quality of learning resources	Course Instructor	- Staff development programs - Student feedback on course materials - Variation in teaching methods to enhance learning
The extent to which CLOs have been achieved	Course Instructor Peer Reviewer	- Student performance analysis (exam results, assignment scores) - Peer evaluation of course structure - Statistical comparison of student achievement across semesters
Other	Course Instructor Program Director	- Evaluation of student engagement (participation in discussions, projects, and fieldwork) - Post-course review for continuous improvement

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	





Course Specification

— (Bachelor)

Course Title: **Ecotoxicology**

Course Code: **BIOE4513**

Program: **Environmental Sciences**

Department: **Biology**

College: **Science**

Institution: **Umm Al-Qura University**

Version: **2**

Last Revision Date: **7/1/2025**



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A. General information about the course:

1. Course Identification

1. Credit hours: (.....)

2 hours

2. Course type

A. University College Department Track Others

B. Required Elective

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

4. Course General Description:

Toxicology is the study of the nature, properties, effects, and detection of toxic substances in the environment and any environmentally exposed species, including humans. This course will provide a general understanding of toxicology related to the environment. Fundamental toxicological concepts will be covered, including dose-response relationships, absorption of toxicants, distribution and storage of toxicants, biotransformation and elimination of toxicants, target organ toxicity and teratogenesis, mutagenesis, carcinogenesis, and risk assessment.

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

Environmental pollution

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

7. Course Main Objective(s):

The student will be able to:

- Define the basic principles of environmental health toxicology and ecotoxicology.
- Introduce the student to the systems used for classifying environmental toxicants.
- Illustrate the impact of environmental toxins on human health through specific examples
- Introduce the students to ways to examine the epidemiology of environmental toxicology.
- Illustrate the effects of toxic chemical substances and natural toxic natural substances on humans.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	2hrs/week	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)





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

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Demonstrate an understanding of the core concepts of the science of toxicology, including evaluating health risks from exposure to various chemical hazards.	K1-K4	In-class lecturing -Homework assignments -Discussions (connecting what they learn in the class. -Small group discussions.	-Homework and Quizzes. -Midterm and final written exams -Evaluation of reports - Oral presentation
2.0	Skills			
2.1	Have an overview of the fundamental statistical methods for data analysis and be able to conduct appropriate statistical analyses of ecotoxicological data, including the determination of the critical thresholds.	S1	-Apply essential scientific techniques through lectures and essays. - Small group discussion - Search projects --Homework assignments	-Midterm and final exams -Checking the homework assignments
3.0	Values, autonomy, and responsibility			
3.1	know important aspects of environmental pollution, understand this discipline's role in society,	V1		-Assignments Presentation assessments. -Research



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and assess ethical issues within this field.			
3.2	carry out and solve advanced tasks and projects, both independently and in teams, and can assess their efforts in projects.	V3		

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Toxicology and general principles of toxicity	2
2.	Major Classes of Contaminants (Organic and inorganic pollutants Emerging contaminants (e.g., pharmaceuticals, microplastics)	4
3.	Toxicokinetics and Toxicodynamics (Absorption, distribution, metabolism, and excretion)	2
4.	Biotransformation, Detoxification, Elimination, and Accumulation. Factors Influencing Bioaccumulation.	2
5.	Midterm Exam I	2
6.	Hazardous Waste, Characteristics of Hazardous Waste, Sources, Classification of Hazardous Waste, effects, and definition of heavy metals.	4
7.	Ecotoxicological Testing and Methods (essays and field studies, Bioindicators and biomarkers)	2
8.	Effects on Ecosystems (Population dynamics and community structure, Impacts on biodiversity)	4
9.	Acute and Chronic Lethal Effects on Individuals. Risk and Damage Assessment of Contaminants	4
10.	Midterm Exam II	2
11.	Risk Management (Ecological risk assessment frameworks Policy and regulation)	2
Total		30





D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Oral presentation	weekly	10
2.	Mid-term Exam I	6 th	20
3.	Mid-term Exam II	12 th	20
4.	Final Exam (written test)	16 th	50

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

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<ul style="list-style-type: none"> • Ahmed, A. (2024). Environmental Toxicology. In: Moneim Elhadi Sulieman, A., Alshammari, N.I. (eds) Microbial Toxins in Food Systems: Causes, Mechanisms, Complications, and Metabolism. Springer, Cham. https://doi.org/10.1007/978-3-031-62839-9_7 Bhagat, J., Singh, N., Shimada, Y. (2024). Ecotoxicology and Risk Assessment of Contaminated Water. In: Alshemmari, H., Hashmi, M.Z., Kavi, Y.N., Shu-hong, W. (eds) Contaminated Land and Water. Emerging Contaminants and Associated Treatment Technologies. Springer, Cham. https://doi.org/10.1007/978-3-031-65129-8_1 Casarett and Doull's Toxicology: The Basic Science of Poisons. C.D. Klaassen, McGraw Hill, New York. (Latest edition). • Wright and Wellbourne. Environmental Toxicology. • Connell, Lam, Richardson and Wu. Ecotoxicology • Timbrell. Introduction to Toxicology • Fundamentals of Ecotoxicology. CRC Press, latest edition.
Supportive References	
Electronic Materials	<p>www.PubMed.com http://www.sciencebuddies.org/ The American Association for the Advancement of Science http://www.aaas.org/</p>
Other Learning Materials	

2. Required Facilities and equipment



Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room Library
Technology equipment (projector, smart board, software)	Computers and Internet connection Active Board Data shown is required in every room
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect - Questionnaires
Effectiveness of Students assessment	Program committee. - Staff members. - Students.	Direct - Questionnaires. - Reports. - Meetings
Quality of learning resources	Program leaders. - Peer Reviewer.	Direct & Indirect - Questionnaires. - Reports. - Meetings
The extent to which CLOs have been achieved	- Peer Reviewers Students	Direct & Indirect
Other	NA	NA

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	2
DATE	7/1/2025





Course Specification

— (Bachelor)

Course Title: **Ecophysiology**

Course Code: **BIOE4305**

Program: **Environmental Sciences**

Department: **Biology**

College: **Science**

Institution: **Umm Al-Qura University**

Version: **2**

Last Revision Date: **13 January 2025**



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A. General information about the course:

1. Course Identification

1. Credit hours: (3 hours)

2. Course type

A. University College Department Track Others

B. Required Elective

3. Level/year at which this course is offered: (Fourth Year / Level 7)

4. Course general Description:

This course explores the physiological adaptations of organisms to their environment, with an emphasis on understanding how environmental factors such as temperature, water availability, and salinity influence biological systems. Students will analyze the mechanisms organisms use to maintain homeostasis and thrive in diverse ecosystems, integrating knowledge of eco-biochemistry and plant vegetation.

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

Eco-biochemistry
Plant Vegetation

6. Course Main Objective(s):

- To develop a comprehensive understanding of how environmental factors shape physiological processes in organisms.
- To analyze the mechanisms of adaptation in plants, animals, and microorganisms in various ecosystems.
- To encourage critical thinking and application of ecophysiological principles in solving environmental challenges.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5hr/week	100%
2	E-learning	0	0
3	Hybrid <ul style="list-style-type: none"> • 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	30
2.	Laboratory/Studio	45
3.	Field	-
4.	Tutorial	-
5.	Others (specify)	-
Total		75

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Know and Understand the basics and concept of adaptation and Environmental stresses	K1		
1.2	Define Environmental stresses: its meaning and definition. Environmental changes and their effect on the vegetation. Strategies of plant adaptations to their environmental conditions.	K1 + K2	Lecture Reading topics Presentation Study case	Exam
2.0	Skills			
2.1	Students will be able to collect the data and collect plant and materials that help to gain more information about adaptation and Environmental stresses	S1+ S2		Observing student achievement on materials Presentations Topics discussion



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	How to get useful information by internet Using computer programs	S3		
3.0	Values, autonomy, and responsibility			
3.1	Skills of teamwork	V3		
3.2	Ability to read results Getting use of technology Knowledge of analyzing data. Using the Internet and computer programs	V2	Study case presentation Internet link Computer program	Discussion of studied topics Monthly exams Final exam

C. Course Content

No	List of Topics	Contact Hours
1.	Overview of Environmental Stresses <ul style="list-style-type: none"> Definition and classification: Abiotic vs. biotic stresses. Stress signaling in plants: An introduction 	2
2.	Water Stress: Drought and Desiccation <ul style="list-style-type: none"> Mechanisms of drought perception and response. Physiological changes under water deficit. Desiccation tolerance in resurrection plants. 	2
3.	Salinity Stress <ul style="list-style-type: none"> Effects of salt stress on plant physiology. Ion homeostasis and osmotic adjustment. Salt-tolerant species and halophytes. 	2
4.	Heat Stress <ul style="list-style-type: none"> Impact of high temperatures on plant metabolism. Heat shock proteins and thermotolerance mechanisms. Role of membranes and antioxidants under heat stress. 	2
5.	Cold and Freezing Stress <ul style="list-style-type: none"> Cellular and molecular effects of low temperatures. 	2



	<ul style="list-style-type: none"> • Antifreeze proteins and cryoprotective mechanisms. • Chilling-sensitive vs. cold-tolerant plants. 	
6.	<p>Oxidative Stress</p> <ul style="list-style-type: none"> • Reactive oxygen species (ROS) and their effects. • Role of enzymatic and non-enzymatic antioxidants. • Cross-talk between oxidative and other stress responses. 	2
7.	<p>UV-B Radiation Stress</p> <ul style="list-style-type: none"> • Effects of UV-B radiation on plant growth and photosynthesis. • DNA damage, repair mechanisms, and UV-absorbing compounds. • Role of phenolics in UV protection. 	2
8.	<p>Heavy Metal Stress</p> <ul style="list-style-type: none"> • Toxic effects of heavy metals on plant physiology. • Mechanisms of metal detoxification and tolerance. • Phytoremediation: Plants in pollution cleanup. 	2
9.	<p>Flooding and Hypoxia Stress</p> <ul style="list-style-type: none"> • Effects of oxygen deprivation on plant growth. • Adaptive mechanisms: Aerenchyma formation and anaerobic metabolism. • Flood-tolerant plant species and strategies. 	2
10	<p>Nutrient Deficiency and Toxicity</p> <ul style="list-style-type: none"> • Physiological effects of macro- and micronutrient imbalances. • Strategies for nutrient acquisition under stress conditions. • Adaptive responses in nutrient-poor environments. 	2
11.	<p>Biotic Stresses: Pathogens and Herbivores</p> <ul style="list-style-type: none"> • Plant defense mechanisms: Structural and biochemical responses. • Role of secondary metabolites and signaling pathways. • Induced resistance and plant-microbe interactions. 	2
12.	<p>Combined Stresses</p> <ul style="list-style-type: none"> • Synergistic and antagonistic effects of multiple stresses. • Cross-talk between stress signaling pathways. 	2



	<ul style="list-style-type: none"> Mechanisms of adaptation to simultaneous abiotic and biotic stresses. 	
13.	Climate Change and Stress Responses <ul style="list-style-type: none"> Effects of elevated CO₂, temperature, and erratic rainfall on plants. Role of stress physiology in adaptation to climate change. Mitigation strategies for future agriculture. 	2
14.	Epigenetics and Stress Memory <ul style="list-style-type: none"> Role of epigenetic modifications in stress tolerance. Stress memory and transgenerational adaptation. Application of epigenetics in crop improvement. 	2
15.	Biotechnological Approaches to Stress Tolerance <ul style="list-style-type: none"> Genetic engineering for stress resistance. CRISPR and gene editing in stress response pathways. Breeding strategies for climate-resilient crops. 	2
16.	Assessing the moisture content of various seed varieties and its correlation with germination rate (Practical)	6
17.	Effect of water stress (Practical)	6
18.	Photostress (Practical)	6
19.	Impact of UV radiation on seed germination (Practical)	3
20.	Heat stress (Practical)	6
21.	Salinity stress (Practical)	6
22.	Pollution stress (Practical)	3
23.	Heavy metals stress (Practical)	6
24.	Extraction and quantification of proline in plants exposed to salt stress (Practical)	3
Total		45 Hours

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Periodical Exam(s)	4	10%
2.	Mid Term Exam (Theoretic)	6	20%





No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	Lab activity	continuous	10%
4.	Activities	13	10%
5.	Final Lab Exam	14	10%
6.	Final Exam	15	40%
	Total		100%

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

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<ul style="list-style-type: none"> Brunetto, G. <i>et al.</i> (2024). Heavy Metal Stress Response in Plants and Their Adaptation. In: Gutiérrez Gamboa, G., Fourment, M. (eds) Latin American Viticulture Adaptation to Climate Change. Springer, Cham. https://doi.org/10.1007/978-3-031-51325-1_5 Ncama, K., Aremu, O.A., Sithole, N.J. (2022). Plant Adaptation to Environmental Stress: Drought, Chilling, Heat, and Salinity. In: Galanakis, C.M. (eds) Environment and Climate-smart Food Production . Springer, Cham. https://doi.org/10.1007/978-3-030-71571-7_5 Environmental Physiology of Animals. Willmer, P., Stone, G., & Johnston, I. (2005). Wiley-Blackwell. Physiological Plant Ecology. Larcher, W. (2003). Springer. أفلمة الظروف البيئية. محمد اليمني، رمضان الدسوقي (٢٠٠٩). جامعة الملك سعود Response of Plants to Environmental Stresses.Vol.II Levitt,J (1980). Ed.Academic Press, Inc.New York and London. Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation [1st Edition.] Ashwani Pareek, S.K. Sopory, Hans J. Bohnert, Govindjee (2010).Springer
Supportive References	Journals: <i>Ecophysiology</i> (Springer), <i>Environmental Science & Technology</i>
Electronic Materials	Online articles and databases provided through the university portal
Other Learning Materials	

2. Required Facilities and equipment





Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, laboratories
Technology equipment (projector, smart board, software)	Technology resources (AV, data show, Smart Board, software, etc.)
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct
Effectiveness of Students assessment	Lecturer / Department	Direct
Quality of learning resources	Unit management system	Indirect
The extent to which CLOs have been achieved	Unit management system	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	BIOLOGY DEPARTMENT / DR. DALIA M MELEBARI
REFERENCE NO.	
DATE	JANUARY 2025





Course Specification

— (Bachelor)

Course Title: Chemical Safety

Course Code: CHM4250

Program: Environmental Sciences

Department: Chemistry

College: Faculty of Science

Institution: Umm Al-Qura University

Version: Course Specification Version Number

Last Revision Date: 5/2/2025



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A. General information about the course:

1. Course Identification

1. Credit hours: (2 h, theoretical)

2. Course type

A. University College Department Track Others

B. Required Elective

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

4. Course general Description:

This course concerns laboratories, chemicals, chemical wastes, radiations and how to work safely with them.

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

Chemical Treatment of Environmental Pollution CHM3233

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

7. Course Main Objective(s):

By the end of this course students have all the information about:

- Understanding the chemicals nature and hazards in laboratories.
- Understanding the importance of MSDS and COSHH forms.
- Implementing methods of self-protection while dealing with chemicals and radiations.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	E-learning	---	---
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 	---	---
4	Distance learning	---	---

3. Contact Hours (based on the academic semester)



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

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Know different laboratories, their composition and how to handle chemicals.	K2	- Lectures - Scientific discussion	Mid-term exam Final exam
1.2	Recognize the hazards associated with the work environment.	K4	- Lectures - Web based study	Mid-term exam Final exam
1.3	Describe the measures used for working safely in laboratories.	K3	- Lectures - Scientific discussion	Mid-term exam Final exam
2.0	Skills			
2.1	Develop reverse thinking skills and predict the suitable procedures for working with chemicals.	S2		- long and short essays - posters lab manuals
2.2	Explain the methods used for mitigating the hazards associated with different chemicals and wastes.	S4		



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	Explain a suitable method to work with radioactive materials and laboratories.	S5	- Lectures	Final exam
3.0	Values, autonomy, and responsibility			
3.1	Work effectively both in a team, and independently on solving some Chemical safety problems.	V1	- Group discussion - Project	Write a report and Observation of group's teamwork performance
3.2	Write COSHH forms to illustrate information related to hazardous chemicals in some laboratories.	V2	- Presentation	Observation by the instructor
3.3	Work collaboratively and constructively in teams to extract MSDS and write COSHH forms.	V3	- Presentation	Observation by the instructor

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction, laboratory definition, types, composition and use.	2
2.	Recognizing hazards, definition, physical hazard examples, health hazard examples and pictograms.	4
3.	Hazardous waste – Biomedical waste	4
4.	Material safety data sheet (MSDS)	2
5.	Radiation hazards, x-ray, lazeretc	4
6.	Mid-term exam	2
7.	Safety in the laboratories	4
8.	Special requirements for peroxides, explosives.	2
9.	Safety equipment. How to deal with spills	4
10.	Chemical emergency response procedure, accident reporting and documentation.	2
Total		30





D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and/or activities.	During all weeks	20%
2.	Midterm Exam.	8	30%
3.	Final Exam. (2 hours exam)	16-17	50%
Total		---	100%

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

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<ul style="list-style-type: none"> Stephen K. Hall, <i>Chemical safety in the laboratory</i>, CRC press (2018) Ilya Obodovskiy, <i>Fundamentals of radiation and chemical safety</i>, Elsevier (2015)
Supportive References	---
Electronic Materials	<ul style="list-style-type: none"> http://www.chemweb.com http://www.sciencedirect.com http://www.rsc.org
Other Learning Materials	Lecture Handouts available on the coordinator website

2. Required Facilities and equipment

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

F. Assessment of Course Quality

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



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

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CHEMSITY DEPARTMENT, FACULTY OF SCIENCE
REFERENCE NO.	
DATE	5/2/2025

