Course Specification
(Bachelor)

Course Title:	Behavioral Ecology
Course Code:	BIOE4520
Program:	Environmental Sciences
Department:	Biology
College:	Science
Institution:	Umm Al- Qura University
Version:	47
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 Hrs.....)					
2					
2. Course type					
A.	☐University	☐College	☒ Department	☐ Track	Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (level 8/ year4)					
4. Course general Description:					
Behavioral Ecology is the study of the evolutionary and ecological bases of animal behavior. This course examines how behaviors such as foraging, mating, predator avoidance, communication, and social interaction evolve and are shaped by environmental pressures. We will explore the genetic, physiological, and ecological influences on behavior, using a range of examples from the animal kingdom. The course integrates principles from ecology, evolutionary biology, and ethology to understand how animals interact with their environments and how these interactions are adapted for survival and reproduction.					
5. Pre-requirements for this course (if any)**:**					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
1. Understand the basic principles of behavioral ecology and evolutionary theory. 2. Identify and analyze different types of animal behaviors and their adaptive significance. 3. Investigate how ecological factors such as resource distribution and predation affect behavior. 4. Evaluate the role of genetic and environmental factors in the development of behavior. 5. Analyze how behaviors are shaped by natural selection and can be influenced by kin selection, group selection, and sexual selection. 6. Design simple experiments or observational studies in behavioral ecology. 7. Critically assess scientific literature on behavioral ecology.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	2 hours/ week	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • 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 core concepts and the fundamentals of the relationship between animal behavior, evolutionary theory, and ecological contexts.	**K1**	Lectures	Exams
1.2	Identify the behavioral ecology concepts to interpret real-world animal behavior	**K2**	Seminaries	Research Paper/Project: A research project on a behavioral ecology topic
2.0	**Skills**			
2.1	Apply broad theories, principles, and	**S1**	-Lectures.	Research Paper/Project: A research project

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	concepts in behavioral ecology		- Seminars.	on a behavioral ecology topic
2.2	Use critical thinking and develop creative solutions to environmental issues and problems that relayed to behavioral ecology	**S2**	- Brain storming. - Discussion. - Seminars.	Class Participation: Active participation in discussions, group activities, and peer reviews.
2.3	communicates effectively to explain theoretical knowledge to a variety of audiences.	**S5**	- Brain storming. - Discussion. - Seminars.	Class Participation: Active participation in discussions, group activities, and peer reviews.
3.0	Values, autonomy, and responsibility			
3.1	Demonstrate commitment to professional and academic values and ethics.	**V1**	- Internet search assignments and essays. -Students will be asked for delivering a summary regarding certain topics related to the course.	-Evaluation of student essays and assignments. -Evaluating the discussion and the report .
3.2	Work collaboratively and effectively in teams with responsibility.	**V3**	- Oral presentations. - Internet search assignments and essays. -Students will be asked for delivering a summary regarding certain topics related to the course.	Evaluation of student essays and assignments. -Evaluating the discussion and the report .

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Behavioral Ecology • Overview of behavioral ecology • Basic concepts in animal behavior • The role of natural selection in shaping behavior • The relationship between genetics and behavior	2
2.	Foraging Behavior • Optimal foraging theory • Cost-benefit analysis in foraging • Patch choice and resource distribution • Group foraging	2
3.	Predator-Prey Interactions • Anti-predator behaviors • Cryptic coloration and camouflage • Vigilance and predator avoidance strategies • Coevolution of predators and prey	2
4.	Communication and Signaling • Types of animal communication: visual, auditory, chemical, and tactile • The evolution of communication systems • Pheromones and chemical signaling	2
5.	Social Behavior • Social structures in animal groups • Group living : costs and benefits • Cooperation, dominance, and territoriality	4
6.	Mid-Term Exam.	
7.	Evolution of Behavior • Evolutionary theories of behavior • Kin selection and inclusive fitness	2
8.	Evolution of Behavior • Altruism and cooperation • Sexual selection and mate choice	2
9.	The Evolution of Reproductive Behavior & Mating Systems. • Mating systems: monogamy, polygyny, polyandry • Mate guarding and competition • Mate choice and sexual dimorphism	2
10.	The Evolution of Parental Care. • Parental care and reproductive strategies • Parental investment theory	2
11.	Behavioral Adaptations to Environmental Stressors • Responses to environmental change	4

	• Behavioral thermoregulation • Migration and hibernation • Evolution of behavioral flexibility	
12.	Presentations assessment	2
13.	Report assessment and discussion	2
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Periodical exam(s)	4 + 12	10%
2.	Mid term Exam	8	30%
3.	Assessment (report- presentation)	5	10%
4.	Final written Exam	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	Krebs, J.R., & Davies, N.B. (2018). An Introduction to Behavioral Ecology (4th edition). Wiley-Blackwell.
Supportive References	• Alcock, J. (2013). Animal Behavior: An Evolutionary Approach (10th edition). Sinauer Associates. • Dugatkin, L. (2009). Principles of Animal Behavior (2nd edition). W.W. Norton & Company.
Electronic Materials	https://www.researchgate.net/publication/
Other Learning Materials	Selection of recent and classic research articles in behavioral ecology.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• classrooms equipped with a Data show. • Instructors use their own laptop.
Technology equipment (projector, smart board, software)	• Projector • Software

Items	Resources
Other equipment (depending on the nature of the specialty)	• Library/Database Access: Access to journals, books, and ecological databases.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct
Effectiveness of Students assessment	Program Leaders	Direct
Quality of learning resources	Program Leaders	Direct
The extent to which CLOs have been achieved	Program Leaders	Direct
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:	**Green Chemistry**
Course Code:	**CHM4440**
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**

Table of Contents

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: (6th or 8th level/4th year)					
4. Course general Description:					
This course introduces principles and developments of green chemistry to the students and the role of green chemistry in solving environmental problems and preventing related hazards.					
5. Pre-requirements for this course (if any)**:**					
Quantitative Chemical Analysis CHM2240					
6. Pre-requirements for this course (if any)**:**					
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7. Course Main Objective(s):					
By the end of this course student will be familiar with the basic principles of green chemistry and the implementation of green chemistry practices.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
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**	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	Familiar with principles and concepts of green chemistry.	K1	- Lectures - Scientific discussion	Mid-term exam Final exam
1.2	Identify the different conventions and/or chemical terminology related to green chemistry	K4	- Lectures - Web based study	Mid-term exam Final exam
2.0	**Skills**			
2.1	Design and develop sustainable solutions to major environmental/biological problems by applying appropriate green chemistry tools based on solid scientific research.	S2		- long and short essays - posters lab manuals
2.2	Demonstrate effective writing, oral communication skills and using ICT tools in topics related to green chemistry.	S4		
3.0	**Values, autonomy, and responsibility**			
3.1	Students will demonstrate	V1	- Group discussion - Project	Write a report and

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	commitment to professional and academic values, and ethics in the field of green chemistry			Observation of group's teamwork performance
3.2	Write and present a chemical report related to green chemistry	V2	- Presentation	Observation by the instructor

C. Course Content

No	List of Topics	Contact Hours
1.	Principles and Concepts of Green Chemistry	2
2.	Waste: production, problems, and prevention.	4
3.	Measuring and controlling environmental performance	4
4.	Catalysis and Green Chemistry	2
5.	Organic Solvents and Environmentally benign solutions	4
6.	Mid-term exam	2
7.	Renewable resources	4
8.	Emerging Green technologies and Alternative Energy	2
9.	Green Nanotechnology	4
10.	Industrial case studies.	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	Green Chemistry – An introductory text", Mike Lancaster , The Royal Society of Chemistry 2002
Supportive References	---
Electronic Materials	• 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 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

Course Specification
(Bachelor)

Course Title:	Bioremediation
Course Code:	BIOE3519
Program:	Environmental Sciences
Department:	Biology Department
College:	Faculty of Science – Biology Department
Institution:	Umm Al-Qura University
Version:	2
Last Revision Date:	13 January 2025

Table of Contents

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: (Level 5 / 3rd Year)					
4. Course general Description:					
This course provides an in-depth understanding of bioremediation techniques and their application in addressing environmental pollution. The course covers the principles and practices of microbial, fungal, and plant-based bioremediation strategies, along with advanced approaches such as nanotechnology. Emphasis is placed on the physiological, chemical, and biological interactions in the remediation process, along with real-world applications, challenges, and future directions					
5. Pre-requirements for this course (if any):					
6. Pre-requirements for this course (if any):					
7. Course Main Objective(s):					
• Understand the fundamental principles of bioremediation and its role in environmental sustainability. • Explore various bioremediation strategies, including microbial, fungal, and phytoremediation techniques. • Evaluate the efficiency of bioremediation methods for different types of pollutants, including heavy metals, pesticides, and explosives. • Analyze the role of nanotechnology in enhancing bioremediation processes. • Develop critical thinking and problem-solving skills for practical environmental applications.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30Hr	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**	30 Hours
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		30 Hours

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 basic principles and scientific concepts behind bioremediation and its importance in addressing environmental challenges.	**K1**	• Interactive lectures with multimedia presentations • In-class brainstorming discussions	• Comparative essays • Written exams
1.2	Differentiate between bioremediation strategies such as microbial, fungal, and phytoremediation, and compare their applications.	**K2**	• Case study analysis • Use of flowcharts and comparative diagrams	• Multiple-choice quizzes • Midterm exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.3	Explain the principles of aerobic vs. anaerobic bioremediation and their relevance to site-specific conditions.	**K2**	• Problem-based learning sessions • Simulations using specialized software	• Problem-solving exercises • Short-answer tests
1.4	Analyze the role of nanotechnology in enhancing the efficiency of bioremediation processes, including pollutant targeting and degradation.	**K4**	• Guest lectures by experts in nanotechnology • Group discussions on scientific articles	• Research reports • Oral presentation
2.0	**Skills**			
2.1	Design bioremediation approaches for specific contaminants, considering factors like site conditions, pollutant types, and available resources.	**S1**	• Group project workshops • Laboratory experiments	• Project proposals • Laboratory reports
2.2	Evaluate the challenges and limitations of bioremediation methods, including their cost, efficiency, and environmental impacts.	**S3**	• Debate sessions • Critical analysis of real-world case studies	• Critical review papers • Individual assignments
3.0	**Values, autonomy, and responsibility**			
3.1	Develop innovative, sustainable solutions to mitigate environmental pollution using bioremediation technologies, considering ethical and societal impacts.	**V2**	• Capstone projects • Collaborative learning activities	• Final project presentation • Peer evaluations
3.2	Demonstrate ethical responsibility in	**V1**	• Role-playing activities	• Reflection journals

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	applying bioremediation technologies, including compliance with environmental regulations and promotion of sustainability.		simulating environmental decision-making • Reflective discussions	• Participation grades
3.3	Exhibit teamwork and communication skills while working on collaborative projects related to bioremediation, including proposal writing and presenting findings to diverse audiences.	**V3**	• Group projects • Mock conferences	• Group project assessments • Presentation evaluations

C. Course Content

No	List of Topics	Contact Hours
1.	*Introduction* • Concept of environmental pollutions • Type of environmental pollutions. • Differentiation between bioremediation and biodegradation • Terminology related pollutions • Type of environmental pollutions. • Differentiation between bioremediation and biodegradation • Advantages of Bioremediation and biodegradation • Problems face the biological treatments • Pollutants suitable for biological treatment • Methods for biological treatment • Microorganisms involved in bioremediation	**4**
2.	*Bioremediation Techniques* • Overview of Bioremediation Strategies • Physicochemical Treatments • Biological Treatments • Aerobic vs. Anaerobic Bioremediation • Biostimulation vs. Bioaugmentation • In-Situ vs. Ex-Situ Bioremediation • Microbial Bioremediation vs. Phytoremediation	**4**

	• Pathways of microbial bioremediation. • General Approaches to Spatial Bioremediation • Selection of Nutrients and Delivery Systems	
3.	*Phytoremediation of Environmental Pollutants* • Overview of Phytoremediation Processes • Absorption and Metabolism of Organic Compounds by Plants (Green Liver Model) • Advanced Methods in Phytoremediation Applications • Advantages and Limitations of Phytoremediation • Remediation of Soil and Water Contaminated with Radioactive Materials • Current Applications and Future Trends	**4**
4.	*Mycoremediation of Environmental Pollutants* • Overview of Fungal Environmental Traits • Fungal Decomposition and Degradation • Fungal Bioreactors • Fungi as Environmental Indicators • Fungal Diversity and Pollutant Degradation • Biodegradation of Persistent Organic Pollutants and Metals • Environmental Applications and Future Directions	**4**
5.	*Biodegradation and Bioremediation of Pesticides and PCBs* • Beneficial and Adverse Effects of Pesticides • Types of Organic Pesticides • Bioremediation of Pesticides • Overview of PCBs (Polychlorinated Biphenyls) • Biological Transformation of PCBs • Bioremediation of PCBs (Bacteria, Fungi, Plants)	**4**
6.	*Bioremediation of Heavy Metals and Explosives* • Soil Contamination by Heavy Metals and Sources • Microbial Interactions with Heavy Metals • Biosorption Mechanisms • Bioremediation of Metals	**2**
7.	*Nanotechnology in Pollution Treatment* • Overview of Nanoparticles in Nature • Role of Nanoparticles in Bioremediation • Water Purification Using Nanoparticles • Nanocatalysts and Nanomembranes	**2**

	• Environmental Applications and Future Trends	
8.	*Evaluation of bioremediation* • Methods for flow and evaluation of biological treatment • Evaluation of toxicity risks • Environmental biomarkers • Saudi Arabia's efforts for sustainability and the use of bioremediation technologies to preserve the environment	**2**
Total		**26 + 4 hours for exam**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Periodical Exam (s)	**3 + 11**	**10%**
2.	Mid Term Exam	**7**	**30%**
3.	Reports and essay	**14**	**10%**
4.	Final Exam	**15**	**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	• Rashed Zaghloul, Hussien Abulreech, Khaled Elbanna (2021), Bioremediation of environmental pollutants, Tkween Publisher, Saudi arabia. Tanaka, S. (2022). Environmental Pollution and Remediation. In: Tanaka, S., Kurasaki, M., Morikawa, M., Kamiya, Y. (eds) Design of Materials and Technologies for Environmental Remediation. The Handbook of Environmental Chemistry, vol 115. Springer, Singapore. https://doi.org/10.1007/698_2021_819 Kumari, P., Nag, S., Dhasmana, A., Bora, J., Malik, S. (2023). Applications of Bioremediation in Treatment of Environmental Pollution. In: Shah, M.P. (eds) Advanced and Innovative Approaches of Environmental Biotechnology in Industrial Wastewater Treatment. Springer, Singapore. https://doi.org/10.1007/978-981-99-2598-8_17 • Alaa Aldeen Abdalkhaleq, Ali Sarar, Yasser Awadallah (2019), Bioremediation of Environmental Pollutants - Fundamentals and Principles, King Saud University Press, Saudi Arabia. • Ollivier, B. and Magot, M. (2005) *Petroleum Microbiology*. ASM Press, Washington DC, USA.

	• Atlas, RM, and Philp, J. (2005) *Bioremediation: Applied Microbial Solutions for Real-World Environmental Cleanup*. ASM Press, Washington DC, USA.
Supportive References	Ernest Beerstecher Jr. (2013) Petroleum Microbiology: An Introduction to Microbiological Petroleum Engineering.
Electronic Materials	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC309048/
Other Learning Materials	-

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom is already provided with data show • The area of classroom is suitable concerning the number of enrolled students and air conditioned
Technology equipment (projector, smart board, software)	Projector
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:	Renewable Bioenergy
Course Code:	BIOE4521
Program:	Environmental Sciences
Department:	Biology
College:	Science
Institution:	Umm Al-Qura University
Version:	Version 2
Last Revision Date:	28 December 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 credit hours)					
2 credit hours					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (3rd year / level 6)					
4. Course general Description:					
This course covers alternative, renewable biofuels derived from biological sources and their applications. The topics to be covered include bioenergy as a sustainable clean fuel, biofuel generations, microbial bioenergy and biofuel, bioreactors for biofuel production, biohydrogen, biogas, biodiesel, bio-alcohol, biomass, and bioelectricity this will include the microorganisms used in bioenergy and biofuels production, microbial fuel cell, and photo microbial fuel cell design					
5. Pre-requirements for this course (if any)**:**					
6. Pre-requirements for this course (if any)**:**					
Not applicable					
7. Course Main Objective(s):					

- **To understand the Global and local importance of bioenergy, (bioenergy as a sustainable and environmentally friendly clean energy source).**
- **To be familiarized with different types of renewable bioenergy (solid, liquid, gas).**
- **To be familiarized with different types of microbes associated with bioenergy.**
- **Understand role of microbes in producing Bioenergy and Biofuel.**
- **Lab scale production of bioenergy and biofuel using conventional bioreactor, digester, and fuel cell**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
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**	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	Describe global importance of biofuels	**K2, K3**	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments. 3.Discussions (connecting what they learn in the class and applying this information in laboratory). 4. Handout of lecture notes for each topic	Exams, Assignments, Course activities and Written analyses
1.2	List different types of biofuels	**K2**	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments. 3.Discussions (connecting what they learn in the class and applying this	Exams, Assignments, Course activities and Written analyses

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			information in laboratory). 4. Handout of lecture notes for each topic	
1.3	List microbes associated with bioenergy	**K2, K3**	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments. 3.Discussions (connecting what they learn in the class and applying this information in laboratory). 4. Handout of lecture notes for each topic	Exams, Assignments, Course activities and Written analyses
1.4	Describe the mechanisms involved in microbial production of all types of bioenergy	**K2, K3**	1.In-class lecturing where the previous knowledge is linked to the current and future topics. 2.Homework assignments. 3.Discussions (connecting what they learn in the class and applying this information in laboratory). 4. Handout of lecture notes for each topic	Exams, Assignments, Course activities and Written analyses
2.0	**Skills**			
2.1	Interpret the bioenergy products of microbial activities	**S1, S2, S3**	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.

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
				Checking the homework assignments. Course work reports
2.2	Link between bioenergy and environmental sustainability	**S1, S2, S3**	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
3.0	**Values, autonomy, and responsibility**			
3.1	To demonstrate independently and with multi-disciplinary teams.	**V1, V2**	Engage student in carrying out internet search. The ability to debate the scientific basis of topics related to safety and occupational health in laboratories. Writing group reports. Solving problems in team. Cooperative learning and application of scientific method in thinking the scientific problem solving. Work as part of a team. Conducting group experiments and writing group reports.	1-Oral exams. 2-Evaluation of student essays assignments and search work. 3-Observation of student ethical and moral behavior. 4-Students' attendance is recorded during lectures. 5-Assessment of the student reports. 6-Grading homework assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.2	To cooperate in providing scientific and technical services in bioenergy and environmental sustainability	**V1, V2**	Engage student in carrying out internet search. The ability to debate the scientific basis of topics related to safety and occupational health in laboratories. Writing group reports. Solving problems in team. Cooperative learning and application of scientific method in thinking the scientific problem solving. Work as part of a team. Conducting group experiments and writing group reports.	1-Oral exams. 2-Evaluation of student essays assignments and search work. 3-Observation of student ethical and moral behavior. 4-Students' attendance is recorded during lectures. 5-Assessment of the student reports. 6-Grading homework assignments
3.3	To demonstrate responsibility and accountability	**V3**	Engage student in carrying out internet search. The ability to debate the scientific basis of topics related to safety and occupational health in laboratories. Writing group reports. Solving problems in team. Cooperative learning and application of scientific method in thinking the scientific problem solving. Work as part of a team. Conducting group experiments and writing group reports.	1-Oral exams. 2-Evaluation of student essays assignments and search work. 3-Observation of student ethical and moral behavior. 4-Students' attendance is recorded during lectures. 5-Assessment of the student reports. 6-Grading homework assignments

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Biofuel: Introduction, Global and local economic and environmental importance of biofuel, biofuel as a sustainable clean fuel	2
2.	Biofuel terminologies, biofuel types (solid, liquid, and gas forms), biofuel generations, microbial bioenergy and biofuel, types of microbial fuels (Biodiesel, Bioethanol,Biomethane/Biogas, Biohydrogen etc,), bioreactors for biofuel production	6
3.	Biological solid fuel and biomass	4
4.	Gaseous biofuels (Biohydrogen and Biomethane)	4
5	Liquid Biofuels (biodiesel, bio-alcohol)	4
6	Microbial fuel cell, and photo microbial fuel cell	4
7	Key issues and assessment of bioenergy and biofuel production	4
8	Environmental and economic considerations of Bioenergy	2
Total		30 hours

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	4, 10	25%
2.	Exam Midterm	6	25%
3.	Final Exam	16	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	**(1)- Luque R. et al. (2022) Handbook of Biofuels: Production, Process and Technologies 3rd edition. Woodhead Publishing (ISBN: 978-0323911931)** **(2)- Zhu D et al. (2024) Biofuels and Sustainability: Life Cycle Assessments, System Biology, Policies and Emerging Technologies. Woodhead Publishing (ISBN: 978-0443214332)**

	(3)- Bhatia S. et al. (2025) Microbial Biofuel: A Sustainable Source of Renewable Energy. Woodhead Publishing (ISBN: 978-1032662039)
Supportive References	(1)- Willey J., Sandman K., Wood D. (2019) Prescotts' Microbiology 11th edition. McGraw-Hill (ISBN: 1260409023). (2)- Madigan MT, Martinko JM. Parker J. (2020) Brock Biology of Microorganisms 16th edition. Pearson (ISBN: 0135845688) (3)- Chess, B. (2020) Talaro's Foundation in Microbiology: Basic Principles 11th edition. McGraw-Hill (ISBN: 1260575381)
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Projector, data show, smart board
Other equipment (depending on the nature of the specialty)	Laboratory equipped with incubators, autoclave, glassware and microbiological media and stains

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	questionnaires
Effectiveness of Students assessment	Member of staff	Random marking of students work by other staff member
Quality of learning resources	Student and staff	questionnaires
The extent to which CLOs have been achieved	Quality assurance committee	CLO's form
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	PREPARED BY DR. AHMAD ALSAIGH

REFERENCE NO.	
DATE	

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title: Biological Control
Course Code: BIOE3517
Program: Environmental Sciences
Department: Biology
College: Science
Institution: Umm Al-Qura University
Version: 1447
Last Revision Date: 26 December 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 hr)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (3rd Year / 5th Level)					
4. Course general Description:					
This course introduces the concept of biological control and its applications in pest management. It covers various biological agents, including predators, parasitoids, and pathogens, and examines their roles in controlling pest populations. The course also explores the ecological principles behind biological control and its integration with other pest management strategies.					
5. Pre-requirements for this course (if any)**:**					
6. Pre-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
The main objective of the course is to provide students with a deep understanding of biological control mechanisms and how they can be applied to manage pest populations. The course will also emphasize the environmental and economic benefits of biological control over traditional chemical methods.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom (V)	**30**	**100%**
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-

No	Mode of Instruction	Contact Hours	Percentage
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 biological foundations of biological control and its relevance to sustainable pest management.	K1, K2	- Interactive lectures - Group discussions	- - Written exams - Assignment - Open-book exam - Quizzes
1.2	Identify various biological agents used in pest control and describe their roles in pest population management.	K1, K2	- Interactive lectures - Group discussions	- - Written exams - Assignment - Open-book exam - Quizzes
1.3	Analyze the ecological principles behind biological control and evaluate its integration with other pest management techniques.	K1, K2, K3	- Interactive lectures - Group discussions	- - Written exams - Assignment - Open-book exam - Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	Skills			
2.1	Demonstrate practical skills in identifying and using biological control agents for pest management.	S1, S2	- - Practical work - Interactive lectures	- - Written exams - Assignment - Open-book exam - Quizzes
2.2	Develop analytical skills to assess the effectiveness of biological control agents in controlling pest populations.	S2	- - Practical work - Data analysis	- - Written exams - Assignment - Open-book exam - Quizzes
2.3	Apply theoretical knowledge to practical case studies of biological control in different ecosystems.	S2, S3	- - Practical work - Case study analysis	- - Written exams - Assignment - Open-book exam - Quizzes
2.4	Work collaboratively with peers to design and evaluate biological control programs.	S3	- - Group projects - Interactive lectures	- - Written exams - Assignment - Open-book exam - Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	Appraise the value of ethical decision-making in the implementation of biological control strategies.	V1	- Practical work - Lab demonstration	- Assignments
3.2	Demonstrate personal integrity and ethical behavior in the use of biological control methods.	V1, V2, V3	- Small group discussion - Lab demonstration	- Assignments

C. Course Content

No	List of Topics	Contact Hours

1.	Introduction to Biological Control	2
2.	Principles of Pest Management	2
3.	Types of Biological Control Agents: Predators	2
4.	Types of Biological Control Agents: Parasitoids	2
5.	Types of Biological Control Agents: Pathogens	2
6.	Ecological Principles of Biological Control	2
7.	Case Studies in Biological Control	2
8.	Integrated Pest Management and Biological Control	2
9.	Economic and Environmental Benefits of Biological Control	2
10.	The Future of Biological Control in Pest Management	2
11.	Practical Applications and Field Work	2
12.	Evaluation and Assessment in Biological Control	2
13.	Ethical Considerations in Biological Control	2
14.	Current Advances in Biological Control Research	2
15.	Innovative Strategies in Pest Management	2
Total		30

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	20
2.	**Exam Midterm (Lecture)**	Week 7	30
3.	**Final Exam (Lecture)**	Week 16	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	○ *Biological Control: Theory and Applications*, P. G. Mason, McGraw-Hill Education, 2018.
Supportive References	○ *Biological Control in Agroecosystems*, Journal of Applied Entomology. ○ *Integrated Pest Management: Principles and Practice*, Oxford University Press.

Electronic Materials	○ *Introduction to Biological Control*, ALISON – online learning website.
Other Learning Materials	○ **Course Handouts**: Detailed course notes on biological control agents, pest management strategies, and ecological principles of biological control. ○ **Lab Manuals**: Practical guides that include instructions for laboratory experiments such as the application of biological control agents, pest population monitoring, and data analysis. ○ **Research Papers**: Recent publications on the latest advancements in biological control, including studies on predators, parasitoids, and pathogens used for pest management. ○ **Case Studies**: Real-world examples of successful biological control programs, including pest management in agriculture and forestry. ○ **Online Modules**: Interactive online materials that provide in-depth information on biological control mechanisms, monitoring, and case studies of its application. ○ **Simulations**: Software tools for simulating biological control scenarios in various ecosystems, helping students to analyze the effectiveness of different control strategies.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- - Lecture room - Laboratory - Exhibition room for marine samples (if applicable) - Simulation rooms for environmental modeling

Items	Resources
Technology equipment (projector, smart board, software)	- - Computers - Internet access - Smart Board - Projector - Software for environmental modeling (e.g., GIS, marine simulation software) - Marine environmental data collection software
Other equipment (depending on the nature of the specialty)	- - Display screen - White board - SDS electrophoresis tanks and its contents - DNA electrophoresis tanks and its contents - PCR Thermocycler - UV rays for DNA visualization - Environmental monitoring devices (temperature sensors, tide gauges) - Water quality monitoring instruments (pH meters, salinity meters)

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Teaching	**Course Instructor**	- Review of teaching methods and materials - Student feedback through written comments - Regular peer evaluations - Student satisfaction surveys at the end of each semester
Effectiveness of Students assessment	**Students**	- - Written feedback by individuals - Satisfaction survey at the end of each semester - Peer evaluation of student progress - Self-assessment
Quality of learning resources	**Course instructor**	- - Attending staff development workshops and programs - Continuous professional education - Implementing student feedback to improve resources

Assessment Areas/Issues	Assessor	Assessment Methods
		- Variations of teaching strategies including tutorials, PBL (Problem-Based Learning), and emphasizing practical sessions
The extent to which CLOs have been achieved	**Course instructor** **Peer reviewer** **Program director**	- - Course development based on analysis of student feedback - Monitoring students' performance throughout the semester using formative assessments - Analyzing students' progress - Using statistics to analyze students' achievement at the end of each semester and implement data comparison - Peer evaluation of the instructor - Aligning CLOs with course material and teaching strategies
Other	**Course Instructor** **Program Director**	- Assessment of student engagement in class activities - External review and feedback - Post-course evaluations for continuous course improvement - Faculty and peer input for course enhancement

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:	Circular Economy
Course Code:	ECO4944
Program:	Bachelor Of Environmental Science
Department:	Economics
College:	College of Business and Economics
Institution:	Umm Al-Qura University
Version:	First version
Last Revision Date:	NEW

Table of Contents

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: (……)					
4. Course General Description:					
This course introduces the concept of the **Circular Economy (CE)** to students from non-economics backgrounds, including science, engineering, environmental studies, business, and social sciences. The course explores how circular principles can be applied across various disciplines, focusing on sustainable design, resource efficiency, waste management, and regenerative business models.					
5. Pre-requirements for this course (if any)**:**					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					
By the end of this course, students will be able to: 1. Understand the principles of circular economy and how they differ from the linear model. 2. Analyze the role of circular economy strategies in various fields (e.g., engineering, design, environmental science). 3. Apply circular economy principles to real-world sustainability challenges. 4. Evaluate biological, technological, and industrial cycles within circular systems. 5. Investigate waste valorization, upcycling, and regenerative resource use.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	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**	30 Hours
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		30 Hours

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	Define the core principles of the circular economy and their relevance across disciplines.	**K1**	Lectures Discussions Homework Assignments	HW Quizzes Mid-term exams Final exam
1.2	Identify sustainable material cycles and resource management techniques in circular systems.	**K1**	Lectures Discussions Homework Assignments	HW Quizzes Mid-term exams Final exam
...				
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	Compare and contrast linear and circular models in environmental, engineering, and social contexts.	**S1**	Lectures Discussions in the lectures Homework assignments Independent study	Follow up homework assignments Short exams Discussions with the students in the class Mid-Term and final exams
2.2	Apply circular economy principles to product design, industrial processes, or waste management.	**S1**	Lectures Discussions in the lectures Homework assignments Independent study	Follow up homework assignments Short exams Discussions with the students in the class Mid-Term and final exams
2.3.	Assess sustainability strategies for reducing waste and increasing efficiency in various sectors.	**S1**	Lectures Discussions in the lectures Homework assignments Independent study	Follow up homework assignments Short exams Discussions with the students in the class Mid-Term and final exams
3.0	**Values, autonomy, and responsibility**			
3.1	Take initiative in promoting circular economy strategies within communities.	**C1**	The discussion with the students and asking questions during the lecture. Homework assignments. Group assignments.	Instructor's assessment of student's performance through discussions during lectures Follow up the homework assignments.
3.2	Encourage ethical leadership in sustainability and circular practices.	**C1**	The discussion with the students and asking questions during the lecture. Homework assignments. Group assignments.	Instructor's assessment of student's performance through discussions during lectures Follow up the homework assignments.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.3	Engage in sustainability discussions and initiatives.	**C1**	The discussion with the students and asking questions during the lecture. Homework assignments. Group assignments.	Instructor's assessment of student's performance through discussions during lectures Follow up the homework assignments.

C. Course Content

No	List of Topics	Contact Hours
1.	**Module 1: Introduction to the Circular Economy** 1- Principles of the Circular Economy (CE) 2- Linear vs. Circular Systems 3- Global trends and drivers of circularity	**5 Hours**
2.	**Module 2: Circular Strategies Across Disciplines** 1- Engineering & Material Science: Sustainable design, upcycling, biomaterials 2- Environmental Science: Resource recovery, ecosystem services, waste valorization 3- Social Sciences & Policy: Consumer behavior, sharing economy, and governance 4- Healthcare & Life Sciences: Biodegradable solutions, pharmaceutical waste management	**7 Hours**
3	**Module 3: Sustainable Resource Management & Innovation** 1- Waste management: Recycling, composting, and industrial symbiosis 2- Sustainable product design: Eco-design principles, cradle-to-cradle thinking 3- Technological innovation: Digitalization and AI in circular systems	**6 Hours**
4	**Module 4: Policy, Business, and Implementation** 1- Circular economy policies and regulatory frameworks 2- Role of businesses and industry in circular transitions 3- Key Circular Economy Solutions in Different Sectors	**6 Hours**
5	**Module 5: Key Concepts for the Future of Circular Economy** 1- **The Future of Circular Economy:** How circularity is evolving in different fields 2- **Main Challenges of Circular Economy:** Limitations, barriers, and misconceptions	**6 Hours**

	3- **Scientific and Technological Innovations Supporting Circularity:** Emerging trends such as bio-based materials, digital tracking of resources, and AI in waste management 4- **Circular Economy and Climate Change:** The role of circular principles in reducing carbon footprints and protecting ecosystems 5- **The Role of Individuals and Institutions:** How governments, companies, and consumers contribute to the circular transition	
Total		**30 Hours**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	3 & 5	10 %
2.	Homework	weekly	10%
3.	Midterm exam	7	30%
4.	Final exam	11-13	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	**The Circular Economy: A Wealth of Flows - 2nd Edition by Ken Webster (2017)**
Supportive References	**Waste to wealth: The circular economy advantage- P. LacyJ. Rutqvist (2016)**
Electronic Materials	**- Ellen MacArthur Foundation Reports** **- UN Sustainable Development Goals (SDGs) and CE Policies** **- World Economic Forum CE White Papers**
Other Learning Materials	**A white board & Computer with internet and data show.**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classroom to accommodate 25 students equipped with usual blackboard or smart board**
Technology equipment (projector, smart board, software)	**A whiteboard & Computer with internet and data show.**

Items	Resources
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
Effectiveness of Students assessment	Faculty	Direct
Quality of learning resources	Program Leaders	Direct
The extent to which CLOs have been achieved	Peer Reviewer	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTEMENT OF ECONOMICS**
REFERENCE NO.	**1**
DATE	**13/02/2025**