Course Specification

(Postgraduate Programs)

Course Title:	**Biomonitoring of Ecotoxicological Risks**
Course Code:	**BIO-6038**
Program:	**Master of Science in Applied Biology (Industrial and Environmental Biotechnology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	***Pick Revision Date.***

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A. General information about the course:

1. Course Identification:

1. Credit hours: 2(Lecture 2 + lab 0)

2. Course type

A.	☐ University	☐ College	☐ Department	☒ Track
B.	Required		☒ Elective	

3. Level/year at which this course is offered: (Undetermined level)

4. Course general Description:

in this course, as an introduction, we will explore the impact of environmental toxins on living organisms and ecosystems.
This course delves into the critical biological tools and techniques used to monitor and assess these risks.
Unravel the secrets of biomonitoring: Discover how we use both community surveys (observing ecological changes) and bioassays (testing on living organisms) to measure the presence and impact of toxins.
Master the art of the bioassay: Learn about the diverse range of bioassays, from assessing genotoxicity (DNA damage) to cytotoxicity (cell damage), and explore model test systems like bacteria, algae, and invertebrates.
Dive into the realm of biomarkers: Uncover the powerful tools known as biomarkers, which act as early warning signals for environmental toxicity within organisms. You'll explore different types of biomarkers, from genetic alterations to cellular stress responses.
Shine a light on environmental genotoxicity and cytotoxicity: Investigate the specific biomarkers used to track these forms of cellular damage caused by environmental toxins.
Confront the silent threat of radiation: Learn about the unique challenges of monitoring radiation pollution and the specific biomarkers employed to assess its impact.
Embrace the future with "Omics" technologies: Discover cutting-edge tools like genomics, transcriptomics, and proteomics that are revolutionizing our understanding of ecotoxicological risks.
By the end of this course, you will be equipped to:
Apply biomonitoring tools and techniques to assess environmental health.
Interpret and communicate complex ecotoxicological data for informed decision-making.
Contribute to the development and implementation of strategies for environmental protection and risk mitigation.
This course is ideal for anyone interested in environmental science, biology, toxicology, or public health.

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

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

7. Course Main Objective(s):

1-Understand the key principles of ecotoxicology and its implications for environmental health.

2-Master the concepts and applications of biomonitoring tools, including bioassays and community surveys, for assessing ecotoxicological risks.

3-Gain in-depth knowledge of different types of bioassays used to measure genotoxicity, cytotoxicity, and other cellular responses to environmental toxins.

4-Explore the diverse range of biomarkers available for detecting and monitoring environmental toxicity in organisms.

5-Analyze the specific challenges and approaches for assessing environmental genotoxicity, cytotoxicity, and radiation exposure using biomarkers.

6-Discover the potential and limitations of emerging "Omics" technologies in ecotoxicological risk assessment

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	-	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, Teaching Strategies, Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Ecotoxicology Essentials:** Define and explain the key concepts of ecotoxicology. Identify different types of environmental toxins and their sources. Analyze the pathways of exposure and mechanisms of action of environmental toxins in living organisms. Assess the potential health impacts of environmental toxins on individuals and ecosystems. Evaluate the regulatory frameworks and policies pertaining to ecotoxicological risk management.		Two credits weekly lectures	-Quizzes -Presentations -Assignments -written exams
1.2	**Biomonitoring Tools and Techniques:** Explain the principles and applications of biomonitoring for assessing ecotoxicological risks. Differentiate between community surveys and bioassays as biomonitoring methods.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Describe the design and implementation of different types of bioassays (acute, chronic, genotoxicity, cytotoxicity). Interpret and analyze bioassay data to assess the toxicity of environmental samples. Evaluate the strengths and limitations of various biomonitoring tools for specific environmental contexts.			
1.3	**Bioassay and Biomarker Expertise:** Define and classify bioassays based on their target organisms, endpoints, and applications. Explain the basic principles of cell biology and toxicology underlying bioassay responses (genotoxicity, cytotoxicity). Differentiate between biomarkers of exposure, effect, and susceptibility. Identify and characterize different types of biomarkers used in ecotoxicological risk assessment (genetic, protein, enzymatic). Interpret and analyze biomarker data to assess the presence and impact of environmental toxins in individual organisms and populations.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.4	**Environmental Genotoxicity and Cytotoxicity:**		Two credits weekly lectures	Quizzes -Presentations -Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Explain the mechanisms of genotoxicity and cytotoxicity induced by environmental toxins. Identify specific biomarkers used to detect and quantify environmental genotoxicity (DNA damage, mutations). Analyze the effects of environmental cytotoxicity on cell function and viability. Evaluate the potential consequences of genotoxicity and cytotoxicity for individual organisms and ecosystems.			-written exams
1.5	**Specific Threats and Technologies:** Explain the unique challenges of monitoring and assessing the impact of environmental radiation using biomarkers. Describe the principles and applications of "Omics" technologies (genomics, transcriptomics, proteomics) in ecotoxicological risk assessment. Evaluate the potential of "Omics" technologies for improving sensitivity, specificity, and early detection of environmental toxicity.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
2.0	Skills			
2.1	**Biomonitoring Design and Implementation:** Design and implement appropriate biomonitoring strategies for specific		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	environmental concerns and contaminants. Select and adapt suitable bioassays and biomarker analyses based on the environmental context and research goals. Collect and process environmental samples using proper protocols to ensure data integrity. Perform basic bioassay procedures and laboratory techniques for biomarker analysis. Maintain accurate records and document biomonitoring activities as per scientific standards.			
2.2	**Data Analysis and Interpretation:** Analyze bioassay and biomarker data using appropriate statistical tools and software. Interpret biomonitoring results in the context of established ecotoxicological knowledge and relevant environmental guidelines. Identify and analyze potential confounding factors and limitations in biomonitoring data. Draw conclusions and inferences from biomonitoring studies to inform environmental risk assessment and management decisions.		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.3	**Critical Thinking and Problem-Solving:** Critically evaluate existing knowledge and apply it to address new ecotoxicological challenges. Develop creative solutions for improving biomonitoring strategies and interpretation of data. Recognize ethical considerations and potential biases in environmental research and data analysis. Contribute to the advancement of biomonitoring techniques and technologies for effective ecotoxicological risk assessment		-Two credits weekly lectures -Tutorials	-Presentations -Reports
2.4	**Continuous Learning and Professional Development:** Stay updated with the latest advancements in ecotoxicology, biomonitoring techniques, and "Omics" technologies. Seek out opportunities for professional development and collaboration with other ecotoxicologists and environmental professionals. Adapt and expand your skillset to address emerging environmental challenges and contribute to innovative solutions			
3.0	Values, autonomy, and responsibility			
3.1	**Values**		Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Environmental Stewardship: Develop an understanding of the intrinsic value of ecosystems and a commitment to their protection from ecotoxicological threats. Sustainability: Integrate principles of sustainability into biomonitoring practices, considering long-term consequences and minimizing environmental impact. Precautionary Principle: Apply the precautionary principle when assessing potential ecotoxicological risks, favoring caution and proactive measures even in the face of uncertainty. Social Justice: Recognize the unequal distribution of environmental risks and advocate for equitable access to safe environments for all communities.			
3.2	**Autonomy**: Critical Thinking and Problem-Solving: Foster independent thinking skills for evaluating biomonitoring data, interpreting results, and proposing innovative solutions to environmental challenges. Scientific Integrity: Uphold the principles of scientific integrity by conducting research with honesty, transparency, and accountability. Lifelong Learning: Develop a passion for continuous learning		Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and self-directed research to stay current with advances in ecotoxicological knowledge and techniques. Professional Communication: Hone effective communication skills to share complex ecotoxicological data and analyses with diverse audiences, influencing informed decision-making.,			
3.3	**Responsibility**: Data Quality and Ethics: Ensure adherence to ethical research practices and maintain high standards of data quality control throughout the biomonitoring process. Risk Communication: Effectively communicate risks and uncertainties associated with environmental toxins to stakeholders, empowering them to make informed decisions about their health and environment. Policy Advocacy: Engage in responsible advocacy for effective environmental policies and regulations based on sound scientific evidence, promoting informed risk management strategies. Professional Accountability: Recognize and take responsibility for the potential impacts of biomonitoring activities on the environment and surrounding communities.		Group discussions	-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1	Introduction of ecotoxicology and its health implications	2
2	Biomonitoring and Community Surveys as Tools in Ecotoxicology	3
3	Bioassay Definition, Classification and model test systems	3
4	Bioassay of environmental Genotoxicity and cytotoxicity	3
5.	Biomarker Definition, Classification	3
6	Environmental Genotoxicity and Cytotoxicity Biomarkers	3
7	Biomarkers of Radiation in the Environment	3
8	applications of “Omics" technologies	4
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	20%
2.	**Midterm exam-2**	10th week	20%
3.	**Assignments, presentations, attendance, data search, participation**	Throughout the course duration	20%
4.	**Final exam**	16th week	40%

*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- Gross, Elisabeth M and Garric, Jeanne .2019. Ecotoxicology : new challenges and new approaches. London : ISTE Press Ltd ; Kidlington, Oxford : Elsevier Ltd. 2- Wood, Michael D., Carmel Emelia Mothersill., Tsakanova, Goher., Cresswell, Tom and Woloschak, Gayle E. 2002. Biomarkers of radiation in the environment : robust tools for risk assessment. Dordrecht : Springer. 3- Menone, Mirta L and Chris D. Metcalfe. 2023. The ecotoxicology of aquatic macrophytes. Cham, Switzerland : Springer. 4-
Supportive References	Standard Methods for the Examination of Water and Wastewater, 24th Edition American Public Health Association (APHA) 1015 15th Street NW Washington, DC 20005 USA 2022
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classroom**
Technology equipment (Projector, smart board, software)	**Projector, smart board**
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	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

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

Assessment Methods (Direct, Indirect)