Course Specification

(Postgraduate Programs)

Course Title:	**Photobiology and photobiostimulation**
Course Code:	**BIO-6034**
Program:	**Master of Science in Applied Biology (Industrial and Environmental Biotechnology & Sustainability)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

Table of Contents

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:				

This postgraduate course provides the candidates with a comprehensive understanding of the interaction between biological systems and light. Gain a solid foundation in the basic principles of photobiology, including the nature of light, its properties, and its interactions with biological molecules. Understand the molecular mechanisms by which organisms, including plants, perceive and respond to light. This may involve studying photoreceptor proteins and their roles in signal transduction. Photosynthesis and Light Reactions: Explore the role of light in photosynthesis, including the absorption of light by pigments, the light-dependent reactions, and the synthesis of ATP and NADPH. Investigate how organisms, from bacteria to plants and animals, exhibit specific responses to light stimuli. This includes phototropism, circadian rhythms, and photomorphogenesis. Learn about the applications of photobiology in medicine, such as the use of light in photodynamic therapy and the effects of light on human health, including circadian rhythm regulation. Explore how light influences ecological processes, including the adaptation of organisms to different light conditions, the role of light in ecosystems, and the impact of light pollution. Delve into specialized areas of photobiology, such as the study of UV radiation effects, photorepair mechanisms, and the use of light in biotechnology and agriculture. Acquire hands-on experience with laboratory techniques used in photobiological research. This may include spectrophotometry, fluorescence analysis, and other methods for studying light-matter interactions. Recognize the interdisciplinary nature of photobiology and its connections to other scientific disciplines, such as physics, chemistry, and environmental science.

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

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

7. Course Main Objective(s):

The objective of this course is to provide the students with a fundamental theoretical understanding of This postgraduate course provides the candidates with a comprehensive understanding of the interaction between biological systems and light. Gain a solid foundation in the basic principles of photobiology, including the nature of light, its properties, and its interactions with biological molecules.

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	**Distinguish the photobiology and its significance to plants, light spectrum, and wavelengths.**		Two credits weekly lectures	-Quizzes -Presentations -Assignments -written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	**Understanding plant photoreceptors including phytochrome, cryptochromes, and phototropins.**		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.3	**Outline the structure and organization of photosynthetic pigments, light harvesting complexes.**		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
2.0	Skills			
2.1	**Interpret and analyze the role of light wavelengths on plants growth and development.**		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.2	**Relate between the light stress and photoprotection mechanisms in plants, ROS and antioxidants defense.**		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.3	**Design a research study in photobiology and photobiostimulation using critical thinking and the acquired skills**		-Two credits weekly lectures -Tutorials	-Presentations -Reports
3.0	Values, autonomy, and responsibility			
3.1	**Show independence and responsibility and cooperate effectively in a team to carry out research work on Photobiology**		Group discussions	-Presentations -Reports
3.2	**Discuss the scientific issues and present research results via oral presentations and in written format.**		Group discussions	-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Fundamental principles on Photobiology:** • Overview of photobiology and its significance in plants • Historical development and key milestones in plant photobiology • Introduction to light as a crucial environmental factor for plants • Light spectrum, wavelengths, and their effects on plant growth and development	3
2.	**The Photoreceptors in plants** • Understanding plant photoreceptors: phytochromes, cryptochromes, phototropins, and others • Molecular mechanisms of photoreceptor action • Signal transduction pathways in response to light signals • Role of photoreceptors in various plant processes, such as seed germination, flowering, and phototropism	4
3.	**Photosynthesis and light harvesting** • Photosynthetic pigments and their absorption spectra • Light-dependent reactions in photosynthesis • Light harvesting complexes and their role in capturing light energy •Regulation of photosynthesis by light intensity and quality	4
4.	**Light and Plant development** • Photomorphogenesis: light-induced changes in plant development • Photoperiodism and its significance in flowering • Circadian rhythms in plants	4
5.	**Light Stress and Plant Responses:** • Effects of light stress on plant growth and development • Photoprotection mechanisms in plants • Reactive oxygen species (ROS) and antioxidant defenses • Role of light in abiotic stress responses.	3
6.	**Advanced Topics in Plant Photobiology:** • Light signaling networks in plants • Recent research and advancements in plant photobiology • Applications of plant photobiology in agriculture and horticulture • Future directions in plant photobiology research	4
7.	**Review and Synthesis:** • Recap of key concepts and topics covered throughout the course • Discussion of recent research papers in plant photobiology	2

	• Integration of plant photobiology principles into broader aspects of plant biology	
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	*Björn LO (ed) (2015) Photobiology. Springer New York, New York, NY. https://link.springer.com/book/10.1007/978-0-387-72655-7 * McDonald, M. S. (2003). Photobiology of higher plants. J. Wiley. Giese, A. C. (2013). Photophysiology: Current topics in photobiology and photochemistry (Vol. 6). Elsevier. *Whitelam, G. C., & Halliday, K. J. (Eds.). (2010). Plant Photobiology: Theoretical Principles and Experimental Approaches. Berlin: Springer. * Nicholls, D. G., & Ferguson, S. J. (2013). Bioenergetics (4th edition). Academic Press, Elsevier..
Supportive References	https://www.photobiology.eu/photobiology-school
Electronic Materials	**https://www.photobiology.eu/photobiology-school** **http://photobiology.info/Chalker-Scott.html**
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities	**Classroom, Field**

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	
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)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**BIOLOGY DEPARTMENT COUNCIL**
REFERENCE NO.	**23**
DATE	**23/8/1445**