



**Jordan University of Science and Technology**  
**Faculty of Science & Arts**  
**Applied Biological Sciences Department**

BIO714 Advance Plant Biotechnology

First Semester 2021-2022

**Course Catalog**

3 Credit Hours. This course intends to give an advance overview of the various aspects of plant biochemistry and molecular biology. Successful completion of this course will provide students with fundamental knowledge of biochemistry and specific knowledge of compounds and biochemical pathways that occur in plants including: Plant cell wall and plant organelles; photosynthesis and photorespiration; carbon, nitrogen and sulfur metabolism; plant hormones and elicitors perception and transduction; plant response to pathogens and abiotic stress; plant secondary metabolites and plant biotechnology and crop improvement.

**Text Book**

<b>Title</b>	Biochemistry and Molecular Biology of Plants
<b>Author(s)</b>	Buchanan, Grissem, and Jones
<b>Edition</b>	2nd Edition
<b>Short Name</b>	Ref # 1
<b>Other Information</b>	

**Course References**

Short name	Book name	Author(s)	Edition	Other Information
Ref # 2	Plant Biochemistry	Hans-Walter Heldt	4th Edition	

**Instructor**

Name	<b>Dr. Rami Alkhatib</b>
Office Location	PH1-L1
Office Hours	Sun : 10:00 - 11:00 Mon : 10:00 - 12:00 Tue : 10:00 - 11:00 Wed : 11:00 - 13:00
Email	rqalkhatib@just.edu.jo

<b>Class Schedule &amp; Room</b>
Section 1: Lecture Time: Mon : 14:30 - 17:30 Room: NF38

<b>Tentative List of Topics Covered</b>		
<b>Weeks</b>	<b>Topic</b>	<b>References</b>
Week 1	Plant Cell wall: Cell wall sugar building blocks, Macromolecules and architecture of cell wall, Biosynthesis and growth of the cell wall, Cell differentiation and cell wall fibers	<b>Chapter 2</b> From <b>Ref # 1</b>
Week 2	Plant metabolic compartment: Vacuoles, Plastids, Mitochondria, Peroxisomes, Endoplasmic Reticulum, Golgi apparatus, Translocators, Ion channels and Porins.	<b>Chapter 1</b> From <b>Ref # 2</b>
Week 3	Photosynthesis: Light absorption and energy conversion, Reaction center complex, Photosystems, Electron transport pathway in chloroplast membrane, ATP synthesis, CO <sub>2</sub> fixation in C <sub>3</sub> +C <sub>4</sub> +CAM plants	<b>Chapter 12</b> From <b>Ref # 1</b>
Week 4	Respiration and Photorespiration: Overview of respiration, Mitochondrial ATP synthesis, Photorespiration pathway, Role of photorespiration in Plants.	<b>Chapter 14</b> From <b>Ref # 1</b>
Week 5	Carbohydrates Metabolism: Hexose phosphate pathway, Triose/Pentose phosphate metabolite pool, Starch synthesis and degradation, Pathways interaction.	<b>Chapter 13</b> From <b>Ref # 1</b>
Week 6	Midterm Exam	
Week 7	Nitrogen and Sulfur metabolism: Nitrogen fixation, Ammonia uptake and transport, Nitrate and Nitrite reduction, Sulfur uptake and transport, Sulfur assimilation, Glutathione and its derivatives.	<b>Chapter 16</b> From <b>Ref # 1</b>
Week 8	Plant Hormones and Elicitors: Gibberellins, Abscisic acid, Cytokinnins, Auxin, Ethylene, Brassinosteroids, Polymaines Jasmonic acid, Salicylic acid.	<b>Chapter 17</b> From <b>Ref # 1</b>
Week 9	Signal Perception and Transduction: Plant receptors, G-protein and phospholipid signaling, Cyclic nucleotides, Calcium, Protein kinases, Plant growth regulators.	<b>Chapter 18</b> From <b>Ref # 1</b>
Week 10	Plant response to Pathogen: Plant defense system, Plant-pathogen interaction, Defense responses and reaction.	<b>Chapter 21</b> From <b>Ref # 1</b>
Week 11	Plant responses to Abiotic Stress: Water deficit, Osmotic and salinity, Freezing stress, Flooding and oxygen deficit, Oxidative stress, Heat stress Plant responses to Abiotic Stress	<b>Chapter 22</b> From <b>Ref # 1</b>
Week 12	Plant Secondary Metabolites: Terpenoids, Terpenoids, Alkaloids, Lignans, Lignins, Flavonoids, Suberin, Coumarin, Tannins.	<b>Chapter 24</b> From <b>Ref # 1</b> , <b>Chapter 16+17+18</b> From <b>Ref # 2</b>
Week 13	Plant Gene Technology: Gene technology to alter plants to meet requirements of agriculture, nutrition and industry.	<b>Chapter 22</b> From <b>Ref # 2</b>

<b>Mapping of Course Outcomes to Program Student Outcomes</b>	<b>Course Outcome Weight (Out of 100%)</b>	<b>Assessment method</b>
Understand plant cell structure, organization, apply specific biochemical functions to metabolic compartments of the plant cell, and discuss the metabolic pathways of photosynthesis, photorespiration and carbohydrates metabolism. [1A]	30%	Term Paper, Paper Presentation, Final Exam
Learn and understand the central metabolism of nitrogen and sulfur, physiological function of hormones and elicitors and the signal perception and transduction in plants growth and development. [1A, 1D]	20%	Term Paper, Paper Presentation, Final Exam
Describe and explain the molecular basis of plant response to pathogens, plant abiotic stress physiology, the rich diversity of plant secondary metabolites and the plant gene technology and its role in crop improvement [1A, 1C]	20%	Term Paper, Final Exam
Demonstrate the effective reading and critical thinking in this course in term of weekly paper critique of a research article related to the lecture topics. [1D, 1E]	20%	Term Paper, Paper Presentation, Final Exam
Enable the students to demonstrate their learning and investment in this course in term of power point presentation of a research article for 20 min. [1D, 1E, 1F]	10%	Term Paper, Final Exam

<b>Relationship to Program Student Outcomes (Out of 100%)</b>					
A	B	C	D	E	F
50		10	23.33	13.33	3.33

<b>Evaluation</b>	
<b>Assessment Tool</b>	<b>Weight</b>
Term Paper	30%
Paper Presentation	20%
Final Exam	50%

<b>Policy</b>	
Attendance:	Students are expected to attend classes. Consequently, students are responsible for ALL material presented or assigned during the scheduled class period and are expected to obtain such information on their own should a class period be missed. Whenever possible, absences will be discussed with the instructor in advance. Class attendance will be taken in lecture.
Policy on academic dishonesty and Make-up examinations	JUST regulations and rules will be strictly implemented. Refer to University's student information book for more details about exams, exam make up and absence rules; If you are absent from one or more of your examinations for medical or other reasons, you must provide documentary evidence to justify your absence for the consideration of a make up exam within one week or else no make up exam will be permitted.
Cell Phone	Cell phones must be turned off during lectures, exams and presentations

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