Philadelphia University	PHILADELPHIA UNIVERSITY THE WAY TO THE FUTURE	**Approval date:**
Faculty: Science		**Issue:**
Department: Biotechnology and Genetic Engineering		**Credit hours: 3**
Academic year: 2022/2023	**Course Syllabus**	**Bachelor**

Course information

Course#	Course title	Prerequisite
0240326	**Plant biotechnology**	0240216

Course type	Class time	Room #
☐ University Requirement ☐ Faculty Requirement ☐ Major Requirement ☐ Elective ☒ Compulsory	**11:15-12:45 Mon, Wed**	**21001**

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Ayat Al-Azab	**1018**	**2475**	**Sun, Tue: ٩:٤٥ – ١١:٠٠ Mon, Wed:١٤:٠٠ –١٣:٠٠**	**aalazab@philadelphia.edu.jo**

Course Delivery Method

Course Delivery Method			
☒ **Physical** ☐ **Online** ☐ **Blended**			
Learning Model			
Precentage	**Synchronous**	**Asynchronous**	**Physical**

Course Description

This course presents an overview of the different techniques used in plant transformation and production of genetically manipulated plants. Students are expected to develop a better understanding of what plant biotechnology is along with the commercial applications, and issues/challenges in the area of plant production to meet the uprising continuous global demand in food production.

Course Learning Outcomes

Number	Outcomes	Corresponding Program outcomes
		Knowledge
K01	Understand the concepts of plant biotechnology.	Kp2
K02	Compare between the traditional and modern methods for plant crop improvement	Kp2
K03	List the disadvantages of traditional methods of plant breeding	Kp2
K04	Understand the different methods of mutagenesis to obtain plant with desired trait	Kp2
K05	Understand the mechanism of gene transfer into the plant cell	Kp2

K06	Describe the different methods using for transgenic plant production	Kp2
K07	Identify the important traits for plant genetic engineering	Kp2
K08	Discuss the benefits and the risks of genetic manipulation of plants.	Kp2
Skills		
Competencies		
C01	Describe the role of plant biotechnology in solving some environmental problems, such as climate change, food security.	Cp1
C02	Learn how plants with desired traits can be produced by gene transfer.	Cp1
C03	Utilize the gained knowledge as guidance in debating issues like global warming, world hunger, and environmental sustainability	Cp1
C04	Be able to analyze and interpret results through discussion of scientific articles or other publications related to plant biotechnology.	Cp1
C05	Apply critical thinking and problem solving skills.	Cp1

Learning Resources

Course textbook	(1) Stewart Jr, C. N. (Ed.). (2016). *Plant biotechnology and genetics: principles, techniques, and applications*. John Wiley & Sons. (2) Ricroch, A., Chopra, S., & Kuntz, M. (Eds.). (2021). *Plant biotechnology: experience and future prospects*. Springer Nature.
Supporting References	
Supporting websites	
Teaching Environment	**☒Classroom ☐ laboratory ☐Learning platform ☐Other**

Meetings and subjects timetable

Week	Topic	Learning Methods *	Tasks	Learning Material Text book
1	The Evolution of agriculture and tools for plant innovation - Emergence of agriculture. - Hybrids and first biotechnologies. - Advanced breeding techniques: Genetic modification Technologies.	Lectures		**P. 13-35 (2)**
2,3	The molecular basis of genetic modification and production of transgenic plants: - Transcription and translation. - Marker genes and promoter (selectable marker genes: selection on antibiotic, selection on herbicides). - Non selectable marker genes (*B* Glucurnonidase, Luciferase, Green fluorescent proteins).	Lectures		**P. 133-145 P. 233-250 (1)**
4,5	Transgenic plant production	Lectures		**P. 262-284**

	- General transformation process, DNA delivery, target tissue status, selection and regeneration. - Agrobacterium; history of our knowledge of Agrobacterium, T-DNA, Agroinfiltration, Arabidopsis and floral dip. - Particle bombardment; history of particle bombardment; fate of introduced DNA, power and problems of direct DNA introduction. - Other methods; protoplasts, whole tissue electroporation, Silicon carbide whiskers, viral vectors, laser micropuncture and nanofiber arrays.			**(1)**
6,7	Genes and traits of interest for transgenic plants - Identifying genes of interest via genomics and other omics technologies. - Traits for improved crop production using transgenics -Herbicides resistance. -Insects resistance. -Pathogen resistance. -Traits for improved products and food quality.	Lectures		**P. 211-222 (1)**
8	Techniques and tools of modern plant breeding: Field crops - Plant breeding and plant ideotypes. - Plant breeding exploits phenotype and genotype. - Molecular markers and plant breeding. - Recombinant inbred lines for plant breeding. - Plant breeding and gene expression techniques. - Forward and reverse genetics. - Targeted genome editing technology	Lectures		**P. 25-35 (2)**
9	**Midterm exam**			
10	Genomic methods for improving abiotic stress tolerance in crops - The difficulty of improving abiotic stress tolerance in crops. - Some basic concept of QTL analysis and MAS performed at gene level. - Genomic methods available for gene discovery. and increasing breeding efficiency: -Next generation sequencing (NGS). -Association analysis. -Genome wide selection.	Lectures		**P. 35-45 (2)**
11,12	Virus-Resistant Crops and Trees - Can Plants Defend Themselves Against Viruses? - Are Cultivated Plants More Susceptible to Viruses Than Their Wild Relatives? - Examples of Natural Resistance - Examples of Transgenic Resistance - RNAi: A Newly Discovered, Nucleic Acid Sequence-Based Inducible Defense Mechanism - Manipulating RNAi to Induce Virus Resistance in Plants - Modification of the RNAi Strategy: RNAi, or Gene Silencing, Can Be Used, for Instance, to Affect Insect Vector Performance	Lectures		**P. 155-169 (2)**

13	Role of biotechnology to produce plants resistant to fungal pathogens - Plant disease caused by fungi. - Traditional methods used to control fungal diseases. - Mechanism of plants resistance to fungal pathogens in nature. - Use of transgene technology to produce plants resistant to fungal pathogens. - Some examples of transgenic plants shown to be resistant to fungal disease.	Lectures		**P. 169-181 (2)**
14	Production of medicines from engineered proteins in plants: Proteins for a new century - Recombinant proteins turning to plant production. - The first approved recombinant plant protein drug. - Recombinant proteins from plants can help battle various diseases. - Tobacco-Based production of proteins with health benefits - Plant proteins for other medical conditions.	Lectures		**P. 263-277 (2)**
15	Is it possible to overcome the GMO controversy? - The 'Modern' Thought - The 'Environmentalist' thought - The 'Postmodern' thought - Religious views on GMOs	Lectures		**P. 10-117 (2)**
16	**Final Exam**			

* includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

Course Contributing to Learner Skill Development

Using Technology
Communication skills
Application of concepts learnt

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	% 30	9	K01-K07 C01,C02
Various Assessments *	% 30	2,3,5,7,8,11,13,14,15	K01-K08

			C01-C05
Final Exam	% 40	16	K01-K08 C01-C05
Total	%100		

* includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Alignment of Course Outcomes with Learning and Assessment Methods

Number	Learning Outcomes	Learning Method*	Assessment Method**
Knowledge			
K01-K05	All outcomes	Lectures	**Quizzes and exams**
Skills			
Competencies			
C01-C04	All outcomes	Lectures	**Quizzes and exams**

* includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

** includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).
Missing Exams	• Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from the exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date.
Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and seven lectures (S,T,R). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded.
Academic Honesty	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights.

Program Learning Outcomes to be assessed in this Course

Number	Learning Outcome	Course Title	Assessment Method	Target Performance level
1	Kp2	Environmental biotechnology	Quizzes and exams	
2	Cp1	Environmental biotechnology	Quizzes and exams	

Description of Program Learning Outcome Assessment Method

Number	Detailed Description of Assessment
Kp2	Quizzes and exams
Cp1	Quizzes and exams

Assessment Rubric of the Program Learning Outcome
