Field Crops Department

College of Agricultural Engineering Sciences

Salahaddin University - Erbil

Course-Book: 4th Stage/ First Semester

Lecturer name: Dr. Saman Abd Rasul

Academic Year: 2022-2023

Course Book

1. Course name	**Plant Biotechnology**
2. Lecturer in charge	**(Theory): Dr. Saman Abd Rasul**
3. Department/ College	**Field Crops Department**

4. Contact	**Email: saman.rasul@su.edu.krd** **Tel: (optional) 07504686596**
5. Time (in hours) per week	**Theory: 2 hours** **Practical: 3 hours**
6. Office hours	**Sunday from 12:30 -2:30**
7. Course code	
8. Teacher's academic profile	**BSc Plant Production, Salahaddin University, 2005-2006** **MSc Biology/ Plant production , Blaise Pascal university/ France**
9. Keywords	**Plant Biotechnology, DNA ,Polymerase Chain Reaction ,Plant Transformation , Tissue culture**

10. Course overview:

Studying this course provides an opportunity for the student to understand the term of Principles of Plant Biotechnology. This course very important and necessary materials for college students in general and in particular scientific agriculture college students because it cannot keep up with modern developments without knowledge of this aspect of modern science.

In this course addressed some of the basics necessary to genetics to understand plant biotechnology include genetic engineering and molecular genetics, in addition tissue culture.

11. Course objective:

The objectives of this course that the students learns how to use his knowledge in the field of genetics in order to increase the productivity of plants using new roads and a shorter period with higher accuracy

12. Student's obligation

The obligation of the student in this course includes attendance in the lectures and listening teachers carefully, asking about new terms in the class, preparation for the exam by studying the material, make a report about Genetic engineering, DNA recombinant, PCR and Gel Agarose then present it for the other students at the class.

13. Forms of teaching

The form of teaching is including use of Microsoft PowerPoint at the class to present the lecture, using white board, using data show, and give the lectures to the student by Microsoft word for each lecture.

14. Assessment scheme Theory part:
Two exams: 25 mark

Practical part: two exam 10, quiz and report with presentation from 5, total is 15 mark

15. Student learning outcome:

1. Uunderstand how biotechnology has been used to develop knowledge of complex processes that occur in the plant
2. Use basic biotechnological techniques to explore molecular biology of plants
3. Understand the processes involved in the planning, conduct and execution of plant biotechnology experiments
4. Explain how biotechnology is used for plant improvement and discuss the ethical implications of that use
5. Communicate effectively using oral and written means for both scientific and non-technical audiences
6. Cooperate and work effectively as a member of a team to solve problems

16. Course Reading List and References:

[1] J. M. Albaret and E. Aubert. Etalonnage 15-19 ans du test de rotation mentale de vandenberg. Evolutions psychomotrices, pages 206–209, 1996.

[2] J. Ardouin, A. L´ecuyer, M. Marchal, C. Riant, and E. Marchand. Flyviz: a novel display device to provide humans with 360 vision by coupling catadioptric camera with hmd. In Proceedings of the 18th ACM symposium on Virtual reality software and technology, pages 41–44.
ACM, 2012.

[3] F. Bacim, E. D. Ragan, C. Stinson, S. Scerbo, and D. A. Bowman. Collaborative navigation in virtual search and rescue. In 3D User Interfaces (3DUI), 2012 IEEE Symposium on, pages 187–188. IEEE,
2012. [4] J. Brooke et al. Sus-a quick and dirty usability scale. Usability evaluation in industry, 189(194):4–7, 1996.

[5] H. G. Debarba, S. Perrin, B. Herbelin, and R. Boulic. Embodied interaction using non-planar projections in immersive virtual reality. In Proceedings of the 21st ACM Symposium on Virtual Reality Software and
Technology, pages 125–128. ACM, 2015.

17. The Topics:	**Lecturer's name**
Introduction to plant Biotechnology	**Dr.Saman Abd Rasul**
DNA as genetic material	
DNA replication methods	
From DNA to RNA to protein	
DNA packaging in the chromosome	

First examination	
DNA Extraction	
Gel electrophoresis	
Polymerase chain reaction	
Genetic engineering	
Plant Transformation	
Recombinant DNA technology	
Second Examination	

18. Practical Topics

Practical How to make solution. How to use some instrument such HPLC, Nanodrop and spectrophotometer Learning biotechnological techniques PCR polymerase chain reaction DNA extraction Gel Electrophoresis Recombinant DNA – Genetic Engineering Plant Tissue Culture	(MSc) Arian Mustafa Abdullah

Q1/ Define the following terms:

(25 Marks)

TBE Buffer Nano Drop Electrophoresis ladder Ti plasmid

Q2/ a. Write about *Agrobacterium*-mediated Plant Transformation Process.

(12 marks)

b. Briefly write about the Molecular Identification.
(12

Marks)

Q3/ Fill the following blanks with suitable phrases:
(26

marks)

1. The ---------- is the time between injection and detection.
2. The following are some of the techniques use in Cellular target practice a

   ----------b ---------- c ----------.
3. ---------- DNA building blocks.
4. ---------- and ---------- help stabilize DNA While the ----------

   - break the cell membrane in the processes of DNA extraction.
5. Several devices are available either for manual or auto injection of the

   sample in HPLC: a---------- b---------- c----------.

6. The dual role of buffer in Agarose gel are ---------- and--------
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21. Peer review

] J. M. Albaret and E. Aubert. Etalonnage 15-19 ans du test de rotation

mentale de vandenberg. Evolutions psychomotrices, pages 206–209, 1996.

[2] J. Ardouin, A. L´ecuyer, M. Marchal, C. Riant, and E. Marchand. Flyviz: a novel display device to provide humans with 360 vision by coupling catadioptric camera with hmd. In Proceedings of the 18th ACM symposium on Virtual reality software and technology, pages 41–44. ACM, 2012.

[3] F. Bacim, E. D. Ragan, C. Stinson, S. Scerbo, and D. A. Bowman. Collaborative navigation in virtual search and rescue. In 3D User Interfaces (3DUI), 2012 IEEE Symposium on, pages 187–188. IEEE, 2012.

[4] J. Brooke et al. Sus-a quick and dirty usability scale. Usability evaluation in industry, 189(194):4–7, 1996.

[5] H. G. Debarba, S. Perrin, B. Herbelin, and R. Boulic. Embodied interaction

using non-planar projections in immersive virtual reality. In Proceedings of the 21st ACM Symposium on Virtual Reality Software and Technology, pages 125–128. ACM, 2015.

Field Crops Department

College of Agricultural Engineering Sciences

Salahaddin University – Erbil

Subject: Biotechnology / Practical part

Course Book: 4th stage / 1st Semester

Lecturer's name:

Assistant Lecturer Arian Mustafa Abdullah

Academic Year: 2022-2023

Course Book

1. Course name	**Biotechnology / Practical Part**
2. Lecturer in charge	**Arian Mustafa Abdullah**
3. Department/ College	**Field Crops/ Agriculture College**
4. Contact	**e-mail: arian.abdullah@su.edu.krd** **Tel: 07503482505**
5. Time (in hours) per week	**Practical: 3**
6. Teacher's academic profile	• **BSc:** Plant Production / College of Agriculture (2006 -2007) / University of Salahaddin / Kurdistan Region/ Iraq. • **MSc:** Biotechnology / Graduate School of Science (2015)/ The University of Melbourne.
9. Keywords	Biotechnology, GM crops, Biotech techniques, DNA, Protein,

	Nucleic acids, PCR, Solution preparation, concentrations, HPLC.

10. Course overview:

Biotechnology is a useful application of a biological product or process. It is a growing area of applied science and covers a variety of specialist fields including agriculture more specifically field crops production. Studying this course will provide an opportunity to the students to understand and learn how the biotechnology has rapidly improved the yield, some characteristics such as disease and pest resistance to the plants and specifically field crops worldwide.

11. Course objective:

In order to instruct and train the students to understand the most important principles and bases of Biotechnology. Upon completion of the subject, student should be able to practice some biotech techniques such as Polymerase Chain Reaction, DNA Extraction… etc. This course will also enable the students to prepare important solutions and use some instruments such as Spectrophotometer, Nano-drop and High performance Liquid Chromatography.

12. Student's obligation and assessment

The obligations for the students in this course are attendance and participating in the lectures, asking all the new terms and topics in class. Well preparation for exams, short presentations and report about the techniques of Biotechnology.

13. Forms of teaching

Teaching Methods

1. Lecture
2. Self study

Teaching Media

1. Texts and teaching materials
2. Power point presentations: for the lectures and using explanation diagrams when needed.
3. practical part such as preparing solution and gels as well as observing the available instruments.

14. Assessment scheme

1. Each lecture will start with a short quiz, which covers any information presented in the previous lecture which will be totally out of 2 marks.
2. Two exams will consist of a variety of questions, including MCQs, filling the blanks, reasons, differences between different aspects and sometimes short answer questions. Preparation for the exam will be through studying the materials given in the lectures.
3. A group assignment (report) about the biotech techniques is required and presenting the materials about the assignment. The presentation will be at the beginning of each lecture and the submission of the report will be prior to the last lecture in the course.

15. Student learning outcome:

Upon completion of this course students will be able to

1. Demonstrate basic laboratory skills necessary for biotechnology sector.

2. Demonstrate a basic knowledge in biology and molecular biology.

16. Course Reading List and References:

1. Ian D.Wilson[a]RobertPlumb[b]JenniferGranger[b]HilaryMajor[c]RebeccaWilliams[a]Eva M.Lenz[a] , HPLC-MS-based methods for the study of metabolomics, *Journal of Chromatography B*, Volume 817, Issue 1, 5 March 2005, Pages 67-76.
2. Metzker, M. L. and Caskey, C. T. 2009. Polymerase Chain Reaction (PCR). eLS.
3. Okasman-Caldenty, K-M & Barz, W (eds) 2002, *Plant Biotechnology and Transgenic plants*, Marcel Dekker, New York.
4. R.K. Scopes, Measurement of protein by spectrophotometry at 205 nm, Analytical Biochemistry, Volume 59, Issue 1, May 1974, Pages 277-282
5. Salah M. Aljanabi, Iciar Martinez; Universal and rapid salt-extraction of high quality genomic DNA for PCR-based techniques, *Nucleic Acids Research*, Volume 25, Issue 22, 1 November 1997, Pages 4692-4693, https//doi.org/10.1093/nar/25.22.4692.
6. Wilson, S & Roberts, S 2011, Recent advances towards development and commercialization of plant cell culture processes for the synthesis of bimolecular, *Plant Biotechnology Journal*, vol. 10, pp. 249-268.

18. The Topics of the Lectures

Weeks	**Subject Titles**
1st week	Basics and important information about safety in the laboratory Definition of Biotechnology: General Definition and Detailed Definition
2nd week	Solution Preparation : Some basic information about concentration and dilution
3rd week	Apparatus and instruments used in biotech lab
4th week	Measuring Protein Concentration through Absorption Spectrophotometry & Nano-drop
5th week	DNA and DNA Extraction

6th week	1st Examination
7th week	Polymerase chain reaction PCR
8th week	Gel Electrophoresis
9th week	High Performance Liquid Chromatography HPLC
10th week	Plant Tissue Culture
11th week	2nd Examination

19. Examinations:

1/ Fill in the blanks

1. The application of the technology to modify the ---------- of an organism by adding ----------from another organism.

2. In General, Plant Biotechnology Techniques, Fall into two classes, ---------- and----------.

3. ---------- Maintains pH and ionic strength of the reaction solution suitable for the activity of the enzyme.

4. Organisms can be identified by using----------.

5. DNA source are: ---------, ----------, ---------and ---------.

2/ What is the PCR? Explain the steps for amplification the segment of

DNA.

3/ What are some potential sources of error in absorbance measurements?

4/ Mention the Common Specific Applications of HPLC.

5/ Choose the right answer

1. The ability of plants to alter their metabolism, growth and development to best suit their environment.
   a. PTC b. Explant c. Totipotency d. Plasticity

2. When the ultimate goal of cell culture is protoplast isolation we need to take tissues from
   a. Leaf tissue from aseptically germinated seed b. Hypocotyl c. Terminal shoot bud d. Pieces of stem.

3. HPLC is accomplished by injection of a small amount of liquid sample into a moving stream of liquid called
   a. Stationary phase b. Subculture c. PCR d. Mobile phase

Answers

1/

1. The application of the technology to modify the biological function of an organism by adding gene from another organism.

2. In General, Plant biotechnology techniques, Fall into two classes, Gene Manipulation and Gene

3. Introduction

3. Buffer solution Maintains pH and ionic strength of the reaction solution suitable for the activity of the enzyme.

4. Organisms can be identified by using PCR.

5. DNA source are: blood, semen, hair, and root.

2/ PCR is a biochemical technology in molecular

biology to amplify a single or a few copies of a piece

of DNA across several orders of magnitude,

generating thousands to millions of copies of a

particular DNA sequence.

It is called “polymerase” because the only enzyme used in this reaction is DNA polymerase. It is called “chain” because the products of the first reaction become substrates of the following one, and so on.

3/ Spectrophotometric measurements are affected by many factors, such as the type of solvent used, temperature, wavelength of light at which the measurements are made, and presence of impurities in the sample being studied. To eliminate absorbance due to the solvent, the spectrophotometer is always zeroed (tared) against the solvent.

Another potential problem is light scattering is due to suspended particles. As shown below in Figure 2, the particulates will deflect light rays and cause an artificial increase in absorbance. To avoid light scattering, it is common practice to centrifuge the sample before measuring absorbance to remove particulates.

4/

•Quantitative/qualitative analyses of amino acids, nucleic acids, proteins in physiological samples

• Measuring levels of active drugs, synthetic by products, degradation products in pharmaceuticals

• Measuring levels of hazardous compounds such as pesticides and insecticides

• Monitoring environmental samples

• Purifying compounds from mixtures

6/

1. d. Plasticity
2. a. Leaf tissue from aseptically germinated seed
3. d. d. Mobile phase

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