



Department of Biology

College of Science

Salahaddin University Erbil (SUE)

Subject: **Biotechnology**

Course Book – 4

Lecturer's name: **Dr. Mukhlis Hamad Aali**

Academic Year: **2022/2023**

Course Book

1.Course name	Biotechnology (Theory)
2. Lecturer in charge	Mukhlis Hamad Aali
3. Department/ College	Biology Department/ College of Science
4. Contact	e-mail: mukhlis.aali@su.edu.krd
5. Time (in hours) per week	Theory: 3 hrs
6. Office hours	Appointment of timetable Schedule
7. Course code	
8. Teacher's academic profile	<p>I received an M.Sc. in molecular biology in 2010 and began working as an assistant lecturer in Salahaddin University Erbil's biology department's faculty of science that same year. I then began working there as an assistant lecturer in the same department. Then, in 2019, I obtained my Ph.D. from Universiti Teknologi Malaysia and Salahaddin University Erbil.</p> <p>The teaching experience is both theoretical and practical including:</p> <p>Undergraduate:</p>

	<p>1- Biotechnology</p> <p>2- Molecular Biology.</p> <p>3- Medical Genetics</p> <p>4- Cell biology.</p> <p>Postgraduate:</p> <p>1- Gene Cloning.</p> <p>2- Medical Genetics.</p> <p>2021-2023 Supervising MSc Student.</p>
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9. Keywords | Biotechnology, PCR, Electrophoresis, Blotting Technique, DNA Sequencing

10. Course overview:

The course will cover Biotechnology. Biotechnology is a field of applied biology that involves the use of living organisms or parts of organisms for practical uses and bioprocesses in engineering, technology, medicine and other fields requiring bioproducts. Modern use similar term includes genetic engineering as well as cell- and tissue culture technologies. Biotechnology, as ‘the appliance of bioscience’, is helping to diagnose and treat major human diseases, provide solutions for a cleaner environment and produce new industrial bioproducts and processes. Over the last 20 years, biotechnological advances have revolutionized biology. It's now possible to manipulate the DNA present in an organism. Recent biotechnological advances have dramatically influenced agriculture, basic research, medicine, and the legal system. It is the integrated use of biochemistry, microbiology and engineering sciences in order to exploit microorganisms, cultured tissues/cells, to their best.

Through this semester discusses some of the methods and applications of biotechnology. We’ll look at the technique’s biologists use in the lab to manipulate DNA and see how to alter the genetic material present in an organism. There are many practical uses for biotechnology, and we’ll touch on some of them. We’ll also discuss the practical and ethical questions raised by the ability to alter an organism’s genetic make-up.

11. Course objective:

At the end of this course students should be able to demonstrate a clear understanding of the facts and basic concepts of molecular biology and biotechnology which are covered in lecture and laboratory, including;

1. To enable candidates to acquire the knowledge and develop an understanding of how materials are provided by biological agents to provide goods and services.
2. To appreciate the role played by biotechnology in improving health care for human beings.
3. To understand the interdisciplinary nature of this subject.
4. To create awareness about the appreciation of biological processes to industries.
5. To develop the ability to appreciate biological phenomenon in nature and the contribution of biotechnology to human welfare.
6. To develop scientific attitude towards biological phenomenon.

As a student on this exciting course, you will be stimulated by the emphasis on laboratory work and research. On a typical morning you might be analysing DNA on a gel and in the afternoon using a fermenter to produce commercial products. One day might involve learning about how microbes can clean up pollution, and on another day visiting a company that researches new anti-cancer drugs.

Our students gain a wide range of laboratory-based skills and techniques, which both provide the practical basis for their studies and provide a useful portfolio of employability skills. These skills, plus associated research experience gained in the final year Honours project, have enabled our biotechnology graduates to establish an excellent reputation in medical, industrial and research laboratories.

12. Course Rationale:

- Biotechnology laboratory methods and techniques is a rigorous course that develops problem-solving skills necessary for success doing science at the bench while exploring in depth the chemistry of biological molecules. Knowledge in this area is directly applicable to the biotechnology fields of pharmaceuticals, environmental processes and remediation, as well as bioinstrumentation .

13. Forms of teaching

Different forms of teaching will be used to reach the objectives of the course: power point presentations for the head titles and definitions and summary of conclusions, movies, photomicrographs and any other illustrations. There will be discussions and the laboratory notes will give enough background to translate, solve, analyze, and evaluate problems sets, and different issues discussed throughout the course.

To get the best of the course, it is suggested that you attend classes as much as possible, read the required lectures, teacher's notes regularly as all of them are foundations for the course. Lecture's notes are for supporting and not for submitting the reading material including the handouts. Try as much as possible to participate in classroom discussions, preparing the assignments given in the course. Teaching with technology can deepen student learning by supporting instructional objectives.

- Data Show Projector
- Blackboard
- Video.

14. Assessment scheme

Breakdown of overall assessment and examination

Grading System:

The students are required to do one closed book exam at the mid of the semester besides other assignments including translations and one project paper. The exam has 10 marks (mean of two examination), the attendance, classroom activities; translations and project paper count 5 marks. There will be a final exam on 15 marks. So that the final grade will be based upon the following criteria:

Mean of two practical examinations: 10%

Daily quizzes: 3%

Classroom activity: 1%

Report and presentation: 1%

Final practical examination: 15%

Total practical Marks: 30/100

16. Course Reading List and References:

Course material

Required book:

Basic Laboratory Methods for Biotechnology (2nd Edition) by Lisa A. Seidman & Cynthia J. Moore

ISBN-13: 978-0-321-57014-7

Publisher: Pearson Benjamin-Cummings Publishing Company

Spiral bound 751pp

Pub. Date: January 2009

Introduction to Biotechnology (2nd Edition), by William J Thieman & Michael A. Palladino

ISBN-13: 9780321491459

Publisher: Benjamin Cummings

Paperback, 408pp

Pub. Date: August 2008

Molecular Biology and Biotechnology: A Guide for Students, (3rd Edition) by Helen Kreuzer & Adrienne Massey

Book ISBN or Item Number: 978-1-55581-472-4

Publisher: ASM Press

Paperback, 498 pages, two-color throughout with full-color insert, Illustrations, glossary, index.

Publication Date: Oct 2007

Biotechnology: Science for the New Millennium, by Ellen Daugherty

ISBN-13: 978-0008195397

Publisher: EMC/Paradigm

Spiral bound Pub. Date: 2007

And any other Biotechnology and Molecular Biology books published.

The core materials of the course consist of the above book, articles from media and internet, and laboratory lecture notes, make sure you read all the materials and prepare well before going for the examinations.

Students are encouraged to search for any other materials that may help improve their English language ability in reading, writing, listening and speaking biotechnology and molecular biology texts. This syllabus may be subject to changes, i.e., we may take either longer or shorter time to finish a topic, if any changes happened you will be notified well in advance.

I hope you enjoy the course and find its content useful no matter where your future studies take you!

17. The Topics: Lecturer's name

<p>Week 1: Basic Concept on Biotechnology.</p> <p>Week 2: Electrophoresis Technique Analysis</p> <p>Week 3: Polymerase Chain Reaction Technique (PCR)</p> <p>Week 4: REVERSE TRANSCRIPTASE PCR (RT-PCR).</p> <p>Week 5: REALTIME POLYMERASE CHAIN REACTION.</p> <p>Week 6: First semester- 1st examination</p> <p>Week 07: Restriction Fragment Length Polymorphism (RFLP)-PCR.</p> <p>Week 08: DNA LIGASE ANALYSIS</p> <p>Week 09: : Polyacrylamide Gel Electrophoresis</p> <p>Week 10: DNA Sequencing (Gene Sequencing)</p> <p>Week 11: Next-Generation Sequencing (NGS)</p> <p>Week 12: Second semester- 2nd examination</p> <p>Week 13: Chromatographical Analysis</p>	
Week 14: Southern Blotting Technique	
Week 15: Northern Blotting Technique	
Week 16: Western Blotting Technique	
Week 17: DNA Microarray Analysis	
Week 18: Third semester- 3rd examination which is out of 10%	
<p>19. Examinations: Theory</p> <p>Examples of Semester Examinations</p> <p>Q1/ Choose the correct answer of the following (Multiple Choice Questions):</p> <p>.1 The analysis and determining molecular weight of protein fragments is one purpose of:</p> <p>a) Gene sequencing.</p> <p>b) RFLP-PCR.</p> <p>c) Agarose gel electrophoresis.</p> <p>d) SDS PAGE.</p>	

- .2 The type of Next Generation Sequencing can be used to identify epigenetic changes is called:
- Ribo-seq.
 - ChIP-seq.
 - RNA-seq.
 - WTSS.
- .3 The dual hybridization probe is carried out based on:
- Hybridize between a donor flourophore RNA probe and an acceptor flourophore RNA probe.
 - Hydrolyze between a donor flourophore DNA probe and an acceptor flourophore DNA probe.
 - Hybridize between a donor flourophore DNA probe and an acceptor flourophore DNA probe.
 - Hydrolyze between a donor flourophore protein probe and an acceptor flourophore protein probe.
- .4 An enzyme that cleavage and recognize relatively short sequences of bases within a strand of DNA is:
- DNA polymerase Enzyme .
 - RTase Enzyme.
 - DNA Ligase Enzyme.
 - REase Enzyme.
- .5 Which of the following statements describing the red biotechnology is NOT False?
- Making wine, cheese, and beer by fermentation.
 - Managing of arid lands and deserts.
 - Production of vaccines and antibiotics and development of diagnostic tests.
 - Making the rapid organization and analysis of biological data possible.
- Q2/ Briefly Compare the following:
- E. coli DNA Ligase and T4 DNA Ligase.
 - Linkage mapping and Physical mapping
 - Protein gel electrophoresis and Agarose Gel Electrophoresis.

.4 first strand reaction and second strand reaction in RS-PCR.

Q3/ What is the meaning NGS and mention the steps to the preparation of NGS library with illustrating by figures?

Q4/ Enumerate each the following:

- .1 Methods used for DNA sequencing.
- .2 Detection in real time PCR Products.
- .3 Types DNA polymorphisms.
- .4 Inserting of DNA fragment to vector.

Q5/ Explain the essential of DNA photocopier reaction components?

20. Extra notes:

21. Peer review پيداچوونهوهى

21. Peer review هاوهل پيداچوونهوهى

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

نهم كورسبوو كه دهبيت له لايهن هاوهلنيكي نهكاديميهوه سهير بكرت و ناوهروكي بابتهكاني كورسهكه پهسهند بكات و جهند وشهيهك بنوسيت لهسه شياوى ناوهروكي كورسهكه و ازووى لهسه بكات. هاوهل نهو كهسهيه كه زانيارى ههبيت لهسه كورسهكه و دهبيت پلهى زانستى له ماموستا كهتر نهبيت.

Peer reviewed by:

Mr. Mohammed Ali Salim (Head of Biology Department)