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|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Philadelphia University</b>                             |  <b>PHILADELPHIA UNIVERSITY</b><br><small>THE WAY TO THE FUTURE</small> | <b>Approval date:</b>   |
| <b>Faculty of Science</b>                                  |                                                                                                                                                          | <b>Issue:</b>           |
| <b>Department of biotechnology and Genetic Engineering</b> |                                                                                                                                                          | <b>Credit hours (2)</b> |
| <b>Academic year (2022/2023)</b>                           |                                                                                                                                                          | <b>Bachelor</b>         |

### Course information

| Course#                                                                                                                                                                                                                                | Course title                         | Prerequisite                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------------------------------------------------|
| <b>0240282</b>                                                                                                                                                                                                                         | <b>Introduction to Biotechnology</b> | <b>0240107</b>                                             |
| Course type                                                                                                                                                                                                                            |                                      | Room #                                                     |
| <input type="checkbox"/> University Requirement <input type="checkbox"/> Faculty Requirement<br><input checked="" type="checkbox"/> Major Requirement <input type="checkbox"/> Elective <input checked="" type="checkbox"/> Compulsory |                                      | <b>1003</b>                                                |
|                                                                                                                                                                                                                                        |                                      | <b>Class time</b><br><b>Sun, Mon</b><br><b>08:15-09:15</b> |

### Instructor Information

| Name                 | Office No.  | Phone No.   | Office Hours                                                                            | E-mail                              |
|----------------------|-------------|-------------|-----------------------------------------------------------------------------------------|-------------------------------------|
| <b>Ahmad Ghuneim</b> | <b>s823</b> | <b>2491</b> | <b>Sun, Tue, Thr</b><br><b>(09:30-10:30)</b><br><b>Sun, Mon</b><br><b>(12:00-13:00)</b> | <b>aghuneim@philadelphia.edu.jo</b> |

### Course Delivery Method

| Course Delivery Method                       |                                 |                                  |             |
|----------------------------------------------|---------------------------------|----------------------------------|-------------|
| <input checked="" type="checkbox"/> Physical | <input type="checkbox"/> Online | <input type="checkbox"/> Blended |             |
| Learning Model                               |                                 |                                  |             |
| Percentage                                   | Synchronous                     | Asynchronous                     | Physical    |
|                                              |                                 |                                  | <b>100%</b> |

### Course Description

The course covers the definitions and applications of biotechnology and genetic engineering; it surveys the latest applications of recombinant DNA technology in medical diagnosis and therapy, agriculture, microbial biotechnology and environmental biotechnology. Lectures will underlie the principles and application of Recombinant DNA technology in industrial, agricultural, pharmaceutical, and biomedical fields.

## Course Learning Outcomes

| Number              | Outcomes                                                                                                                                                                                                                                                                                                                       | Corresponding Program outcomes |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <b>Knowledge</b>    |                                                                                                                                                                                                                                                                                                                                |                                |
| <b>K1</b>           | Understand what is Biotechnology and how it was developed. Appreciate the importance of biotechnology in our lives. Understand the concepts, regulation and applications.                                                                                                                                                      | <b>Kp2</b>                     |
| <b>K2</b>           | Introduce biotechnology techniques and their use in existing and emerging methods of biotechnology.                                                                                                                                                                                                                            | <b>Kp3</b>                     |
| <b>K3</b>           | Understand the different applications of biotechnology in plants, animal and human.                                                                                                                                                                                                                                            | <b>Kp2</b>                     |
| <b>K4</b>           | Define basic concepts in microbial biotechnology and ecology for biodegradation and bioremediation of pollutants, fermentation kinetics, primary / secondary metabolite excretion and ingredients for food industry and recognize the different products of biotechnology and know their importance in different applications. | <b>Kp5</b>                     |
| <b>Skills</b>       |                                                                                                                                                                                                                                                                                                                                |                                |
| <b>S1</b>           | -                                                                                                                                                                                                                                                                                                                              | -                              |
| <b>Competencies</b> |                                                                                                                                                                                                                                                                                                                                |                                |
| <b>C1</b>           | Recognize the use of biotechnology to study, monitor and treat diseases and alter food and environment                                                                                                                                                                                                                         | <b>Cp1</b>                     |

## Learning Resources

|                       |                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course textbook       | <b>Introduction to Biotechnology; 4<sup>th</sup> Ed (2020)</b><br><b>William J. Thieman and Michael A. Palladino</b><br>Pearson Education Limited<br>eBook ISBN 13: 978-1-292-26179-9                                                                                                                                                                   |
| Supporting References | <b>Biotechnology</b><br>Clark, David P.; Pazdernik, Nanette J.<br>Amsterdam: Elsevier, 2016; 2nd ed.<br>ISBN 978-0-12-385015-7<br><b>Biotechnology for Beginners</b><br>2016, 2nd Edition<br>Reinhard Renneberg, Vanya Lorocho<br>eBook ISBN: 9780128012734<br>Academic Press                                                                           |
| Supporting websites   | The textbook publisher site contain more detailed information in some topics and quizzes for each chapter. Select the name of the book from this page:<br><a href="https://media.pearsoncmg.com/intl/ge/abp/resources/index.html">https://media.pearsoncmg.com/intl/ge/abp/resources/index.html</a><br>or<br><a href="#">Resources for the Textbook</a> |
| Teaching Environment  | <input checked="" type="checkbox"/> Classroom <input type="checkbox"/> laboratory <input type="checkbox"/> Learning platform <input type="checkbox"/> Other                                                                                                                                                                                             |

## Meetings and subjects timetable

| Week  | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Learning Methods                | Tasks    | Learning Material  |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------|--------------------|
| 1     | <b>Ch1: The Biotechnology Century and Its Workforce</b><br>1.1 What Is Biotechnology and What Does It Mean to You?<br>1.2 Types of Biotechnology<br>1.3 What Will the New Biotechnology Look Like? An Example from Medical Biotechnology<br>1.4 The Biotechnology Workforce                                                                                                                                                                                                          | Lecture, collaborative learning |          | Text book page 21  |
| 2     | <b>Ch.2: An Introduction to Genes and Genomes (Brief Review)</b><br>2.1 A Review of Cell Structure<br>2.2 The Molecule of Life<br>2.3 Chromosome Structure, DNA Replication, and Genomes<br>2.4 RNA and Protein Synthesis<br>2.5 Regulation of Gene Expression<br>2.6 Mutations: Causes and Consequences<br>2.7 Revealing the Epigenome<br>2.8 Immune Response Mechanism in Prokaryotes Results in Extraordinary New Technology for Editing Genes <i>In vitro</i> and <i>In vivo</i> | Lecture, collaborative learning | Quiz     | Text book page 49  |
| 3 & 4 | <b>Ch3: Recombinant DNA Technology and Genomics</b><br>3.1 Introduction to Recombinant DNA Technology and DNA Cloning<br>3.2 How Do You Identify and Clone a Gene of Interest?<br>3.3 Laboratory Techniques and Applications of Recombinant DNA Technology<br>3.4 Genomics and Bioinformatics: The Hottest Disciplines in the History of Biotechnology<br>3.5 Systems Biology and Synthetic Biology                                                                                  | Lecture, collaborative learning | Homework | Text book page 80  |
| 5     | <b>Ch4: Proteins as Products</b><br>4.1 Proteins as Biotechnology Products<br>4.2 Protein Structures<br>4.3 Protein Production<br>4.4 Proteomics                                                                                                                                                                                                                                                                                                                                     | Lecture, collaborative learning | Quiz     | Text book page 125 |
| 6 & 7 | <b>Ch5: Microbial Biotechnology</b><br>5.1 The Structure of Microbes<br>5.2 Microorganisms as Tools<br>5.3 Using Microbes for a Variety of Everyday Applications<br>5.4 Vaccines<br>5.5 Microbial Genomics<br>5.6 Microbial Diagnostics<br>5.7 Combating Bioterrorism<br>5.8 Microbes for Making Biofuels                                                                                                                                                                            | Lecture, collaborative learning |          | Text book page 150 |
| 8     | <b>Midterm Exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Lecture, collaborative learning | Quiz     |                    |

|     |                                                                                                                                                                                                                                                                                                                                                                 |                                 |          |                    |
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| 8&9 | <b>Ch6: Plant Biotechnology</b><br>6.1 Uses of Biotechnology to Enhance Selective Breeding<br>6.2 Genetic Engineering of Plants<br>6.3 Practical Applications<br>6.4 Health and Environmental Concerns                                                                                                                                                          | Lecture, collaborative learning |          | Text book page 186 |
| 10  | <b>Ch7: Animal Biotechnology</b><br>7.1 Animals in Research<br>7.2 Cloning<br>7.3 Transgenic Animals<br>7.4 Producing Human Antibodies in Animals                                                                                                                                                                                                               | Lecture, collaborative learning |          | Text book page 203 |
| 11  | <b>Ch8: DNA Fingerprinting and Forensic Analysis</b><br>8.1 What Is a DNA Fingerprint?<br>8.2 Preparing a DNA Fingerprint<br>8.3 Putting DNA to Use<br>8.4 DNA and the Rules of Evidence<br>8.5 Familial Relationships and DNA Profiles<br>8.6 Non-human DNA Analysis                                                                                           | Lecture, collaborative learning | Quiz     | Text book page 220 |
| 12  | <b>Ch9: Bioremediation</b><br>9.1 What Is Bioremediation?<br>9.2 Bioremediation Basics<br>9.3 Cleanup Sites and Strategies<br>9.4 Turning Wastes into Energy<br>9.5 Applying Genetically Engineered Strains to Clean Up the Environment<br>9.6 Environmental Disasters: Case Studies in Bioremediation<br>9.7 Challenges for Bioremediation                     | Lecture, collaborative learning |          | Text book page 239 |
| 13  | <b>Ch10: Aquatic Biotechnology</b><br>10.1 Introduction to Aquatic Biotechnology<br>10.2 Aquaculture: Increasing the World's Food Supply through Biotechnology<br>10.3 Genetic Technologies and Aquatic Organisms<br>10.4 Medical Applications of Aquatic Biotechnology<br>10.5 Nonmedical Products<br>10.6 Environmental Applications of Aquatic Biotechnology | Lecture, collaborative learning | Quiz     | Text book page 267 |
| 14  | <b>Ch11: Medical Biotechnology</b><br>11.1 Animal Models of Human Disease<br>11.2 Detecting and Diagnosing Human Disease Conditions<br>11.3 Sequence Analysis of Individual Genomes<br>11.4 Precision Medicine and Biotechnology<br>11.5 Gene Therapy<br>11.6 The Potential of Regenerative Medicine                                                            | Lecture, collaborative learning |          | Text book page 297 |
| 15  | <b>Ch12: International Biotechnology Regulations</b><br>12.1 Overview of International Regulations<br>12.2 Protection of Human, Animal, and Plant Health                                                                                                                                                                                                        | Lecture, collaborative learning | Homework | Text book page 348 |

|    |                                                                                                                                                                                                                                                                                                                                                 |                                 |             |                           |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------|---------------------------|
|    | 12.3 Biodiversity Conservation and the Cartagena Protocol on Biosafety<br>12.4 Management of Genetic Resources 354<br>State Sovereign Rights<br>12.5 Trade and Intellectual Property Rights<br>12.6 Human Rights<br>12.7 Preventing the Hostile Use of Biotechnology<br>12.8 Role of Scientists in the Development of International Regulations |                                 |             |                           |
| 15 | <b>Ch13: Ethics and Biotechnology</b><br>13.1 What Is Ethics?<br>13.2 Examples of Ethics and Biotechnology<br>13.3 Economics, the Role of Science, and Communication                                                                                                                                                                            | Lecture, collaborative learning | <b>Quiz</b> | <b>Text book page 364</b> |
| 16 | <b>Final Exam</b>                                                                                                                                                                                                                                                                                                                               |                                 |             |                           |

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

### Course Contributing to Learner Skill Development

| Using Technology                                           |
|------------------------------------------------------------|
| Recognize legitimate and scientific information            |
| Communication skills                                       |
| Encourage interaction and asking questions during lectures |
| Application of concepts learnt                             |
|                                                            |

### Assessment Methods and Grade Distribution

| Assessment Methods           | Grade Weight | Assessment Time (Week No.) | Link to Course Outcomes |
|------------------------------|--------------|----------------------------|-------------------------|
| <b>Mid Term Exam</b>         | <b>% 30</b>  | <b>7</b>                   | <b>K1 and K2</b>        |
| <b>Various Assessments *</b> | <b>% 30</b>  | <b>See Time table</b>      | <b>K1-4 and C1</b>      |
| <b>Final Exam</b>            | <b>% 40</b>  | <b>16</b>                  | <b>All</b>              |
| <b>Total</b>                 | <b>%100</b>  |                            |                         |

\* 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**      |
|---------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------|
| <b>Knowledge</b>    |                                                                                                                |                                 |                          |
| <b>K1</b>           | Understand what is Biotechnology and how it was developed.                                                     | Lecture, collaborative learning | Quiz, Homework and Exams |
| <b>K2</b>           | Appreciate the importance of biotechnology in our lives. Understand the concepts, regulation and applications. | Lecture, collaborative learning | Quiz, Homework and Exams |
| <b>K3</b>           | Introduce biotechnology techniques and their use in existing and emerging methods of biotechnology.            | Lecture, collaborative learning | Quiz, Homework and Exams |
| <b>K4</b>           | Understand the different applications of biotechnology in plants, animal and human.                            | Lecture, collaborative learning | Quiz, Homework and Exams |
| <b>Skills</b>       |                                                                                                                |                                 |                          |
| <b>S1</b>           |                                                                                                                |                                 |                          |
| <b>Competencies</b> |                                                                                                                |                                 |                          |
| <b>C1</b>           | Recognize the use of biotechnology to study, monitor and treat diseases and alter food and environment         | Lecture, collaborative learning | Quiz, Homework 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 Policies

| Policy                  | Policy Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Passing Grade</b>    | The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Missing Exams</b>    | <ul style="list-style-type: none"> <li>Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment.</li> <li>A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from the an exam or assessment due date.</li> <li>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.</li> </ul>                                                                               |
| <b>Attendance</b>       | 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. |
| <b>Academic Honesty</b> | 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 |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------|--------------------------|
| <b>Kp2</b> | Understand concepts, applications and regulations of the existing and emerging methods of biotechnology and the role of bio-entrepreneurs in the successful commercial .innovations | <b>Introduction to Biotechnology</b> | Quiz, Homework and Exams | <b>100%</b>              |
| <b>Cp1</b> | Recognize the use of biotechnology to study, monitor and treat diseases and alter food and environment                                                                              | <b>Introduction to Biotechnology</b> | Quiz, Homework and Exams | <b>90%</b>               |