



Philadelphia University
Faculty of Science
Department of Biotechnology and Genetic Engineering

Course Catalogue

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CHAPTER 1

INTRODUCTION TO CURRICULUM DESIGN

This catalogue contains a set of module descriptions and some information on the curriculum design. These modules are offered at the Department of Biotechnology and Genetic Engineering, Faculty of Science/ Philadelphia University, to obtain the four years B.Sc. (Honor) degree in Biotechnology and Genetic Engineering. The information given in this catalogue is extracted for the program specifications for the Degree programme. These specifications are published separately.

1.1 Fundamental Concepts

The most important concepts for understanding the module descriptions are as follows:

The modules described in this catalogue are defined in relation to a general taxonomy of that portion of Biotechnology and Genetic Engineering appropriate for an undergraduate curriculum. That taxonomy represents the body of knowledge for Biotechnology and Genetic Engineering. The body of knowledge is organized hierarchically into three levels. The highest level of the hierarchy is the area, which represents a particular disciplinary sub-field. The areas are broken down into smaller divisions called units, which represent individual thematic modules within an area. Each unit is further subdivided into a set of topics, which are the lowest level of the hierarchy. For coding the modules, the Department of Biotechnology and Genetic Engineering has applied the following scheme of coding. Each area is identified by a one-digit number, such as 0 for General Biology.

The whole Biotechnology and Genetic Engineering areas are listed in Table (1-1):

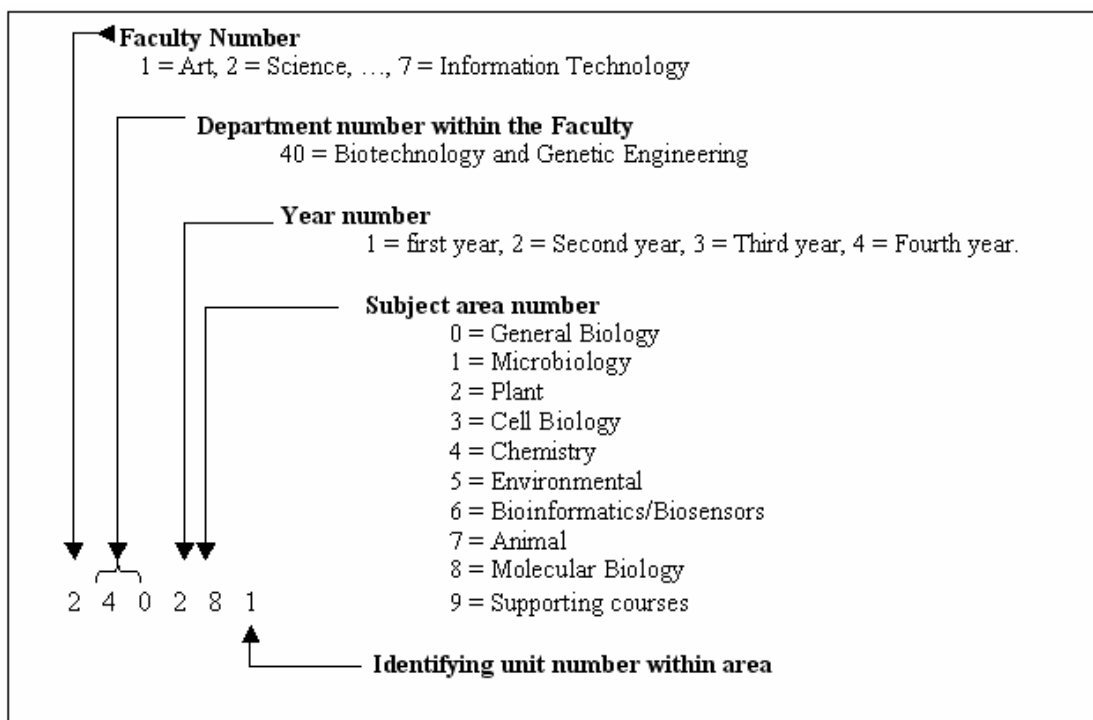
Coding Area	Topic Areas of Biotechnology and Genetic Engineering
0	General Biology
1	Microbiology
2	Plant Biotechnology
3	Cell Biology
4	Chemistry
5	Environmental Biotechnology
6	Bioinformatics/Biosensors
7	Animal biotechnology
8	Molecular Biology
9	Supporting Courses

Each unit is further subdivided into a set of topics, which are Core and Elective Units. Given the expanding scope of the Biotechnology discipline, it is impossible to insist that every undergraduate learn all the topics that were at one time considered fundamental to the field. Because the core is defined as minimal, the core alone cannot constitute a complete undergraduate curriculum. The undergraduate program must include additional elective units from the body of knowledge. These elective units could be chosen according to the needs of the individual student. Note that, occasionally, timetabling difficulties restricts elective units. To give a sense of the time required to cover a particular unit, a time metric should be chosen. The system of study at Philadelphia University is based on the credit hours. The basic measure unit of the curriculum is 3 credit hours module (or course unit). A module, which delivers at least 3 hours per week of lectures, is worth 3 credit hours. Some modules may have 1 credit hour for laboratory. In general, over a 16 weeks semester, a typical module provides minimum 45 hours of contact time. The final week of the semester is used for the examinations. The contact time corresponds to the in-class time required to present the material in a traditional lecture oriented format. Note that this time does not include the instructor's preparation time or the time students spend outside of class. As a general guideline, the time required outside of class is twice the time of the in-class time. Thus, a unit that is listed as requiring 3 credit hours will typically entails a total of 9 hours (3 in class and 6 outside). It is also important to keep in mind that the time associated with each unit represents the minimum number of hours required for adequate coverage, and that it is always appropriate to spend more time than the listed minimum.

1.2 Format of the Module Coding Adopted

Each module in the Biotechnology and Genetic Engineering programme is identified by a code and a title. For example, "240281" Introduction to Biotechnology represents a module offered by Faculty of Science, Department of Biotechnology and Genetic Engineering in the second year, in the area of molecular Biology, and the module title is Introduction to Biotechnology. Figure (1-1) illustrates the scheme of module coding and numbering, where the Introduction to Biotechnology module is presented as an example.

Figure (1-1) Module Coding and Numbering Scheme



CHAPTER 2

CURRICULUM DESIGN, ORGANISATION, AND CONTENT

2.1 Outlines of the Degree Programme

Within the general area of Biotechnology and Genetic Engineering, the modules recognize several major subject themes. This represents General Biology, Microbiology, Molecular Biology, Plant Biotechnology, Animal Biotechnology, Bioinformatics, Environmental Biotechnology, Chemistry and Supporting Courses.

Details of each module are set out in Chapter (3).

2.2 Requirements for the Degree Programme

The Biotechnology and Genetic Engineering programme is covered with different requirements. For obtaining the full award, students should complete 44 modules, each of 3 credit hours, (i.e. a total of 132 credit hours) summarised as follows:

8 Modules (University requirements)	(27 credit hours)
6 Modules (Faculty requirements)	(24 credit hours)
21 Modules (Departmental Compulsories)	(67 credit hours)
3 Modules (Departmental Electives)	(3 credit hours)
5 Modules (Supportive modules)	(11 credit hours)

2.3 Design, Organization, and Content of Curriculum

The Biotechnology and Genetic Engineering programme is covered with different requirements. For obtaining the full award, students should Organization of Modules:
The modules are organized into three levels according to the year at which they occur in the curriculum:

- 1- Level 1: Introductory modules,
- 2- Level 2: Intermediate modules,
- 3- Level 3: Advanced modules.

Modules designated as Introductory are offered in the first and second years of the Department curriculum. Modules listed as Intermediate are usually offered in the second or third year and build a foundation for further study in the field. Modules designated as Advanced tend to be taken in later years (third and fourth) and focus on those topics that require significant preparation in the earlier coursework. For these modules, the Department wishes to orient such modules to its own areas of expertise. While these distinctions are easy to understand in their own right, it is important to recognize that there is no necessary relationship between the notions of core and elective - which apply to units in the body of knowledge - and the level of the module. The introductory and intermediate modules concentrate on core material, and the advanced modules include some core material and elective modules. The point of organizing the modules into three levels: Introductory, Intermediate, and Advanced is to provide natural boundaries for defining implementation strategies.

The Study Plan:

The whole modules of the curriculum offered by the Biotechnology and Genetic Engineering Department are shown in Appendix A of this catalogue.

The Guidance Plan:

The Department guides students in their registration and selection of modules during the four years. The Department organizes a guidance plan that is where UR, FR, DR, and SR indicate University Requirements, Faculty Requirements, Department Requirements, and Supportive Requirements, respectively.

First year:

First semester

130101	English language skills 1	(UR)
240101	General Biology 1	(UR)
212101	General Chemistry 1	(FR)
212102	General Chemistry lab	(SR)
240106	General Biology lab	(SR)
710101	Computer skills 1	(UR)
111133	Civilization and human thoughts 1	(UR)

Second Semester

110101	Arabic language skills 1	(FR)
130102	English language skills 2	(UR)
210101	Calculus 1	(FR)
240107	General Biology 2	(SR)
212103	General Chemistry 2	(SR)
710102	Computer skills 2	(UR)

Second Year

First semester

210231	Introduction to Probability & Statistics	(FR)
240216	Microbiology	(DR)
240217	Microbiology lab	(DR)
240233	Cell Biology	(DR)
212241	Analytical Chemistry	(SR)
212242	Analytical Chemistry lab	(SR)
11101	National Education	(UR)
240108	General Biology 2 lab	(SR)

Second semester

111100	Military Science	(UR)
211105	General Physics	(SR)
240231	Genetics	(DR)
240232	Genetics lab	(DR)
240281	Introduction to Biotechnology	(SR)
212243	Organic Chemistry	(SR)

Third year

First semester

240337	Immunology	(DR)
240338	Immunology lab	(DR)
240234	Human Genetics	(DR)
240335	Cytogenetics	(DR)
240343	Biochemistry 1	(DR)
240344	Biochemistry 1 lab	(DR)
240386	Molecular Biology	(DR)
240387	Molecular Biology lab	(DR)

Second semester

240462	Bioinformatics	(DR)
240322	Plant Biotechnology	(DR)
240352	Environmental Biotechnology	(DR)
240471	Animal Biotechnology	(DR)
240472	Animal tissue culture lab	(DR)
240336	Cytogenetics lab	(DR)
	Elective course	(DR)

Fourth year

First semester

240417	Microbial Biotechnology	(DR)
240484	Applied Molecular Biology	(DR)
240485	Applied Molecular Biology lab	(DR)
	Elective Course	(DR)
210122	Fundamentals of Scientific Knowledge	(DR)
240323	Plant Tissue culture lab	(DR)
240391	Entrepreneurship	(DR)

Second semester

240441	Pharmaceutical Biotechnology	(DR)
240491	Ethics in Biotechnology	(DR)
240490	Quality control & Lab management	(DR)
240499	Graduation Project	(DR)
	Elective course	(DR)
	University course	(UR)
240494	Field Training	(DR)

CHAPTER 3

FULL DESCRIPTION OF MODULES

This chapter presents the full description of the Department modules

3.1 Module Descriptor

The Department organized a format for the module descriptor that includes much information on the module. This sub-section presents the components of the adopted module descriptor that are shown in Figure (3-1).

Figure (3-1) Components of the Module Description

Module Number, Module Title

Year:

Credit:

Module description:

Aims:

Learning Outcomes:

3.2 Introductory Modules

Table (3-1) presents the Introductory (Level 1) modules whose full descriptions are given below.

Table (3-1) Introductory Modules in Biotechnology and Genetic Engineering Department

Module Number	Module title	Prerequisite(s)
240101	General Biology 1	
240106	General Biology lab	
240107	General Biology 2	240101
240108	General Biology 2 lab	240107 or con

Module Number: 240101

Module Name: General Biology (1)

Level: 1

Credit Hours: 3

Course description:

- This course is a required introductory course designed for the first level students at the faculty of science, nursing and pharmacy.
- The course will cover basic information in cell structure, function, energy transfer and division, in addition to an introduction to animal form and function.

Course objectives:

- The course will provide the students with the basic understanding of the fundamental principles of biology.
- The topics covered in this course will allow the students to better comprehend other courses during the following academic years.

Learning outcomes:

• Knowledge and understanding:

At the end of this module, students will be able to:

- * Describe the characteristics and compounds that make up living things.
- * Discuss how matter and energy are interrelated in photosynthesis and cell respiration.
- * Identify key cell organelles and relate their function and structure.
- * Compare and contrast mitosis and meiosis in term of their goals and outcome.
- * Gain knowledge of the anatomical structure and physiological functions of tissues and organ systems of the human.

• Cognitive skills (thinking and analysis):

- The Thinking and Meditation about the Great Ability of God in Creation of our body and the biological systems.
- The thinking skills will be developed by encouraging students to conclude answers to different questions that the instructor intends to use during the presentation of the scientific material.
- The instructor intends to stimulate the student's analytical thinking side via connections with general aspects in daily life or through questions, net searching, and home works.

• Communication skills (personal and academic):

- Gain Teamwork skills
- The students have the option to share open discussion and to ask questions during the class or any other times.
- Students have the opportunity to communicate with others especially professors, while searching answers for home works or through encouraging them to attend different scientific activities that are available in the department.

• Practical and subject specific skills (Transferable Skills)

- Improve the ability to search using the scientific ways to get the biological concepts.
 - Improve the ability to analyze different terms or phrases to its basic parts.
 - Enhance the using of the most appropriate ways for studying the text book material in order to benefit from the biological subjects for life.
 - The students will be encouraged to convert the theoretical material to 3-dimensional models from simple available raw materials.
-

Module Number: 240106

Module Name: Practical General Biology

Level: 1

Credit Hours: 1

Course description:

This course is a required course designed for the first level students at the department of Biotechnology and Genetic Engineering. The course will provide the students with the basic biological principles with regard to the hierarchical organization, structure, function, regulation and control of the various tissues, organs, and systems of animal and plant organisms.

Course module objectives:

- To provide students with basic knowledge of the concepts and themes of the study of life.
- To present the students with an overview of biology to be able to analyze the basic concepts behind the major themes of biology.
- To outline the process of science in studying biology.

Learning outcomes:

• **Knowledge and understanding**

At the end of this module, students will be able to gain knowledge about:

- The various fundamental biological concepts
- The functional relationships at all levels of organization in animal and plant bodies
- The homeostatic processes
- The energy requirements for maintaining life
- The evolutionary adaptation of living organisms

• **Cognitive skills (thinking and analysis):**

At the end of this module, students will be able to develop their intellectual skills through understanding the concepts of biology and formulating questions and thinking of the appropriate answers to their questions.

• **Communication skills (personal and academic)**

At the end of this module, students will be able to develop personal communication skills through participating in open-discussions with their colleagues and instructors.

• **Practical and subject specific skills (Transferable Skills)**

At the end of this module, students will be able to:

- improve their ability to search for information using various communication settings.
 - improve their ability to analyze data based on their understanding to the basic biological concepts.
 - Benefit from all supplementary material provided with the textbook
-

Module Number: 240107
Level: 1

Module Name: General Biology (2)
Credit Hours: 3

Course description:

- This course is a required introductory course designed for the first level students at the faculty of science, department of Biotechnology and Genetic Engineering.
- The course will cover basic information in cell structure, function, energy transfer and division, in addition to an introduction to animal form and function in a practical form.

Course module objectives:

- The course will provide the students with the basic understanding of the fundamental principles of practical biology.
- This course aims to provide the students with the basic fundamentals tools and skills to reinforce the concepts covered in the lectures of the general biology course (240101). It is my hope that this course will help you develop the skills, habits and intellectual practices needed to be a successful independent learner.
- The topics covered in this course will allow the students to better comprehend other practical courses during the following academic years.

Learning outcomes:

• **Knowledge and understanding**

At the end of this module, student will be able to:

- * Follow and apply the laboratory safety rules during the laboratory time.
- * Describe the characteristics and compounds that make up living things.
- * Discuss how matter and energy are interrelated in photosynthesis and cell respiration.
- * Identify key cell organelles and relate their function to their structure.
- * compare and contrast mitosis and meiosis in terms of their goals and outcomes.
- * Gain knowledge of the anatomical structure and physiological functions of plants tissues and organs.
- * Gain knowledge of the anatomical structures and physiological functions of tissues and organ systems of human.

• **Cognitive skills (thinking and analysis):**

- The Thinking and Meditation about the Great Ability of God in Creation of our body and the biological systems.
- The thinking skills will be developed by encouraging students to conclude answers to different questions that the instructor intends to use during the presentation of the scientific material.
- Improve practical skills in analyzing results obtained during the lab work.
- Improve the ability to work independently and time management.

• **Communication skills (personal and academic):**

- Gain Teamwork skills by getting opportunities to work productively with others
 - The students have the option to share their ideas in open discussion and to ask questions during the lab or any other time.
 - Students have the opportunity to communicate with others especially professors, while searching answers for home works or through encouraging them to attend different scientific activities that are available in the department.
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Module Number: 240108
Level: 1

Module Name: Practical General Biology (2)
Credit Hours: 1

Course description:

This course focuses on the following: plant and animal tissues, plant organs, animal organs and anatomy.

Course objectives:

To acquire the basic biological concepts in the plant and animal tissues, plants organs, animal organs and anatomy.

Learning outcomes:

• **Knowledge and understanding:**

At the end of this module, students will be able to gain knowledge about:

- The various fundamental biological concepts
- The functional relationships at all levels of organization in animal and plant bodies
- The anatomy of the various organs and systems of plants and animals

• **Cognitive skills (thinking and analysis):**

At the end of this module, students will be able to develop their intellectual skills through understanding the concepts of biology and formulating questions and thinking of the appropriate answers to their questions.

• **Communication skills (personal and academic):**

At the end of this module, students will be able to develop personal communication skills through participating in open-discussions with their colleagues and instructors.

• **Practical and subject specific skills (Transferable Skills):**

At the end of this module, students will be able to:

- improve their ability to search for information using various communication settings.
 - improve their ability to analyze data based on their understanding to the basic biological concepts.
 - Benefit from all supplementary material provided with the textbook
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3.3 Intermediate Modules

The Intermediate (Level 2) modules are listed in Table (3-2) and their full descriptions are given below.

Prerequisite(s)	Module title	Module Number
240107	Microbiology	240216
240216 or con	Microbiology lab	240217
240107	Cell Biology	240233
240107	Genetics	240231
240231 or con	Genetics lab	240232
240107	Introduction to Biotechnology	240281

Module Number: 240216

Module Name: Microbiology

Level: 2

Credit Hours: 3

Course description:

This course will cover the basic principles of the microbial world, diversity of prokaryotes, their development, structure and function. The basic concepts of prokaryotic metabolism, nutrition and growth, microbial genetics and control as well as the fundamental principles of the interrelationship of microorganisms and man, and their role in the environment will also be covered in this course.

Course objectives and knowledge outcome:

By the end of the course students should be able to:

- Differentiate between the structure and gene organization in prokaryotic and eukaryotic cell.
- Describe the differences between the cell wall structure for Gram + and Gram -ve cells.
- Describe the shapes, gram reaction and procedures to identify the major groups of bacteria and the use of different types of media for that purpose.
- Describe the requirements for bacterial growth, bacterial growth and growth curve.
- Define the environmental parameters that affect growth and microbial adaptation to extreme environment.
- Describe the diversity in microbial world.
- Describe the different physical and chemical methods for controlling microbial growth.
- Define genetic material transfer and recombination in prokaryotes.

Learning outcomes:

• **Cognitive skills (thinking and analysis):**

- The capacity to identify different perspectives, theories and models potentially relevant to different subject matter and to appraise their strengths and weaknesses.
- The capacity to be aware of the limitations of existing knowledge and understanding and to recognize the relevance of developing new approaches to situations and problems.
- Learning logical thinking through taking the important ideas, facts and conclusions involved in a problem and arranging them in chains like progression that takes on a meaning in and of itself.

• **Communication skills**

Speak with more confidence and listen carefully to build rapport.

Students will be encouraged to express themselves more effectively.

240216 or con	Microbiology lab	240217
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Module Number: 240233
Level: 2

Module Name: Cell Biology
Credit Hours: 3

Course description:

This course overviews the basic information concerning the structure and the functions of the cell and its components. This includes structural, molecular, biochemical and genetic basis of the biological activities.

Course objectives and knowledge outcome:

By the end of the course students should be able to grasp the fundamentals in understanding the molecular organization of the cells, function and structure of the different organelles including regulatory mechanisms for processes like; respiration, photosynthesis, energetics, cell division, cell communication, DNA replication and flow of information and transport across the unit membrane.

Learning outcomes:

• **Cognitive skills (thinking and analysis):**

- The capacity to identify different perspectives, theories and models potentially relevant to different subject matter and to appraise their strengths and weaknesses.
- The capacity to be aware of the limitations of existing knowledge and understanding and to recognize the relevance of developing new approaches to situations and problems.
- Learning logical thinking through taking the important ideas, facts and conclusions involved in a problem and arranging them in chains like progression that takes on a meaning in and of itself.

• **Communication skills:**

- Speak with more confidence and listen carefully to build rapport.
 - Students will be encouraged to express themselves more effectively.
-

Module Number: 240231
Level: 2

Module Name: Basic Genetics
Credit Hours: 3

Course description:

This module is a major requisite for the students of biotechnology and genetic engineering and it is presented in 16 weeks completing 40 lecturing hours. Its contents focus on an overview of basic genetics (an introduction to Mendelian and non-Mendelian inheritance. DNA Structure, at the end of the course some quantitative genetics issues are discussed).

Course objectives:

- Define the basic laws of Mendelian genetics
- Analyze genetic pedigrees & Compute Probabilities of different genotypes
- Define the basic structure of molecular molecules (DNA, RNA)
- Explain the variation in characteristics on genetic basis

Learning outcomes:

• Knowledge and understanding:

The students should be able to know the basic principles of inheritance and Mendelian genetics.

• Cognitive skills (thinking and analysis):

The students will learn the ability to correlate between different problems and problem solving abilities such as biostatistics.

Module Number: 240232
Level: 2

Module Name: Practical Basic Genetics
Credit Hours: 1

Course description:

This module is a major requisite for the students of biotechnology and genetic engineering and it is presented in lectures. Its contents focus on isolation of DNA and genetic material for studying and applying Mendel's laws using experiments on fruit flies.

Course module objectives:

- Define the basic laws of Mendelian genetics.
- Analyze genetic material and check purity.

Learning outcomes:

• **Knowledge and understanding:**

The students should be able to know the basic principles of inheritance and Mendelian genetics in practice

• **Cognitive skills (thinking and analysis):**

The students will learn the ability to correlate between different problems and problem solving abilities such as biostatistics

• **Practical and subject specific skills (Transferable Skills):**

- DNA isolation and quantization
- Identification and characterization and crossing of Fruit flies
- PCR techniques
- Gel electrophoresis

Module Number: 240281
Level: 2

Module Name: Introduction to biotechnology
Credit Hours: 3

Course module description:

This module is a major (Mandatory) Departmental course for the Second Year. It is an introductory course of Biotechnology. This module offers a broad view of biotechnology, integrating historical and modern topics. The module describes the processes and methods used to manipulate living organisms or the substances and products from these organisms for medical, agricultural, and industrial purposes. Using case studies and examples, the module rounds out discussions by detailing the technology and how it is applied, including discussions on the implications of biotechnology in such areas as gene therapy, medicine, agriculture, marine biology, and forensics.

Course objectives:

This module explores the followings:

- 1- Fundamental issues of biotechnology.
- 2- What is Biotechnology and how did it come about? How is biotechnology done and how is it being used today?
- 3- What are the consequences of biotechnology applications to the lives of humans and other animals, plants, and to the environment?
- 4- Finally, what are some of the issues that Biotechnology raises about the role of science and technology in Society?

Learning outcomes:

• **Knowledge and understanding:**

At the end of this module, student will be able to:

- Grasp knowledge and Understanding the definition of Biotechnology by using the living organisms to produce goods and services for practical and industrial purposes
- Describe the means by which cells are transformed by Genetic Engineering
- Give examples of Biotechnology products and Biotechnology techniques
- Discuss the importance of Transgenic Plant, Bacteria and Animals
- Describe the issues that Biotechnology arises about the role of science and technology in society?

• **Cognitive skills (thinking and analysis):**

The lecturer will present the material in the text book in an interactive way that stimulates the thinking side of students. Conducting the learning objectives for each module components in clear manner to insure the material is digested by the students.

• **Communication skills (personal and academic):**

- Module language: English
- For every lecture the last five minutes will be open for discussion. For further discussion, the students are welcome at the lecturer.s office hour as appeared in first page.
- The students have the option to submit their module activities either by email or by hand
- The students are welcome to share open discussions through the net
- Practical and subject specific skills (Transferable Skills)
- The students will take tour for all instruments and devices, which related to the module/within the department.
- Practical related session will be taken in the advance module.

Table (3-3) Advanced Modules in Biotechnology and Genetic Engineering Department

Module Number	Module title	Prerequisite(s)
240337	Immunology	240233
240338	Immunology lab	240337 or con
240234	Human Genetics	240231
240335	Cytogenetics	240234
240343	Biochemistry 1	212243 + 240233
240344	Biochemistry 1 lab	240343 or Con
240386	Molecular Biology	240233
240387	Molecular Biology lab	240368 or Con
240462	Bioinformatics	240231+ 240335
240322	Plant Biotechnology	240281
240352	Environmental Biotechnology	240216
240471	Animal Biotechnology	240386
240472	Animal tissue culture lab	240471 or Con
240336	Cytogenetics lab	240335 or Con
240417	Microbial Biotechnology	240216
240484	Applied Molecular Biology	240386
240485	Applied Molecular Biology lab	240485 or con
240323	Plant Tissue culture lab	240322 or Con
240441	Pharmaceutical Biotechnology	240343
240491	Ethics in Biotechnology	90 Credit Hours
240490	Quality control & Lab management	90 Credit Hours
240499	Research Project	Dept. Approval.
240391	Entrepreneurship	60 Credit Hours
240494	Field Training	Dept. Approval.

Module Number: 240337
Level: 3

Module Name: Immunology
Credit Hours: 3

Course Module Description

This is an introductory course of immunology. It is intended for students in the Biotechnology and Genetic Engineering field. The course consists of interactive lectures that incorporate Power Point presentations that help the instructor present the intended ideas clearly. Additionally, the instructor uses the help of pre-made CD animations that come with the book. These animations are utilized throughout the material to extend the explanation of specific ideas. Furthermore, the instructor uses some pre-evaluated educational movies and presentations made and prepared by professional institutions. The instructor incorporated a new technique in this class that is currently used in most immunology laboratories world-wide; it is the flow cytometry, in which the instructor was trained on for quite long time in the recent past. Students are introduced to basic concepts of flow cytometry and are acquainted with its major applications. The textbook, Immunobiology, 6th edition, is the most used text book in immunology at academic institutions in the US and Canada, both for undergraduate and graduate immunology courses. The instructor aims at preparing his students for graduate studies if they intend to do so. The book presents immunological concepts in an interesting and imaginative way that makes learning immunology both easy and exciting.

Course Module Objective

1. Familiarize students with basic concepts in immunology
2. Introduce students to the most important theories in immunology
3. Introduce to the students the different types of failures of the immune system
4. Present the difference between innate and adaptive immune responses
5. Introduce the basic concepts in T cell education, survival, and maturation
6. Familiarize the students with the different types of immunoglobulins and their functions

Learning Outcomes:

Upon successful completion of this course, students will be familiar with the concepts related to the following topics:

• **Cognitive skills (thinking and analysis):**

The instructor intends utilize his skills to present the material in the textbook in an interactive way that stimulates the thinking side of students brains. Analyzing schematics and mechanisms in immunological responses in different settings will be an integral part of this course.

• **Communication skills (personal and academic):**

The course will be taught in the English language. Students will be encouraged to communicate their ideas with the instructor at all times during and after the class. To facilitate discussions and asking questions, the instructor usually starts every lecture either by asking questions or giving a quiz about the previous lecture.

• **Practical and subject specific skills (Transferable Skills):**

Some areas of immunology require specific skills in the transfer process of information from the instructor to the students. This, sometimes, might require the presentation of other instruments which will be very helpful if the students are enrolled in the laboratory class accompanying the immunology lecture class.

Module Number: 240338

Module Name: Immunology Lab

Module Number: 240234

Module Name: Human Genetics

Course module description:

This module is advanced course in genetics it is a major requirement for the department. It is based on lectures and it focuses on the genetic basis of human diseases using interactive and analysis procedures.

Course module objectives:

- Explain the hereditary basis of human genetic diseases
- Understanding of the structure, function, and transmission of genes, the interactions both among genes and between genes and the environment, and the role of genetic factors in health and diseases
- Demonstrate the ability to apply knowledge of hereditary disorders and congenital anomalies to formulate appropriate diagnostic evaluation and patient management plans and to communicate information regarding genetic conditions to individuals of differing educational, socioeconomic, ethnic, and cultural backgrounds

Learning outcomes:

Knowledge and understanding:

The students should be able to know the basic principles of inheritance and Mendelian genetics.

Cognitive skills (thinking and analysis):

The students will learn the ability to correlate between different problems and problem solving abilities such as biostatistics.

Course module description:

This module is a major (Mandatory) Departmental course for the third year. This course deals with the study of Chromosomes and provides the cytological explanation of different genetic disease. Chromosome studies are an important laboratory diagnostic procedure in prenatal diagnosis, in certain patients with mental retardation and multiple birth defects, in patients with abnormal sexual development, and in some cases of infertility or multiple miscarriages. Cytogenetic analysis is also useful in the study and treatment of patients with malignancies and hematologic disorders.

Course module objectives:

On completion of the course, students should be able to:

- Explain the organization and complexity of human genome at the Cytogenetic Level
- Explain the nature of chromosomal abnormalities in clinical syndromes associated with cytogenetic disorders
- Explain the nature of chromosomal abnormalities in the disorders of sexual differentiation
- Evaluate appropriately the family pedigree and the population and ethnic aspects of inherited disorders
- Estimate the risk of recurrence of various inherited disorders in affected families
- Explain the essential elements of genetic counseling and indications for prenatal Diagnosis
- Understand the importance of genetics in personalized medicine

Learning outcomes:

This module gives the students the opportunity to:

- Methods used to identify and analyze cytogenetic alteration.
- Cytogenetic mechanisms of disease expression
- Cytogenetic alterations and relationship to specific clinical expression
- Cytogenetic alteration related to development of leukemia

Knowledge and understanding:

- Knowledge of basic cytogenetic laboratory techniques necessary to prepare tissue samples or cytogenetic diagnosis
- Understood the principles of the cell cycle and how it relates to tissue culture
- Developed an understanding of the mechanisms which contribute to cytogenetic alterations and determine the possible gametes from cytogenetic alteration in a parent

Cognitive skills (thinking and analysis):

- Appreciated and understood the implications of the most cytogenetic report that differ from normal
- Recognized the most common cytogenetic Abnormalities encountered in the population

Communication skills (personal and academic):

- Learn the principle of Genetic Counseling encountered the local society.
-

Module Number: 240343

Module Name: Biochemistry

Course module description:

This module is required for all students in the major "Biotechnology and Genetic Engineering". It will be taught to third year biotechnology students.

Course module objectives:

This will enable the students to understand how the living cell works at the molecular level. How the cell degrades and synthesizes its molecules as well as the link and regulation between the different molecules.

Learning outcomes:

- Knowledge and understanding of the basic principles in biochemistry including solvents and buffers of biochemical reactions, the chemical composition of the cell (carbohydrates, proteins, lipids and nucleic acids), the metabolic reactions of the carbohydrates, proteins, lipids and nucleic acids with some practical connections to every-day life.
 - Gain thinking and analysis skills in biochemistry of simple text book experiments. This should be useful to utilize in other modules and after graduation and future career.
 - Communication skills will be developed by encouraging student participation in discussion and asking questions.
-

Module Number: 240344

Module Name: Biochemistry Lab

Module Number: 240386

Module Name: Molecular Biology

Course module description:

This module is a major (Mandatory) Departmental course for the third Year. The course covers the central dogma of molecular biology including gene replication, transcription, translation, gene expression regulation in both prokaryotes and eukaryotes and the future practical application for each process.

Course module objectives:

This course aims at introducing the student to the basic concepts in molecular Biology. It begins by considering the molecular nature of genes and organization of the prokaryotic and eukaryotic genomes. This is followed by DNA replication, repair, gene expression and regulation of gene expression. Techniques used to study these processes will be covered in brief.

Learning outcomes:

Knowledge and understanding

Student will learn the essential concepts of molecular biology which include the structure and function of nucleic acids and the molecular mechanisms of DNA replication and gene expression.

Cognitive skills (thinking and analysis)

Students should be able to:

1. Deduce the structure of DNA and the mechanism of its replication.
2. Correlate the DNA structure to its function
3. Correlate the protein-DNA interaction to DNA replication and gene expression
4. Predict the consequences of various types of mutations on gene expression and organism's viability.

Communication skills (personal and academic)

The instruction medium is English. For every lecture the last five minutes will be open for discussion. For further discussion, the students are welcome at the lecturer's office hour.

Practical and subject specific skills (Transferable Skills)

This course provides the student with a good background in molecular biology which enables him to practice some molecular biology techniques in the practical part of this course (240346).

Module Number: 240387

Module Name: Molecular Biology Practical

Course module description:

This module is a major (Mandatory) Departmental course for the Third Year. It is taught by lectures, and Technology-based labs. The course deals with procedures that have been developed to exploit our knowledge of the replication and expression of genetic information. Recombinant DNA technology enables us to identify, isolate, amplify, analyze and express virtually any genetic material, whether it is DNA or RNA. Increasingly, identify and characterize genetic polymorphisms in a gene by using the polymerase chain reaction (PCR).

Course module objectives:

At the end of this module, student should be able to:

- Demonstrate practical experience of selected Molecular Biological Techniques.
- Demonstrate the basic techniques involved in recombinant DNA manipulations including DNA restriction, ligation, transformation and selection of recombinant plasmid.
- Demonstrate the principle of PCR and its applications (e.g Analysis of DNA repeats to estimate its frequency in the population).

Learning outcomes:

• **Cognitive skills (thinking and analysis)**

Gain Self-management and professional development such as skills necessary for self-managed and lifelong learning (working independently, time management, organization).

• **Communication skills (personal and academic):**

- Gain interpersonal and Teamwork skills by getting opportunities to work productively with others in the laboratory
- Practical and subject specific skills (Transferable Skills)

Improve Practical skills such as ability to work with mammalian cell line and tissues and the ability to obtain record, collate and analyze information in the laboratory.

Module Number: 240462

Module Name: Bioinformatics

Course module description:

This module explains bioinformatics techniques such as BLAST algorithm, pairwise & multiple sequence comparisons, queries of biological databases & phylogenetic analysis.

Course module objectives:

This module aims to introduce the daily application of a variety of bioinformatics tools and to provide an overview of a complex field. It aims to facilitate rapid and structured access to applied bioinformatics.

Learning outcomes:

Knowledge and understanding:

The students will be able to handle raw sequences: editing, alignment and further analysis such as drawing phylogenetic tree. In addition they will be able to extract biological and genetic information from the databases.

Practical and subject specific skills (Transferable Skills):

The students will be able to use variable software to analyze genetic data such as DNA and protein sequences.

Module Number: 240322

Module Name: Plant Biotechnology

Course module description:

This module is required for all the students at the department of "Biotechnology and Genetic Engineering". This module will present an overview of the principles of plant molecular biology and molecular techniques including, recombinant DNA technology, cloning and plant tissue/cell culture. 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 biotechnology. Students are encouraged to take both of this module and the practical module # 240323 in the same term.

Course module objectives:

Upon the completion of this course, students are expected to

- Demonstrate knowledge of the basic principles in plant tissue culture and some selected applications that can be utilized later in the laboratory module "Plant Tissue Culture".
- Understand the basic principles of genetic variations, sources, conservation, analysis and utilization in improving plant through breeding.
- Explain the different methods used for plant transformation and the use of transgenic plants in crop improvement or other biotechnological applications.

Module Number: 240352

Module Name: Environmental Biotechnology

Course module description:

This module describes the diverse problems of the environment and the approaches toward their solution or mitigation in connection to the modern or classical methods of biotechnology. It describes the significance in conservation of environmental resources and biodiversity, provision for alternate sources of energy, biological control of pests and pathogens, purification of environment, mitigation of problems of chemical fertilizers, and most important of all, improvement in the quality of life.

Course module objectives:

This module aims to give the students a comprehensive idea of the different facets of environment in which the emerging biotechnology has started playing a significant role and the future possibilities it holds. It attempts to exploit some of the basic biological processes in cost-effective manners towards the amelioration of the degrading eco-health and eco-resources.

Learning outcomes:

- Knowledge and understanding

The students should be able to understand the fundamentals of environmental biotechnology.

- Practical and subject specific skills (Transferable Skills).

The students should be able to draw the attention towards the possibilities of utilization of bio-methodologies in restoring ecohealth.

Module Number: 240471

Module Name: Animal Biotechnology

Course module description:

This course is a major requirement for the department. It is based on lectures. This course contains five parts: the basic science of gene and gene manipulation; valuable genes for animal biology, applications of molecular technologies to animal and nutritional scientific research, gene therapy and we will address the ethical, legal and social implications of advances in biotechnology and will discuss governmental regulation of food, drugs, and biotechnology itself.

Learning Outcomes:

At the end of this module, student will be able to:

- (1) Develop an understanding to genes and genome.
- (2) Develop an understanding of current techniques used in biotechnology and their applications to animal agriculture and the biomedical field.
- (3) Develop an understanding to the vaccine development.
- (4) Develop an understanding to the gene therapy.
- (5) Understand and discuss the social and ethical issues associated with biotechnology.

Module Number: 240472

Module Name: Animal tissue culture lab

Module Number: 240336

Module Name: Cytogenetics Lab

Course module description:

This module is a major (Mandatory) Departmental course for the Third Year and taught by Technology-based labs. This module deals mainly with human Chromosomal analysis-Karyotyping.

Course module objectives:

This module gives the students the opportunity to:

- See what Human chromosomes look like under the light microscope.
- Distinguish chromosomes on the basis of reproducible banding patterns that are accentuated with the use of various staining protocols using a mild trypsin treatment followed by staining with the dye Giemsa and other techniques that allow for increased resolution of chromosome banding patterns.
- permitting differentiation of a greater number of Chromosomal abnormalities
- Chromosome nomenclature

Learning outcomes:

- **Communication skills (personal and academic)**

-Module language: English

- During each practical session the lecture will provide full assessment and instructions for the students.
- Further assessments provided in the open lab sessions, which will be assigned by the lab demonstrator.
- The students have the option to submit their module activities either by email or submitting by hand
- The students are welcome to share open discussions through the net

- **Practical and subject specific skills (Transferable Skills)**

Ability to work with Human samples and the ability to obtain, record, observe and analyze information in the laboratory.

-Module Number: 240417

Module Name: Microbial Biotechnology

Course module description:

The course focuses on the vast array of applications in microbiology, which is often referred to as microbial biotechnology. Lectures will cover the fundamentals of bacterial genetics and techniques for genetic engineering as well as the role of microbiology in medicine, agriculture, and the environment. The theory, practice, and the importance of applied microbiology in these areas are explored through examples such as water and sewage treatment.

Course module objectives:

1. Introduce the student to new era of biotechnology.
2. Familiarized the student of the industrial application of microorganism such as enzymes, antibiotics production, bioremediation etc.

Learning outcomes:

Upon successful completion, students will be able to:

1. Explain how microbiology is applied to manufacturing in the pharmaceutical industry
2. Relate quality control to the manufacturing process
3. Describe the production methods for pharmaceuticals of microbial origin such as antibiotics and vaccines.
- 4- Improvement of microorganisms: rational screening based on known biochemical pathways and metabolic regulation; metabolic engineering by genetic manipulation of metabolic pathways or sequentially acting enzymes.
5. Mutation of cloned genes and protein engineering: site-directed and random mutagenesis, directed evolution, protein engineering to alter enzyme structure and function.
6. Fermentation processes: medium design for microbial fermentation and fermentation substrate considerations; modes of microbial growth; sterilization of medium and air, heat, chemical, UV and filtration; characteristics of cultures during growth, heat production, viscosity, oxygen transfer; factors affecting oxygen transfer and scale-up.
7. Production of proteins and primary and secondary metabolites.
8. Downstream processing & product recovery.

• Cognitive skills (thinking and analysis):

1. Students will have a basic understanding of the scientific method.
2. Students will have the opportunity to practice thinking critically and analytically and reason logically using current information and past experiences.
3. Students will have practice in assessing basic sources of information and how to evaluate and use this information.

• Communication skills (personal and academic):

Students will gain experience in effective communication skills by practicing, listening, reading, writing and speaking clearly. Short oral presentations of 5-8 minutes will be required of all students and will be given during a class period. Students will pick a microbial biotechnology topic and discuss specific issues related to the topic.

• Practical and subject specific skills (Transferable Skills):

1. Students will develop an awareness of the relationship between science and technology in terms of the life and Microbial Biotechnology.
2. Emphasis will be placed upon an analytical problem-solving approach to microbial biotechnology. This approach will be implemented in both lectures and laboratories. Students will be given the opportunity to apply techniques discussed during the lecture in the lab.

Module Number: 240484

Module Name: Applied Molecular Biology

Course module description:

This module is a major (Mandatory) Departmental course for the Fourth Year. The module starts with description the basic techniques essential to molecular biology and explained by putting them in the context of the impact which molecular Biology is having upon modern mainstream biology.

Course module objectives:

At the end of this module, student will be able to:

- Review critically the fundamental and key concepts of Molecular Biology and gene cloning
- Grasp a common and valuable techniques used by molecular Biologists
- Understand a broad range of experimental techniques used in molecular biology and how they are used to improve the concepts of replication, transcription and translation

Learning outcomes:

• **Cognitive skills (thinking and analysis)**

The lecturer will present the material in the text book in an interactive way that stimulates the thinking side of students. Conducting the learning objectives for each module components in clear manner to insure the material is digested by the students.

• **Communication skills (personal and academic)**

-Module language: English

- For every lecture the last five minutes will be open for discussion. For further discussion, the students are welcome at the lecturer's office hour as appeared in first page.
- The students have the option to submit their module activities either by email or by hand
- The students are welcome to share open discussions through the net

• **Practical and subject specific skills (Transferable Skills)**

-Practical related session will be taken in the Applied Molecular Biology Practical (240485).

Module Number: 240485 **Module Name:** Applied Molecular Biology Practical

Course module description:

This module is a major (Mandatory) Departmental course for the Fourth Year. It is taught by lectures, lab and Technology-based. The module focuses on selected basic methods in the purification of biological macromolecules: Protein and RNA. The course deals with horizontal and vertical electrophoresis using denaturing polyacrylamids and agarose gels, centrifugation, detection techniques such as immunoblotting and other essential techniques in modern gene technology i.e cDNA synthesis and RT- PCR.

Course module objectives:

At the end of this module, student will be able to:

- Demonstrate the Macromolecules extraction (protein and RNA) from mammalian cell lines and tissues.
- Demonstrate the separation of protein and RNA molecules by applying the vertical denaturing polyacrylamide (SDS PAGE) and horizontal agarose gels electrophoresis.
- Integrate the Protein gel electrophoresis (SDS PAGE) with Protein Fingerprinting analysis.
- Demonstrate the detection techniques such as Western Blot and other essential techniques in modern gene technology i.e cDNA synthesis and RT- PCR.

Learning outcomes:

• **Cognitive skills (thinking and analysis)**

Gain Self-management and professional development such as skills necessary for self-managed and lifelong learning (working independently, time management, organization).

• **Communication skills (personal and academic)**

Gain interpersonal and Teamwork skills by getting opportunities to work productively with others in the laboratory

• **Practical and subject specific skills (Transferable Skills)**

Improve Practical skills such as ability to work with mammalian cell line and tissues and the ability to obtain record, collate and analyze information in the laboratory.

Module Number: 240323

Module Name: Plant Tissue culture lab

Course module description:

This laboratory course in the first few weeks, aims to introduce the students to the principles and applications of plant tissue culture as well as the biology of cultured plant cells. Later through the course, students will be exposed to some molecular techniques using plant systems. The designed experiments will illustrate the principles and ideas discussed in the plant biotechnology module. Students are encouraged to enroll in this practical and affiliated theoretical course 240322 & 240383 in the same semester. Lab sheets will be mailed or handed to the students a week before the scheduled lab. The students are expected to read and comprehend these sheets pre the lab session. A quiz will be given at the beginning of every lab session. The students are supposed to write reports discussing the obtained results and following a format explained by the instructor Miss Lana Al Qadoumi

Course module objectives:

Upon the completion of this course, students are expected to

- Be able to work under aseptic conditions to cultivate different plant species and/or parts *in vitro*.
 - Practice scientific thinking to analyze the experiments, keep records, and present results.
 - Be able to use the current techniques in plant molecular biology, including RNA and DNA extraction, design of primers, electrophoresis and expression analysis.
 - Be familiarized to the use of the plant websites like the Tair www.arabidopsis.org and www.ncbi.nlm.nih.gov
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Module Number: 240441

Module Name: Pharmaceutical Biotechnology

Course module description:

This course is a core requirement for the department. It is based on lectures.

This course contains three major parts:

- I. To understand the various techniques in biotechnology and their applications in the manufacturing of biopharmaceuticals and biomedical research.
- II. To gain knowledge in some of the physicochemical properties, pharmacology and the formulation of commonly used biopharmaceuticals.
- III. To understand the principles of the mechanism of some biotechnologically derived diagnostic aids/tests.

Course module objectives:

At the end of this module, student will be able to:

- I. By understanding the composition and technology of biopharmaceutical drug production, and development and use of the gene therapy, students will expand their practical knowledge and understanding of therapeutical effects as well as of undesired side effects of biopharmaceuticals.
- II. Transferable/Key Skills and other attributes:
- III. Appreciate and understand the legal steps involved in progressing a new drug to market.
- IV. Demonstrate knowledge and understanding of currently topical and newly emerging aspects of pharmaceutical biotechnology.

Learning outcomes:

Cognitive skills (thinking and analysis)

1. Students will have a basic understanding of the scientific method.
2. Students will have the opportunity to practice thinking critically and analytically and reason logically using current information and past experiences.
3. Students will have practice in assessing basic sources of information and how to evaluate and use this information.

Communication skills (personal and academic)

Students will gain experience in effective communication skills by practicing, listening, reading, writing and speaking clearly. Short oral presentations of 5-8 minutes will be required of all students and will be given during a class period. Students will pick Pharmaceutical Biotechnology topic and discuss specific issues related to the topic.

Practical and subject specific skills (Transferable Skills)

1. Students will develop an awareness of the relationship between science and technology in terms of the life and Pharmaceutical Biotechnology.
 2. Emphasis will be placed upon an analytical problem-solving approach to Pharmaceutical Biotechnology.
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Module Number: 240491

Module Name: Ethics in Biotechnology

Course Module Description

This is ethics in biotechnology class with one credit hour. It is intended for students in the Biotechnology and Genetic Engineering field. I intend to familiarize the students with the ethical standards associated with employing techniques in biotechnology in various laboratory settings. I will concentrate on recent implications of newly developed biotechniques that are usually controversial in nature. In addition to classic ethical issues in biotechnology, I will emphasize on recent advancements, such as the use of animals in research, cloning debates, use of embryonic stem cells, use of embryonic tissues and organs, and ex-vivo tissue and organ regeneration. Students will be asked to select a topic on which they will write a report and make an oral presentation towards the end of the semester.

Course Module Objectives

1. Introduce the students to the common fields in biotechnology
2. Steer the students towards the moral concerns of the biotechnology community
3. Present the students with frequent concerns of social communities concerning biotechnical issues.
4. Present the common controversial biotechnical issues
5. Assist students in developing presentation techniques for controversial issues

Learning Outcomes:

Upon successful completion of this course, students will be familiar with the concepts related to the following topics:

1. Common fields in biotechnology
2. Ethical issues in biotechnology fields
3. How to address social concerns regarding common biotechnology issues
4. How to deal with controversial issues in biotechnology
5. How to present their own ideas in professional manners

Cognitive skills (thinking and analysis):

I intend to utilize my skills and experience in the different fields of biotechnology to advance the students understanding of controversial and sensitive issues.

Communication skills (personal and academic):

The course will be taught in the English language. Students will be asked to present their chosen topics to the class at the end of the semester.

Module Number: 240490

Module Name: Quality control & Lab management

Course module description:

This module is a major requirement for the department. It is based on lectures and it focuses on using interactive materials and assessments to plan and analyze plans for establishing and managing a laboratory.

Course module objectives:

- Understanding the responsibilities of managing a medical lab
- Ability to puts plans for the established laboratory.
- Demonstrate the ability to apply these plans without losing any rights.
- Ability to interact with different cultural and intellectual levels

Learning outcomes:

Knowledge and understanding

The students should be able to know how to establish a laboratory managing system

Cognitive skills (thinking and analysis)

The students will learn the ability to correlate between different problems and problem solving abilities.

Module Number: 240498.

Module Name: Seminar

Level: 4th year

Credit Hours: One

Aims (Module Purpose):

This module is a major Department requirement. It is based on discussion of a scientific issues related to the field

Learning Outcomes:

- * Understand how to prepare a seminar using the latest software and visual aids.
- * Practice writing a scientific paper and using available references.
- * Exposure to different research papers in the same subject and learn how to correlate to each other.
- * Gain talkative and presentation skills

Module Number: 240493

Module Name: Scientific writing

Level: 4th year

Credit Hours: 1

Aims (Module Purpose):

This module is a major requirement for the Faculty. It is based on tutorials and research projects

Learning Outcomes:

At the end of this module, student will be able to:

- * Understand the basis of scientific writing.
- * Gain writing skills
- * Demonstrate the ability to write references in scientific way.

Module Number: 240499

Module Name: Research Project

Course module description:

This course is required from all students that study the New Plan (after 2005). It combines in one course both the Seminar and the Scientific Writing (from the earlier Plans). It also includes research work done under the supervision of one (or more) department staff. This course is intended to demonstrate the "research and development" process in a selected area of Biotechnology and Genetic Engineering or solving current problems in this field.

Course module objectives:

The main objective of this course is to gain some experience in some different aspects of research projects that include conducting field, laboratory and/or computer work, writing scientific reports and presenting scientific research results to an audience using appropriate visual aids.

Learning outcomes:

- Expose students to different aspects of research work that will be useful in their future career or graduate studies.
 - Practice scientific writing using available references and proper documentations.
 - Exposure to different research papers in one subject and learn how to correlate to each other.
 - Understand how to prepare a seminar using the latest software and visual aids and gain talkative and presentation skills in front of audience.
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Module Number: 240494

Module Name: Field Training

Course module description:

This module applies only on the students registered for this fall 2008/2009 semester. In This module, students are expected to do 100 hours of practical field training at an off-campus site prior to graduation. The training must be related to any of the fields of biotechnology. During this training, the students will have the opportunity to apply the knowledge gained at the classroom to a practical experience. Training is designed to prepare students for both academic achievement and successful employment in the applied fields of biotechnology. Through the training period, the students are requested to be sincere and self-motivated, thoroughly committed to the goals and objectives of this training, and respectful of the ethical issues related to dealing with colleagues, trainers and costumers. Students must consult with the course coordinator before registering the module.

Course module objectives:

Upon the completion of this field training, the students are expected to

- 1- Be exposed to the applied fields of biotechnology, Impart knowledge and develop skills in some of the techniques commonly used in biochemistry, molecular biology and biotechnology laboratory.
- 2- Be able to discuss issues, and address questions relevant to typical responsibilities of professionals in the field.
- 3- Formulate and facilitate their decision regarding a potential career choice and confidently deal with job applications and interview skills

Learning outcomes:

Upon the completion of this program a student will be able to:

- Complete, independently, basic laboratory tasks common to Biotechnology such as documentation, buffer preparation, dilutions, and gel electrophoresis.
- Define and explain the basic principles, concepts, and the techniques of Biotechnology.
- Be technically prepared for employment and/or postgraduate studies.
- Keeping in mind the interdisciplinary nature of biotechnology, students should develop excellent written and verbal communication skills. Students will have the mental flexibility to pick up and incorporate different approaches to analyze and solve problems

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3.4 Elective Modules

Each student should select 3 modules out of a list of 13 modules according to his/her interest. The Department has a list of elective modules, which can be updated according to the staff expertise and the most recent trends in the field of Biotechnology and Genetic Engineering. The current list of such modules is shown in Table (3-4).

Table (3-4) Elective Modules in Biotechnology and Genetic Engineering Department

Module Number	Module title	Prerequisite(s)
240314	Virology	240216
240324	Plant Physiology	240107
240349	Biochemistry (2)	240343
240340	Food Biotechnology	240281
240373	Animal Physiology	240233
240439	Heamatology	240337
240448	Proteomics & protein technology	240343+240386
240453	Aquatic Biotechnology	240352
240455	Medical and Forensic Biotechnology	240386
240463	Biosensors	240386
240495	Selected Topics (A)	Dept. Approval
240496	Selected Topics (B)	Dept. Approval
240497	Selected Topics (C)	Dept. Approval

Module Number: 240314

Module Name: Virology

Aims (Module Purpose):

The course covers the fundamental principles related to the interaction mainly animal viruses with host cells. General topics include chemical and physical properties of viruses, virus classification, cultivation and assay of viruses, molecular events during viral replication and morphogenesis and persistent infections and viruses as the cause of disease and neoplasma.

Learning Outcomes:

At the end of this module, student will be able to:

- Differentiate the nature of viruses as particles or structures
- The special techniques by which we can replicate viruses
- Laboratory diagnosis of viruses using different techniques (such as: Molecular, immunological etc.)
- Classification of viruses.
- Understanding the main and new emerging threats of viral diseases eg. HIV influenza
- How to combat viral infections.

Module Number: 240324

Module Name: Plant physiology

Module Number: 240349

Module Name: Biochemistry (2)

Module Number: 240340

Module Name: Food Biotechnology

Course module description:

Biotechnology is becoming increasingly important to food. Biotechnology has been used in food production for thousands of years (e.g. brewing, yoghurt, pickling.). The new Biotechnology has a high potential in food production and processing. This course will cover the applications of new biotechnology in food production or processing.

Course module objectives:

The objective of this course is to combine the biotechnological applications studied in other courses and relate to food. This will give students a comprehensive understanding of transgenic food, biotechnological food additives, biotechnological food diagnosis and regulations.

Learning outcomes:

- Knowledge and understanding of definition and the different uses of food biotechnology. This includes the tools used, production of recombinant proteins and additives to use in food technology, transgenic foods, diagnostic system used in food industry, and ethics and safety of food biotechnology.
- After the course the students are expected to understand new development in the field with analytical thinking of the various aspects of the new technology.
- Students are expected to ask questions and participate in discussions.

Module Number: 240373

Module Name: Animal Physiology

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Module Number: 240439

Module Name: Hematology

Course Description:

Hematology is a science that deals with blood and its components, their structure, function, and disorders. The course will be 4 credit hours. Three credit hours will be designated for lectures and one credit hour for laboratory. The course will contain an introductory part, in which basic concepts of hematology are introduced and major terms are defined; then, specialized topics will be tackled in a systematic approach to cover the major diseases of blood and its components.

Objectives:

The course is especially designed for undergraduate students who intend to work in diagnostic laboratories. Upon the completion of the course, students would have benefited from the following objectives of the course:

1. Explain major concepts in hematology, including hemeopoiesis, bone marrow structure, blood composition, and functions of blood components.
2. Elucidate the basis of blood diseases, including anemias, hemoglobinopathies, bleeding disorders, and hematological malignancies
3. Clarify in detail the major concepts regarding blood transfusion, and bone marrow transplantation
4. Provide the latest information regarding the newest techniques utilized by hematologists to treat and diagnose hematological disorders, including stem cell purification and transplantation, flow cytometry analysis, and molecular HLA matching techniques.

Module Number: 240448

Module Name: Proteomics & Protein Technology

Course module description:

This is an elective course in the old study plane but an obligate course for the new study plane (2008) for the major "Biotechnology and Genetic Engineering".

Course module objectives:

The course aims to provide students with a comprehensive overview of protein biotechnology in three main themes: protein biochemistry, protein analysis and purification, and recombinant protein expression and harvesting. Examples of important proteins will be also discussed within the previous themes. The subject "Protein Biotechnology" has common principles learned in other courses such as Pharmaceutical Biotechnology. In this course we will try to minimize such repetition by emphasizing the general principles that are common for proteins.

Learning outcomes:

At the end of this module, student will be able to:

- Explain the different aspects of protein biochemistry and structure.
 - Modify a protein purification scheme to a specific application.
 - Understand the different systems of recombinant protein expression with advantages and disadvantages of each
 - Comprehend the difficulties in working with proteomics compare to genomics.
 - Gain thinking and analysis skills in protein biochemistry.
 - Communication skills will be developed by encouraging student participating in discussion and asking questions.
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Module Number: 240453

Module Name: Aquatic Biotechnology

Module Number: 240455

Module Name: Medical & Forensic Biotechnology

Course module description:

The course introduces the students to some disciplines of forensic medicine/science, with emphasis on the use of forensic DNA analysis in human individualization and identification. Lectures will cover some of the principles and techniques of forensic investigation in forensic identification, forensic entomology, forensic toxicology, crime scene, etc.

Course module objectives:

At the end of this course, the students should be familiar with some of the various applications of forensic medicine/science, and able to apply the state of the art techniques in solving or finding answers to criminal settings.

Learning outcomes:

Upon the successful completion of this module, students should be:

1. Familiar with the various disciplines of forensic medicine/science
2. Familiar with some of the forensic techniques used in forensic investigations.

• **Cognitive skills (thinking and analysis)**

1. Students will have a basic understanding of the scientific method.
2. Students will have the opportunity to practice thinking critically and analytically and reason logically using current information and past experiences.
3. Students will have practice in assessing basic sources of information and how to evaluate and use this information.

• **Communication skills (personal and academic)**

Students will gain experience in effective communication skills by practicing, listening, reading, writing and speaking clearly.

• **Practical and subject specific skills (Transferable Skills)**

1. Students will develop an awareness of the relationship between science and technology in terms of the life and forensic Biotechnology.
2. Emphasis will be placed upon an analytical problem-solving approach to forensic biotechnology. This approach will be implemented in lectures.

Students will be given the opportunity to discuss forensic techniques during scientific visits.

Module Number: 240463

Module Name: Biosensors

Course module description:

This module is an advanced course that is a selective requirement for the department. It is based on lectures and it focuses on different types of biosensors and their use in diagnostic and application in biosafety. A basic emphasis on the design and structure of commonly used biosensors using interactive and analysis procedures

Learning Outcomes:

Specify individual learning outcomes you expect students to achieve during the module, using appropriate action verbs (define, demonstrate, analyze, compute, explain design,. etc.) to begin each statement.

At the end of this module, student will be able to:

- Explain the importance of biosensors

- Understanding of the structure, function, and uses of different types of biosensors in diagnosis and commercial application
 - Demonstrate the ability to apply knowledge of usability of such devices in the biotechnology field and deriving the right information from the analysis of these devices including quality control.
-

Module Number: 240495

Module Name: Selected Topics (A)

Course module description:

This course will cover the principles of Molecular Diagnosis which is the process of identifying a disease by studying molecules, such as proteins, DNA, and RNA, in a tissue or fluid. Molecular diagnostics is a new discipline that captures genomic and proteomic expression patterns and uses the information to distinguish between two or more conditions at the molecular level. The conditions under investigation can be human genetic disease or infectious diseases. Molecular diagnostics is not confined to human diseases but can be used in animals or plants. It can be also used in environmental monitoring, food processing ...etc.

Course module objectives:

The objective of this course is learning and understanding how molecular techniques that were studied in other classes can be developed and utilized in diagnosis and sold in diagnostic kits.

Learning outcomes:

- Knowledge and understanding of the basic principles used in molecular diagnosis.
 - Gain thinking and analysis skills to understand new diagnostic methods
 - Ability to collect information to develop a new diagnostic kit
 - Knowledge and skills gained in the course should be useful in practical life in developing or using diagnostic kits
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Module Number: Module Name: Selected Topics (B)

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Module Number: 240497

Module Name: Selected Topics (C)

Course module description:

This module is a comprehensive overview of a 400 level which will be taught to 4th year-the expected graduate Biotechnology students. The module will explore different and basic information of different areas concerned with Biotechnology and Genetic Engineering programme. At the first place the modules overviews the fundamental in understanding the Molecular organization of the cell, Chemical composition, Function, relationship between structure of different organelles and Biological function of Macromolecules such as Nucleic Acids and Protein.

Then the module reviews the fundamental issues, definition of Biotechnology by transforming living organisms (Animal, Plant and Microorganisms) using the newly emerging technologies concerning producing the Genetic Engineering cells.

Furthermore, the module focuses the potential applications of transgenic animals, transgenic improved plants and the capability of Microorganisms to reverse and prevent Environment problems.

Learning Outcomes:

At the end of this module, student will be able to:

- Grasp knowledge and Understanding the definition of Biotechnology by using the living organisms to produce goods and services for practical and industrial purposes
 - Describe the means by which cells are transformed by Genetic Engineering
 - Give examples of Biotechnology products and Biotechnology techniques
 - Discuss the importance of Transgenic Plant, Bacteria and Animals
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Appendix A

The Academic Guidance Plan

Biotechnology and Genetic Engineering Department

2008/2009

Dep. Of Biotechnology & Genetic Engineering

Study plan(2008-2009)

Second semester				First semester				
Pre-req.	Cr	Course Name	Course No.	Pre-req.	Cr	Course Name	Course No.	Year
----	3	Arabic language skills 1	110101	----	3	English language skills 1	130101	1st year
130101	3	English language skills 2	130102	----	3	General Biology 1	240101	
----	3	Calculus 1	210101	----	3	General Chemistry 1	212101	
240101	3	General Biology 2	240107	----	1	General Chemistry lab	212102	
212101	3	General Chemistry 2	212103	----	1	General Biology lab	240106	
710101	3	Computer skills 2	710102	----	3	Computer skills 1	710101	
				----	3	Civilization and human thoughts 1	111133	
18 Cr		▪ Total		17 Cr		▪ Total		
----	3	Military Science	111100	-----	3	Introduction to Probability & Statistics	210231	2nd year
----	3	General Physics	211105	240107	3	Microbiology	240216	
240107	3	Genetics	240231	240216 or Con	1	Microbiology lab	240217	
240232 or Con	1	Genetics lab	240232	240107	3	Cell Biology	240233	
240107+130102	2	Introduction to Biotechnology	240281	212103	3	Analytical Chemistry	212241	
212103	3	Organic Chemistry	212243	212241 or Con	1	Analytical Chemistry lab	212242	
				----	3	National Education	111101	
				240107 or Con	1	General Biology 2 lab	240108	
15 Cr		▪ Total		18 Cr		▪ Total		
240231+240335	2	Bioinformatics	240462	240233	3	Immunology	240337	3rd year
240281	3	Plant Biotechnology	240322	240337 or Con	1	Immunology lab	240338	
240216	3	Environmental Biotechnology	240352	240231	2	Human Genetics	240234	
240386	3	Animal Biotechnology	240471	240234	1	Cytogenetics	240335	
240471 or Con	1	Animal tissue culture lab	240472	212243 + 240233	3	Biochemistry 1	240343	
240335 or Con	1	Cytogenetics lab	240336	240343 or Con	1	Biochemistry 1 lab	240344	
	3	Elective course		240233	3	Molecular Biology	240386	
				240368 or Con	1	Molecular Biology lab	240387	
16 Cr		▪ Total		15 Cr		Total		
240343	3	Pharmaceutical Biotechnology	240441	240216	3	Microbial Biotechnology	240417	4th year
90 Credit Hours	1	Ethics in Biotechnology	240491	240386	3	Applied Molecular Biology	240484	
90 Credit Hours	1	Quality control & Lab management	240490	240484 or Con	1	Applied Molecular Biology lab	240485	
Dept. Approval	3	Research Project	240499		3	Elective Course		
	3	Elective course		---	3	Fundamentals of Scientific Knowledge	210122	
	3	University course		240322 or Con	1	Plant Tissue culture lab	240323	
Dept. Approval	3	Field Training	240494	60 Credit Hours	2	Entrepreneurship	240391	
14 Cr		▪ Total		16 Cr		▪ Total		