دبلوم التكنولوجيا الحيوية
Diploma of Biotechnology

التقنيات الحيوية من أسرع الصناعات نمواً في العالم حيث تقوم دول عديدة بالترويج لهذا القطاع كأساس للتطوير الاقتصادي في المستقبل .وتعرف التقنيات الحيوية بأنها تطبيقات لجوانب التقدم في بيولوجيا الخلية و البيولوجيا الجزيئية في مجالات الطب و الزراعة و البيئة وغيرها .و بفضل التقنيات الحديثة كهندسة الجينات مثلاً أصبحت التقنيات الحيوية تؤثر في مسارات مختلفة في الطب (السرطان، الطعومات، علاج و تشخيص الأمراض الوراثيه) وإنتاج الغذاء(النباتات المهجنة) والصناعة الدوائية .كما تشتمل التقنيات الحيوية على ميادين سريعة التطور مثل تكنولوجيا الأجسام المضادة وهندسة الجينات .وبواسطة التقنيات الحيوية تم تطوير جيل جديد من الأدوية و الطعوم والهرمونات والأدوية المضادة للالتهاب.

الأهداف ومخرجات التعلم المقصودة:

سوف تقدم هذه الدبلوم دراسة نظرية ومعملية لطلاب الدراسات العليا في تخصص التكنولوجيا الحيوية للتميز فى المجالات الآتية:

1. ايضاح المعرفة وفهم النظريات والتقنيات ذات الصلة بمجالات التكنولوجيا الحيوية
2. استخدام تقنيات متقدمة جديدة من التكنولوجيا الحيوية في الطب و العلاج و الأغذية والزراعة والبيئة والصناعة
3. إنتاج منتجات ذات قيمة مختلفة مثل الأدوية والوقود للاستخدام التجاري
4. تنمية المجتمع والحفاظ على البيئة في ضوء التغيرات العالمية والإقليمية.
5. تطبيق مختلف التحاليل النوعية والكمية لتقييم المواد المعزولة (الحمض النووى الرايبوزى والبروتينات والانزيمات، واللقاحات، والوقود ...)
6. القدرة على وضع التطبيقات المفيدة للمؤسسات الخاصة
7. اتخاذ القرار المهني المناسب في ضوء المعلومات المتاحة.

Program Courses

1. Compulsory Courses:

First Semester							
Course code	Course title		Total Credit Hours	Lecture Credit Hours	Lab Credit Hours	Exam Duration (hour)	Final grades out of
	English	Arabic					
BT501	Biochemistry	الكيمياء الحيوية	1	1	0	1	50
BT502	Fermentation Technology	تكنولوجيا التخمير	2	1	1	1	100
BT503	Immunology	المناعة	2	1	1	1	100
BT504	Microbiology	الميكروبيولوجي (علم الأحياء المجهري)	3	2	1	1	150
BT505	Principles of Molecular Biology	أساسيات البيولوجيا الجزيئية	2	1	1	1	100
BT506	Proteomics	علم البروتينات	2	1	1	1	100
Second Semester							
Course code	Course title		Total Credit Hours	Lecture Credit Hours	Lab Credit Hours	Exam Duration (hour)	Final grades out of
	English	Arabic					
BT507	Plant Biotechnology	التكنولوجيا الحيوية النباتية	2	1	1	1	100
BT508	Bioinformatics	المعلوماتية الحيوية	2	1	1	1	100
BT509	Concepts of Genetic Engineering	مفاهيم الهندسة الوراثية	3	2	1	2	150
BT510	Applications of nanomaterials in biotechnology	تطبيقات المواد النانوية في مجال التكنولوجيا الحيوية	2	1	1	1	100
BT511	Instrumentation and lab safety	الأجهزة وسلامة المختبر	1	1	0	1	50
BT512	Modern Applications of Biotechnology	التطبيقات الحديثة للتكنولوجيا الحيوية	2	2	0	2	100

2. Elective courses:

Elective Courses							
Course code	Course title		Total Credit Hours	Lecture Credit Hours	Lab Credit Hours	Exam Duration (hour)	Final grades out of
	English	Arabic					
BT513	Bioassay Development	تطوير التحاليل البيولوجية	2	2	0	2	100
BT514	Biochemical Engineering	هندسة الكيمياء الحيويه	2	1	1	1	100
BT515	Food Biotechnology	التكنولوجيا الحيوية للأغذية	2	2	0	2	100
BT516	Green Chemistry	الكيمياء الخضراء	2	2	0	2	100
BT517	Introduction to Biostatistics	مقدمة في الإحصاء الحيوي	2	1	1	1	100

For graduation you should complete total credit hours = 28

[Compulsory Courses (24 credit hours) + Elective Courses (4 credit hours)]

Course Specifications

BT501 Biochemistry

This course provides the linkage between the inanimate world of chemistry and the living world of biology.

The course explores roles of essential biological molecules in different living organisms, covering proteins, lipids, and carbohydrates chemistry. It provides a systematic and methodical application of general and organic chemistry principles. Metabolic pathways are also examined.

BT502 Fermentation Technology

Introduces bioprocess principles used in large scale production of microbial cultures and their products. Topics of interest include microbial kinetics, bioreactors types and design, modes of operation and sterilization. Process variables and process control. On-line and off-line analytical instruments. Scaling up. Downstream process. Economics of fermentation processes. Bio-Process Technology for industrial production of metabolites, recombinant vaccines, therapeutic proteins, antibiotics and fuel.

Practical Course: Students will grow microorganisms for production of some important biotechnological products (e.g. recombinant protein). During the cultivation, the student will monitor and control several vital parameters. Also the student will follow the changes in cell growth and product formation using some analytical skills as pH and spectrophotometric measurements.

BT503 Immunology

This course is designed to provide students with a comprehensive background in immunology and immunochemistry in biotechnology. Topics range from antibodies as tools in Over-The-Counter and research immunoassays to genetic and molecular modifications of cells reactive in cancer immunotherapy. The immunological and immunochemical basis for these applications are stressed.

Practical Course: ELISA, blood grouping. Flow cytometry principle and interpretation of data. Theory beyond ELISpot, immunoblot and dot blot. CBC interpretation.

BT504 Microbiology

This course aims to refresh knowledge of microorganisms via studying the following: Ultrastructure of a bacterial cell, fungal cell and virus. Types of culture media. Growth of microorganisms (phases, nutrients, oxygen requirements, pH)). Microbial metabolism. Applications of different microorganisms in Biotechnology.

Practical Course: emphasizes on good laboratory techniques in the handling, manipulation, staining and identification of microbes.

BT505 Principles of Molecular Biology

Topics covered include differences between Prokaryotic and Eukaryotic cells and the central dogma of molecular biology. Gene expression, mutations will be covered. Polymerase Chain Reaction, DNA markers and DNA fingerprinting. Relevance and use of these techniques in medicine and industry.

Practical Course: Includes practical applications for theoretical course: sample preparation and sterilization, DNA extraction, DNA elution, DNA detection, gel preparation and DNA visualization, PCR.

BT506 Proteomics

Protein sequencing, Peptide sequencing and synthesis. Methodology and techniques in protein structure prediction and analysis; expression, separation and detection, including key techniques such as western blotting spectrophotometric assay, mass spectrometry, protein crystallization and analysis of protein structure using computational approaches. Proteomics significance in Biotechnology.

Practical Course: Laboratory experiments that will be performed include liquid chromatography, gel electrophoresis, amino acid analysis, protein crystallization and enzymatic assays.

BT507 Plant Biotechnology

The course introduces students to the principles, practices and application of plant tissue culture and transformation in science, agriculture, environment and pharmaceutical industry. Also students need to become familiar with environmental safety issues.

Practical course: hands-on experience and training in representative plant tissue culture and genetic engineering techniques. Also the student will follow the changes in plant growth and product formation using some analytical skills.

BT508 Bioinformatics

The course covers the genetic databases; the rapidly-increasing number of genome databases, including the human genome database; the sequence homology search engines and search algorithms; software for the identification of structural sequence components; and the determination of evolutionary relationships between sequences.

BT509 Concepts of Genetic Engineering

Recombinant DNA technology, basic and advanced cloning techniques, RNAi, DNA sequencing. Relevance and applications of these techniques in medicine and industry.

Practical Course:- Includes practical application for theoretical course: preparation of competent cells, transformation techniques, cloning strategies using RE ligases, test for successful cloning.

BT5010 Applications of nanomaterials in biotechnology

Nanobiotechnology is an interdisciplinary field that exploits the unique functional properties of natural and synthetic biomolecular-sized (nanometer-scale) constructs such as quantum dots, carbon nanotubes, nanostructured surfaces, liposomes, artificial membranes, and molecular machines for biotechnology. This course will survey the applications of nanotechnology to medical diagnostics, imaging, and therapeutics (including drug delivery and anticancer treatments); nanofluidics, bioassays, biosensors, and bio-inspired engineering. Also, applications of nanotechnology in different environmental aspects will

be discussed.

Practical Course:- includes different nanomaterial preparation, characterization and some applications in biotechnology.

BT511 Instrumentation and lab safety

Bio-ethics, lab management, and how to deal with biological hazards. Centrifugation Techniques: Principles, type of centrifuges, and applications in isolation of cells, cell organelles and biomolecules. Chromatographic Techniques: Principles, types and applications in biotechnology. Electrophoretic techniques: Proteins, Carbohydrates, and Nucleic Acids. Spectroscopic Techniques: Principles, types and applications in biotechnology.

BT512 Modern Applications of Biotechnology

Applications of modern biotechnology in health, medicine and environment, and safety in biotechnology. Advanced topics in biotechnology will be covered such as stem cells, vaccinology, transplantation, marine biotechnology, and applications of biotechnology in renewable energy and water treatment.

BT513 Bioassay Development

This course will cover methodological approaches to bioassay development for high throughput screening. Both cell-based (cytotoxicity; cytoprotection, high content imaging, and reporter systems) and cell-free assay systems (enzyme, FRET, time resolved fluorescence, quenching assays, immunological assays) will be included with discussion of the potential promise and pitfalls associated with each assay system. Various assay formats, visualization techniques, and current developments in assay technology will be discussed. Project management techniques will be utilized to aid in the process of assay development.

BT514 Biochemical Engineering

Microbial Growth Kinetics: Thermodynamic principles, Stationary cell growth, Growth yield, Specific growth rate, Product yield, Saturation constant, Biomass energetics, Yield equations. Scale-up Studies: Criteria for translation between two scales of operation, Non-geometric scale-up. Mass Transfer in Microbial System: Fluids and its properties, Non-Newtonian fluids, Gas–liquid mass transfer, Oxygen transfer and utilization in gassed microbial system, mass transfer resistances, and heat transfer coefficient correlations.
Practical Course: Includes practical application for theoretical course: stoichiometry, kinetic reactions, enzyme kinetics, fluid flow and mixing.

BT515 Food biotechnology

The topics cover food ingredients, FDA regulations, rapid detection techniques of foodborne pathogens, chemical senses, nutrigenomics and nutraceuticals.

BT516 Green Chemistry

This course helps students understand the notion of sustainability and how it applies to chemistry. It also explores the history of chemistry, outlines critical need for green chemistry, and the principles that guide its practice as an emerging and important field of science.

BT517 Introduction to Biostatistics

Statistical methods and reasoning, with an emphasis on the techniques and terms commonly encountered in research, are presented as tools for students to determine the impact of research on practice, especially in the areas of probability and statistical inference. Statistical software is used extensively to perform and simplify statistical calculations.