



Tanta University
Faculty of Science
Botany Department



جامعة طنطا
كلية العلوم
قسم النبات

برنامج التقنية الحيوية الصناعية (Industrial Biotechnology)

(بنظام الساعات المعتمدة)



درجة البكالوريوس في العلوم
(تقنية حيوية صناعية)
2016



اللائحة الداخلية لبرنامج التقنية الحيوية الصناعية

مقدمة:

برنامج التقنية الحيوية الصناعية بنظام الساعات المعتمدة مُقدم من قسم النبات، كلية العلوم، جامعة طنطا. وهو برنامج صُمم ليلبي طموحات الطلاب، و يُشبع تطلعاتهم إلي تطبيق ما يدرسونه، ويدربهم على الابتكار. ويهدف إلي الحصول علي خريج مُلم بالمفاهيم النظرية للعلوم البيولوجية، و تطبيقاتها التكنولوجية في الصناعة، و الاستفادة منها في خدمة البيئة والمجتمع الذي يعيش فيه. كما تؤهله للعمل في المصانع المختلفة، معامل التحاليل، المستشفيات، بنوك الدم، مصلحة الطب الشرعي، هيئة المصل واللقاح، شركات الأدوية، فروع جهاز شؤون البيئة، محطات معالجة المياه، الجامعات الحكومية و الخاصة، ومراكز البحوث المنتشرة بأنحاء الجمهورية. كما أن برنامج التقنية الحيوية الصناعية يهدف إلي إعداد خريج مُدرب ومُجهز لتطبيق ما يدرسه في تأسيس مشروع خاص به من أجل إنتاج أو صناعة منتجات جديدة باستخدام تطبيقات التقنية الحيوية التي يدرسها بتعمق، ويتدرب عليها بكفاءة من خلال الدراسة النظرية والعملية والتدريب الميداني الذي يتلقاه علي مدار سنوات الدراسة.

رؤية البرنامج: يسعى برنامج التقنية الحيوية الصناعية إلي أن يحقق الريادة علي المستوي المحلي والإقليمي والدولي في جودة التعليم التطبيقي في مجال التقنية الحيوية.

رسالة البرنامج: يُقدم برنامج التقنية الحيوية الصناعية المعلومات الأساسية والمهارات اللازمة لإعداد خريج مُزود بالمهارات و القدرات التي تُؤهله للمنافسة في سوق العمل علي الفرص المتاحة بمصانع المنتجات الغذائية و الكيماوية و الصناعية المعتمدة في إنتاجها علي الكائنات الحية أو مكوناتها، إضافة إلي مجال التحاليل الطبية والصناعات الدوائية.

مادة (1) قواعد القبول:

أولاً: يُشترط في من يتقدم للالتحاق بالبرنامج أن يستوفي الشروط التي يحددها المجلس الأعلى للجامعات علي النحو التالي:

(1) الحصول علي شهادة إتمام الدراسة الثانوية العامة المصرية (شعبة العلوم)، أو الثانوية المعادلة العربية والأجنبية.

(2) القبول بكلية العلوم – جامعة طنطا- سواء عن طريق الترشيح أو التحويل.

(3) يجوز لمجلس الكلية بعد موافقة مجلس الجامعة قبول طلاب حاصلين علي درجة البكالوريوس من كليات العلوم (نبات، ميكروبيولوجي، علم حيوان، كيمياء حيوي، كيمياء، فزياء حيوي)، والطب البيطري والزراعة والصيدلة وفق الضوابط التي يحددها مجلس الكلية ومجلس الجامعة.

ثانياً: يكون قبول الطلاب بالبرنامج سنوياً حسب مجموع درجاتهم في شهادة الثانوية العامة، أو ما يعادلها وفقاً للعدد الذي تقرره اللجنة العليا للبرنامج في ضوء اقتراح اللجنة التنفيذية بعد أخذ رأي مجلس القسم المختص.

مادة (2) الدرجة العلمية:

يمنح مجلس جامعة طنطا، بناءً علي طلب مجلس كلية العلوم، درجة البكالوريوس في العلوم تخصص "تقنية حيوية صناعية".

مادة (3) نظام الدراسة:

(1) مدة الدراسة بالبرنامج أربع سنوات على الأقل وفق نظام الساعات المعتمدة. ويُسمح للطلاب الذي تمتد فترة دراسته أكثر من أربع سنوات جامعية أن يتخرج إذا حقق متطلبات التخرج في أي من الفصلين الدراسيين لعام التخرج، على أن يستوفي متطلبات التخرج.

- (2) ينقسم كل عام دراسي إلى فصلين دراسيين، مدة كل منها ستة عشرة (16) أسبوعاً شاملة الامتحانات.
- (3) يجوز طرح بعض المقررات في فصل دراسي صيفي مدته ثمانية (8) أسابيع من الدراسة المكثفة.
- (4) الساعة المعتمدة هي وحدة قياس دراسية وتُعادّل ساعة دراسية نظرية، أو ساعتين لكل درس عملي أسبوعياً لمدة أربعة عشر (14) أسبوعاً، وتُدرس علي مدي فصل دراسي واحد.
- (5) صُمم البرنامج الدراسي بحيث يتم التعلم عن طريق المحاضرات و الدروس العملية التطبيقية، والتدريب في المصانع و مراكز البحوث والمعامل الحكومية والخاصة في مجال التقنية الحيوية الصناعية، إلي جانب حلقات النقاش وإجراء مشاريع التخرج التطبيقية، بالإضافة إلي التعاون مع المجتمع الخارجي.
- (6) على الطالب أن يواظب علي حضور المحاضرات والدروس العملية وزيارات التدريب الميداني. وللجنة التنفيذية للبرنامج بناءً علي طلب مجلس القسم المختص أن يحرم الطالب من التقدم للامتحان التحريري إذا تجاوزت نسبة الغياب 25% من إجمالي الساعات المقررة.

مادة (4) لغة الدراسة:

الدراسة في هذا البرنامج باللغة الإنجليزية ويجوز تدريس بعض متطلبات الجامعة والكلية باللغة العربية بناءً علي توصية اللجنة التنفيذية واللجنة العليا ومجلس الجامعة.

مادة (5) متطلبات الحصول على درجة البكالوريوس:

- (1) مدة الدراسة بالبرنامج: أربعة سنوات (ثمانية فصول دراسية).
- (2) يتطلب الحصول علي درجة البكالوريوس في العلوم تخصص التقنية الحيوية الصناعية استيفاء عدد الساعات الدراسية المبينة علي النحو التالي:

النسبة المئوية	عدد الساعات	نوع المقرر
4.54%	6	متطلبات جامعة
10.61%	14	متطلبات الكلية (العلوم الأساسية)
75.75%	100	مقررات البرنامج التخصصية (الإجبارية)
9.10%	12	مقررات البرنامج التخصصية (الاختيارية)
100%	132	إجمالي عدد ساعات البرنامج

(3) يُدرس مقرر حقوق الإنسان بواقع ساعتين نظري أسبوعياً في المستوى الأول ولا تُحسب من الساعات المعتمدة.

(4) التدريب الميداني: أربع أسابيع في إحدى المؤسسات ذات الصلة بتخصص البرنامج وذلك للطلاب المُسجلين بالمستوى الثالث على الأقل.

مادة (6) مستويات الدراسة:

(1) تُحدد مستويات الدراسة للطلاب طبقاً للجدول التالي:

عدد الساعات المعتمدة التي اجتازها الطالب بنجاح		المستوى الدراسي
أقل من أو يساوي	أكبر من	
24	صفر	المستوى الأول
66	24	المستوى الثاني
98	66	المستوى الثالث
132	98	المستوى الرابع

(2) تُرقم المقررات المختلفة بالبرنامج والمبينة بجدول المقررات الدراسية بحروف يتبعها ثلاثة أرقام، ومدلولاتها من اليسار إلى اليمين علي النحو التالي:



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



- أ) الحروف تدل علي القسم العلمي الذي يتبعه هذا المقرر.
ب) يمثل الرقم الأول من اليسار المستوى الدراسي الذي يُقدم فيه هذا المقرر وهو الرقم (1) للمستوى الأول، (2) للمستوى الثاني، (3) للمستوى الثالث، و (4) للمستوى الرابع.
ج- يمثل الرقمان الثاني والثالث من اليسار تسلسل المقرر في المستوى الدراسي، بحيث ترمز الأرقام الفردية لمقررات الفصل الدراسي الاول، والأرقام الزوجية ترمز لمقررات الفصل الدراسي الثاني.

مادة (7) التقييم:

- 1) النهاية العظمى لدرجات كل مقرر دراسي هي 100 درجة.
- 2) زمن الإمتحان النظري النهائي للمقرر ساعتان.
- 3) الحد الأدنى للنجاح في أي مقرر هو 60% من النهاية العظمى لدرجة المقرر.
- 4) يتم تقييم المقررات بناءً علي العناصر التالية:

نوع المقرر	أعمال فصلية	شفوي	تطبيقي	عملي/ تمارين تطبيقية	نظري
مقررات نظرية	20%	10%	-	10%	60%
مقررات بها محتوى نظري وعملي	15%	5%	5%	15%	60%

- 5) تقييم الطلاب في مقرر المقال والبحث يكون علي النحو التالي:

- 40% من النهاية العظمي لدرجات المقرر تُخصص لتقييم مدى شمول وتنظيم المادة العلمية للبحث ويتم التقييم من خلال المشرف.
- 15% من النهاية العظمي لدرجات المقرر تُخصص لتقييم مدى التزام الطالب بالمتابعة مع المشرف.
- 45% من النهاية العظمي لدرجات المقرر تُخصص بالتساوي لتقييم: (1) المناقشة الشفهية, (2) المناقشة التطبيقية, (3) العرض, ويتم التقييم من خلال لجنة الممتحنين.
- (6) يتولي منسق المقرر تنظيم الأعمال الفصلية، وإعداد كشوف رصد الدرجات وإعداد أوراق أسئلة الامتحانات النهائية.
- (7) يعتبر الطالب الغائب في الامتحان النظري للفصل غائباً في المقرر.
- (8) تُمنح مرتبة الشرف للطالب الذي يحصل على معدل تراكمي 2,5 أو أكثر عند التخرج بشرط ألا يقل معدله في أي مستوى عن 2,5 و ألا يكون قد رسب في أي مقرر دراسي خلال تسجيله في الكلية أو في الكلية المحول منها.
- (9) يجوز أن تُؤجل نتيجة الطالب في مقرر من المقررات لعدم اكتمال متطلباتها لأسباب قهرية (عدم دخول الطالب الامتحان النهائي بعذر مقبول) بعد عرضها على اللجنة التنفيذية خلال مدة لا تتجاوز فصل دراسي واحد , و يُعطى الطالب في هذه الحالة تقدير (غير مكتمل), و إن لم يستكمل الطالب متطلبات المقرر في الفترة التي يُعقد بها الامتحان النهائي للمقررات غير المكتملة و هي امتحانات الفصل الدراسي التالي مباشرة خلال الأسبوع الأول منه , يُعتبر الطالب راسباً في هذا المقرر و يُرصد له تقدير "راسب".

مادة (8) التسجيل و الحذف و الإضافة :

- 1) تقوم إدارة شؤون الطلاب بالكلية بعد مراجعة المرشد الأكاديمي بتسجيل المقررات إلكترونياً في الأسبوع الأول بكل فصل دراسي لكل طالب.
- 2) يُشترط لتسجيل المقرر أن يكون الطالب قد اجتاز بنجاح المتطلب السابق لهذا المقرر (إن وُجد).
- 3) لا يُسمح للطالب بالتسجيل المتأخر إلا بموافقة عميد الكلية وبعذر مقبول، على ألا تزيد مدة التأخير عن أسبوعين من نهاية فترة التسجيل، وفي الفصل الدراسي الصيفي لا تزيد عن أسبوع واحد.
- 4) يتم تسجيل عدد من المقررات لكل طالب يتراوح بين 12 (كحد أدنى) و 18 ساعة معتمدة (كحد أقصى) في كل فصل دراسي، علي ألا يزيد عن 9 ساعات معتمدة في الفصل الدراسي الصيفي.
- 5) لا يجوز التسجيل بأكثر من 12 ساعة معتمدة للطالب الحاصل علي معدل تراكمي أقل من (1).
- 6) يجوز للطالب بعد إكمال إجراءات التسجيل أن يحذف أو يضيف مقرراً أو أكثر مع مراعاة الحد الأدنى و الحد الأقصى للعبء الدراسي، و ذلك حتي نهاية الأسبوع الثاني من بدء الدراسة، وفي الفصل الدراسي الصيفي حتي نهاية الأسبوع الأول.

مادة (9) المواظبة:

- يتولى أستاذ المقرر تسجيل حضور الطلاب في كل محاضرة أو درس عملي أو تدريب في سجل معد لذلك من قبل إدارة شؤون التعليم والطلاب مع مراعاة ما يلي :
- 1) الحد المسموح به لغياب الطالب بدون عذر مقبول هو 25 % من مجموع ساعات المقرر ويتولى أستاذ المقرر إخطار ادارة شؤون التعليم والطلاب بالكلية



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



بخطاب في حالة تجاوز هذه النسبة لإنذار الطالب مرتين وبعد ذلك تُعرض حالة الطالب على مجلس الكلية لاتخاذ اللازم .

(2) إذا زادت نسبة غياب الطالب عن 25 % في المقرر وكان الغياب بدون عذر تقبله لجنة شؤون التعليم والطلاب ويعتمده مجلس الكلية يُحرم الطالب من دخول الامتحان النهائي ويُسجل له تقدير منسحب برسوب (WF).

(3) إذا زادت نسبة غياب الطالب عن 25 % في المقرر وكان الغياب بعذر تقبله لجنة شؤون التعليم والطلاب ويعتمده مجلس الكلية يسجل للطالب تقدير منسحب بعذر مقبول (WE).

مادة (10) التدريب الصيفي:

يُسمح للطالب المُقيد بالمستوى الثالث علي الأقل أن يُؤدي فترة تدريب ميداني بما لا يقل عن أربعة (4) أسابيع تدريب، وذلك تحت إشراف أحد أعضاء هيئة التدريس بالقسم بالإضافة إلي الإشراف الخارجي، وذلك في إحدي المؤسسات ذات الصلة بتخصص البرنامج والتي يقررها مجلس القسم واللجنة التنفيذية للبرنامج. ولا يُمنح الطالب درجة البكالوريوس إلا إذا اجتاز التدريب الميداني بتقدير مُرضي (S).

مادة (11) الدلالات الرقمية والرمزية للدرجات والتقييمات:

(1) تُقدر الدرجات والتقييمات والنقاط التي يحصل عليها الطالب في كل مقرر دراسي على النحو التالي:

التقدير	النسب المئوية	عدد النقاط	
ممتاز	A	90-100	5
	B ⁺	85-89	4,5
جيد جداً	B	80-84	4
	C ⁺	75-79	3,5
جيد	C	70-74	3
	D ⁺	65-69	2,5
مقبول	D	60-64	2
راسب	F	أقل من 60	0
غير مكتمل	I	-	-
Incomplete			
منسحب	W	-	-
Withdrawn			
منسحب بعذر مقبول	WE	-	-
Withdrawn Excuse			
منسحب برسوب	WF	-	0
Withdrawn Fail			

(2) يكون تقدير التدريب الميداني بأحد التقديرين التاليين:

S (Satisfactory): مُرضي U (Unsatisfactory): غير مُرضي

(3) المعدل الفصلي sGPA: هو متوسط ما يحصل عليه الطالب في الفصل

الدراسي الواحد ويُقرب إلى رقمين عشريين فقط، ويُحسب كما يلي:

$$\text{المعدل الفصلي} = \frac{\text{مجموع (حاصل ضرب نقاط كل مقرر X عدد ساعاته المعتمدة)}}{\text{عدد الساعات المعتمدة المسجلة في الفصل نجاحاً ورسوباً}}$$



4) المعدل التراكمي العام cGPA: هو متوسط ما يحصل عليه الطالب من نقاط خلال الفصول الدراسية ويقرب إلى رقمين عشريين فقط ويُحسب كما يلي:

المعدل التراكمي = $\frac{\text{مجموع (حاصل ضرب نقاط كل مقرر تمت دراسته} \times \text{عدد ساعاته المعتمدة)}}{\text{حاصل جمع الساعات المعتمدة المسجلة في جميع الفصول نجاحاً ورسوباً}}$

5) الحد الأدنى للنجاح في المقرر هو (60 درجة) وتعادل (2,0) مقبول.

6) الحد الأدنى للمعدل التراكمي للتخرج هو (2,0) مقبول.

7) يُبين في شهادة تخرج الطالب النقاط المكتسبة إلي جانب التقدير العام للتخرج.

مادة (12) الرسوب في المقررات:

أولاً: يعتبر الطالب راسباً في المقرر في الحالات الآتية:

1) تغيب الطالب بدون عذر مقبول عن الامتحان النظري النهائي أو حرمانه من أداء الامتحان النظري النهائي في المقرر.

2) حصول الطالب علي أقل من 60% من النهاية العظمي لمجموع درجات المقرر.

ثانياً: إذا رسب الطالب في أي مقرر إجباري في أي فصل دراسي فعليه إعادة دراسة ذات المقرر والامتحان فيه. أما إذا رسب في مقرر اختياري فيمكنه إعادة دراسته أو دراسة مقرر اختياري آخر بديل لإكمال متطلبات التخرج وذلك بعد موافقة المرشد الأكاديمي وإدارة البرنامج.

ثالثاً: عند إعادة الطالب لمقرر رسب فيه، سواء مقرر إجباري أو اختياري، يُرصد في سجله الدراسي جميع تقديرات المقررات الحاصل عليها في جميع محاولاته، وتدخل جميعاً في حساب متوسط نقاط التقدير التراكمي للدرجات.



مادة (13) الانقطاع عن الدراسة:

- 1) يعتبر الطالب منقطعاً عن الدراسة إذا لم يسجل مقررات في أي فصل دراسي، أو انسحب من الفصل بعد نهاية المواعيد المقررة بدون عذر مقبول.
- 2) يجوز للطالب أن ينقطع فصلين دراسيين متتاليين، أو أربعة (4) فصول دراسية متقطعة، ويُفصل من الكلية في حالة انقطاعه مدة أطول بدون عذر تقبله اللجنة العليا للبرنامج.

مادة (14) أحكام عامة:

تسري أحكام اللائحة الداخلية - نظام الساعات المعتمدة - لمرحلة البكالوريوس بكلية العلوم - جامعة طنطا والصادرة بالقرار الوزاري رقم 772 بتاريخ 2010/4/19 وتعديلاتها علي برنامج التقنية الحيوية الصناعية فيما لم يرد فيه نص بهذه اللائحة.



A. Programme Specification

Programme Title	Industrial Biotechnology
Awarded Degree	B. Sc. Industrial Biotechnology
Parent Department	Botany Department
Awarding Institution	Faculty of Science – Tanta University
Coordinator	Head of Botany Department
QAA Benchmarking Standards	Academic Reference Standards (ARS)
Date of Approval	-----

I- Introduction

Biotechnology is the use of organisms and their cellular, subcellular or molecular components in order to provide goods and services to man and other forms of life. Biotechnology is a rapidly expanding area, offering enormous benefits and challenges, and the prospect of solving many of the problems faced by the world today. It requires the knowledge of Microbiology, Botany, Zoology, Biochemistry, Genetic Engineering sciences and their integration to design and process competitively valuable food, pharmaceutical and industrial products, in addition to clinical and environmental services.

Faculty of Science, Tanta University is introducing an inter-departmental B.Sc. degree majoring in **Industrial Biotechnology**. This program is mainly taught by three Departments: Botany (offering and coordinating), Zoology and Chemistry. In addition, and whenever required, nominated expertise from the industry sector could be invited to teach some lectures relevant to the contents of selected courses. It



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



is a four years distinctive program based on the credit hours system. It aims to prepare market-ready, well-trained professional graduates in different aspects of biotechnology and its applications within the agricultural, industrial and environmental sustainability. The graduates of this program will be **market-competitive**, as they will receive high quality training in various biotechnology aspects including PCR techniques, gene cloning, gene discovery, gene transfer, cell and tissue cultures, immunology, fermentation, microbial, plant and animal biotechnology, medicinal biotechnology, pharmaceutical biotechnology, bioinformatics, project management, marketing... etc.

Students will regularly attend training sessions in relevant companies and factories. Importantly, between level three and level four, students will attend obligatory summer training for four weeks (20 hours/week) in companies, factories or research institutes for training on applications of biotechnology. Furthermore, as a requirement of graduation, every student will execute a research project (during level four) that includes a novel idea about an application of biotechnology for the production of a valuable and competitive product.

Various courses in this program were designed to fulfill the requirements for preparing graduates of Industrial Biotechnology that are stated by the following Academic Reference Standards (ARS).

II- Academic Reference Standards (ARS) for B.Sc. degree in industrial biotechnology (by Faculty of Science, Tanta University)

The program provides an integrated study of the biology, practical skills and production methods relevant to biotechnology. Students will receive high quality training in various biotechnology aspects including



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



PCR techniques, gene cloning, gene discovery, gene transfer, cell and tissue cultures, immunology, fermentation, microbial, plant and animal biotechnology, medicinal biotechnology, pharmaceutical biotechnology, molecular farming, bioinformatics, project management, marketing... etc. Technological advances, such as genetic engineering and the design of fermenters, on which the modern revolution in biotechnology is based, are highlighted. Specific applications, particularly in agriculture, food production, forensics and clinical medicine, have been chosen to illustrate the economic, social and environmental importance of biotechnology.

Career opportunities for the graduates in this program include food industry, agricultural business, pharmaceutical companies, public and private hospitals, Vaccine and Serum Agency, blood banks, gene banks, Environmental Affairs Agency, various industrial companies and research institutes, etc.

1. General attributes of Industrial Biotechnology graduates

Graduates of Industrial Biotechnology program must be able to:

1. Integrate biological concepts, facts, ideas and techniques for practical applications of biotechnology in society and industry.
2. Demonstrate skills in problem solving, particularly in practical contexts associated with biotechnology.
3. Exhibit awareness of the ways in which biotechnology can beneficially affect the human life and improve the quality of the environment without undesirable side effects.

2. Knowledge and understanding

Graduates of Industrial Biotechnology program must be able to:

1. Report the structure, function and classification of different living organisms.



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



2. State different principles of Mathematics, Physics and Chemistry that are important for Biology.
3. Review the basic metabolism in plants and animals.
4. Give an account on various hormones, enzymes and cofactors in living organisms
5. Describe various concepts of molecular genetics and genetic engineering, with ability to present an understanding of the topics of genomics and proteomics.
6. Report various techniques of microbial growth, sterilization, culturing and identification.
7. Give an account of tissue culture and its applications.
8. Give accounts on different environmental issues including, environmental sustainability, management, impact assessment, biodiversity and natural reserves.
9. Review the topics of immunochemistry, drug metabolism and clinical biochemistry.
10. Report the importance and applications of microbial, plant and animal biotechnology in the production of valuable goods.
11. Present an understanding of the applications of biotechnology in industry, agriculture, medicine, forensics and drug manufacturing.
12. Review the applications of enzymes in biotechnology.
13. Give accounts on the importance of programming, biostatistics and bioinformatics in biotechnology.
14. Present an awareness of international standards of bioethics and biosafety in biotechnology

3. Intellectual skills

Graduates of Industrial Biotechnology program must be able to:

1. Argue the importance and benefits of biotechnology for human life and the environment.
2. Compare between the production of a product by traditional ways and by the application of genetic engineering tools.



برنامج التقنية الحيوية الصناعية
Industrial Biotechnology



3. Discuss various molecular aspects of cell signaling in different living organisms, and be able to integrate them for a cautious use of biotechnology applications.
4. Explain different applications of biotechnology in agriculture, industry, medicine and environmental issues.
5. Develop hypotheses for how to apply different biotechnology practices in industry, agriculture, food production, drug industry, clinical medicine or in facing an environmental problem.

4. Practical skills

Graduates of Industrial Biotechnology program must be able to:

1. Apply biotechnology techniques to use microorganisms, plants and animals for production of valuable goods.
2. Use techniques of biotechnology in food industry.
3. Apply genetic engineering tools for production of crop plants and animals with improved quantity and quality and with improved resistance to severe environments.
4. Design bioreactors for production of biological products on a large scale.
5. Employ biotechnology in production of pathogen-free plants.
6. Use of biotechnology in production of biofertilizers and biopesticides.
7. Apply biotechnology procedures in bioremediation of contaminated environments.
8. Employ biotechnology techniques in the production of competitive industrial, medicinal and pharmaceutical products.
9. Apply biotechnology techniques in bio-fuel production.
10. Apply different skills of programming, biostatistics and bioinformatics in biotechnology.
11. Make a feasibility study and construct an industrial plan for production of valuable and competitive product(s) using biotechnology techniques.
12. Economically market biotechnology products.
13. Demonstrate well entrepreneurship skills in the marketplace.



III. Curriculum Structure and contents:

Program duration: at least four years (8 semesters),

Programme levels: four levels (132 hours)

Programme structure:

Number of credit hours per semester

Level – 1	First semester:	Lectures	12	Lab.	5	Total	17
	Second semester:	Lectures	12	Lab.	5	Total	17
Level – 2	First semester:	Lectures	12	Lab.	5	Total	17
	Second semester:	Lectures	12	Lab.	5	Total	17
Level – 3	First semester:	Lectures	12	Lab.	4	Total	16
	Second semester:	Lectures	12	Lab.	4	Total	16
Level – 4	First semester:	Lectures	12	Lab.	4	Total	16
	Second semester:	Lectures	11	Lab.	5	Total	16
Overall credit hours		Lectures	95	Lab.	37	Total	132

Number of credit hours of basic sciences courses:

No.	26	%	19
-----	----	---	----

Number of credit hours of courses of social sciences and humanities:

No.	6	%	5
-----	---	---	---

Number of credit hours of specialized courses:

No.	100	%	76
-----	-----	---	----

Practical/field training (Summer training)

4 weeks



IV. Course codes

Code	Description
BT	Biotechnology
ZO	Zoology
CH	Chemistry
MA	Mathematics
PH	Physics
BC	Biochemistry
CS	Computer Science
UN	University



V. Courses contributing to the program

LEVEL ONE

Semester (1): (17 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT121	-----	Botany I	2	2	3
BT123	-----	Introduction to biotechnology	1	-	1
ZO125	-----	General Zoology I	2	2	3
CH127	-----	General Chemistry I	2	2	3
MA129	-----	Mathematics I	1	2	2
PH131	-----	General Physics I	1	2	2
UN133	-----	Scientific English	2	-	2
		Select 1 credit from the			
UN135	-----	التعلم الذاتى	1	-	1
UN137	-----	General geology	1	-	1
UN139	-----	تاريخ وفلسفة العلوم	1	-	1
					17

Semester (2): (17 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT122	-----	Botany II	2	2	3
BT124	-----	Bio-membranes	1	-	1
ZO126	-----	General Zoology II	2	2	3
CH128	-----	General Chemistry II	2	2	3
MA130	-----	Mathematics II	1	2	2
PH132	-----	General Physics II	1	2	2
UN134	-----	اللغة العربية	2	-	2
		Select 1 credit from the			
UN136	-----	ثقافة الجودة	1	-	1
UN140	-----	القانون والمجتمع	1	-	1
UN138	-----	ثقافة بيئية	1	-	1
					17



LEVEL TWO

Semester (1): (17 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT221	BT122	Viruses and Bacteria	2	2	3
BT223	-----	Mycology and plant pathology	2	2	3
BT225	BT121	Photosynthesis and respiration	2	2	3
BT227	-----	General ecology and biodiversity	2	2	3
BT229	CH127	Nanochemistry for biotechnology	2	-	2
BC231	BT121	Enzymes and cofactors	2	2	3
					17

Semester (2): (17 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT222	-----	Algae and their applications	2	2	3
BT224	-----	Hormones	2	2	3
BT226	BT122	Molecular biology methods and genetic engineering	2	2	3
ZO228	ZO125	Toxicology	2	-	2
BC230	CH128	Basic metabolism	2	2	3
CH232	-----	Chemistry of dyes and Textile	2	2	3
					17



LEVEL THREE

Semester (1): (16 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT321	-----	Bioremediation	2	-	2
BT323	BT221	Physiology of microorganisms	2	2	3
BT325	BT224	Cell and tissue culture	2	2	3
BT327	BT225	Molecular bases of plant stresses	2	-	2
ZO329	ZO126	Parasitology	1	2	2
BC331	BC230	Clinical biochemistry	1	2	2
BC333	CH128	Body fluid and biological functions	2	-	2
					16

Semester (2): (16 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT322	BT226	Genomics and proteomics	2	-	2
BT324	BT327	Biostatistics and Bioinformatics	2	2	3
ZO326	ZO125	Immunochemistry	2	2	3
ZO328	-----	Molecular embryology	2	2	3
BC330	BC333	Drug metabolism	2	-	2
CS332	-----	Introduction to programming	2	2	3
					16



LEVEL FOUR

Semester (1): (16 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT421	BT323	Bioreactors	2	2	3
BT423	BT222	Biotechnology and bio-fuel production	1	2	2
BT425	BT221	Applied microbiology	2	2	3
BT427	BT226	Plant biotechnology	2	-	2
		Select 6 credits from the following modules			
BT429	BT226	Forensic biotechnology	1	2	2
BT431	BT325	Biotechnology and plant breeding	2	-	2
BT433	-----	Economics and marketing in biotechnology	2	-	2
BT435	BT124	Molecular aspects of cell signaling	2	-	2
BT437	-----	Scientific writing and presentations	1	2	2
ZO439	BT123	Animal biotechnology	2	-	2
					16



Semester (2): (16 Hours/Week)

Code	Preq.	Course title	Hours/Week		
			Lec.	Prac.	Cred.
BT422	BT425	Industrial and food microbiology	2	2	3
BT424	-----	Research project (biotechnology)	-	6	3
BT426	BT227	Environmental management and impact assessment	2	-	2
BT428	BT226	Bioethics and bio-safety in biotechnology	2	-	2
		Select 6 credits from the following modules			
BT430	BT123	Pharmaceutical biotechnology	1	2	2
BT432	BT226	Medical biotechnology	2	-	2
BT434	BT427	Biofertilizers and biopesticides	2	-	2
BT436	BT223	Plant pathogenicity	2	-	2
BT438	-----	Entrepreneurship skills	2	-	2
BT440	BT123	Current topics in biotechnology	2	-	2
					16



برنامج التقنية الحيوية الصناعية
Industrial Biotechnology



Field training:

Students are required to undertake one period of at least 4 weeks (20 hours/week) of approved field (natural protectorates) experience in industry, or in appropriate laboratories or institutions. The students are expected to seek the relevant training starting from level three.



B. Course Descriptions

Level (1) – Semester (1)

BT121- Botany I (2-2-3)

This course gives an opportunity to provide the students with comprehensive principles and concepts underlying plant structure and physiology. The course aims to provide students with knowledge and understanding about the concepts of plant morphology, and environmental effects. Also, this course aims to provide students with knowledge and understanding about plant tissues and anatomy, of primary structure of stems and roots and anatomy of plant leaves. In addition, this course includes topics in Plant Physiology that will enable students to gain knowledge and understanding of properties of water, the plant-water relationships and transport processes. The topics in this course also are extended to enzyme action and factors affecting its activity. Most importantly, students will gain detailed information about the two main metabolic processes: photosynthesis and respirations.

Practical: This course will include laboratory sessions covering the inspection of plant cell contents, types of tissues and plant organs. Physiological experiments will study various phenomena including osmosis, enzyme action, photosynthesis and respiration in plants.

BT123- Introduction to biotechnology (1-0-1)

This course aims to introduce first year Industrial Biotechnology students to the definition of biotechnology and basic principles applied in industrial biotechnology. Economic and ethical aspects of the development of novel products and the potential environmental benefits of using biotechnological processes will be presented. An overview of the methods and techniques used in biotechnology will be introduced. Simple applications for biotechnology in agriculture, medicine, food industry etc. will be presented as well.



ZO125- General Zoology I (2-2-3)

This course aims to enable students to gain the fundamental cellular and sub-cellular characteristics of cells with emphasis on structure and function of organelle systems common to eukaryotic cells. The course is extended to include the histology of different organs. The mechanisms of some biological process covering the animal activity, the mechanism of the animal development, as well as the interaction between animals and their environments will be discussed.

Practical: This course will include laboratory sessions covering the inspection and study of different cytological and histological structures.

CH127- General Chemistry I (2-2-3)

The aims of this course are to discuss the basic principles of writing chemical equations, units and chemical calculations, concepts of the matter and its states (solid, liquid and gaseous) and the underlying laws, and provide students with the elementary concepts of thermochemistry including writing of the thermochemical equations with emphasis on the corresponding laws. And to place an emphasis on the theories discussing atomic and molecular structure, the basis for arrangement of the elements in the periodic table, the periodic trends of properties as well as the nature and types of chemical bonding. In addition, this course will give students an introduction to the fundamental and basic components of atomic nucleus and the theories describing the stability of the nucleus as well as the nature of radioactivity. Other concepts including ionic equilibrium in solutions, the principles and procedures of qualitative separation and identification of both acidic and basic radicals will be covered as well.

Practical: This course will include laboratory sessions dealing with the identification of various elements depending on their properties related to their location in the periodic table including analysis of elements from group II, III, IV, V and VI.



MA129- Mathematics I (1-2-2)

This course aims to discuss how to find the limits, continuous and differentiation for functions that have one variable. And to teach how to use the differentiation to expand any function and draw it by the upper and lower limits. Also this course aims to develop the mathematical induction to proof validity of the inequality and equations and study the mean of the mathematical logic and how to use it in solving problems.

Practical: Exercise sessions covering the theoretical parts of this course will be introduced in parallel to the lectures of this course.

PH131- General Physics I (1-2-2)

This course aims to enable students to acquire good awareness of units and dimensions of different physical quantities and know how to use dimensions to derive equations that describe the relation between different physical quantities. The course also introduces the different states of matter and the properties of solids, elasticity, stress, strain, Hooke's law, elastic limit of material, energy of the simple harmonic oscillator, temperature, thermometry, Newton's law of cooling, and Joule's equivalent of heat.

Practical: This course will include laboratory sessions covering the study of stress, strain, Hooke's law, energy of the simple harmonic oscillator, temperature, thermometry, Newton's law of cooling, Joule's equivalent of heat.

UN133- Scientific English (2-0-2)

This course aims to provide a general linguistic training which will give students an appreciation of the value of words and help him to use his own language more effectively. It also intends to give students an access to the literature of other countries by teaching them how to read the foreign language with facility and so add to his cultural and recreational resources.



UN135 – Self-Learning التعلّم الذاتى (1-0-1)

This course aims to provide students with general information about self-directed learning and working system of the human brain. Also, this course helps students to understand different self learning strategies and gives them a way to learn the skills of self-control.

UN137-General geology (1-0-1)

This course aims to introduce students to general geology knowledge including the origin of the Earth and creation of the Universe, The Earth's interior (composition and structure), materials of the Earth's crust (crystals, minerals and rocks), continents, ocean basins, lithosphere, hydrosphere, biosphere and atmosphere. Internal processes including volcanism, earthquakes, crustal deformation, mountain building and plate tectonics will be discussed. Also, external processes including weathering, mass wasting, streams, glaciers, groundwater, deserts and coasts. Exercises include topographic and geologic maps will be presented as well.

UN139- تاريخ وفلسفة العلوم- (1-0-1)

يقدم هذا المقرر مقدمة لأبرز المشكلات الفلسفية التي تطرحها العلوم الطبيعية مثل : حدود التجريبية، أشكال التفسير العلمي، علاقة النظرية بالملاحظة ، مشكلة الاستقراء، شروط تكذيب النظريات العلمية، الاحتمال، والمنهج العلمي. كما يقدم المقرر دراسة للعلاقة التاريخية بين الفلسفة والعلوم ابتداء من الفلسفات القديمة مرورا بمناهج البحث العلمي في العصور الوسطى إلى استقلال العلم عن الفلسفة في العصر الحديث.

Level (1) – Semester (2)

BT122- Botany II (2-2-3)

This course gives an opportunity to provide the students with comprehensive principles and concepts underlying plant systematic and general genetics. It includes topics in plant systematic that will enable students to gain knowledge and understanding of the systematic position, structure and life cycle of different plant groups including, in addition to viruses, bacteria, fungi, algae and archegoniates. Also, this module provides an introduction to the principles of Mendelian genetics. The genetic systems of higher organisms and microbes are described,



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



including mechanisms of gene transmission and genetic exchange and mutation. The course will introduce the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes. Especial emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control.

Practical: This course will include laboratory sessions covering the inspection of the structure of individual organisms of various plant groups including bacteria, fungi, algae and archegoniates. In addition, the different phases of mitotic and meiotic divisions will be inspected.

BT124-Bio-membranes (1-0-1)

The aim of this module is to provide an introduction to the overall structures of prokaryotic and eukaryotic cells; organization and function of biological membranes; compartmentalization of eukaryotic cells; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication.

ZO126-General Zoology II (2-2-3)

The module of General Zoology provides an introduction to animal diversity that considers the heart of zoology sciences. The aim of this module is to provide a systematic survey of animals like protozoa with invertebrate and vertebrate animals with an emphasis on Egyptian examples. The course includes practical experience in the identification of representative organisms with systematic position of different species using slides, specimens and dissection.

Practical: This course will include laboratory sessions covering the inspection of the structure of individual organisms of various animal groups including protozoa, invertebrate and vertebrate animals.

CH128-General Chemistry II (2-2-3)

This course aims to provide students with the basic concepts and terminology of simple chemical kinetics, chemical equilibrium and phase equilibrium in single component systems and to place emphasis on the conditions and principles of phase and chemical equilibrium, nature and types of solutions, their properties and applications as well



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



as basic laws of electrolysis of electrolytes, colligative properties of solutions. Also, this course will give students an introduction to the fundamental principles of chemistry of carbon-based compounds including hybridization and nature of bonds, polarization and polarizability in molecules, electronic effects as induction and mesomerism, and finally classification of reactions based on the nature of bond fission.

Practical: This course will include laboratory sessions covering physical properties of solutions including viscosity, heating and cooling curves, solubility of salts etc. and applying specific chemical tests to detect the presence of various organic compounds including identification of simple organic compounds such as simple aliphatic and aromatic carboxylic acids etc.

MA130-Mathematics II (1-2-2)

This course gives student an opportunity to learn the methods of the integrate functions and to use the integration to find the area and the volume. Also, this course intends to provide students with mathematical principles of the circle, parabola, ellipse and hyperbola. The polar coordinates and how to change it will be introduced, as well.

Practical: Laboratory exercises covering the theoretical parts of this course will be introduced in parallel to the lectures of this course.

PH132-General Physics II (1-2-2)

This course aims to enable students to acquire good awareness of electric charges, insulators and conductors, coulomb's law, the electric field, electric flux and Gauss's law. Also, principles of potential energy, electric potential, electrical circuits components including; capacitance, electric current, resistance and Ohm's law, will be presented. In addition, the course intends to provide students knowledge and understanding of sources of electrical magnetic field, magnetism, magnets and the definition of geometrical optics. Furthermore, students will receive knowledge about the development of the theories of the nature of light, methods of measuring the velocity of light and basic laws of reflection and diffraction, and understand image



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



formation by mirrors, spherical surfaces, lenses, optical devices.

Practical: This course will include laboratory sessions covering the study of coulomb's law, Gauss's law, electric potential, electrical circuits components including; capacitance, electric current, resistance and Ohm's law, basic laws of reflection and diffraction, image formation by mirrors, lenses, optical devices.

UN134- اللغة العربية (2-0-2)

يهدف هذا المقرر إلي تعريف الطالب بطبيعة اللغة العربية من خلال محورين اثنين هما التحصيل المعرفي، و الأداء الوظيفي علي النحو التالي: (1) التحصيل المعرفي من خلال مستويات عدة مثل المستوى الصوتي (تتوزع فيه الأصوات دون وجود أدنى تنافر بين صوت و آخر)، والمستوى الصرفي (يحتوي على مجموعة من القوانين الصارمة التي تقيد صياغة المصدر أو اسم الفاعل أو اسم المفعول و التصغير و النسب و غير ذلك)، والمستوى النحوي (الذي لانتجد فيه تعارضا بين قاعدة و اخرى مما يؤدي إلى عدم خطأ بين القراءة او الكتابة و الإعراب للكلمات و الجمل و أشباه الجمل)، والمستوى البياني و المستوى الدلالي (باستعمال المعجم العربي و الاخطاء الشائعة)، إضافة إلي المستوى الكتابي (نظام الكتابة و الخط و الاملاء و الترتيم). (2) الاداء الوظيفي (و تتمثل في القراءة الصامتة و الجهرية و قراءة الاستماع). خلال هذا المقرر سوف يتم تدريس العديد من الدروس التي تتناول مختلف المواقف الحياتية لمعرفة طبيعة اللغة العربية، و التعرف على بعض الاتجاهات الحديثة في اللغة العربية و تطبيقاتها، و اكتساب مهارة تقويم المتعلمين من الطلاب في تعلم اللغة العربية و كيفية ممارسة التقويم الذاتي، إضافة إلي اكتساب اتجاهات و قيم و اخلاقيات العلم الايجابية و تمتيتها لدى الطلاب، مع اكتساب مهارات عناصر الجانب الوجداني المرتبطة بمهارة التحدث أمام جمع من الناس بصورة ايجابية.

UN136- ثقافة الجودة (1-0-1)

يهدف هذا المقرر إلي تعريف الطالب بمفاهيم الجودة . سوف لتعرف الطالب علي المفاهيم الأساسية ومصطلحات الجودة، التعريف بالاعتماد وأنواعه وأهميته في التعليم العالي. إضافة إلي ذلك، خلال دراسة الطالب لهذا المقرر سوف يتعرف علي معايير الاعتماد وأليات تحقيقها، إضافة إلي إبراز دور الطلاب في منظومة ضمان الجودة.

UN138- القانون والمجتمع (1-0-1)

يهدف هذا المقرر إلي تعريف الطالب بالمفاهيم القانونية العامة مع الإشارة إلي بعض القواعد القانونية التي تنظم بعض المعاملات داخل المجتمع. يشمل هذا المقرر دراسة للنظرية العامة للقانون التي تبدأ بتعريف معنى القاعدة القانونية ومعنى القانون والفارق بين القاعدة القانونية والقواعد الاجتماعية الأخرى (قواعد الأخلاق - قواعد الدين...) ثم الحديث عن مصادر القاعدة القانونية، وأنواع القواعد القانونية، وتطبيقها، وتدرج القواعد القانونية. كما يتضمن تدريس الشخصية القانونية والأهلية وفكرة الحق وكل ذلك على النحو الذي يهيئ الدارس لفهم معنى



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



القانون مع ضرب أمثلة لبعض القواعد القانونية التي تنظم بعض العلاقات والمعاملات داخل المجتمع.

UN140-ثقافة بيئية- (1-0-1)

يهدف هذا المقرر إلى التعريف بمعنى النظام البيئي ودور الإنسان فيه، وتبصرة الطالب بمدى أهمية البيئة للإنسان. كما يهدف إلى انماء الخلفية الثقافية بأهم مشكلات البيئة وأضرارها، وانماء فلسفية حب الإنسان للبيئة ومدى ارتباطه بها مع الإشارة إلى كيفية الحفاظ على الثروات الطبيعية وصون الحياة البرية.

Level (2) – Semester (1)

BT221-Viruses and Bacteria (2-2-3)

This course introduces students to the detailed biological properties (structure and replication) of viruses particularly those associated with major diseases of man, and plants and provides awareness of the transmission, epidemiology, pathogenesis and control of certain virus groups. The module also embraces the basic specific and non-specific host defense mechanisms associated with these infections and the principles concerned with the diagnosis of viral infections by laboratory producers. Also, this course deals with the occurrence and distribution of bacterial organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described.

Practical: This course will include laboratory sessions covering the inspection of various bacterial groups and bacterial staining. Different laboratories will cover bacterial growth and identification.

BT223-Mycology and plant pathology (2-2-3)

This course gives students an opportunity to extend fundamental concepts and principles of Mycology to an advanced level. It provides students with an understanding of the basic principles of the core of fungi taxonomic groups. Also, this module provides theoretical and practical knowledge of plant diseases; their causative agents and their control. It will cover diseases caused by fungi and other agents such as viruses, plant parasites, insects and nematodes. The module will also include plant disease resistance and disease control.



Practical: This course will include laboratory sessions covering the inspection of the structure of various members belonging to different fungal groups. Different laboratories will help students how to identify various types of fungal diseases in plants.

BT225-Photosynthesis and respiration (2-2-3)

The aim of this module is to study with some details the process of photosynthesis with its biochemical pathways. Students will acquire knowledge of the control of flux through photosynthetic pathways, and the ways in which photosynthesis is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors, and the ways in which knowledge of this can lead to the ability to manipulate metabolism in plants. Also, this course will introduce the mechanisms of aerobic and anaerobic respiration with an emphasis on the amount of energy produced and the mechanism of ATP synthesis.

Practical: This course will include laboratory sessions covering the extraction and study of various photosynthetic pigments and study of photosynthetic activity in intact plant leaves. Many experimental sessions will be devoted to the estimation of the photosynthetic products including mono- and disaccharides. Experiments studying the respiratory quotient will be done.

BT227-General ecology and biodiversity (2-2-3)

This module introduces the students to plant ecology and covers several topics including the component of the ecosystem, energy flow, food chain, ecological pyramids, bio-geochemical cycles, temporal variations (at population and community level), the ecological factors: (biotic factors, climate, topography, soil) and their effect on plants, plant vegetation and ecosystems. The course will also cover plant indicators, responses of plant behaviors to ecological factors. Also, this course aims to provide students with knowledge and understanding of the concepts of biodiversity conservation, and information on importance of biological conservation, conserved species and natural reserves in Egypt.

Practical: This course will include laboratory sessions covering topics of Climatology and soil science. Students will be introduced to



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



various metrology equipments. Experiments of soil analyses will include physical analyses (e.g. soil moisture, soil porosity etc.) and chemical analysis (salt content, soil pH value etc.). This course includes field trips to apply the information presented in the lectures on the field.

BT229-Nanochemistry for biotechnology (2-0-2)

This course considers the application of the newly emerging science of nanotechnology and its principles, concepts and tools. The working principles of some important apparatus such as atomic force microscopy will be described and its cellular and molecular applications will be taught. In addition, the possible biological applications of carbon nano-tubes, quantum dots, and the rapidly developing techniques of DNA chips will be discussed. The module will also consider single molecular manipulation techniques, particularly those concerning DNA and proteins. This course will be continuously updated to include new discoveries and applications of nano-techniques in biological sciences.

BC231-Enzymes and cofactors (2-2-3)

This module will focus on the types, nomenclature and classification of plant enzymes. The course also covers the structure, kinetics and functions of enzymes. It will also cover topics related to the nature of enzymes, enzyme specificity, mechanisms of enzyme action, and separation and purification of enzymes. The following topics will also be dealt with in this course: factor affecting enzymatic reactions, the type of inhibition, regulatory enzymes, multi-enzyme system, prosthetic groups and cofactors.

Practical: This course will include laboratory sessions covering enzyme extraction and enzyme activity. Many experimental sessions will be devoted for studying factors affecting enzyme activity.

Level (2) – Semester (2)

BT222-Algae and their applications (2-2-3)

This course gives an opportunity to explore the fundamental principles of systematic of algae with reference to occurrence and distribution, cytology of algal cell, different types of life cycles and bases of algal



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



classification. Also, this course gives an opportunity to explore the fundamental uses and economic importance of algae with reference to its application in food, industry, agriculture, pharmacy and medicine.

Practical: This course will include laboratory sessions covering the inspection of the structure of various algal groups. Different laboratories will cover algal growth and identification.

BT224-Hormones (2-2-3)

This module provides students with knowledge of the key areas of plant growth and development with emphasis on the role of plant growth regulators on cell division and differentiation. Detailed topics will include the chemistry, biosynthesis, translocation, action and role of various plant hormones including auxins, gibberellins, cytokinins, ethylene, salicylic acid and abscisic acid. Also, this course will consider the chemistry, biosynthesis, translocation, action and role of different hormones in human and animals, including hypothalamus hormones, pituitary (anterior and posterior) hormones, thyroid hormones, parathyroid hormones, adrenal (cortex and medulla) hormones, steroid hormones and pineal hormones and pancreatic hormones.

Practical: This course will include laboratory sessions covering the study of the action of various hormones including auxins, gibberellins, cytokinins, adrenal, thyroid hormones etc.

BT226-Molecular biology methods and genetic engineering (2-2-3)

This course gives an opportunity to provide the students with comprehensive principles and concepts underlying the different molecular biology methods, including gel electrophoresis, polymerase chain reaction (PCR), microarrays and RNA sequencing technologies. Throughout the course, students will be well-informed about how these methods are applied in different approaches of biotechnology. Also, this course will deal with the development of method and approaches of genetic engineering including gene cloning and gene transfer, genetic libraries and production of genetically modified crops.

Practical: This course will include laboratory sessions covering the study of various molecular biology methods, including gel



electrophoresis and polymerase chain reaction (PCR). Students will be trained on different experiments of gene cloning, as well.

ZO228-Toxicology (2-0-2)

This module will provide students with various definitions of toxicological terms and concepts. It also will help them to understand the principle of detoxification of various foreign molecules and the role undertaken by the liver in drug metabolism. The impact of environmental hazards on the animal and human life will also be considered. Signs and symptoms of toxicity and managements of the cases will be emphasized.

BC230-Basic metabolism (2-2-3)

This course will introduce the basic metabolism in living organisms. The course provides the details of carbohydrate biosynthesis, classification, derivatives and reactions, digestion and absorption. The catabolism of carbohydrate including glycolysis, TCA cycle, and pentose phosphate pathway will be presented in brief. The course will discuss the anabolism of carbohydrate including glucogenesis and glycogenesis. Also, this course will introduce lipid biosynthesis, classification and organization in biological membranes in the form of lipoproteins. Digestion of lipids and catabolism of fatty acids including fatty acid oxidation will be presented. This course, also, introduces the metabolism of proteins including turnover, catabolism of the carbon skeletons of amino acids, biosynthesis of non-essential amino acids, biosynthesis of amino acid derived compounds and protein synthesis. Urea cycle and physiologically active amines (seratoneine, histamine) will be discussed as well.

Practical: This course will include laboratory sessions covering methods for extraction and estimation of sugars in different types of juice, estimation of casein and calcium in milk, estimation of proteins and lipids in seeds.

CH232-Chemistry of dyes and Textile (2-2-3)

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo,



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction. Topics in this course will also extended to cover the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) manmade fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber. This course will also refer to the recent applications of biotechnology in dyes and textile industry.

Practical: This course will include laboratory sessions covering experiments on nitroso, nitro, azo, triarylmethane, xanthane, indigo, and reactive dyes. The practical activities of this course will include visits to the factories of textile fabric to learn how to apply biotechnology in dyes and textile industry.

Level (3) – Semester (1)

BT321-Bioremediation (2-0-2)

This course introduces the concept of bioremediation where plants and microorganisms are used to combat environmental pollution with an introduction to drinking and irrigation water standards. The aim of one part of this module is to address the mechanisms by which hyper-accumulator plants phytoremediate polluted waters and soils. Different examples of hyper-accumulator plants will be presented. A second part of the course covers the use of microorganisms in bioremediation. The interactions between metals and microorganisms, including discussions of metal toxicity, biosorption, biosensing and metal leaching/mining will be presented. A third part of the course will concentrate on the biotechnology of micro-algae and the bioremediation of polluted groundwater systems. The course will also deal with the role of genetic engineering of plants and microbes in developing new approached for bioremediation.

BT323-Physiology of microorganisms (2-2-3)

This module deals with aspects related to the physiological processes in microorganisms, it will deal with the culture media (natural, semi-



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



synthetic and synthetic). Microbial growth and the internal and external factors affecting growth in vitro will be discussed. The course will further address the organic and inorganic microbial nutrition, the utilization and metabolism of carbon and nitrogen sources. Additional topics are the antimicrobial agents and their mode of action.

Practical: This course will include laboratory sessions covering the study of the bacterial and fungal nutritional requirements, and physical conditions required for growth. The laboratory classes will include the study of the effects of different antimicrobial agents on microbial growth.

BT325-Cell and tissue culture (2-2-3)

This course provides graduate-level knowledge of and expertise in animal and plant tissue culture theory and practice. This course has a vocational focus and introduces the student to the theory and practice of animal cell culture and plant tissue culture and their role from modifying plants in plant biotechnology to the propagation of endangered plants and from modifying cell lines in biotechnology to the propagation of all lines for use in medical, microbiological and biochemical research. It prepares the students in particular for a career with plants, both in plant biotechnology and in environmental biotechnology. Students study media, sterilization, explants, micro propagation, callus culture, organogenesis, embryogenesis, somatic variation, doubled haploids, interspecific hybrids, protoplast fusion and environmental conditions required. These are related to uses of tissue culture and compared with traditional techniques.

Practical: This course will include laboratory sessions covering the study of the media, sterilization, explants, micro propagation, callus culture, organogenesis, embryogenesis, somatic variation, protoplast fusion and environmental conditions required.

BT327-Molecular bases of plant stresses (2-0-2)

This course aims to provide students with comprehensive knowledge and understanding of the molecular bases of various biotic and abiotic stresses that would help them applying various strategies of biotechnology to improve the productivity of crop plants. At the molecular level, the course will discuss the plant response to different pathogens (bacteria and fungi) and to different abiotic stresses



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



including drought, extreme temperatures, salinity and heavy metal pollution. The course will make emphasis to the involvement of different stress signaling messengers in modulating expression of relevant genes to build adaptive responses to different environmental challenges. The studied signaling messengers will include plant phyto-hormones (ABA, SA, JA and Ethylene), reactive oxygen species, calcium etc. Examples for marker genes used in engineering stress resistant crop plants will be presented.

ZO329-Parasitology (1-2-2)

This course aims to enable students to acquire principles, practices and informative knowledge concerning parasitism and the diversity of parasites covering the protozoan and metazoan parasites. The course, also, aims to develop awareness of concepts underlying the design of epidemiological studies, control strategies, and modern trends in parasitology. And to equip students with special skills to enable them to pursue a career in a wide range of contexts such as research, teaching, health and environment monitoring.

Practical: This course will include laboratory sessions covering the inspection and identification of various parasites in samples from different sources.

BC331-Clinical Biochemistry (1-2-2)

This course focuses on the biochemical mechanisms controlling different pathways under different physiological and nutritional conditions and the importance of diseases arising from defects in these pathways. Particular emphasis will be placed upon the aetiology, symptoms and treatment of diseases such as Type I and II diabetes mellitus; atherosclerosis and other lipid disorders and inborn errors of carbohydrate and amino metabolism.

Practical: This course will include laboratory sessions covering the study of physical and chemical examination of urine analysis, complete blood picture, and estimation of serum uric acid, glucose serum cholesterol, triglycerides and total lipids, serum iron and calcium, and serum total protein and albumin.

BC333-Body fluid and biological functions (2-0-2)

This course provide the students with terms of body fluids, importance of water to the body and life, the compositions and functions of blood,



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



ascetic fluids, cerebrospinal fluids, semen and milk, and the composition of lymphatic system. Also, this course acquires students with essentials of the liver, physiology, mechanism of bilirubin synthesis, excretion and virus. The functions of the kidney, urine formation and analysis, the urinary calculi and its types and its causes will be discussed. This course will enable students to study the CSF normal and abnormal composition, and be able to recognize the ascites, diagnosis and management and semen analysis.

Level (3) – Semester (2)

BT322-Genomics and proteomics (2-0-2)

This course provides knowledge and understanding of functional genomics and proteomics, with particular emphasis on techniques used in eukaryotes (specially plants) to understand the responses of these organisms at the 'whole-genome' level to biotic and abiotic stresses. It also covers the topic of pharmacogenomics, and the implications of the application of the basic research finding to add value for agricultural crops. The environmental, economic and ethical aspects of this emerging technology will be examined and discussed. Throughout the course, students will be well-informed about how to employ the different genomics and proteomics approaches in the field of biotechnology.

BT324- Biostatistics and Bioinformatics (2-2-3)

This course aims to strengthen the ongoing University research in the area of life sciences. It aims to develop an expert manpower to help bioinformatics industry, academia and thereby society, create an advanced research facility to carry out research in frontier areas of bioinformatics and computational biology; teach computer applications, including resources that exist on the internet; instruct some of the basic algorithms and programming concepts that underlie these problems. In addition, this course will introduce the students to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis testing, multivariate analysis, and nonparametric techniques. Various concepts including, approximations



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty) will be presented as well.

Practical: This course will include laboratory sessions including training and application of various concepts presented in the theoretical lectures whether in Biostatistics or Bioinformatics.

ZO326-Immunochemistry (2-2-3)

The aim of this course is to provide an understanding of the key immunological principles and terminology and to perform and interpret basic serological and leucocyte tests. In addition, this course aims to elucidate the molecular, cellular and organelle components of the immune system; the nature and causes of its malfunctions; and the scope for intervention and exploitation.

Practical: This course will include laboratory sessions covering serological and leucocyte tests and the study of some cellular and organelle components of the immune system.

ZO328-Molecular embryology (2-2-3)

This course is a comparative study of vertebrate embryology with emphasis on the fundamental developmental processes shared by vertebrate embryos. Topics include gametogenesis, fertilization, and development of Amphioxus, Amphibia, chick and human embryos from zygote through the differentiation of the neural tube. Besides the development of selected organ systems including the nervous system, sense organs, and the cardiovascular, digestive, respiratory, and urinogenital systems. The course includes various principals of the embryonic stem cells; the differentiation potential of stem cells, basic concepts and definitions, sources of adult stem cells, defining properties of an embryonic stem cell, stem cells and repairing a damaged heart, mouse embryonic stem cell cultures.

Practical: This course will include laboratory sessions covering fertilization, and development of Amphioxus, Amphibia, chick embryos. Besides the study of the development of various organ systems including the nervous system, sense organs, and the cardiovascular, digestive, respiratory, and urinogenital systems and some studies on stem cells.



BC330- Drug metabolism (2-0-2)

Throughout this course, the student will reach a clear understanding of the processes governing the rate and degree of absorption, distribution and elimination of drugs and other xenobiotics in the body (pharmacokinetics), and how these processes affect the intensity and duration of drug response (pharmacodynamics). The student shall be able to apply such knowledge to analyze and interpret preclinical and clinical data. The student shall be confident with both non-compartmental as well as compartmental analysis. The general principles of drug metabolism shall be understood. The student shall understand reasons for choosing dosing strategies for optimizing drug therapy. Emphasis is placed on the causes and expression of individual variability in drug absorption and disposition. The student will be able to understand and interpret qualified pharmacokinetic information and after critical review be able to provide such information to others.

CS332-Introduction to Programming (2-2-3)

This is a course in computer programming for those who have never programmed a computer before, developing elementary programming skills using C++. The course aims to develop the student's ability to formulate problems logically, to design, write and test code. Students will learn how to write C++ programs, how to inculcate good programming practices, how to write programs and develop the ability to solve practical real world computational problems, and how to logically think and produce a solution (program).

Practical: Exercise and training sessions covering the theoretical parts of this course will be introduced in parallel to the lectures of this course.

Level (4) – Semester (1)

BT421-Bioreactors (2-2-3)

This course will discuss the key engineering issues in bioreactor design and operation. The course will introduce the main three basic processes that contribute to production of biological products via bioreactors including; 1) Processes in which the product is produced by the cells is either extracellular (e.g., alcohols), or intracellular (e.g.,



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



a metabolite or enzyme), 2) Processes that produce a cell mass, Bakers' yeast, is an example of a produced cell mass, others include single-cell proteins for food sources, 3) Processes that modify a compound and are referred to as biotransformations (where cells of all types can be employed to biocatalyze a transformation of certain compounds via dehydration, oxidation, hydroxylation, amination or isomerization). Also, this course will give an emphasis on the bioreaction parameters that need to be considered when operating bioreactors, including: controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The various types of bioreaction systems will be covered in this course including; batch, continuous, semi-continuous, surface/tray, submerged, and air-lift loop bioreactors. Finally, technologies under development will be referred to here, as well.

Practical: This course will include laboratory sessions covering the the bioreaction parameters that need to be considered when operating bioreactors, including: controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The practical part of this course will include several visits to factories that use bioreactors for production of their products to make students be familiar with different types of bioreactors.

BT423-Biotechnology and bio-fuel production (1-2-2)

This course will give detailed information about the production of biodiesel from microalgae as renewable energy source, how to extract oil from algae and evaluate the produced biodiesel, and provide the background to compare between biodiesel from algae with other diesel sources. It also gives an idea about the bioethanol and hydrogen production from microalgae. The applications of bacteria in energy production will be presented as well. The course topics will be extended to discuss the application of biotechnology in increasing biomass production of higher plants for fuel production.

Practical: This course will include laboratory sessions covering methods for large scale production of algae for biofuel production. Methods of collection, drying and extraction of lipids and oils from



algae will be practiced. Experiments on the production of electricity by bacteria will be introduced as well.

BT425-Applied microbiology (2-2-3)

This course aims to introduce student to knowledge of the fermentation processes currently utilized in the pharmaceutical industry. Special attention will be given to antibiotic production, microbes as hosts for production of mammalian gene products, plant biomass conversion, microbial informatics, biocatalysts and biosensors. In addition, applications of microorganisms in food industry will be presented. Modern approaches to strain improvement and genetic manipulation of microorganisms will be presented, as well.

Practical: This course will include laboratory sessions covering the fermentation processes currently utilized in the pharmaceutical industry. The main part of the practical classes will include experiments on antibiotic production, and use of microbes as biocatalysts. Examples for the use of microorganisms in food industry will be exercised as well. The practical part of this course will include several visits to factories that use microorganism in the production of their products.

BT427-Plant biotechnology (2-0-2)

This course will provide students with knowledge and understanding of how genetic diversity is manipulated to develop new crop cultivars that enhance production systems around the world. Also, this course will review the opportunities and challenges of biotechnology in crop improvement programs.

BT429-Forensic biotechnology (1-2-2)

This course aims to provide students with information about various fingerprinting techniques that are used for the identification of criminals in certain crimes and testing the susceptibility to genetic diseases in carrier parents and infants. The most common of these techniques are restriction fragment length polymorphisms (RFLPs), random amplified polymorphic DNA (RAPDs), amplified fragment length polymorphisms (AFLPs), simple sequence repeats (SSRs) or micro-satellites. The techniques used to produce molecular markers will be described particularly PCR and Real time PCR. Other markers derived from sequencing data and DNA micro-array will also be dealt with in this



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



course. The particular role of these markers in crime diagnosis is emphasized.

Practical: This course will include laboratory sessions covering the techniques used in DNA fingerprinting including restriction fragment length polymorphisms (RFLPs), random amplified polymorphic DNA (RAPDs), amplified fragment length polymorphisms (AFLPs), simple sequence repeats (SSRs). The use of these techniques in crime diagnosis will be exercised.

BT431-Biotechnology and plant breeding (2-0-2)

This course considers the application of biotechnology to plants, for both agricultural and research uses. It covers alternative techniques such as culture-induced variation or marker assisted plant breeding that can be used to produce genetically improved crop varieties without use of genetic engineering. The principles of plant breeding will be explained and an emphasis will be given to molecular markers and their use in breeding.

BT433-Economics and marketing of biotechnology products (2-0-2)

This course introduces students to the strategic and tactical approaches used in the marketing of biotechnological products and services. The roles of managers and leaders within biotechnology companies undergo constant change. Students gain thorough understanding of the research and planning necessary methodologies to develop a marketing plan, the relationship between the marketing and sales functions, the difference between marketing a scientific product and a scientific service ,pricing strategies, distribution alternatives, communications, promotion, and the importance of perception. Knowledge of marketing terminology and techniques prove helpful to anyone in the industry.

BT435-Molecular aspects of cell signaling (2-0-2)

The growth, development, and environmental responses of even the simplest microorganism are determined by the programmed expression of its genes. Among multicellular organisms, turning genes on (**gene expression**) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of the plant response



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



to its environment in relation to the regulation of gene expression. The course will introduce various internal signals that are required for coordinating the expression of genes during development and for enabling the plant to respond to environmental signals through **signal transduction pathways**.

BT437-Scientific writing and presentations (1-2-2)

Analysis and interpretation of scientific data are essential skills for modern scientists and are important for handling of biotechnological information. The purpose of this module is to develop these skills through a directed program of reading, discussion and question answering, based on a series of research papers. This module will introduce the students to the elements of scientific writing starting with how to present the data, prepare tables and graphs and write the sections of research papers. The know-how of presenting scientific data in a poster or oral sessions will be described in detail.

Practical: This course will include laboratory sessions including training and application of various concepts presented in the theoretical lectures.

ZO439-Animal biotechnology (2-0-2)

This course aims to provide students with knowledge and understanding of the potential uses of animal biotechnology. Various examples for transgenic animals will be discussed, including production of animals with increased growth rates, enhanced lean muscle mass, enhanced resistance to disease or improved use of dietary phosphorous to lessen the environmental impacts of animal manure. The production of transgenic poultry, swine, goats and cattle that generate large quantities of human proteins in eggs, milk, blood or urine, with the goal of using these products as human pharmaceuticals, will be discussed. The production of human pharmaceutical proteins including enzymes, clotting factors, albumin and antibodies, will be considered, as well. The major factors limiting the widespread use of transgenic animals in agricultural production systems will be assessed. Future perspectives of animal biotechnology will be presented.



Level (4) – Semester (2)

BT422-Industrial and food microbiology (2-2-3)

This module will introduce students to current research and development thinking across food biotechnology. Examples of the impact of the intersection of food science, nutrition and biotechnology on food processing, chronic disease, sensory properties and food safety will be provided. The course will describe developments in the field of functional dairy products and describe examples of the application of omics techniques in food analysis including food authenticity, food safety. Also, the topics of this course will be extended to enable students to design assessment strategies to engineer flavour profiles in plants and food materials, plan a safety assessment strategy for food developed through genetic engineering, outline the major technical considerations for detecting GM foods and for species identification in meat products. Also, this course deals with the microorganisms that live in food and effects of microbial growth on food quality. The methods used to control, detect, and enumerate microorganisms in food will be addressed. Special emphasis will be devoted to the identification and management of food microorganisms and ways to protect the consumers from microbes in food.

Practical: This course will include laboratory sessions covering the detection of GM (genetically modified) foods, species identification in meat products (e.g., beef or donkey!). Also, experimental classes will deal with detecting and identifying the microorganisms that live in food and effects of microbial growth on food quality. The methods used to control, detect, and enumerate microorganisms in food will be addressed.

BT424-Research project (in biotechnology) (0-6-3)

This module aims to develop written communication skills, and the ability to obtain information, integrate it, and cogently present an argument pertinent to a specified theme in biotechnology. Students will be supervised to apply a biotechnological technique in an endeavor to produce a primary commercial biotechnology product.

BT426-Environmental management and impact assessment (2-0-2)

This course will introduce the students to the regulation and regulatory framework of the environmental and hazardous Waste law; Definitions;



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



policy guidance versus regulations role of the states, municipalities and the EEAA, compliance issues; case studies. The course will also give knowledge about the environmental management system (EMS), understanding ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; environmental planning; implementation and operation; checking and corrective action; environmental auditing and the environmental management system in Egypt. The course will further describe the objective and needs of environmental impact assessment (EIA); activities involved in EIA, characteristics of impacts); EIA methods, checklists, overlay mapping, net work, matrices, estimates of resources demand for EIA studies; recommended methodologies for rapid EIA, case studies; guidelines for EIA in developing countries; environmental impact statement, land evaluation and suitability analysis.

BT428-Bioethics and bio-safety in Biotechnology (2-0-2)

This course presents definitions of bio-safety and bioethics, good laboratory procedures and practices, standard operating procedures for biotechnology research, legal and institutional framework for biosafety, international agreements and protocols for bio-safety.

BT430-Pharmaceutical biotechnology (1-2-2)

This module will cover the actual status of biotechnology and its applications in pharmaceutical industry. It also covers the impact of biotechnology and genomics on the drug development process and the ways and means to increase productivity and accelerate the drug development process. The module will emphasize the biopharmaceuticals expressed in plants, particularly the use of transgenic plants and plant cell culture as bioreactors of secondary metabolites and recombinant proteins. Other topics of this module may include the process of DNA vaccines, characterization and bioanalytical aspects of recombinant proteins as pharmaceutical drugs. The module will further cover the pharmacokinetics and pharmacodynamics of biotech drugs, patents in the pharmaceutical biotechnology industry and maintaining high standards in quality assurance of products.

Practical: This course will include laboratory sessions covering the biopharmaceuticals expressed in plants, and the use of plant cell and tissue culture as bioreactors of secondary metabolites and



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



pharmaceutical proteins. Laboratory sessions on pharmacokinetics and pharmacodynamics of biotech drugs will be included.

BT432-Medical biotechnology (2-0-2)

The genetic constitution of man has a major influence on lifetime health, influencing the risk that we will suffer from various common diseases. Identification of the alleles contributing to the risk would allow predictive tests of individual susceptibility and the development of novel treatments for the disease when they have occurred. However, identification of the alleles concerned is very difficult. This course will deal with the causes and types of genetic diseases and review the strategies that are being employed to identify these alleles. Changes in chromosome structure and number are also a common cause of disease. The course will also consider the mechanisms by which these occur and how they are diagnosed.

BT434- Bio-fertilizers and bio-pesticides (2-0-2)

This course gives detailed information about algalization technology. Use of cyanobacteria, micro and macroalgae as agricultural biofertilizers, and benefits of algalization on crops, soil characteristics and aggregation will be considered. The application of bacteria in fertilizers industry will be presented as well. Also, this course will give students general knowledge of biological control of different plant pests as viral, microbial, nematode, weeds and vertebrate pests. The course will introduce the investigation the effective means of reducing or mitigating pests and pest effects through the use of natural enemies.

BT436-Plant pathogenicity (2-0-2)

Plant health in both natural and agricultural ecosystems is essential for sustaining human society and all other life forms on Earth. Plant disease epidemics are common and diverse and can have devastating effects on our population and economy by debilitating the ecosystems on which we depend. This course focuses on biological and environmental factors that influence microbe-plant interactions which in turn determine plant health and initiate plant disease epidemics. This course will provide students an understanding of pathogen and host biology, as well as the role of the environment in disease epidemiology, thus they be able to develop strategies for maintaining healthy plants in both natural and agricultural ecosystems. Students



برنامج التقنية الحيوية الصناعية Industrial Biotechnology



will learn about the survival and spread of important plant-infecting fungi, bacteria, and viruses and how mechanisms for microbial pathogenicity are influenced by the environment.

BT438-Entrepreneurship skills (2-0-2)

This course aims to provide students with knowledge and understanding of business and management with an emphasis on entrepreneurship. It aims to teach students how to start own business, to grow a family business or to innovate inside an existing organization. Also, this course provides the opportunity to develop management, leadership and entrepreneurial skills to enhance potential capabilities and employability.

BT440-Current topics in biotechnology (2-0-2)

The aim of this module is to introduce students to areas of biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future.