جامعة دمنهور
DAMANHOUR UNIVERSITY
كلية العلوم

# اللائحة الداخلية

## لكلية العلوم - جامعة دمنهور

## ( مرحلة البكالوريوس )

## نظام الساعات المعتمدة

2022 م

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# كلمة السيد الأستاذ الدكتور/ عميد الكلية

تُعدُّ كلية العلوم - جامعة دمنهور مجتمعاً علمياً متنوع المعارف والثقافات، كما تعتبر مركزاً رائداً للأجيال العلمية لنشر وتطبيق المعرفة في مجال العلوم الأساسية وذلك منذ تأسيسها بالقرار الجمهوري رقم 87 في 27 مارس 2007 . تقوم كلية العلوم جامعة دمنهور بدور واضح في تقديم العلوم الأساسية لطلاب كلية العلوم بالاضافة الي كليات التربية والتمريض والحاسبات والمعلومات بالجامعة .

إرتكازاً علي:-

1. **المادة 21 من الدستور** والتي تنص علي أن "تكفل الدولة توفير التعليم الجامعى وفقا لمعايير الجودة العالمية، وتعمل على تطوير التعليم الجامعى وفقا لمعايير الجودة العالمية، وتعمل على تطوير التعليم الجامعى وتكفل مجانيته فى جامعات الدولة ومعاهدها، وفقا للقانون ".
2. **استراتيجية مصر 2030 للعلوم والتكنولوجيا** والتي من أهدافها "رفع قدرات كليات العلوم الأساسية وتهيئة بيئة مشجعة للعلوم والتكنولوجيا والابتكار وبناء قاعدة علمية قوية".
3. **خطة الدولة للتنمية المستدامة 2030** والتي تتضمن "إتاحة التعليم للجميع دون تمييز– تحسين جودة التعليم بما يتّوافق مع النظم التعليم الدولية -تحسين تنافسية نظم ومخرجات التعليم".
4. **إستراتيجية مصر الرقمية 2030** حيث تستهدف "تحويل كافة مؤسسات الدولة إلى المنظومة الرقمية".

تحرص كلية العلوم - جامعة دمنهور علي الاستفادة من التعلم الالكتروني والتحول الرقمي لاستثماره في عمليتي التعليم والتعلم لخدمة الطلاب وتنمية مهاراتهم وتطوير معارفهم العلمية والعملية للارتقاء بمنظومة التعليم الجامعي وخلق بيئة تعليمية جاذبة ومحفزة لضمان الجودة والاعتماد الأكاديمي وبالتالي تقديم خريج مؤهل قادر علي المنافسه في اسواق العمل المحلية والاقليمية.

من هذا المنطلق قامت الكلية بتطوير لائحتها الدراسيه لمرحلة البكالوريوس إيماناً منها بأهمية ملائمة مناهجها التعليمية وبرامجها الدراسية مع التطورات التكنولوجية الحديثة لتدعيم نواتج عملية التعلم مع الأخذ بعين الاعتبار إحتياجات سوق العمل الحالية والمستقبلية.

جميعنا مطالبين بأن نبذل قصارى جهداً ونستنفر طاقاتنا الخلاقة لدعم هذه الانطلاقة المتميزة لأبناء الكلية المخلصين، وفقنا الله جميعاً إلى ما يرفع شأن وطننا الحبيب مصر.

والله ولى التوفيق

**عميد الكلية**

**أ.د./ إلهامى على ترابيس**

# كلمة السيد الأستاذ الدكتور/ وكيل الكلية لشئون التعليم والطلاب

في عالم سريع التغير والتطور يأتي العلم والعلماء علي رأس أسباب هذا التطور؛ وتأتي كلية العلوم علي رأس الأساسيات العلمية لهذا التطور. وكلية العلوم وما تتضمنه الدراسة بها من علوم طبيعية وبيولوجية وعلوم الأرض هي بمثابة الأساس من الصرح العظيم الذي هو التقدم التكنولوجي. ولمواكبة المستجدات العالمية والمحلية كان لزاما تحديث هذه اللائحة الدراسية بنظام الساعات المعتمدة وتطوير البرامج الأكاديمية لجميع أقسام الكلية وإنشاء برامج علمية جديدة متميزة تخدم سوق العمل وتنهض بالمجتمع لإنتاج مخرج تعليمي يتمتع بالجودة والمنافسة محليا ودوليا وتحقيق معايير الاعتماد الأكاديمي وفقًا للمرجعيات العالمية.

كل الشكر والتقدير للذين ساهموا بالجهد والنصيحة في إنجاز هذه اللائحة على كل المستويات والاقسام العلمية بالكلية حتى أصبحت اللائحة تتناسب مع أحدث الطرق في تطوير المناهج وأساليب التدريس، وذلك بهدف خدمة الطلاب ورفع كفاءتهم وصقل مهاراتهم وتخريج طالب مؤهل لمتطلبات سوق العمل. والبرامج المستحدثة باللائحة أصبحت تتواكب مع اتجاه الدولة لتطوير وتحديث المناهج وتبني برامج جديدة تتماشى مع البرامج العالمية.

**وكيل الكلية لشئون التعليم والطلاب**

**ا.د./ السيد إبراهيم سعد**

# نبذة تاريخية

أنشئت كلية العلوم بدمنهور بصدور القرار الجمهوري رقم 87 في 27 مارس عام 2007 م الموافق 8 من ربيع الاول عام 1428 هـ كواحدة من الكليات التابعة لفرع دمنهور التي تضمها جامعة الإسكندرية. ثم اصبحت من الكليات الرئيسية التى انشأت عليها جامعة دمنهور بالقرار الجمهوري رقم 303 لسنة 2010 م وهي تضم ستة اقسام رئيسية هي: الكيمياء - الفيزياء - النبات - علم الحيوان - الرياضيات – الجيولوجيا. وقد تم تطوير لائحة الكلية لتشمل تخصصات حديثة بالأقسام المختلفة لتواكب التحديات الجديدة في جميع المجالات العلمية، مثل إنشاء قسم الكيمياء الحيوية.

**الرؤية:**

تحقيق الريادة في التدريس والبحث العلمي في مجالات العلوم الأساسية وتطبيقاتها لخدمة احتياجات المجتمع.

**الرسالة:**

تلتزم كلية العلوم بجامعة دمنهور بإعداد خريج متميز فى العلوم الأساسية والتطبيقية، يناسب سوق العمل وباحثين ذوي كفاءة عالية للمساهمة فى مجالات البحث العلمى والتنمية فى ضوء رسالة الجامعة والمعايير القومية للجودة والاعتماد وقيم المجتمع.

**الاهداف الاستراتيجية:**

- طلاب وخريجون متميزون وقادرون على المنافسة والابتكار.
- الارتقاء بمنظومة الدراسات العليا بالكلية لسد احتياجات المجتمع من التطوير المهني المطلوب.
- الارتقاء بمنظومة البحث العلمي والابتكار في الكلية بما يلبي رؤية مصر 2030.
- كسب ثقة المجتمع عن طريق تعزيز وتطوير الخدمات المجتمعية.
- تعزيز القدرات الإدارية والتنظيمية وتطويرها بما يحقق رؤية ورسالة الكلية.
- تنمية الموارد الذاتية للكلية لتدعيم العملية التعليمية والبحثية.
- ضمان جودة الأداء المؤسسي والتطوير المستمر والتنمية المستدامة للموارد البشرية للحصول على الاعتماد الأكاديمي.

# اللائحة الداخلية

# لكلية العلوم. جامعة دمنهور

# للعمل بنظام الساعات المعتمدة

## الفصل الأول

## مواد اللائحة المنظمة للدراسة

## مادة (1) المعايير والاهداف

تم إعداد هذه اللائحة في ضوء قواعد الهيئة القومية لضمان الجودة والاعتماد في مجال التعليم العالي بالمعايير الأكاديمية المرجعية NARS والمعايير المرجعية الأكاديمية ARS المعدة من قبل فريق جودة الكلية.

وتهدف اللائحة إلى إعداد طلاب يتمتعون بجميع المظاهر المعرفية الخاصة بطلاب العلوم والواردة في NARS وبصفة خاصة المعارف والمفاهيم، والمهارات الذهنيه والمهنية، والمهارات القابلة للنقل من مجال إلى آخر.

لذا فإن الخطط الدراسية الواردة في هذه اللائحة تحقق التوصيف الخاص بهيكل برامج الكلية وبصفة خاصة المؤشرات التحليلية للنسب المئوية للعلوم الأساسية، والعلوم الإنسانية واللغوية، والمقررات التخصصية، والكمبيوتر وتقنية المعلومات، ومشروعات البحث والتخرج، والمقررات الاختيارية طبقا لما ورد في NARS.

ومن ناحية أخرى، تم مراعاة الإطار العام للوائح مرحلة البكالوريوس بقطاع العلوم الأساسية بنظام الساعات المعتمدة وبصفة خاصة عدد الساعات المعتمدة اللازمة للتخرج وتوزيع هذه الساعات المعتمدة ما بين متطلبات الجامعة، والكلية، والتخصص. وكذلك تم توزيع الساعات المعتمدة التخصصية بين ساعات إجبارية وساعات اختيارية على حسب البرنامج الأكاديمي للتخصص كونه منفرد، أو مزدوج طبقاً لمقترح الإطار العام للوائح مرحلة البكالوريوس بقطاع العلوم الأساسية بنظام الساعات المعتمدة، وتخضع هذه اللائحة للتحديث كل دورة تخرج طلابية حسب القواعد المنظمة لذلك.

## مادة (2) أقسام الكلية

أ- تتكون كلية العلوم. جامعة دمنهور من الأقسام العلمية التالية:

جدول (1)

| م | القسم العلمي | م | القسم العلمي |
|---|---|---|---|
| 1 | قسم الرياضيات وعلوم الحاسب | 5 | قسم علم الحيوان |
| 2 | قسم الفيزياء | 6 | قسم علوم الأرض |
| 3 | قسم الكيمياء | 7 | قسم الكيمياء الحيويه |
| 4 | قسم النبات والميكروبيولوجي | | |

ب- يمكن أن تنشأ بالكلية أقسام أخرى وفقا لأحكام قانون تنظيم الجامعات ولائحته التنفيذية.

## مادة (3) الدرجات العلمية

أ- تمنح جامعة دمنهور بناء على طلب مجلس كلية العلوم درجة البكالوريوس فى العلوم (Bachelor's Degree in Science (B.Sc. فى أحد التخصصات المنفردة (Single Major) الموضحة بجدول (2) أو التخصصات المزدوجة (Double Major) الموضحة بجدول (3)، بالإضافة إلى سبعة برامج خاصة من البرامج الجديدة المتخصصة بمصروفات وهي: الطاقة المتجددة والمستدامة - الفيزياء الحيوية - المناعة والكيمياء - جيولوجيا الأثار - الغاز الطبيعي والثروات الطبيعية - الكيمياء الحيوية والتغذية - الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية.

جدول (2)

| م | القسم | التخصص | الرمز | م | القسم | التخصص | الرمز |
|---|---|---|---|---|---|---|---|
| 1 | **الرياضيات وعلوم الحاسب** | الرياضيات | Math | 4 | **النبات والميكروبيولوجي** | النبات | Bot |
| | | علوم الحاسب | CS | | | الميكروبيولوجيا | Mic |
| | | الإحصاء وعلوم البيانات | Stat | 5 | **علم الحيوان** | علم الحيوان | Zoo |
| 2 | **الفيزياء** | الفيزياء | Phys | 6 | **علوم الأرض** | الجيولوجيا | Geo |
| | | | | 7 | **الكيمياء الحيوية** | الكيمياء الحيوية | BCh |
| 3 | **الكيمياء** | الكيمياء | Chem | | | | |
| **إجمالي البرامج المنفردة الأقسام = 10 برنامج** | | | | | | | |

جدول (3)

| م | القسم | التخصص | الرمز |
|---|---|---|---|
| 1 | الرياضيات وعلوم الحاسب | علوم الحاسب والرياضيات | CS – Math |
| 2 | الفيزياء والرياضيات وعلوم الحاسب | الفيزياء وعلوم الحاسب | Phys – CS |
| | | الفيزياء والرياضيات | Phys – Math |
| 3 | الفيزياء والكيمياء | الفيزياء والكيمياء | Phys – Chem |
| 4 | الفيزياء | الفيزياء الحيوية والبيوتكنولوجي | BPhy – Biot |
| | | المواد وعلوم النانو | MNS |
| 5 | النبات والميكروبيولوجي والكيمياء | النبات والكيمياء | Bot – Chem |
| | | الميكروبيولوجى والكيمياء | Mic – Chem |
| 6 | علم الحيوان والكيمياء | علم الحيوان والكيمياء | Zoo – Chem |
| | | علم الحشرات والكيمياء | Ent – Chem |
| 7 | علوم الأرض | الجيولوجيا والجيوفيزياء | Geo – GPh |
| 8 | علوم الأرض والكيمياء | الجيولوجيا والكيمياء | Geo – Chem |
| 9 | الكيمياء الحيوية والكيمياء | الكيمياء الحيوية والكيمياء | BCh – Chem |
| إجمالي البرامج المزدوجة الأقسام = 13 برنامج | | | |

ب - يجوز أن تنشأ بالكلية برامج دراسية أخرى وفقا لأحكام قانون تنظيم الجامعات ولائحته التنفيذية.

ج - تقوم الكلية بتوزيع الطلاب على الشعب المختلفه بتنسيق داخلي بالكلية طبقا للقواعد التى يقرها مجلس الكلية وبناء علي احتياجات سوق العمل وامكانيات الاقسام البشرية والمعملية.

د - يتم منح الدرجات العلمية للطلاب الذين أتموا متطلبات التخرج في ثلاثة أدوار للتخرج بنهاية كل فصل دراسي (دور يناير - دور مايو - دور سبتمبر).

## مادة (4) نظام الدراسة

نظام الدراسة المتبع بالكلية هو نظام الساعات المعتمدة Credit Hour System في إطار الفصل الدراسي بواقع 136 ساعة معتمدة موزعه على 8 فصول دراسية. وهو نظام يشترط لتخرج الطالب اجتيازه عدد من المقررات الدراسية بنجاح وفق المستوى الذي تحدده الكلية، كما يتيح للطالب حرية الدراسة والمشاركة في وضع خطة دراسته وفقا لقدراته وحسب النظام المعمول به. وبتوجيه من المرشد الأكاديمي، وذلك في ضوء الحدود الدنيا والعليا لعدد الساعات المعتمدة التي يسمح له بالتسجيل فيها لكل فصل دراسي.

## مادة (5) الفصل الدراسي

مدة الفصل الدراسي سبعة عشر أسبوعا موزعة على النحو التالي:

- فترة التسجيل مدتها أسبوعا واحد.
- فترة الدراسة مدتها أربعة عشر أسبوعا.
- فترة الامتحانات النهائية في نهاية الفصل الدراسي ومدتها أسبوعان على الأقل.

ويجوز لمجلس الكلية أن يوافق على فتح فصل دراسي صيفي مكثف مدته ثمانية أسابيع يسجل فيه فقط الطلاب الراسبون أو من هم في فصل التخرج في مقرر أو أكثر وبحد أقصى تسع ساعات معتمدة نظير رسوم إضافية يقرها مجلس الجامعه بناءا على أقتراح مجلس الكلية.

- فترة التسجيل أربعة أيام.
- فترة الدراسة سبعة أسابيع.
- فترة الامتحان عشرة أيام.

## مادة (6) الفصل الصيفي

(أ) هو فصل دراسي مكثف اختياري للطلاب مدته ثمانية أسابيع خلال الإجازة الصيفية يسجل فيه الطلاب المقررات الدراسية المؤجلة ومقررات الرسوب وكذلك المقررات اللازمة للتخرج أو دراسة مقررات تحسين التقدير وفقاً لمادة (18) بحد أقصى تسع ساعات معتمدة. ويسمح للطلاب المعرضين للفصل، وكذلك الطلاب المحتمل تخرجهم بزيادة الحد الأقصى للتسجيل إلى 12 ساعة معتمدة، وتكون المقررات المطروحة متاحة طبقاً لضوابط يحددها مجلس الكلية.

(ب) يتم تحصيل رسوم إضافية لتسجيل مقررات الفصل الصيفي، ورسوم لإعادة الامتحان في مواد الرسوب، يحدد قيمتها لكل ساعة معتمدة مجلس الكلية، يصرف منها مكافآت للسادة أعضاء هيئة التدريس والعاملين تبعا لضوابط في لائحة تنظيم أعمال الامتحانات بالجامعة.

## مادة (7) معيار الساعة المعتمدة

تحتسب الساعة المعتمدة خلال الفصل الدراسي الواحد على النحو التالي:

(أ) بالنسبة للمحاضرات النظرية: تحتسب ساعة معتمدة واحدة لكل محاضرة مدتها ساعة واحدة أسبوعيا فى الفصل الدراسي الواحد.

(ب) **بالنسبة للدروس العملية والتمارين التطبيقية:** تحتسب ساعة معتمدة واحدة لكل فترة عملية أو تدريبية أو تمارين تطبيقية مدتها 2 أو 3 ساعات أسبوعيا فى الفصل الدراسي الواحد.

## مادة (8) مستويات الدراسة

مدة الدراسة لنيل درجة البكالوريوس في كليات العلوم هي أربع سنوات جامعية أو متى استكمل الطالب عدد الساعات المعتمدة المطلوبة للتخرج (136 ساعة) بنجاح، بما لا يقل عن سبعة فصول دراسية رئيسية، وتقسم هذه المدة إلى أربعة مستويات دراسية، ويشمل المستوى الواحد فصلين دراسيين يفصل بينهما عطلة نصف العام وتحدد مستويات الدراسة بعدد الساعات التي اجتازها الطالب بنجاح كما يلي: -

(أ) المستوى الأول (Freshman) من صفر حتى 36 ساعة

(ب) المستوى الثاني (Sophomore) من 37 ساعة حتى 71 ساعة

(ج) المستوى الثالث (Junior) من 72 ساعة حتى 106 ساعة

(د) المستوى الرابع (Senior) من 107 ساعة وحتى 136 ساعة

## مادة (9) المتطلب السابق

المتطلب السابق لدراسة مقرر ما، هو مقرر دراسي يتعين على الطالب اجتيازه قبل التسجيل في مقرر معين آخر، وفي هذه الحالة فإنه يطلق على الأول متطلب سابقا للمقرر الثاني ويجب أن يكون المتطلب السابق لأي مقرر ضمن مقررات البرنامج الملتحق به الطالب.

## مادة (10) القبول

**أولا-** تقبل كلية العلوم جامعة دمنهور الطلاب الحاصلين على الثانوية العامة (القسم العلمي) أو ما يعادلها وفقا لشروط القبول التى يحددها المجلس الأعلى للجامعات. ويجوز لمجلس الكلية أيضا قبول طلاب وافدين بشروط القيد والتحويل المطبقة على المصريين وبشروط إضافية يقترحها مجلس الكلية ويوافق عليها مجلس الجامعة ويلتحق الطالب المستجد بالمستوى الأول وهو السنة التأسيسية Foundation Year بإحدى الشعب الثلاث التالية:

أ - شعبة العلوم الطبيعية. وتقبل الحاصلين على الثانوية العامة رياضيات أو علوم

ب - شعبة العلوم البيولوجية. وتقبل الحاصلين على الثانوية العامة علوم

ج – شعبة علوم الارض. وتقبل الحاصلين على الثانوية العامة رياضيات أو علوم

علي ان تقوم الكلية بتوزيع طلاب المستوي الأول علي شعب العلوم الطبيعية - العلوم البيولوجية – علوم الأرض بناء علي الامكانيات البشرية والمادية في هذه الشعب وعن طريق تنسيق داخلي بالكلية الذي يقره مجلس الكلية، كما يختار الطالب تخصصه قبل بدء ثالث فصل دراسي له بتنسيق داخلي يعتمد على رغبات الطالب ومعدله التراكمي (CGPA) بالمستوى الأول طبقا للجدول التالي:

جدول (4)

| م | الشعبة (السنة التأسيسية) Foundation Year | التخصصات التابعة للشعبة (البرامج ) |
|---|---|---|
| 1 | أ - شعبة العلوم الطبيعية<br>Physical Sciences Section | - الرياضيات ( تخصص منفرد)<br>- الإحصاء وعلوم البيانات ( تخصص منفرد)<br>- علوم الحاسب (تخصص منفرد)<br>- الفيزياء ( تخصص منفرد)<br>- علوم المواد والنانو (تخصص مزدوج)<br>- الكيمياء ( تخصص منفرد)<br>- علوم الحاسب والرياضيات (تخصص مزدوج)<br>- الفيزياء والرياضيات (تخصص مزدوج)<br>- الفيزياء وعلوم الحاسب (تخصص مزدوج)<br>- الفيزياء والكيمياء (تخصص مزدوج)<br>- الفيزياء الحيوية والبيوتكنولوجي (تخصص مزدوج) |

| | | |
|---|---|---|
| 2 | ب - شعبة العلوم البيولوجية<br>Biological Sciences Section | - الكيمياء حيوية ( تخصص منفرد)<br>- النبات ( تخصص منفرد)<br>- الميكروبيولوجيا ( تخصص منفرد)<br>- علم الحيوان ( تخصص منفرد)<br>- النبات والكيمياء (تخصص مزدوج)<br>- الحيوان والكيمياء (تخصص مزدوج)<br>- الميكروبيولوجى والكيمياء (تخصص مزدوج)<br>- الحشرات والكيمياء (تخصص مزدوج)<br>- الكيمياء الحيوية والكيمياء (تخصص مزدوج) |
| 3 | ج - شعبة علوم الأرض<br>Earth Sciences Section | - الجيولوجيا ( تخصص منفرد)<br>- الجيولوجيا والكيمياء (تخصص مزدوج)<br>- الجيولوجيا والجيوفيزياء (تخصص مزدوج) |

**ثانياً:** فى حال ضم الرياضيات والعلوم فى شهادة الثانوية العامة يتم توزيع طلاب المستوى الأول حسب تنسيق داخلى بالكلية يعتمد على درجات الطلاب فى مواد الرياضيات والعلوم.

**ثالثاً:**

(أ) يجوز لمجلس الكلية قبول طلبات تحويل الطلاب إلى الكلية من الجامعات الأخرى طبقا للقواعد المعمول بها.

(ب) يجوز لمجلس الكلية قبول الطلاب الحاصلين على درجة البكالوريوس أو ما يعادلها من الكليات الأخرى (العملية أو النظرية) والمعاهد العليا من الحاصلين على الثانوية العامة علمي الخاضعة لقانون تنظيم الجامعات للدراسة بمرحلة البكالوريوس في التخصص المناسب، ويجوز قبول خريجي كليات العلوم للحصول على البكالوريوس في تخصص آخر غير الذي تخرج منه ولا يدخل في حساب المعدل التراكمي ولا تتم معادلة المقررات التي درسها الخريج، وذلك من المستوى الأول تمشياً مع مبدأ تكافؤ الفرص وبشروط قبول يقترحها مجلس الكلية.

## مادة (11) متطلبات التخرج

متطلبات التخرج لنيل درجة البكالوريوس فى العلوم هى إجتياز الطالب بنجاح 136 ساعة معتمدة علي الأقل توزع كما يلى:-

**(أ)** متطلبات الجامعة: مقررات ثقافية وعلمية عامة بواقع 8 ساعات معتمدة يختارها الطالب من المقررات المطروحة من قبل الجامعة والكلية منها:

- أربعة ساعات إجبارية هى اللغة الإنجليزية للعلوم – تكنولوجيا المعلومات.
- أربعة ساعات اختيارية وتضم المقررات التالية: (مهارات الاتصال والعرض الفعال – مهارات التفكير – التخطيط الاستراتيجي – الولاء والانتماء والمواطنة - تاريخ وفلسفة العلوم – أخلاقيات مزاولة المهنة – الابتكار وريادة الأعمال - الأمان المعملى – أساليب وكتابة البحث العلمي – الثقافة البيئية والتغيرات المناخية - كتابة ونشر البحوث العلمية - التنوع الحيوى والتنمية المستدامة – أدارة المشروعات الصغيرة)، على أن يحدد مجلس الكلية في بداية كل فصل دراسي بعض المواد الاختيارية التي يختار الطالب من بينها. كما يجوز لمجلس الكلية طرح مقررات إختيارية أخرى تخدم العملية التعليمية في حينها.

**(ب)** متطلبات الكلية: مقررات علوم أساسية مساعدة أو مساندة لفهم التخصص: 28 ساعة إجبارية تشارك فى تقديمها كل أقسام الكلية. ويتضمن الجدول التالى توزيع مقررات العلوم الأساسية للمستوى الأول على الشعب الثلاثه.

جدول (5)

| شعبة العلوم الطبيعية | | | | | |
|---|---|---|---|---|---|
| رياضيات | فيزياء | كيمياء | حاسب | بيولوجي | |
| 8 ساعات | 6 ساعات | 6 ساعات | 4 ساعات | 4 ساعات | |
| شعبة العلوم البيولوجية | | | | | |
| نبات | حيوان | كيمياء | فيزياء | رياضيات | حاسب |
| 6 ساعات | 6 ساعات | 6 ساعات | 4 ساعات | 3 ساعات | 3 ساعات |
| شعبة العلوم الجيولوجية | | | | | |
| جيولوجيا | فيزياء | كيمياء | بيولوجي | رياضيات | حاسب |
| 6 ساعات | 6 ساعات | 6 ساعات | 4 ساعات | 3 ساعات | 3 ساعات |

(ج) متطلبات التخصص المنفرد: 90 ساعة معتمدة، توزع بين مقررات إجبارية (لا غنى عنها لاستيفاء مواصفات الخريج) ومقررات اختيارية من قائمة المقررات النظرية والعملية والتطبيقية.

(د) متطلبات التخصص المزدوج: 45 ساعة معتمدة لكلا من التخصصين، توزع بين مقررات إجبارية (لا غنى عنها لاستيفاء مواصفات الخريج) ومقررات اختيارية من قائمة المقررات النظرية والعملية والتطبيقية

(هـ) مقررات اختيارية حرة: 6 ساعات معتمدة من خارج مقررات التخصص.

(و) 2 ساعتين معتمدة مشروع تخرج: عن كتابة وشرح مقال مرجعى أوتنفيذ مشروع تخرج بحثي فى التخصص المنفرد أو المزدوج بإشراف أحد أعضاء هيئة التدريس، ويكون متصل وممتد على فصلين دراسيين.

(ز) 2 ساعتين دراسات تطبيقية وميدانية لمدة ثمانية أسابيع داخل مؤسسات إنتاجية أو أحد المراكز البحثية أو الأقسام العلمية بالجامعة التى يدرس بها الطالب أو جامعة أخرى.

مجموع الساعات = 90 ساعة تخصص منفرد أو 45 ساعة تخصص مزدوج + 8 ساعات متطلبات الجامعة + 28 ساعة متطلبات الكلية + 6 ساعات مقررات حرة + 2 ساعة مشروع تخرج + 2 ساعة دراسات ميدانية = 136 ساعة معتمدة.

(ح) يعتبر مقرر القضايا المجتمعية متطلب تخرج، ولا يدخل ضمن المعدل الفصلي أو المعدل التراكمي للطالب.

ويلخص الجدول التالى توزيع الساعات المعتمدة كمتطلبات التخرج لنيل درجة البكالوريوس فى العلوم وعدد الساعات الاجبارية والاختيارية لكل متطلب:

جدول (6)

| م | المتطلب | عدد الساعات | | | تعريف بالمتطلب | النسبة المئوية |
|---|---|---|---|---|---|---|
| | | إجبارى | إختيارى | مجموع | | |
| 1 | متطلبات الجامعة | 4 | 4 | 8 | فى المستوى الأول غالبا | 5.88 |
| 2 | متطلبات الكلية | 28 | -- | 28 | فى المستوى الأول غالبا | 20.59 |
| 3 | متطلبات التخصص المنفرد | 62 | 28 | 90 | يبدأ الطالب دراستها اعتبارا من المستوى الثانى | 66.18 |
| 4 | متطلبات التخصص المزدوج | 31 | 14 | 45 | يبدأ الطالب دراستها اعتبارا من المستوى الثانى | 33.09 |
| 5 | المقرارات الحره | | 6 | 6 | يبدأ الطالب دراستها اعتبارا من المستوى الثانى | 4.41 |
| 6 | دراسات ميدانية | 2 | -- | 2 | دراسات تطبيقية 8 أسابيع بعد المستوى الثالث | 1.47 |
| 7 | مشروع تخرج | 2 | -- | 2 | مقال أو بحث معملى | 1.47 |

## مادة (12) النظام الكودى للمقررات الدراسية

رقمت المقررات المبينة بجداول البرامج المختلفة على النحو التالي:

- متطلبات الجامعة والكلية ومقررات المستوى الأول من 101 إلى 199
- مقررات المستوى الثاني من 201 إلى 299
- مقررات المستوى الثالث من 301 إلى 399
- مقررات المستوى الربع من 401 إلى 499

المقررات ذات الأرقام الفردية تعرض عادة في الفصل الدراسي الأول أما المقررات ذات الأرقام الزوجية فتعرض عادة في الفصل الدراسي الثاني، وتسبق أرقام المقررات حروف تعني التخصص الذي يتبعه هذا المقرر، ويجوز للجنة شئون التعليم والطلاب وبناء على اقتراح الأقسام العلمية عرض مقرر في أكثر من فصل دراسي أو في غير موعده.

## مادة (13) التسجيل الأكاديمى

أ . يتابع وكيل الكلية لشئون التعليم والطلاب تحت إشراف عميد الكلية تنفيذ قواعد التسجيل وإجراءاته وإعداد القوائم لكل من المجموعات الدراسية والجدول الدراسى وتجهيز بطاقات المقررات للطلاب وهى عبارة عن البطاقات المنفردة لكل مقرر

بالإضافة إلى البطاقات الإجمالية لكل طالب، على أن تسجل البيانات الأكاديمية فى سجلات خاصة معتمدة، ويتم الإنتهاء من تسجيل الطلاب فى الأسبوع الأول من بدء الفصل الدراسى.

ب . يجوز للطالب الذى لم يتمكن من التسجيل لأسباب قهرية تقرها لجنة شئون التعليم والطلاب ويوافق عليها السيد الأستاذ الدكتور / عميد الكلية أن يسجل متأخرا خلال الفترة الإضافية للتسجيل (الأسبوع الثانى).

**مادة (14) الإرشاد الأكاديمى**

تقوم الأقسام بتخصيص مرشد أكاديمى لكل طالب مهمته توجيه الطالب دراسيا ومساعدته على إختيار المواد الدراسية مع تحديد عدد الساعات التى يسجل فيها وفقا لظروفه وقدراته وإستعداداته، ومساعدته على حل المشكلات التى قد تعترضه أثناء الدراسة، وتخصص بطاقة لكل طالب يسجل فيها كافة البيانات اللازمة عنه والنتائج التي يحصل عليها، كما يقوم بمراجعة المواد التى يسجل فيها الطالب في كل فصل دراسي حتى تخرجه من الكلية (السجل الأكاديمي للطالب).

**مادة (15) العبء الدراسى**

- العبء الدراسي هو عدد الساعات المعتمدة التي يسجلها الطالب للفصل الدراسي الواحد ويقع فيما بين 12 إلى 19 ساعة معتمدة.
- يجوز للطالب المتفوق الحاصل على تقدير ممتاز (معدل تراكمى = 3.667 على الأقل) بعد المستوى الأول - أن يسجل 20 ساعة معتمدة فى الفصل الدراسى الواحد وبحد أقصى 4 مرات طوال فترة الدراسة.
- لا يسمح للطالب بالتسجيل في أي مقرر ما لم يكن مستوفيا لمتطلبات ذلك المقرر، على أنه يجوز السماح لطالب فصل التخرج بالتسجيل في مقرر ما ومتطلبه السابق الذي لم ينجح فيه.
- يجوز لمجلس الكلية زيادة الحد الأقصى للعبء الدراسى إلى 22 ساعة معتمدة لمرة واحدة للطالب الذي إجتاز 100 ساعة معتمدة بغرض إتمام متطلبات التخرج اللازمة له.
- يجوز للطالب التسجيل في المقررات الدراسية الحرة من خارج برنامجه الدراسي ومطروحة من القسم أو الكلية أو الجامعة طالما أنها تخدم تخصصه، وذلك بناء على اقتراح المرشد الأكاديمي وموافقة مجلس القسم على أن تدخل هذه المقررات في حساب المعدل التراكمي بحد أقصى 6 ساعات طول فترة دراسته.
- فيما عدا الطلبة المتوقع تخرجهم، يعتبر تسجيل الطالب لاغيا إذا قل عدد الساعات المعتمدة المسجلة عن 12 ساعة معتمدة بعد نهاية الأسبوع الأول من بدء الدراسة، ويجوز لمجلس الكلية السماح للطلاب بالتسجيل فيما لا يقل عن 9 ساعات معتمدة خلال الأسبوع الأول من بدء الدراسة، حسب شروط أو ظروف قهرية يقبلها المجلس وذلك فيما لا يزيد عن فصلين دراسيين طوال فترة قيد الطالب بالكلية.

**مادة (16) التسجيل**

- تعلن إدارة شئون التعليم والطلاب عن مواعيد التسجيل لكل فصل دراسي باستخدام وسائل الإعلام المناسبة والتي تكون غالبا خلال الأسبوع الأول من بدء الدراسة
- في الحالات التي يتخلف فيها الطالب عن سداد رسوم التسجيل أثناء فترة التسجيل المعلنة يسدد رسوم تأخير يحددها مجلس الكلية بالإضافة إلى رسم التسجيل العادي.
- يجوز للطالب الذي لم يتمكن من التسجيل لأعذار تقبلها لجنة شئون التعليم والطلاب ويوافق عليها مجلس الكلية أن يسجل تسجيلا متأخرا خلال الأسبوع الثاني من بدء الدراسة مع تسديد رسم التأخير المشار إليه في البند السابق.
- إذا قل عدد الطلبة المسجلين في أي مقرر اختياري عن 7 طلاب يغلق المقرر؛ إلا لأسباب تقبلها لجنة شئون التعليم والطلاب وعلى الطلبة اختيار مقررا بديلا.

**مادة (17) الإضافة، الحذف، الانسحاب وتعديل المسار**

أ. يجوز للطالب بعد موافقة المرشد الأكاديمي أن يضيف أو يحذف مقررا أو أكثر حتى نهاية الأسبوع الثانى فقط من الدراسة وذلك بما لايخل بالعبء الدراسى المنصوص عليه فى المادة (15) من هذه اللائحة

ب . يجوز أن ينسحب الطالب من دراسة أى مقرر حتى نهاية الأسبوع الثامن من بدء التسجيل للفصل الدراسى وذلك بموافقة المرشد الأكاديمى، الانسحاب من أربعة مقررات دراسية كحد أقصى طيلة مدة بقاؤه في الكلية، بحد أقصى مقررين في الفصل الدراسي الواحد. ويسجل هذا المقرر فى سجل الطالب الأكاديمى بتقدير (منسحب). وتعرض حالات الإنسحاب الإضطرارية بعد هذا الميعاد على لجنة شئون التعليم والطلاب للنظر فيها وإقرارها من مجلس الكلية على ألا يخل الإنسحاب بالعبء الدراسى للطالب وفقا للمادة (15) من هذه اللائحة.

جـ- يجوز للطالب تعديل مسار تخصصه بشرط إستكمال متطلبات التخصص المرغوب فيه مع عدم إحتساب الساعات المعتمدة التى إجتازها الطالب من قبل ولا تقع فى مجال متطلبات التخصص الجديد. وذلك بعد موافقة المرشد الأكاديمى ولجنة شئون التعليم والطلاب ومجلس الكلية على هذا التعديل.

**مادة (18) إعادة المقرر**

- إذا ما أعاد الطالب مقررا ما للتحسين بعد نجاحه فيه وكان الطالب متعثراً وعلى قائمة الإنذار (مراقب أكاديمياً) وفقا للمادة (26)، يحسب له أعلى تقدير حصل عليه في هذا المقرر ويضاف في سجله الأكاديمي.
- في حالة إعادة الطالب دراسة مقرر رسب فيه، يكون أقصى تقدير يحتسب له هو تقدير +C، وإذا تكرر رسوب الطالب في مقرر ما، يكتفي بإحتساب الرسوب مرة واحدة في معدله التراكمي مع تسجيل عدد المرات التي أدى فيها امتحان هذا المقرر في سجله الأكاديمي.
- تحسب الساعات المعتمدة للمقرر الذي يعيد الطالب دراسته بسبب الرسوب أو لأي سبب آخر مرة واحدة فقط ضمن عدد الساعات المطلوبة للتخرج.
- لا يجوز للطالب أن يعيد دراسة مقرر سبق له دراسته والنجاح فيه بتقدير (C) أو أكثر ما لم يكن على قائمة الإنذار.

**مادة (19) قواعد إعادة القيد والفصل والأعذار المقبولة لعدم تأدية الامتحان**

يخضع الطلاب للنظام العام للجامعة والكلية، وتطبق عليهم قواعد الفصل من الجامعة وفرص إعادة القيد والأعذار المقبولة لعدم تأدية الإمتحان، ووقف القيد الدراسى وكافة القواعد والقوانين واللوائح الخاصة بشأن تأديب الطلاب والمنصوص عليها فى قانون تنظيم الجامعات ولائحته التنفيذية.

**مادة (20) المواظبة**

يتولى أستاذ المقرر ومساعدوه تسجيل حضور الطلاب فى بدء كل محاضرة نظرية أوفترة عملية فى سجل معد لذلك من قبل شئون الطلاب مع مراعاة ما يلى:-

(أ) الحد المسموح به لغياب الطالب بدون عذر مقبول هو 25% من مجموع ساعات المقرر، ويتولى أستاذ المقررإخطار إدارة شئون الطلاب لإنذار الطالب مرتين؛ الإنذار الأول بعد تجاوز الطالب نسبة غياب 10% من ساعات المقرر والإنذار الثانى

بعد تجاوزه نسبة غياب 25%، وبعد ذلك تعرض حالة الطالب على لجنة شئون التعليم والطلاب ومجلس الكلية لحرمانه من استكمال دراسة المقرر أو قبول عذره واعتباره غائب بعذر.

(ب) إذا زادت نسبة الغياب عن 25% فى المقرر، وكان غياب الطالب بدون عذر تقبله لجنة شئون التعليم والطلاب ويعتمده مجلس الكلية، يسجل للطالب تقدير "محروم" فى المقرر وتدخل نتيجة تقدير "محروم" فى حساب المعدل الفصلى والمعدل التراكمى العام للطالب.

(ج) إذا زادت نسبة الغياب عن 25% ، وكان غياب الطالب بعذر تقبله لجنة شئون التعليم والطلاب ويعتمده مجلس الكلية يسجل للطالب تقدير "غائب بعذر" ولا تدخل نتيجة التقدير "غائب بعذر" فى المعدل الفصلى أو المعدل التراكمى العام للطالب.

## مادة (21) التأجيل وعدم الاكتمال وتكرار الرسوب

(أ) تؤجل نتيجة مقرر من المقررات لعدم دخول الطالب الامتحان النهائى لعذر مقبول ولمدة لا تتجاوز فصل دراسى واحد، ويعطى الطالب فى هذه الحالة تقدير مؤجل (م ج Postponed,) ويستكمل الطالب متطلبات المقرر بحضور الإمتحان النهائى للمقرر خلال الأسبوع الأول من الفصل الدراسى التالى مباشرة، وإذا لم يؤدى الطالب الاختبار حينئذ يعتبر راسب ويرصد له تقدير راسب (ر).

(ب) إذا لم تستكمل متطلبات مقرر ما لأسباب ترجع للكلية، يعطى الطالب فى هذه الحالة تقدير غير مكتمل (غ م Incomplete Inc,) وعند اكتمال متطلبات المقرر في الفصول الدراسية التالية ترفع نتيجته على النظام.

(ج) إذا تكرر رسوب الطالب فى مقرر ما، تسجل عدد المرات التى درس فيها هذا المقرر فى سجله الأكاديمى، وتحسب له درجة النجاح التى حصل عليها عند إجتياز الإمتحان.

## مادة (22) التقويم والدرجات

(أ) يتم تقييم إمتحان كل مقرر من (100) مائة درجة ويتم تقييم الطالب فى المقررات النظرية والعملية بناءً على العناصر الواردة فى الجدول التالى:-

**جدول (7)**

| نوع الامتحان | المقرر (نظرى وعملى) | المقرر (نظرى فقط) | المقرر (عملى فقط) |
|---|---|---|---|
| إمتحان نظرى نهائي | %50 | %60 | — |
| إمتحان عملى نهائي | %20 | — | %50 |
| إمتحان شفوى | %10 | %10 | %10 |
| إمتحان نصف فصلى نظرى | %10 | %20 | — |
| إمتحان نصف فصلى عملي | — | — | %20 |
| تقييم مستمر–واجبات وتطبيقات – وتكليفات | %10 | %10 | %20 |
| مجموع درجات الإمتحانات | 100 | 100 | 100 |

(ب) بالنسبة للمقال المرجعي أو مشروع التخرج بالمستوى الرابع والمخصص له ساعتين معتمدة توزع درجاته بواقع 40% على جودة وتقييم المقال أو المشروع، و20% الأنشطة المختلفة التي يقوم بها الطالب خلال إعداده للمقال أو للمشروع، و10% الالتزام بمراجعة المشرف دورياً، و30% للمناقشة الشفهية للمقال أو للمشروع مع لجنة التقييم.

(ج) بالنسبة للدراسات الميدانية يخصص لها ساعتين معتمدة توزع درجاته بواقع 40% على جودة تقرير الطالب، و40% لتقرير مشرف التدريب و20% للمناقشة.

(د) تتم الإمتحانات الشفهية والتحريرية بواسطة لجنة لا تقل عن اثنين من أعضاء هيئة التدريس من بينهم القائم بتدريس المقرر، ويعتبر الطالب الغائب فى الإمتحان التحريرى النهائى غائباً فى المقرر، ويعتبر الطالب الذي يحصل على درجة أقل من 40% من درجة الإمتحان النهائى راسباً فى المقرر مهما كان مجموع درجاته في الأعمال الفصلية خلال الفصل الدراسي.

**مادة (23) الدلالات الرقمية والرمزية للدرجات والتقديرات**

(أ) تقدر الدرجات التى يحصل عليها الطالب فى كل مقرر دراسى على النحو التالى:-

**جدول (8)**

| التقدير Grade | | رمز التقدير | | المكافئ الرقمى بالنقاط من 4 | الدرجة المئوية |
|---|---|---|---|---|---|
| Excellent | ممتاز | $A^+$ | أ+ | 4.000 | 100 >- 90 |
| Excellent | ممتاز | A | أ | 3.667 | 90 >- 85 |
| Very Good | جيد جدا | $B^+$ | ب+ | 3.333 | 85 >- 80 |
| Very Good | جيد جدا | B | ب | 3.000 | 80 >- 75 |
| Good | جيد | $C^+$ | ج+ | 2.667 | 75 >- 70 |
| Good | جيد | C | ج | 2.333 | 70 >- 65 |
| Pass | مقبول | D | ل | 2.000 | 65 >- 60 |
| Fail | راسب | F | ر | 0.000 | 60 >- 0 |
| Postponed | مؤجل | P | م ج | 0.000 | 60 >- 0 |
| Incomplete | غير مكتمل | IC | غ م | 0.000 | 60 >- 0 |
| Denial | محروم | DN | م | 0.000 | 60 >- 0 |
| Withdrawn | منسحب | W | م ن | 0.000 | 60 >- 0 |

**مادة (24) المعدل الفصل والمعدل التراكمى**

(أ) المعدل الفصلى (GPA) Grade Point Average هو متوسط ما يحصل عليه الطالب من نقاط فى فصل دراسى واحد ويقرب إلى ثلاث ارقام عشرية فقط، ويحسب كما يلى :

$$\text{المعدل الفصلى} = \frac{\text{مجموع حاصل ضرب نقاط كل مقرر فصلى} \times \text{عدد ساعاته المعتمدة}}{\text{حاصل جمع الساعات المعتمدة لهذه المقررات فى الفصل}}$$

(ب) المعدل التراكمى (CGPA) Cumulative Grade Point Average: هو متوسط ما يحصل عليه الطالب من نقاط خلال كل الفصول الدراسية التى درسها ويقرب إلى ثلاثة أرقام عشرية فقط، ويبين فى شهادة الطالب النقاط المكتسبة والنسبة المئوية إلى جانب التقديرالعام للتخرج ويحسب المعدل التراكمى كما يلى:

المعدل التراكمى العام = مجموع حاصل ضرب نقاط كل مقررتم دراسته × عدد ساعاته المعتمدة / حاصل جمع الساعات المعتمدة لهذه المقررات التى تم دراستها

(ج) النسبة المئوية التقريبية للمعدل التراكمي العام:

**النسبة المئوية = الحد الأدنى لنسبة التقدير + (المعدل التراكمي للطالب – الحد الأدنى للمعدل التراكمي للتقدير) × معامل التحويل.**

معامل التحويل (Transformation Coefficient) = الحد الأقصى لنسبة التقدير – الحد الأدنى لنسبة التقدير / الحد الأقصى للمعدل التراكمي للتقدير – الحد الأدنى للمعدل التراكمي للتقدير

- تقدير عام مقبول

النسبة المئوية = 15 × (CGPA – 2.000) + 60

- تقدير عام جيد

النسبة المئوية = 15 × (CGPA – 2.333) + 65

- تقدير عام جيد جدا

النسبة المئوية = 15 × (CGPA – 3.000) + 75

- تقدير عام ممتاز

النسبة المئوية = 45 × (CGPA – 3.667) + 85

(د) مثال لحساب المعدل الفصلى والمعدل التراكمى :

| أ- الفصل الدراسى الأول | | | | | | |
|---|---|---|---|---|---|---|
| المقرر | عدد الساعات | الدرجة | النقاط | وزن النقاط | التقدير | الرمز |
| Uni101 | 3 | 73 | 2.667 | 8.000 | جيد | $C^+$ |
| Eng102 | 3 | 66 | 2.333 | 7.000 | جيد | C |
| Chem101 | 3 | 78 | 3.000 | 9.000 | جيد جدا | B |
| Phys101 | 2 | 67 | 2.333 | 4.666 | جيد | C |
| Bot101 | 3 | 82 | 3.333 | 10.000 | جيد جدا | $B^+$ |
| Zoo101 | 3 | 85 | 3.667 | 11.000 | ممتاز | A |
| المجموع | 17 | | | 49.666 | | |
| **معدل الفصل الدراسى الأول** = 49.666 ÷ 17 = 2.922 جيد | | | | | | |

| ب- الفصل الدراسى الثانى | | | | | | |
|---|---|---|---|---|---|---|
| المقرر | عدد الساعات | الدرجة | النقاط | وزن النقاط | التقدير | الرمز |
| CS201 | 3 | 63 | 2.000 | 6.000 | مقبول | D |
| Math201 | 3 | 52 | 0.000 | 0.000 | راسب | F |
| Chem201 | 3 | 68 | 2.333 | 7.000 | جيد | C |

| | | | | | | |
|---|---|---|---|---|---|---|
| Phys201 | 2 | 77 | 3.000 | 6.000 | جيد جدا | B |
| Bot201 | 3 | 88 | 3.667 | 11.000 | ممتاز | $A^+$ |
| Zoo201 | 3 | 84 | 3.333 | 10.000 | جيد جدا | $B^+$ |
| المجموع | 17 | | | 40.000 | | |
| **معدل الفصل الدراسى الثانى** = 40.000 ÷ 17 = 2.353 جيد | | | | | | |

**المعدل التراكمى والتقدير العام** = $\frac{40.000 + 49.666}{34}$ = 89.666 ÷ 34 = 2.637 جيد

**النسبة المئوية للمعدل التراكمى** = 15 × (2.637 – 2.333) + 65 = 69.56 %

## مادة (25) مرتبة الشرف

تمنح مرتبة الشرف للطالب الذي ينهى دراسته بالكلية في مدة لاتزيد عن 8 فصول دراسية أساسية بتقدير ممتاز بحد أدنى 85% من المجموع الكلى للدرجات بما يحقق معدل تراكمى من النقاط قدره **3.667** أو أكثر وبشرط ألا يقل معدله التراكمى فى أى فصل دراسى عن **3.0** (75% من مجموع الدرجات) وألا يكون قد رسب فى أى مقرر دراسى خلال دراسته فى الكلية أو فى الكلية المحول منها إذا كان قد قضى مدة دراسة لا تزيد عن عامين فى كلية أخرى.

## مادة (26) الإنذار والمراقبة الأكاديمية

(أ) إذا حصل الطالب على معدل تراكمى أقل من 2 (60% من الحد الأقصى لمجموع درجات المقررات التى درسها) ينذر إنذاراً أول من مجلس الكلية.

(ب) إذا حصل الطالب على معدل تراكمى أقل من 1.67 بعد نهاية الفصل الدراسي الثاني للمستوى المقيد به الطالب أصبح يعامل معاملة الطالب الباقي للإعادة ويجب عليه إعادة التسجيل فى المقررات الدراسية التي رسب بها حتى يحقق المعدل المطلوب للنجاح في المستوى المقيد به.

(ج) إذا تكرر تدنى المعدل التراكمى للطالب عن 2 لفصل دراسى ثان، ينذر إنذاراً ثان ويعتبر الطالب مراقب أكاديمياً ولا يسمح له بالتسجيل إلا الحد الأدنى للساعات وهو 12 ساعة معتمدة.

(د) لا يحتسب الفصل الصيفي ضمن الفصول الي تمنح فيها إنذارات للطالب حال انخفاض المعدل.

(هـ) الطالب الذي لا يحقق معدل تراكمى 2 أو أكثر عند إتمامه متطلبات التخرج يجب عليه إعادة التسجيل فى عدد من المقررات الدراسية بحد أقصى 12 ساعة معتمدة فى الفصل الدراسي ويحصل على كامل الدرجة فى هذه المقررات حتى يحقق المعدل المطلوب للتخرج، ويحسب له التقدير الأعلى للمقررات التى نجح فيها ويضاف فى سجله الأكاديمى.

## مادة (27) الإنقطاع عن الدراسة وإلغاء القيد والفصل

(أ) يجوز للطالب أن يطلب تأجيل دراسته لمدة لاتزيد عن أربعة فصول دراسية، منفصلة أو متصلة، خلال مدة دراسته بالكلية على أن تقدم طلبات التأجيل فى موعد أقصاه نهاية الأسبوع الخامس من الفصل الدراسى ويكون التأجيل نافذاً بعد أخذ رأى المرشد الأكاديمى ولجنة شئون التعليم والطلاب وموافقة مجلس الكلية ومجلس الجامعة.

(ب) إذا إنقطع الطالب عن الدراسة بالكلية لمدة لاتجاوز فصلين دراسيين لأسباب قهرية وافقت عليها لجنة شئون التعليم والطلاب ومجلس الكلية، يتاح للطالب فرصة أخرى للتسجيل ويستأنف دراسته فى الفصل الدراسى التالى، وتحتسب مدة الإنقطاع ضمن فرص التأجيل المتاحة للطالب.

(ج) يتعرض الطالب للفصل من الكلية طبقاً لعدد مرات الرسوب على النحو التالى:

- يفصل طالب المستوى الأول إذا لم يجتز 30 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال أربعة فصول دراسية رئيسية.
- يفصل طالب المستوى الثانى إذا لم يجتز 64 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال ستة فصول دراسية رئيسية، مع إعطاء الطالب فرصة امتحان من الخارج بعد فصل دراسى سابع بمصروفات يحددها مجلس الكلية ولمرة واحدة.
- يفصل طالب المستوى الثالث إذا لم يجتز 100 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال عشرة فصول دراسية رئيسية، مع اعطاء الطالب فرصة إمتحان من الخارج بعد فصل دراسى حادى عشر بمصروفات يحددها مجلس الكلية ولمرة واحدة.
- يفصل طالب المستوى الرابع إذا لم يجتز 130 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال عشرة فصول دراسية رئيسية، مع إعطاء الطالب فرصة امتحان من الخارج بعد فصل دراسى حادى عشر بمصروفات يحددها مجلس الكلية ولمرة واحدة.

**مادة (28) نظام الإستماع**

يجوز لمجلس الكلية بعد أخذ رأي مجالس الأقسام العلمية المختصة بأن يقبل طلاب من كليات أو جامعات أخرى كمستمعين لبعض المقررات بالكلية وفقا لقواعد ورسوم يحددها المجلس، وتمنح الكلية شهادة باجتياز هذه المقررات مبينا فيها تقدير الطالب ولا يتبع ذلك منح أي درجة جامعية.

**مادة (29) تعديل المحتوي العلمي للمقررات الدراسية**

يجوز لمجلس الكلية بناءا على اقتراح مجالس الاقسام المختصة تعديل المحتوى العلمى لأي مقرر من المقررات الدراسية.

**مادة (30) حذف أو إضافة أو تعديل طرح المقررات الدراسية**

يجوز لمجلس الكلية بعد أخذ رأى مجالس الأقسام العلمية المختصة أن يقترح تعديل أو حذف أو إضافة برامج دراسية وأن يقترح تعديل أو حذف أو إضافة مقررات بالبرامج الدراسية القائمة أو يغير موعد طرح مقرر من فصل دراسى الى آخر وأن يقترح تعديل أو حذف أو إضافة مواد إلى مواد هذه اللائحة وبما لا يتعارض مع المعايير الأكاديمية القومية وقانون تنظيم الجامعات. ويتم إقرارها بعد العرض على المجلس الأعلى للجامعات.

**مادة (31) التعليم الهجين**

يجوز لمجلس الكلية في حالة الظروف الطارئة التي تتطلب ذلك وبعد اخذ راى مجلس القسم المختص وحسب طبيعه المقررات الدراسية ان يقوم بالاتى:

1- يقرر تدريس مقرر أو أكثر بنمط التعليم الهجين بحيث تكون الدراسة في المقرر بنسبة 60% : 70 % وجها لوجه وباقى النسبة بنظام التعليم عن بُعد أو بأي نسبة أخرى.

2- يقرر عقد الامتحان إلكترونياً أو بتقديم ورقة بحثية في مقرر أو أكثر. كما يجوز عقد الامتحان في كل المقرر أو جزء منه بما يسمح بتصحيحه إلكترونياً أو تغيير زمن الامتحان بما يتوافق مع طبيعته.

**مادة (32) تطبيق أحكام قانون تنظيم الجامعات**

تطبق أحكام قانون تنظيم الجامعات ولائحته التنفيذية وأى تعديلات تطرأ عليه فيما لم يرد فيه نص فى هذه اللآئحة.

**مادة (33) سريان اللائحة**

تسرى أحكام هذه اللآئحة مع بداية العام الجامعى التالى لإقرارها بقرار وزارى من وزير التعليم العالى وتطبق فور سريانها على الطلاب المستجدين بالمستوى الاول.اما الطلاب الباقون للأعاده بالمستوى الأول والطلاب المنقولون للمستويات الأعلى تطبق عليهم احكام اللائحه الداخلية التى التحقوا فى ظلها وذلك حتى تخرجهم.

# اللائحة الداخلية

# لكلية العلوم. جامعة دمنهور

# للعمل بنظام الساعات المعتمدة

## الفصل الثاني

## السنة التأسيسية

السنة التأسيسية – Foundation Year

شعبة العلوم الطبيعية – Physical Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | .Prereq | Compulsory | .Lect | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Math111 | — | Calculus (1) | 2 | 1 | 2 |
| CS111 | — | Computer Applications | 1 | 2 | 2 |
| Math151 | — | Mechanics (1) | 2 | 1 | 2 |
| Phys111 | — | Physics (1) | 2 | 3 | 3 |
| Bot111 | — | General Botany | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة العلوم الطبيعية – Physical Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Math112 | — | Calculus (2) | 2 | 1 | 2 |
| Math152 | — | Mechanics (2) | 2 | 1 | 2 |
| CS112 | — | Computer Programming (1) | 1 | 3 | 2 |
| Phys112 | — | Physics (2) | 2 | 3 | 3 |
| Zoo111 | — | General Zoology | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Zoo101 | — | General Zoology (1) | 2 | 3 | 3 |
| Bot101 | — | General Botany(1) | 2 | 3 | 3 |
| Math101 | — | General Mathematics | 2 | 3 | 3 |
| Phys101 | — | General Physics (1) | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| Zoo102 | — | General Zoology (2) | 2 | 3 | 3 |
| Bot102 | — | General Botany (2) | 2 | 3 | 3 |
| Phys102 | — | General Physics (2) | 1 | 3 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة علوم الأرض – Earth Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Geo101 | — | General Geology (1) | 1 | 3 | 2 |
| Bot111 | — | General Botany | 1 | 3 | 2 |
| Math101 | — | General Mathematics | 2 | 3 | 3 |
| Phys111 | — | Physics (1) | 2 | 3 | 3 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 17 |

السنة التأسيسية – Foundation Year

شعبة علوم الأرض – Earth Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
|---|---|---|---|---|---|
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Goe102 | — | General Geology (2) | 1 | 3 | 2 |
| Geo104 | — | Historical Geology | 1 | 3 | 2 |
| Phys112 | — | Physics (2) | 2 | 3 | 3 |
| Zoo111 | — | General Zoology | 1 | 3 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 19 |

# اللائحة الداخلية

# لكلية العلوم. جامعة دمنهور

# للعمل بنظام الساعات المعتمدة

## الفصل الثالث

## البرامج والخطط الدراسية

# قسم الرياضيات وعلوم الحاسب

## الرياضيات (تخصص منفرد)

| | |
|---|---|
| Program Title | Mathematics |
| Program Type | Single (B.Sc.) |
| Department(s) | Mathematics and Computer Science |

Natural Science Section –

شعبة العلوم الطبيعية

Department of Mathematics and Computer Science – قسم الرياضيات وعلوم الحاسب

Mathematics – Single –(تخصص منفرد) الرياضيات

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 -Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | | Compulsory | Lect. | P/T | Total |
| Math211 | Math112 | Mathematical Analysis (1) | 2 | 1 | 2 |
| Math213 | ..... | Advanced Algebra and Fundamental of Mathematics | 2 | 1 | 2 |
| Math215 | ..... | Theory of Matrices | 2 | 1 | 2 |
| Math217 | Math112 | Ordinary Differential Equations | 2 | 1 | 2 |
| Math219 | ..... | Mathematical Software and Programming | 1 | 3 | 2 |
| Math251 | Math152 | Mechanics (3) | 2 | 1 | 2 |
| Stat209 | ..... | Introduction to Probability and Statistics | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| Math231 | ..... | Theory of Numbers | 2 | 1 | 2 |
| Math233 | ..... | History of Mathematics | 2 | 1 | 2 |
| Math253 | Math111 | Vectors Analysis | 2 | 1 | 2 |
| Total | | | | | 16 |

Natural Science Section -شعبة العلوم الطبيعية

Department of Mathematics and Computer Science – قسم الرياضيات وعلوم الحاسب

Mathematics – Single –(تخصص منفرد) الرياضيات

Level Two - Second Semester –المستوي الثاني – الفصل الدراسي الثاني

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Math212 | Math211 | Mathematical Analysis (2) | 2 | 1 | 2 |
| Math214 | ..... | Analytic Geometry (Plane and Solid Geometry) | 2 | 1 | 2 |
| Math216 | Math215 | Linear Algebra | 2 | 1 | 2 |
| Math218 | ..... | Mathematical Logic (1) | 2 | 1 | 2 |
| Math252 | Math251 | Dynamics of Rigid Body | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Stat212 | ..... | Introduction to Mathematical Statistics | 2 | 1 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| Math232 | ..... | Biomathematics | 2 | 1 | 2 |
| Math234 | Math117 | Difference Equations | 2 | 1 | 2 |
| Math236 | ..... | Mathematical Modeling | 2 | 1 | 2 |
| Math254 | Math253 | Tensor Analysis | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الرياضيات (تخصص منفرد)– Mathematics – Single

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Math311 | Math212 | Real Analysis | 2 | 1 | 2 |
| Math313 | Math112 | Numerical Analysis (1) | 2 | 1 | 2 |
| Math315 | Math217 | Special Functions | 2 | 1 | 2 |
| Math351 | Math252 | Analytical Dynamics | 2 | 1 | 2 |
| Math353 | Math251 | Fluid Dynamics (1) | 2 | 1 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules: | | | | | |
| Math331 | Math217 | Fourier Analysis and Transforms | 2 | 1 | 2 |
| Math333 | Math216 | Operations Research | 2 | 1 | 2 |
| Math355 | Math251 | Electromagnetism | 2 | 1 | 2 |
| Math357 | ..... | Methods of Applied Mathematics | 2 | 1 | 2 |
| Stat301 | ..... | Mathematical Statistics | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الرياضيات (تخصص منفرد)– Mathematics – Single

المستوي الثالث – الفصل الدراسي الثاني– Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Math312 | Math212 | Complex Analysis (1) | 2 | 1 | 2 |
| Math314 | Math217 | Partial Differential Equations | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Math316 | Math213 | Theory of Groups | 2 | 1 | 2 |
| Math352 | Math251 | Theory of Linear Elasticity | 2 | 1 | 2 |
| Math354 | Math351 | Quantum Mechanics (1) | 2 | 1 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules: | | | | | |
| Math332 | Math217 | Introduction to Chaos | 2 | 1 | 2 |
| Math334 | Math217 | Numerical Optimization | 2 | 1 | 2 |
| Math356 | Math251 | Electrodynamics | 2 | 1 | 2 |
| Math358 | ..... | Selected Topics in Applied Mathematics | 2 | 1 | 2 |
| Stat311 | Stat212 | Statistical Analysis | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الرياضيات (تخصص منفرد)– Mathematics – Single

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4- Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Math411 | Math311 | Functional Analysis (1) | 2 | 1 | 2 |
| Math413 | Math217 | Integral Equations | 2 | 1 | 2 |
| Math415 | Math214 | Differential Geometry | 2 | 1 | 2 |
| Math451 | Math351 | Special Theory of Relativity | 2 | 1 | 2 |
| Math490 | ..... | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules: | | | | | |
| Math431 | ..... | Selected Topics in Pure Mathematics | 2 | 1 | 2 |
| Math433 | Math218 | Mathematical Logic (2) | 2 | 1 | 2 |
| Math435 | Math313 | Numerical Analysis (2) | 2 | 1 | 2 |
| Math453 | Math352 | Advanced Theories of Elasticity | 2 | 1 | 2 |
| Math455 | Math354 | Quantum Mechanics (2) | 2 | 1 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الرياضيات (تخصص منفرد)– Mathematics – Single

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4- Semester 2 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | P/T | Total |
|---|---|---|---|---|---|
| Math412 | Math311 | General Topology | 2 | 1 | 2 |
| Math414 | Math316 | Rings and Fields | 2 | 1 | 2 |
| Math452 | ..... | Statistical Mechanics | 2 | 1 | 2 |
| Math454 | Math353 | Fluid Dynamics (2) | 2 | 1 | 2 |
| Math490 | ..... | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| Math432 | Math411 | Functional Analysis (2) | 2 | 1 | 2 |
| Math434 | Math311 | Measure Theory | 2 | 1 | 2 |
| Math436 | Math312 | Complex Analysis (2) | 2 | 1 | 2 |
| Math456 | Math451 | General Theory of Relativity | 2 | 1 | 2 |
| Total | | | | | 13 |

# قسم الرياضيات وعلوم الحاسب

## علوم الحاسب (تخصص منفرد)

| | |
|---|---|
| Program Title | Computer Science |
| Program Type | Single |
| Department(s) | Mathematics and Computer Science |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب (تخصص منفرد) – Computer Science – Single

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 -Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS211 | CS112 | Computer Programming (2) | 2 | 1 | 2 |
| CS213 | CS111 | Discrete Structures | 2 | 3 | 3 |
| CS219 | CS112 | Introduction to Object Oriented Programming | 2 | 1 | 2 |
| CS221 | CS112 | Introduction to Software Engineering | 2 | 1 | 2 |
| Stat209 | ..... | Introduction to Probability and Statistics | 2 | 1 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| CS217 | CS112 | Introduction to Database Systems | 2 | 1 | 2 |
| CS215 | ..... | Computer and Information Security | 2 | 1 | 2 |
| CS223 | ..... | Introduction to Information Systems | 2 | 1 | 2 |
| Math231 | ..... | Theory of Numbers | 2 | 1 | 2 |
| Math217 | Math112 | Ordinary Differential Equations | 2 | 1 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب (تخصص منفرد) – Computer Science – Single

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS212 | CS211 | Advanced Programming | 2 | 3 | 3 |
| CS214 | CS213 | Theory of computation | 2 | 1 | 2 |
| CS216 | CS211 | Artificial Intelligence | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| CS218 | CS213 | Introduction to Image Processing | 2 | 3 | 3 |
| Math272 | | Matrices and Linear Algebra | 2 | 1 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| CS220 | | Computer Programming (Practical) | – | 4 | 2 |
| CS222 | CS219 | Concepts of Programming Languages | 2 | 1 | 2 |
| CS224 | CS112 | Human-Computer Interaction | 2 | 1 | 2 |
| Math218 | | Mathematical Logic (1) | 2 | 1 | 2 |
| Math274 | Math112 | Mathematical Analysis | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب (تخصص منفرد) – Computer Science – Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS311 | CS213+CS211 | Data Structures and File Processing | 2 | 3 | 3 |
| CS313 | CS212+CS214 | Introduction to Algorithms Analysis | 2 | 1 | 2 |
| CS321 | CS216 | Intelligent Machines | 2 | 1 | 2 |
| CS323 | CS221 | Selected topics in Software Design and Engineering | 2 | 1 | 2 |
| Math313 | Math112 | Numerical Analysis (1) | 2 | 1 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| CS315 | CS216 | Machine Learning | 2 | 1 | 2 |
| CS317 | CS211 | Online Multimedia and Information Access | 2 | 1 | 2 |
| CS319 | CS212 | Object Oriented Design | 2 | 1 | 2 |
| Math333 | Math272 | Operations Research | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب (تخصص منفرد) – Computer Science – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 – Semester 2 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | P/T | Total |
|---|---|---|---|---|---|
| CS312 | CS213 | Digital Circuits | 2 | 1 | 2 |
| CS314 | CS214 | Operating Systems | 2 | 1 | 2 |
| CS320 | CS313 | Advanced Algorithms | 2 | 1 | 2 |
| CS322 | CS221 | Software Testing and Quality | 2 | 3 | 3 |
| CS324 | CS219 | System Programming | 2 | 1 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| CS316 | CS216 | Introduction to Deep Learning | 2 | 1 | 2 |
| CS318 | CS311 | Information Storage and Retrieval | 2 | 1 | 2 |
| CS326 | CS313 | Algorithms in Bioinformatics | 2 | 1 | 2 |
| Math316 | Math272 | Theory of Groups | 2 | 1 | 2 |
| Math334 | Math272 | Numerical Optimization | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب (تخصص منفرد) – Computer Science – Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS411 | CS311 | Database Management Systems | 2 | 3 | 3 |
| CS413 | CS312 | Computer Architecture and Organization | 2 | 3 | 3 |
| CS419 | CS313 | System Simulation and Modeling | 3 | 1 | 3 |
| CS490 | ..... | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| CS415 | -- | Selected topic in computer science | 2 | 1 | 2 |
| CS417 | CS314 | Parallel Computation | 2 | 1 | 2 |
| CS421 | CS314 | Computer Vision | 2 | 1 | 2 |
| CS423 | CS314 | Advanced Operating Systems | 2 | 1 | 2 |
| Total | | | | | 14 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب (تخصص منفرد) – Computer Science – Single

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS412 | CS314 | Network and Internet Programming | 2 | 3 | 3 |
| CS414 | CS311+CS319 | Data Mining | 2 | 3 | 3 |
| CS420 | CS411 | System Analysis and Design | 2 | 1 | 2 |
| CS490 | ……. | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| CS416 | CS413 | Distributed Systems | 2 | 1 | 2 |
| CS418 | CS411 | Digital Libraries | 2 | 1 | 2 |
| CS422 | CS314 | Advanced Computer Networks | 2 | 1 | 2 |
| CS424 | CS218 | Digital Image Processing | 2 | 1 | 2 |
| Total | | | | | 13 |

# قسم الرياضيات وعلوم الحاسب

## بكالوريوس العلوم في الإحصاء وعلوم البيانات

| | |
|---|---|
| Program | Bsc in Statistics and Data Science |
| Program Type | Single |
| Department(s) | Mathematics and Computer Science |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الإحصاء وعلوم البيانات (تخصص منفرد) – Statistics and Data Science – Single

المستوي الثاني – الفصل الدراسي الأول– Level Two - First Semester

| Level 2 – Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Stat201 | ----- | Fundamentals of Statistics and Probability | 2 | 1 | 2 |
| Stat203 | ------ | Programing with R | 2 | 1 | 2 |
| Math215 | ……. | Theory of Matrices | 2 | 1 | 2 |
| Stat205 | ….. | Data visualization | 2 | 1 | 2 |
| Math211 | Math112 | Mathematical Analysis (1) | 2 | 1 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Stat207 | …… | Statistical Software | 2 | 1 | 2 |
| CS203 | CS111 | Data Security | 2 | 1 | 2 |
| CS205 | CS112 | Introduction to Python Programming | 2 | 1 | 2 |
| Math231 | | Theory of numbers | 2 | 1 | 2 |
| Math213 | | Advanced Algebra and Fundamental of Mathematics | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الإحصاء وعلوم البيانات (تخصص منفرد) – Statistics and Data Science – Single

المستوي الثاني – الفصل الدراسي الثاني– Level Two – Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Stat202 | Stat201 | Regression Analysis | 2 | 1 | 2 |
| Stat204 | Stat201 | Probability Theory (1) | 2 | 1 | 2 |
| Stat206 | Stat203 | Statistical Inference (1) | 2 | 1 | 2 |
| Stat208 | …… | Statistical Learning and Data Mining (1) | 2 | 1 | 2 |
| Stat214 | Stat205 | Data Visualization with Python | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Math216 | Math215 | Linear Algebra | 2 | 1 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| CS216 | …. | Artificial Intelligence | 2 | 1 | 2 |
| Stat210 | Stat203 | Fundamentals of Data Science | 2 | 1 | 2 |
| Stat216 | ……. | Selected Topics in Statistics (1) | 2 | 1 | 2 |
| Math234 | Math217 | Difference Equations | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الإحصاء وعلوم البيانات (تخصص منفرد) – Statistics and Data Science – Single

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Stat301 | …. | Mathematical Statistics | 2 | 1 | 2 |
| Stat303 | Stat204 | Stochastic Processes (1) | 2 | 1 | 2 |
| Stat305 | Stat201 | Probability Theory (2) | 2 | 1 | 2 |
| Stat307 | Stat206 | Experimental Design | 2 | 1 | 2 |
| Stat309 | Stat201 | Statistical Methods | 2 | 1 | 2 |
| Math311 | Math212 | Real Analysis | 2 | 1 | 2 |
| Math333 | Math216 | Operations Research | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math313 | Math112 | Numerical Analysis (1) | 2 | 1 | 2 |
| Stat315 | …… | Reliability Theory (1) | 2 | 1 | 2 |
| Stat313 | Stat206 | Nonparametric Statistics | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الإحصاء وعلوم البيانات (تخصص منفرد) – Statistics and Data Science – Single

المستوي الثالث – الفصل الدراسي الثاني– Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |

| | | | | | |
|---|---|---|---|---|---|
| CS311 | CS112 | Data Structures and File Processing | 2 | 1 | 2 |
| Stat302 | Stat301 | Time series (1) | 2 | 1 | 2 |
| Stat304 | Stat206 | Statistical Inference (2) | 2 | 1 | 2 |
| Stat306 | Stat305 | Statistical Learning and Data Mining (2) | 2 | 1 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Stat308 | Stat201 | Order Statistics | 2 | 1 | 2 |
| Stat310 | Stat301 | Theory of statistical decision | 2 | 1 | 2 |
| Stat312 | Stat301 | Analysis of Categorical Data | 2 | 1 | 2 |
| Stat314 | ..... | Selected topic in statistics (2) | 2 | 1 | 2 |
| Math334 | Math216 | Numerical Optimization | 2 | 1 | 2 |
| Total | | | | | 14 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الإحصاء وعلوم البيانات (تخصص منفرد) – Statistics and Data Science – Single

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Stat401 | Math333 | Advanced Operations Research | 2 | 1 | 2 |
| Stat403 | ..... | Applied Social Statistics | 2 | 1 | 2 |
| Stat405 | Stat301 | Statistics and Analysis of Variance | 2 | 1 | 2 |
| Stat407 | Stat206 | Baysian Analysis | 2 | 1 | 2 |
| Math411 | Math311 | Functional Analysis (1) | 2 | 1 | 2 |
| Stat490 | ..... | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Stat409 | Stat206 | Practical Machine Learning | 2 | 1 | 2 |
| Stat411 | Stat303 | Statistical Computing | 2 | 1 | 2 |
| Stat413 | Stat303 | Optimization | 2 | 1 | 2 |
| Stat415 | Stat309 | Linear Statistical Models | 2 | 1 | 2 |
| Stat417 | .... | Selected topic in Statistics (3) | 2 | 1 | 2 |
| Stat419 | .... | Ethics and Society | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

الإحصاء وعلوم البيانات (تخصص منفرد) – Statistics and Data Science – Single

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 Semester2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Stat402 | Stat401 | Sequential Analysis | 2 | 1 | 2 |
| Stat404 | Stat305 | Multivariate statistics | 2 | 1 | 2 |
| Stat406 | ……. | Statistical Quality Control | 2 | 1 | 2 |
| Stat408 | Stat309 | Data processing and analysis | 2 | 1 | 2 |
| Stat490 | ……. | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following | | | | | |
| Stat410 | Stat315 | Reliability Theory (2) | 2 | 1 | 2 |
| Stat412 | Stat312 | Simulation and Sampling Techniques | 2 | 1 | 2 |
| Stat414 | ….. | Applications of Statistics in Bioscience | 2 | 1 | 2 |
| Stat416 | …… | Selected Topics in Statistics (4) | 2 | 1 | 2 |
| Stat418 | …… | Theory of Algorithms | 2 | 1 | 2 |
| Total | | | | | 13 |

## قسم الرياضيات وعلوم الحاسب

## علوم الحاسب والرياضيات (تخصص مزودج)

| | |
|---|---|
| Program Title | Computer Science and Mathematics |
| Program Type | Double Major |
| Department(s) | Mathematics |

شعبة العلوم الطبيعية – Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب والرياضيات (تخصص مزودج) – Computer Science and Mathematics (Double Major)

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 -Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS211 | CS112 | Computer Programming (2) | 2 | 1 | 2 |
| CS213 | CS111 | Discrete Structures | 2 | 3 | 3 |
| Math251 | Math152 | Mechanics (3) | 2 | 1 | 2 |
| Math271 | | Advanced Algebra and Plane Geometry | 2 | 1 | 2 |
| Math217 | Math112 | Ordinary Differential Equations | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math219 | | Mathematical Software and Programming | 1 | 3 | 2 |
| Math231 | | Theory of Numbers | 2 | 1 | 2 |
| Math233 | ..... | History of Mathematics | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Stat209 | ..... | Introduction to Probability and Statistics | 2 | 1 | 2 |
| CS217 | CS112 | Introduction to Database Systems | 2 | 1 | 2 |
| CS215 | - | Computer and Information Security | 2 | 1 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية – Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب والرياضيات (تخصص مزودج) – Computer Science and Mathematics (Double Major)

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS212 | CS211 | Advanced Programming | 2 | 3 | 3 |
| CS214 | CS213 | Theory of computation | 2 | 1 | 2 |
| Math252 | Math251 | Dynamics of Rigid Body | 2 | 1 | 2 |
| Math272 | | Matrices and Linear Algebra | 2 | 1 | 2 |
| Math274 | Math112 | Mathematical Analysis | 3 | 1 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Math218 | | Mathematical Logic (1) | 2 | 1 | 2 |
| Math232 | ……. | Biomathematics | 2 | 1 | 2 |
| Math234 | Math217 | Difference Equations | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Stat212 | ….. | Introduction to Mathematical Statistics | 2 | 1 | 2 |
| CS216 | CS211 | Artificial Intelligence | 2 | 1 | 2 |
| CS218 | CS213 | Introduction to Image Processing | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية – Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب والرياضيات (تخصص مزدوج) – Computer Science and Mathematics (Double Major)

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS311 | CS213+CS211 | Data Structures and File Processing | 2 | 3 | 3 |
| CS313 | CS212+CS214 | Introduction to Algorithms Analysis | 2 | 1 | 2 |
| Math353 | Math251 | Fluid Dynamics (1) | 2 | 1 | 2 |
| Math351 | Math252 | Analytical Dynamics | 2 | 1 | 2 |
| Math313 | Math112 | Numerical Analysis (1) | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math311 | Math274 | Real Analysis | 2 | 1 | 2 |
| Math333 | Math272 | Operations Research | 2 | 1 | 2 |
| Math331 | Math217 | Fourier Analysis and Transforms | 2 | 1 | 2 |
| Electives: Student selects Two courses (4 credit hours) from the following modules | | | | | |
| Stat311 | Stat212 | Statistical Analysis | 2 | 1 | 2 |
| CS315 | CS216 | Machine Learning | 2 | 1 | 2 |
| CS317 | CS211 | Online Multimedia and Information Access | 2 | 1 | 2 |
| CS319 | CS212 | Object Oriented Design | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية – Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب والرياضيات (تخصص مزدوج) – Computer Science and Mathematics (Double Major)

المستوي الثالث – الفصل الدراسي الثاني– Level Three - Second Semester

| Level 3 – Semester 2 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | P/T | Total |
|---|---|---|---|---|---|
| CS312 | CS213 | Digital Circuits | 2 | 1 | 2 |
| CS314 | CS214 | Operating Systems | 2 | 1 | 2 |
| Math352 | Math251 | Theory of Linear Elasticity | 2 | 1 | 2 |
| Math372 | Math217 | Integral and Partial Differential Equations | 3 | 1 | 3 |
| Math354 | Math351 | Quantum Mechanics (1) | 2 | 1 | 2 |
| Electives: Student selects Two courses (4 credit hours) from the following modules | | | | | |
| Math316 | Math271 | Theory of Groups | 2 | 1 | 2 |
| Math356 | Math251 | Electrodynamics | 2 | 1 | 2 |
| Math332 | Math217 | Introduction to Chaos | 2 | 1 | 2 |
| Math334 | Math272 | Numerical Optimization | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| CS316 | CS216 | Introduction to Deep Learning | 2 | 1 | 2 |
| CS318 | CS311 | Information Storage and Retrieval | 2 | 1 | 2 |
| CS320 | CS313 | Advanced Algorithms | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب والرياضيات (تخصص مزدوج) – Computer Science and Mathematics (Double Major)

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS411 | CS311 | Database Management Systems | 2 | 3 | 3 |
| CS413 | CS312 | Computer Architecture and Organization | 2 | 3 | 3 |
| Math471 | Math274+Math217 | Complex and Special Functions | 3 | 1 | 3 |
| Math490 | ……. | Research Project | 1 | - | 1 |
| Electives: Student selects one course (2credit hours)from the following modules | | | | | |
| Math411 | Math311 | Functional Analysis (1) | 2 | 1 | 2 |
| Math435 | Math313 | Numerical Analysis (2) | 2 | 1 | 2 |
| Math433 | Math218 | Mathematical Logic (2) | 2 | 1 | 2 |
| Math451 | Math351 | Special Theory of Relativity | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| CS415 | -- | Selected topic in computer science | 2 | 1 | 2 |
| CS417 | CS314 | Parallel Computation | 2 | 1 | 2 |
| Total | | | | | 14 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الرياضيات وعلوم الحاسب – Department of Mathematics and Computer Science

علوم الحاسب والرياضيات (تخصص مزدوج) – Computer Science and Mathematics (Double Major)

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS412 | CS314 | Network and Internet Programming | 2 | 3 | 3 |
| CS414 | CS311+CS319 | Data Mining | 2 | 3 | 3 |
| CS490 | ……. | Research Project | 1 | - | 1 |
| Math452 | ……. | Statistical Mechanics | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math412 | Math311 | General Topology | 2 | 1 | 2 |
| Math436 | Math471 | Complex Analysis (2) | 2 | 1 | 2 |
| Math434 | Math311 | Measure Theory | 2 | 1 | 2 |
| Math472 | Math271 | Solid and Differential Geometry | 2 | 1 | 2 |
| Electives: Student selects one course(2credit hours)from the following modules | | | | | |
| CS416 | CS413 | Distributed Systems | 2 | 1 | 2 |
| CS418 | CS411 | Digital Libraries | 2 | 1 | 2 |
| Total | | | | | 13 |

# Physics Department

# Physics – Single program

# قسم الفيزياء

# لائحة برنامج الفيزياء (تخصص منفرد)

| | |
|---|---|
| Program Title | Physics |
| Program Type | Single |
| Department(s) | Physics |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

الفيزياء (تخصص منفرد) – Physics – Single

المستوي الثاني – الفصل الدراسي الأول– Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys201 | Phys102 | Electromagnetism | 2 | 1 (tu) | 2 |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Phys207 | | Mathematical Physics (1) | 2 | 1 (tu) | 2 |
| Phys215 | Phys102 | Waves and vibration | 2 | 1 (tu) | 2 |
| Phys213 | Phys102 | Physical optics and optical instruments | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Phys211 | | Introduction to biophysics | 1 | 2 | 2 |
| Phys217 | | Classical mechanics | 2 | 1 (tu) | 2 |
| Phys223 | | Introductory to Astrophysics (1) | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

الفيزياء (تخصص منفرد) – Physics – Single

المستوي الثاني – الفصل الدراسي الثانى – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys202 | Phys101 | Thermodynamics and statistical physics | 2 | 1 (tu) | 2 |
| Phys204 | Phys102 | Introduction to electronics and crystal physics | 2 | - | 2 |
| Phys206 | | Practical Physics (2) | - | 3 | 1 |
| Phys208 | Phys207 | Mathematical Physics (2) | 2 | 1 (tu) | 2 |
| Phys214 | Phys102 | Energy resources | 2 | - | 2 |
| Phys212 | Phys102 | Alternating current | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Phys216 | | Radiation physics and applications | 2 | - | 2 |
| Phys210 | Phys213 | Fourier optics | 2 | - | 2 |
| Phys218 | Phys213 | Electron microscope and fiber optics | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

الفيزياء (تخصص منفرد) – Physics – Single

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys301 | Phys203 | Quantum physics (1) | 2 | 1 (tu) | 2 |
| Phys303 | Phys203 | Atomic and molecular physics | 1 | 2 | 2 |
| Phys305 | | Practical Physics (3) | - | 3 | 1 |
| Phys317 | Phys201 | Computational physics | 2 | 1 (tu) | 2 |
| Phys309 | | Nonrenewable & Renewable Energy Resources | 2 | - | 2 |
| Phys311 | | Solid state physics (1) | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | 2 |
| Phys313 | | Semiconductor technology | 2 | - | 2 |
| Phys315 | Phys202 | Low temperature physics and vacuum technology | 2 | - | 2 |
| Phys307 | | Radiation protection and safety | 1 | 2 | 2 |
| Phys345 | Phys203 | Analytical mechanics | 2 | 1 (tu) | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

الفيزياء (تخصص منفرد) – Physics – Single

المستوي الثالث – الفصل الدراسي الثانى – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys302 | Phys203 | Nuclear physics (1) | 2 | - | 2 |
| Phys304 | Phys204 | Material science (1) | 2 | - | 2 |
| Phys306 | | Practical Physics (4) | - | 3 | 1 |
| Phys308 | Phys201 | Electrodynamics | 2 | 1 (tu) | 2 |
| Phys310 | Phys303 | Spectroscopy and Laser | 2 | - | 2 |
| Phys318 | | Semiconductors physics and devices | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Phys312 | | Radio-frequency electronics | 2 | - | 2 |
| Phys314 | Phys204 | Applied electronics | 2 | 1(tu) | 2 |
| Phys316 | Phys213 | Principles of remote sensing | 2 | - | 2 |
| Phys320 | | Crystallography and its applications | 2 | - | 2 |

| Total | 15 |
|---|---|

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

الفيزياء (تخصص منفرد) – Physics – Single

المستوي الرابع – الفصل الدراسي الأول–Level Four- First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys401 | Phys302 | Cosmic Rays and Elementary Particles | 2 | - | 2 |
| Phys403 | Phys301 | Quantum physics (2) | 2 | 1 (tu) | 2 |
| Phys405 | | Practical Physics (5) | - | 3 | 1 |
| Phys407 | Phys301 | Nuclear physics (2) | 2 | 1 (tu) | 2 |
| Phys449 | | Digital electronics (1) | 1 | 2 | 2 |
| Phys490 | | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Phys409 | Phys311 | Nano Science and applications | 2 | - | 2 |
| Phys411 | Phys212 | Microwaves | 2 | - | 2 |
| Phys417 | | String theory | 2 | - | 2 |
| Phys419 | | Magnetic resonance | 2 | - | 2 |
| Phys421 | | Selected topics in physics | 2 | - | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

الفيزياء (تخصص منفرد) – Physics – Single

المستوي الرابع – الفصل الدراسي الثانى– Level Four- Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys402 | Phys311 | Solid state physics (2) | 2 | | 2 |
| Phys404 | | Material science (2) | 2 | - | 2 |
| Phys406 | | Practical Physics (6) | - | 3 | 1 |
| Phys408 | Phys301 | Dielectric and electrical properties in solids | 1 | 2 | 2 |
| Phys418 | | Physics of Thin Films | 1 | 2 | 2 |
| Phys490 | | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Phys410 | | Acoustic optics | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Phys412 | Phys311 | Superconductivity | 2 | - | 2 |
| Phys414 | Phys302 | Neutron and reactor physics | 2 | - | 2 |
| Phys416 | Phys401 | Introductory to Astrophysics (2) | 2 | - | 2 |
| Phys420 | Phys407 | Advanced nuclear techniques | 2 | - | 2 |
| Total | | | | | 16 |

# Physics Department

# Materials Science and Nano program

# قسم الفيزياء

# لائحة برنامج المواد وعلوم النانو (تخصص مزدوج)

| | |
|---|---|
| Program Title | Materials and Nanosciences |
| Program Type | Double Major |
| Department(s) | Physics |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

المواد وعلوم النانو (تخصص مزودج) –( Materials and Nanoscience (Double Major

المستوي الثانى – الفصل الدراسي الأول–Level Two- First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys201 | Phys102 | Electromagnetism | 2 | 1 (tu) | 2 |
| Phys213 | Phys102 | Physical optics and optical instruments | 2 | 2 | 3 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| CS211 | CS112 | Computer Programming (2) | 2 | 1 (tu) | 2 |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Math217 | Math112 | Ordinary Differential Equations | 2 | 1 (tu) | 2 |
| BCh213 | Chem101 | Introduction to Biochemistry | 1 | 2 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

المواد وعلوم النانو (تخصص مزودج) –( Materials and Nanoscience (Double Major

المستوي الثانى – الفصل الدراسي الثانى–Level Two- second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys202 | Phys101 | Thermodynamics and statistical physics | 2 | 1 (tu) | 2 |
| Phys204 | Phys102 | Introduction to electronics and crystal physics | 2 | - | 2 |
| Phys206 | | Practical Physics (2) | - | 3 | 1 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem101 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Math272 | | Matrices and Linear Algebra | 2 | 1(tu) | 2 |
| Total | | | | | 14 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

المواد وعلوم النانو (تخصص مزودج) –( Materials and Nanoscience (Double Major

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys301 | Phys203 | Quantum physics (1) | 2 | 1 (tu) | 2 |
| Phys303 | Phys203 | Atomic and molecular physics | 1 | 2 | 2 |
| Phys305 | | Practical Physics (3) | - | 3 | 1 |
| Phys311 | | Solid state physics (1) | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | 2 |
| Phys309 | | Nonrenewable & Renewable Energy Resources | 1 | 2 | 2 |
| Phys323 | | Electric circuits | 1 | 2 | 2 |
| Phys325 | Phys202 | Phase equilibria & diffusion of materials | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

المواد وعلوم النانو (تخصص مزودج) –( Materials and Nanoscience (Double Major

المستوي الثالث – الفصل الدراسي الثانى – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys304 | Phys204 | Material science (1) | 2 | - | 2 |
| Phys306 | | Practical Physics (4) | - | 3 | 1 |
| Phys308 | Phys201 | Electrodynamics | 2 | 1 (tu) | 2 |
| Phys318 | | Semiconductors physics and devices | 2 | - | 2 |
| Phys340 | | Nanomaterials | 2 | - | 2 |
| Phys324 | Phys321 | Ceramic materials | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Phys326 | | Catalysts/sensors | 1 | 2 | 2 |
| Phys322 | | Nanomaterials and biodevices | 1 | 2 | 2 |
| Phys316 | Phys213 | Principles of remote sensing | 2 | - | 2 |
| Phys328 | | Electrochemical processing of materials | 1 | 2 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

المواد وعلوم النانو (تخصص مزدوج) –( Materials and Nanoscience (Double Major

المستوي الرابع – الفصل الدراسي الأول–Level Four- First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys445 | Phys304 | Composite and functional materials | 2 | - | 2 |
| Phys443 | | Photonic and optoelectronic materials | 2 | - | 2 |
| Phys423 | | Material science microscopes | 1 | 2 | 2 |
| Phys437 | | Industrial applications of nanotechnology | 1 | 2 | 2 |
| Phys405 | | Practical Physics (5) | - | 3 | 1 |
| Phys490 | | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Phys403 | Phys301 | Quantum physics (2) | 2 | 1 (tu) | 2 |
| Phys425 | | Fundamental of Quantum Optics | 2 | 1 (tu) | 2 |
| Phys427 | | Selected Topics in Nanoscience | 2 | - | 2 |
| Phys429 | | Nanomaterials applications in electronic devices | 1 | 2 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– Department of Physics

المواد وعلوم النانو (تخصص مزدوج) –( Materials and Nanoscience (Double Major

المستوي الرابع – الفصل الدراسي الثانى– Level Four- Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys402 | Phys311 | Solid state physics (2) | 2 | - | 2 |
| Phys406 | | Practical Physics (6) | - | 3 | 1 |
| Phys422 | | Nanostructured Materials and Processing | 1 | 2 | 2 |
| Phys424 | | Materials characterization techniques | 1 | 2 | 2 |
| Phys428 | | Modeling and Simulation of materials | 2 | 1(tu) | 2 |
| Phys490 | | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Phys412 | Phys311 | Superconductivity | 2 | - | 2 |
| Phys418 | | Physics of Thin Films | 1 | 2 | 2 |
| Phys426 | | Laser Physics and Applications | 1 | 2 | 2 |
| Phys430 | | Nanomaterials and green energy | 2 | - | 2 |
| Total | | | | | 16 |

# Physics Department & Chemistry Department

# Physics and Chemistry program

# قسم الفيزياء والكيمياء

# لائحة برنامج الفيزياء والكيمياء (تخصص مزدوج)

| | |
|---|---|
| Program Title | Physics and Chemistry |
| Program Type | Double Major |
| Department(s) | Physics \ Chemistry |

شعبة العلوم الطبيعية Natural Science Section-

قسم الفيزياء- قسم الكيمياء –Department of Physics &Department of Chemistry

الفيزياء والكيمياء (تخصص مزدوج) – Physics and Chemistry and Physics (Double Major)

المستوي الثانى – الفصل الدراسي الاول – Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Phys213 | | Physical optics and optical instruments | 2 | 2 | 3 |
| Phys205 | | Practical Physics (1) | - | 3 | 1 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following Module | | | | | |
| Phys201 | Phys102 | Electromagnetism | 2 | 1 (tu) | 2 |
| Phys225 | | Micro/Nano fabrication techniques | 1 | 2 | 2 |
| Phys217 | | Classical mechanics | 2 | 1 (tu) | 2 |
| Phys221 | | Introduction to atomic and radiation physics | 2 | - | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية Natural Science Section-

قسم الفيزياء- قسم الكيمياء –Department of Physics &Department of Chemistry

الفيزياء والكيمياء (تخصص مزدوج) – Physics and Chemistry and Physics (Double Major)

المستوي الثانى – الفصل الدراسي الثانى–Level Two- Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys202 | Phys101 | Thermodynamics and statistical physics | 2 | 1 (tu) | 2 |
| Phys204 | Phys102 | Introduction to electronics and crystal physics | 2 | - | 2 |
| Phys206 | | Practical Physics (2) | - | 3 | 1 |
| Phys214 | Phys102 | Energy resources | 2 | - | 2 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Total | | | | | 14 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء- قسم الكيمياء– Department of Physics &Department of Chemistry

الفيزياء والكيمياء (تخصص مزودج) – Physics and Chemistry and Physics (Double Major)

المستوي الثالث – الفصل الدراسي الأول– Level Three- First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys301 | Phys203 | Quantum physics (1) | 2 | 1 (tu) | 2 |
| Phys303 | Phys203 | Atomic and molecular physics | 1 | 2 | 2 |
| Phys311 | | Solid state physics (1) | 2 | - | 2 |
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following Module | | | | | |
| Phys319 | Phys203 | Applied atomic spectroscopy | 2 | - | 2 |
| Phys325 | | Phase equilibria &diffusion of materials | 2 | - | 2 |
| Phys327 | | Micro/nano electrochemical systems | 2 | - | 2 |
| Phys329 | | Solar energy | 2 | - | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء- قسم الكيمياء– Department of Physics &Department of Chemistry

الفيزياء والكيمياء (تخصص مزودج) – Physics and Chemistry and Physics (Double Major)

المستوي الثالث – الفصل الدراسي الثانى– Level Three- Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys302 | Phys203 | Nuclear physics (1) | 2 | - | 2 |
| Phys304 | | Material science (1) | 2 | - | 2 |
| Phys306 | | Practical Physics (4) | - | 3 | 1 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following Module | | | | | |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء- قسم الكيمياء– Department of Physics &Department of Chemistry

الفيزياء والكيمياء (تخصص مزودج) – Physics and Chemistry and Physics (Double Major)

المستوي الرابع – الفصل الدراسي الاول – Level Four - First Semester

| Level 4 -Semester1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys409 | Phys311 | Nano Science and applications | 2 | - | 2 |
| Phys433 | | Electrochemical Processing of Materials | 1 | 2 | 2 |
| Phys435 | | Advanced optics | 1 | 2 | 2 |
| Chem490 | ---------- | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following Module | | | | | |
| Phys431 | | Electronic materials | 2 | 1 (tu) | 2 |
| Phys413 | Phys201 | Nuclear & Mossbaur Spectroscopy | 2 | - | 2 |
| Phys439 | | Optical interferometry and technology | 2 | - | 2 |
| Phys441 | | Advanced microscopy and its applications | 2 | - | 2 |
| Phys443 | | Photonic and optoelectronic materials | 2 | - | 2 |
| Electives: Student selects three courses (6 credit hours) from the following Module | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء- قسم الكيمياء– Department of Physics &Department of Chemistry

الفيزياء والكيمياء (تخصص مزودج) – Physics and Chemistry and Physics (Double Major)

المستوي الرابع – الفصل الدراسي الثانى – Level Four - Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys490 | | Research Project | 1 | - | 1 |
| Phys426 | | Laser Physics and Applications | 1 | 2 | 2 |
| Phys402 | Phys311 | Solid state physics (2) | 2 | - | 2 |
| Phys406 | | Practical Physics (6) | - | 3 | 1 |
| Electives: Student selects one course (2 credit hours) from the following Module | | | | | |
| Phys432 | | Semiconductors and its applications | 2 | - | 2 |
| Phys434 | | Electrical, optical and magnetic properties of materials | 2 | - | 2 |
| Phys428 | | Modeling and Simulation of materials | 2 | 1 (tu) | 2 |
| Phys438 | | Plasma Physics | 2 | - | 2 |

| Electives: Student selects two courses (4 credit hours) from the following Module | | | | | |
|---|---|---|---|---|---|
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | ---- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Total | | | | | 12 |

# Physics Department & Mathematics Departmrent

## Physics & Mathematics program

# قسم الفيزياء وقسم الرياضيات

## لائحة برنامج الفيزياء والرياضيات (تخصص مزودج)

| | |
|---|---|
| Program Title | Physics & Mathematics |
| Program Type | Double Major |
| Department(s) | Physics |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

الفيزياء والرياضيات (تخصص مزودج) –( Physics and Mathematics (Double Major

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 -Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Phys213 | Phys102 | Physical optics and optical instruments | 2 | 2 | 3 |
| Phys207 | | Mathematical Physics 1 | 2 | 1 (tu) | 2 |
| Math251 | Math152 | Mechanics (3) | 2 | 1 | 2 |
| Math271 | | Advanced Algebra and Plane Geometry | 2 | 1 | 2 |
| Math217 | Math112 | Ordinary Differential Equations | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math219 | | Mathematical Software and Programming | 1 | 3 | 2 |
| Math231 | | Theory of Numbers | 2 | 1 | 2 |
| Math233 | ..... | History of Mathematics | 2 | 1 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

الفيزياء والرياضيات (تخصص مزودج) –( Physics and Mathematics (Double Major

المستوي الثاني – الفصل الدراسي الثاني– Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Phys202 | Phys101 | Thermodynamics and statistical physics | 2 | 1 (tu) | 2 |
| Phys208 | Phys207 | Mathematical Physics 2 | 2 | 1 (tu) | 2 |
| Phys206 | | Practical Physics (2) | - | 3 | 1 |
| Math252 | Math251 | Dynamics of Rigid Body | 2 | 1 | 2 |
| Math272 | | Matrices and Linear Algebra | 2 | 1(tu) | 2 |
| Math274 | Math112 | Mathematical Analysis | 3 | 1 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math218 | | Mathematical Logic (1) | 2 | 1 | 2 |
| Math232 | ..... | Biomathematics | 2 | 1 | 2 |
| Math234 | Math217 | Difference Equations | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys212 | Phys102 | Alternating current | 1 | 2 | 2 |
| Phys214 | Phys102 | Energy resources | 2 | - | 2 |
| Phys216 | | Radiation physics and applications | 2 | - | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

الفيزياء والرياضيات (تخصص مزودج) – Physics and Mathematics (Double Major )

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Phys301 | Phys203 | Quantum physics (1) | 2 | 1 (tu) | 2 |
| Phys303 | Phys203 | Atomic and molecular physics | 1 | 2 | 2 |
| Phys305 | | Practical Physics (3) | - | 3 | 1 |
| Phys311 | | Solid state physics (1) | 2 | - | 2 |
| Math353 | Math251 | Fluid Dynamics (1) | 2 | 1 | 2 |
| Math351 | Math252 | Analytical Dynamics | 2 | 1 | 2 |
| Math313 | Math112 | Numerical Analysis (1) | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math311 | Math274 | Real Analysis | 2 | 1 | 2 |
| Math333 | Math272 | Operations Research | 2 | 1 | 2 |
| Math331 | Math217 | Fourier Analysis and Transforms | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys313 | | Semiconductor technology | 2 | - | 2 |
| Phys315 | Phys202 | Low temperature physics and vacuum technology | 2 | - | 2 |
| Phys317 | Phys201 | Computational physics | 2 | 1 (tu) | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

الفيزياء والرياضيات (تخصص مزودج) – Physics and Mathematics (Double Major )

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Phys302 | Phys203 | Nuclear physics (1) | 2 | - | 2 |
| Phys311 | | Solid state physics (1) | 2 | - | 2 |
| Math352 | Math251 | Theory of Linear Elasticity | 2 | 1 | 2 |
| Math372 | Math217 | Integral and Partial Differential Equations | 3 | 1 | 3 |
| Math354 | Math351 | Quantum Mechanics (1) | 2 | 1 | 2 |
| Electives: Student selects Two courses (4 credit hours) from the following modules | | | | | |
| Math316 | Math271 | Theory of Groups | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Math356 | Math251 | Electrodynamics | 2 | 1 | 2 |
| Math332 | Math217 | Introduction to Chaos | 2 | 1 | 2 |
| Math334 | Math272 | Numerical Optimization | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys314 | Phys204 | Applied electronics | 2 | 1(tu) | 2 |
| Phys316 | Phys213 | Principles of remote sensing | 2 | - | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

الفيزياء والرياضيات (تخصص مزودج) – Physics and Mathematics (Double Major )

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Phys401 | Phys302 | Cosmic Rays and Elementary Particles | 2 | - | 2 |
| Phys425 | | Fundamental of Quantum Optics | 2 | 1 | 2 |
| Phys405 | | Practical Physics (5) | - | 3 | 1 |
| Math471 | Math274+Math217 | Complex and Special Functions | 3 | 1 | 3 |
| Math490 | ……. | Research Project | 1 | - | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math411 | Math311 | Functional Analysis (1) | 2 | 1 | 2 |
| Math435 | Math313 | Numerical Analysis (2) | 2 | 1 | 2 |
| Math433 | Math218 | Mathematical Logic (2) | 2 | 1 | 2 |
| Math451 | Math351 | Special Theory of Relativity | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys447 | | Basics of material engineering | 2 | - | 2 |
| Phys449 | | Digital Electronics (1) | 1 | 2 | 2 |
| Total | | | | | 13 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

الفيزياء والرياضيات (تخصص مزودج) – Physics and Mathematics (Double Major )

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| Phys402 | Phys311 | Solid state physics (2) | 2 | | 2 |
| Phys426 | | Laser Physics and Applications | 1 | 2 | 2 |
| Phys428 | | Modeling and Simulation of materials | 2 | 1 (tu) | 2 |
| Phys490 | | Research Project | 1 | - | 1 |
| Math452 | …….. | Statistical Mechanics | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Math412 | Math311 | General Topology | 2 | 1 | 2 |
| Math436 | Math471 | Complex Analysis (2) | 2 | 1 | 2 |
| Math434 | Math311 | Measure Theory | 2 | 1 | 2 |
| Math472 | Math271 | Solid and Differential Geometry | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys432 | | Semiconductors and its applications | 2 | - | 2 |
| Phys428 | | Modeling and Simulation of materials | 2 | 1 (tu) | 2 |
| Phys424 | | Materials characterization techniques | 1 | 2 | 2 |
| Total | | | | | 13 |

# Physics Department& Mathematics Department

## Physics & Computer Science program

# قسم الفيزياء وقسم الرياضيات

## لائحة برنامج علوم الفيزياء والحاسب (تخصص مزدوج)

| | |
|---|---|
| Program Title | Physics & Computer Science |
| Program Type | Double Major |
| Department(s) | Physics |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

علوم الفيزياء والحاسب (تخصص مزودج) –( Physics and Computer Science (Double Major

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 -Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS211 | CS112 | Computer Programming (2) | 2 | 1(tu) | 2 |
| CS213 | CS111 | Discrete Structures | 2 | 3 | 3 |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Phys205 | | Practical Physics (1) | - | 3 | 1 |
| Phys213 | Phys102 | Physical optics and optical instruments | 2 | 2 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys201 | Phys102 | Electromagnetism | 2 | 1 (tu) | 2 |
| Phys229 | | Introduction to electric circuits | 2 | - | 2 |
| Phys227 | | Computational physics | 2 | 1(tu) | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Stat209 | ..... | Introduction to Probability and Statistics | 2 | 1 | 2 |
| CS217 | CS112 | Introduction to Database Systems | 2 | 1 | 2 |
| CS215 | - | Computer and Information Security | 2 | 1 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

علوم الفيزياء والحاسب (تخصص مزودج) –( Physics and Computer Science (Double Major

Level Two - Second Semester – المستوي الثاني – الفصل الدراسي الثاني

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS212 | CS211 | Advanced Programming | 2 | 3 | 3 |
| CS214 | CS213 | Theory of computation | 2 | 1 | 2 |
| Phys202 | Phys101 | Thermodynamics and statistical physics | 2 | 1 (tu) | 2 |
| Phys204 | Phys102 | Introduction to electronics and crystal physics | 2 | - | 2 |
| Phys220 | | Physics of alloys and composite material | 2 | 1 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys212 | Phys102 | Alternating current | 2 | 1 | 2 |
| Phys214 | Phys102 | Energy resources | 2 | - | 2 |
| Phys216 | Phys203 | Radiation physics and applications | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Stat212 | ..... | Introduction to Mathematical Statistics | 2 | 1 | 2 |
| CS216 | CS211 | Artificial Intelligence | 2 | 1 | 2 |
| CS218 | CS213 | Introduction to Image Processing | 2 | 1 | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

علوم الفيزياء والحاسب (تخصص مزدوج) – Physics and Computer Science (Double Major )

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS311 | CS213+CS211 | Data Structures and File Processing | 2 | 3 | 3 |
| CS313 | CS212+CS214 | Introduction to Algorithms Analysis | 2 | 1 | 2 |
| Phys301 | | Quantum physics (1) | 2 | - | 2 |
| Phys303 | Phys203 | Atomic and molecular physics | 1 | 2 | 2 |
| Phys311 | | Solid state physics (1) | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys315 | Phys202 | Low temperature physics and vacuum technology | 2 | - | 2 |
| Phys317 | Phys201 | Computational physics | 2 | 1 (tu) | 2 |
| Phys331 | | Laser physics and technology | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Stat311 | Stat212 | Statistical Analysis | 2 | 1 | 2 |
| CS315 | CS216 | Machine Learning | 2 | 1 | 2 |
| CS317 | CS211 | Online Multimedia and Information Access | 2 | 1 | 2 |
| CS319 | CS212 | Object Oriented Design | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

علوم الفيزياء والحاسب (تخصص مزدوج) – Physics and Computer Science (Double Major )

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS312 | CS213 | Digital Circuits | 2 | 1 | 2 |
| CS314 | CS214 | Operating Systems | 2 | 1 | 2 |
| Phys306 | | Practical Physics (4) | - | 3 | 1 |
| Phys302 | Phys203 | Nuclear physics (1) | 2 | - | 2 |
| Phys304 | Phys204 | Material science (1) | 2 | - | 2 |
| Phys308 | Phys201 | Electrodynamics | 2 | 1 (tu) | 2 |
| Electives: Student selects Two courses (4 credit hours) from the following modules | | | | | |
| Phys318 | | Semiconductors physics and devices | 2 | - | 2 |
| Phys330 | | Laser optics | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| CS316 | CS216 | Introduction to Deep Learning | 2 | 1 | 2 |
| CS318 | CS311 | Information Storage and Retrieval | 2 | 1 | 2 |
| CS320 | CS313 | Advanced Algorithms | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية- Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

علوم الفيزياء والحاسب (تخصص مزدوج) – Physics and Computer Science (Double Major )

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS411 | CS311 | Database Management Systems | 2 | 3 | 3 |
| CS413 | CS312 | Computer Architecture and Organization | 2 | 3 | 3 |
| Phys449 | | Digital electronics (1) | 1 | 2 | 2 |
| Phys405 | | Practical Physics (5) | - | 3 | 1 |
| Phys490 | | Research Project | 1 | - | 1 |
| Electives: Student selects one course (2credit hours)from the following modules | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Phys443 | | Photonic and optoelectronic materials | 2 | - | 2 |
| Phys451 | | Non linear optics | 2 | - | 2 |
| Phys453 | | Group theory of physics | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| CS415 | -- | Selected topic in computer science | 2 | 1 | 2 |
| CS417 | CS314 | Parallel Computation | 2 | 1 | 2 |
| Total | | | | | 14 |

شعبة العلوم الطبيعية-Natural Science Section

قسم الفيزياء– قسم الرياضيات – Department of Physics &Department of Mathematics

علوم الفيزياء والحاسب (تخصص مزدوج) – Physics and Computer Science (Double Major )

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | P/T | Total |
| CS412 | CS314 | Network and Internet Programming | 2 | 3 | 3 |
| CS414 | CS311+CS319 | Data Mining | 2 | 3 | 3 |
| CS490 | ……. | Research Project | 1 | - | 1 |
| Phys450 | | Digital electronics (2) | 1 | 2 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys442 | | Physics of nanomaterials and their properties | 2 | - | 2 |
| Phys444 | | Theoretical atomic physics | 2 | - | 2 |
| Phys446 | | Optics properties of materials | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours)from the following modules | | | | | |
| CS416 | CS413 | Distributed Systems | 2 | 1 | 2 |
| CS418 | CS411 | Digital Libraries | 2 | 1 | 2 |
| Total | | | | | 13 |

# Department of Physics and Zoology

## Biophysics &Biotechnology program

# قسم الفيزياء والحيوان

## لائحة برنامج الفيزياء الحيوية والبيوتكنولوجى (تخصص مزودج)

| | |
|---|---|
| Program Title | Biophysics &Biotechnology |
| Program Type | Double Major |
| Department(s) | Physics |

شعبة العلوم البيولوجية - Biological Science Section

قسم الفيزياء - قسم علم الحيوان – Department of physics &Department of Zoology

الفيزياء الحيوية/البيوتكنولوجى (تخصص مزودج) – Biophysics and Biotechnology (Double Major )

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 -Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Biot201 | | Recombinant DNA technology | 2 | 1 | 2 |
| Bot220 | Bot102 | Biotechnology of plant products | 1 | - | 1 |
| Phys201 | Phys102 | Electromagnetism | 2 | 1 (tu) | 2 |
| BPhy201 | | Modern Biophysics | 1 | - | 1 |
| BPhy203 | | Molecular biophysics and bio modeling | 1 | - | 1 |
| BPhy211 | | General Biophysics (1) | 1 | 2 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BPhy205 | | Electronics integrated circuits | 2 | - | 2 |
| BPhy207 | | Health biophysics | 2 | 1 (tu) | 2 |
| BPhy209 | | Environmental biophysics and renewable energy | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo203 | Zoo101 | Histology and zoo-techniques | 1 | 3 | 2 |
| Zoo205 | Zoo101 | Physiology (1) | 1 | 3 | 2 |
| Biot205 | | Introductory genetics | 2 | 1 | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية - Biological Science Section

قسم الفيزياء - قسم علم الحيوان – Department of physics &Department of Zoology

الفيزياء الحيوية/البيوتكنولوجى (تخصص مزودج)– Biophysics and Biotechnology (Double Major )

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Biot202 | | Cell and tissue culture | 2 | 2 | 2 |
| Biot204 | | Microbial genetics | 1 | 3 | 2 |
| Bch205 | Chem101 | Biochemistry of cells | 1 | 2 | 2 |
| BPhy202 | | Physical optics and its biological application | 2 | 1 | 2 |
| BPhy204 | | Thermodynamics for biological system | 2 | 1 | 2 |
| BPhy206 | | General biophysics and waves | 1 | - | 1 |
| BPhy214 | | General Biophysics (2) | 1 | 2 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BPhy208 | | Membrane biophysics, control and communication | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BPhy210 | | Quantum mechanics and its biological applications | 2 | - | 2 |
| BPhy212 | | Bioenergetic | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Biot206 | | Biological hazard and biosafety | 2 | 1 | 2 |
| Biot208 | | Molecular biogeography | 2 | 1 | 2 |
| Bot220 | Bot102 | Biotechnology of plant products | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biological Science Section

قسم الفيزياء - قسم علم الحيوان – Department of physics &Department of Zoology

الفيزياء الحيوية/البيوتكنولوجى (تخصص مزدوج) – Biophysics and Biotechnology (Double Major )

المستوي الثالث – الفصل الدراسي الأول– Level Three -First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Biot301 | | Plant biotechnology | 2 | 1 | 2 |
| Biot303 | | Molecular biology | 2 | 1 | 2 |
| Phys317 | Phys201 | Computational physics | 2 | 1 (tu) | 2 |
| BPhy301 | | Bio-statics | 1 | - | 1 |
| BPhy303 | | Principles of genetic engineering | 1 | - | 1 |
| BPhy305 | | Electrodynamics and its biological applications | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BPhy307 | | Brachytherapy dosimetry | 2 | 1 | 2 |
| BPhy309 | | Neurophysiology | 2 | 1 | 2 |
| BPhy311 | | Magnetic properties of biomolecules | 2 | 1 | 2 |
| Electives: Student selects Two courses (4 credit hours) from the following modules | | | | | |
| Biot305 | | Microbial biotechnology | 2 | 1 | 2 |
| Biot307 | | Nutraceuticals | 2 | 1 | 2 |
| Zoo303 | Zoo205 | Physiology (2) | 1 | 3 | 2 |
| Ent301 | Zoo102 | Insect Structure and Function | 1 | 3 | 2 |
| Total | | | | | 17 |

شعبة العلوم البيولوجية - Biological Science Section

قسم الفيزياء - قسم علم الحيوان – Department of physics &Department of Zoology

الفيزياء الحيوية/البيوتكنولوجى (تخصص مزدوج) – Biophysics and Biotechnology (Double Major )

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Biot302 | | Proteomics and protein engineering | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Biot304 | | Animal Biotechnology | 2 | 1 | 2 |
| BPhy302 | | Basic of nuclear physics and radiobiology | 2 | - | 2 |
| BPhy304 | | Biophysical techniques in diagnosis andphysical therapy | 3 | - | 3 |
| BPhy306 | | Bioelectronics | 2 | 1 | 2 |
| Electives: Student selects Two courses (4 credit hours) from the following modules | | | | | |
| BPhy308 | | Human anatomy | 2 | 1 | 2 |
| BPhy310 | | Biophysics of hearing and vision | 2 | 1 | 2 |
| BPhy312 | | Advanced Bio-optics | 2 | 1 | 2 |
| BPhy314 | | Technology of drug & biomolecules carrier system | 2 | 1 | 2 |
| BPhy316 | | Biomodeling & Simulation | | | |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Biot306 | | Enviromental biotechnology | 2 | 1 | 2 |
| Biot308 | | Api and maggot therapy | 2 | 1 | 2 |
| Biot310 | | Genomes and genomics | 2 | 1 | 2 |
| Total | | | | | 17 |

شعبة العلوم البيولوجية - Biological Science Section

قسم الفيزياء - قسم علم الحيوان – Department of physics &Department of Zoology

الفيزياء الحيوية/البيوتكنولوجى (تخصص مزدوج) – Biophysics and Biotechnology (Double Major )

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Biot401 | | Biodegradation and Biotransformation | 2 | 3 | 3 |
| Biot403 | | Genome Analysis | 2 | 3 | 3 |
| BPhy401 | | Medical radioactive isotopes, radiation safety and protection | 2 | 1 | 2 |
| BPhy403 | | Biomagnetism | 1 | - | 1 |
| Biot490 | | Research Project | 1 | - | 1 |
| Electives: Student selects one course (2credit hours)from the following modules | | | | | |
| BPhy405 | | Nanotechnology | 2 | 1 | 2 |
| BPhy407 | | Planning radiotherapy | 2 | 1 | 2 |
| BPhy409 | | Nuclear medicine | 2 | 1 | 2 |
| BPhy411 | | Selected Topics in Biophysics | 2 | 1 | 2 |
| BPhy413 | | Biophysical techniques in cancer therapy | 2 | 1 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Biot405 | | Molecular biology of cancer | 2 | 1 | 2 |
| Biot407 | | Molecular diagnostics | 2 | 1 | 2 |
| Biot409 | | Drug targeting | 2 | 1 | 2 |
| Biot411 | | Selected Topics in Biotechnology | 2 | - | 2 |
| Total | | | | | 14 |

شعبة العلوم البيولوجية - Biological Science Section

قسم الفيزياء - قسم علم الحيوان – Department of physics &Department of Zoology

الفيزياء الحيوية/البيوتكنولوجى (تخصص مزودج) –Biophysics and Biotechnology (Double Major )

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Biot402 | | Management and marketing in biotechnology | 2 | 1 | 2 |
| Biot404 | | Stem cell Biology | 2 | 1 | 2 |
| Biot406 | | Industrial Microbiology | 2 | 1 | 2 |
| BPhy490 | | Research Project | 1 | - | 1 |
| BPhy402 | | Cancer biology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BPhy404 | | Biophysical techniques | 2 | 1 | 2 |
| BPhy406 | | Basis of NMR and Medical imaging | 2 | 1 | 2 |
| BPhy408 | | Structure of biological Macromolecules by using X-ray | 2 | 1 | 2 |
| BPhy410 | | Biomaterials and prosthesis | 2 | - | 2 |
| BPhy412 | | Techniques for thin bio Membranes | 2 | - | 2 |
| BPhy414 | | Electronics of biological systems | 2 | - | 2 |
| Electives: Student selects one course(2credit hours)from the following modules | | | | | |
| Biot408 | | Biosensor and Bioelectronics | 2 | 1 | 2 |
| Biot410 | | DNA Forensics | 2 | 1 | 2 |
| Phys426 | | Laser Physics and Applications | 1 | 2 | 2 |
| Total | | | | | 13 |

## قسم الكيمياء

## لائحة برنامج الكيمياء (تخصص منفرد)

| | |
|---|---|
| Programme Title | Chemistry |
| Programme Type | Single |
| Department | Chemistry |

Natural Science Section - شعبة العلوم الطبيعية

Department of Chemistry – قسم الكيمياء

Chemistry – Single – (تخصص منفرد) الكيمياء

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract | Total |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry | 2 | 3 | 3 |
| Stat216 | .... | Selected Topics in Statistics (1) | 2 | 3 | 3 |
| Chem233 | Chem102 | Kinetic theory of gases | 2 | - | 2 |
| Total | | | | | 14 |

Natural Science Section - شعبة العلوم الطبيعية

Department of Chemistry – قسم الكيمياء

Chemistry – Single – (تخصص منفرد) الكيمياء

Level Two - Second Semester – المستوي الثاني – الفصل الدراسي الثاني

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | 3 | 3 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Chem214 | Chem211 | Stereochemistry | 2 | - | 2 |
| Chem216 | Chem211 | Organic chemistry (3) | 2 | 3 | 3 |
| Chem236 | Chem231 | surface and Catalysis Chemistry | 2 | - | 2 |
| Chem224 | Chem221 | Transition Elements Chemistry | 2 | - | 2 |
| Total | | | | | 17 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الكيمياء – Department of Chemistry

الكيمياء (تخصص منفرد) – Chemistry – Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem323 | Chem222 | Chemistry of internal transitional elements | 2 | - | 2 |
| Chem325 | Chem221 | Coordination Chemistry | 2 | 3 | 3 |
| Chem333 | Chem231 | Electro Chemistry (1) | 2 | 3 | 3 |
| Chem313 | Chem221 | Petroleum and Polymers Chemistry | 2 | - | 2 |
| Chem315 | Chem221 | Chemistry of Heterocyclic Compounds | 2 | 3 | 3 |
| Chem317 | Chem221 | Chemistry of Carbohydrates | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| Chem327 | Chem222 | Organometallic Chemistry | 2 | - | 2 |
| Chem335 | Chem231 | Phase Rule | 2 | - | 2 |
| Chem319 | Chem221 | Physical Organic Chemistry | 2 | - | 2 |
| Chem337 | Chem231 | Solid and Nano Chemistry | 2 | - | 2 |
| Total | | | | | 20 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الكيمياء – Department of Chemistry

الكيمياء (تخصص منفرد) – Chemistry – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem322 | Chem221 | Analytical Chemistry (2) | 2 | 3 | 3 |
| Chem324 | Chem222 | Nuclear Chemistry | 2 | - | 2 |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem334 | Chem222 | Quantum Chemistry (1) | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Chem336 | Chem222 | Electro Chemistry (2) | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| Chem332 | Chem231 | Physical Chemistry of Macro molecules | 2 | - | 2 |
| Chem318 | Chem212 | Dyes Chemistry | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الكيمياء – Department of Chemistry

الكيمياء (تخصص منفرد) – Chemistry – Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem423 | Chem221 | Analytical Chemistry (3) | 2 | - | 2 |
| Chem415 | Chem212 | Spectroscopy of Organic Compounds | 2 | - | 2 |
| Chem490 | --------- | Research Project | 1 | - | 1 |
| Electives: Student selects five courses (10 credit hours) from the following modules | | | | | |
| Chem413 | Chem221 | Chemotherapy | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem437 | Chem231 | Molecular and Nuclear Spectroscopy | 2 | - | 2 |
| Chem417 | Chem221 | Topics in Organic Chemistry | 2 | - | 2 |
| Chem423 | Chem231 | Water Treatment Chemistry | 2 | - | 2 |
| Chem419 | Chem221 | Amino Acids and Fats Chemistry | 2 | - | 2 |
| Chem439 | ------ | Computational chemistry | 2 | - | 2 |
| Chem425 | Chem231 | Industrial Inorganic Chemistry | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية - Natural Science Section

قسم الكيمياء – Department of Chemistry

الكيمياء (تخصص منفرد) – Chemistry – Single

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem490 | --------- | Research Project | 1 | - | 1 |
| Electives: Student selects five courses (10 credit hours) from the following modules | | | | | |
| Chem428 | Chem221 | Topics in Inorganic Chemistry | 2 | - | 2 |
| Chem412 | Chem212 | Forensic chemistry | 2 | - | 2 |
| Chem426 | Chem221 | Bio analytical Chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem434 | Chem231 | solutions and colloids Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem416 | Chem212 | Natural Products Chemistry | 2 | - | 2 |
| Chem436 | Chem231 | Topics in physical Chemistry | 2 | - | 2 |
| Chem438 | Chem231 | Quantum Chemistry (2) | 2 | - | 2 |
| Total | | | | | 11 |

قسم النبات والميكروبيولوجى

النبات (تخصص منفرد)

| | |
|---|---|
| Program Title | Botany |
| Program Type | Single |
| Department(s) | Botany and Microbiology |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology – قسم النبات والميكروبيولوجى

Botany – Single – النبات (تخصص منفرد)

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Bot211 | Bot101 | Cell and Genetics | 1 | 2 | 2 |
| Bot213 | Bot102 | Plant Water Relation and Mineral Nutrition | 1 | 2 | 2 |
| Bot215 | Bot102 | General Ecology and Advanced Anatomy | 1 | 2 | 2 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Bot217 | Bot101 | Medicinal Plants | 1 | 2 | 2 |
| Bot219 | Bot102 | Economic Botany | 1 | 2 | 2 |
| Mic219 | ----- | Biostatistics and Experimental Designs | 2 | 1(tu) | 2 |
| CS215 | | Computer and Information Security | 2 | 1(tu) | 2 |
| Total | | | | | 16 |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology – قسم النبات والميكروبيولوجى

Botany – Single – النبات (تخصص منفرد)

Level Two - Second Semester – المستوي الثاني – الفصل الدراسي الثاني

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Bot212 | Bot101 | Principles of Genetics | 1 | 2 | 2 |
| Bot214 | Bot101 | Biology of Algae | 1 | 2 | 2 |
| Bot216 | Bot101 | General Plant Taxonomy | 1 | 2 | 2 |
| Bot218 | Bot102 | Plant Molecular Physiology and Photosynthesis | 1 | 2 | 2 |
| BCh207 | | Biomolecules Chemistry | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Bot220 | Bot102 | Biotechnology of Plant Products | 1 | 2 | 2 |
| Bot222 | --------- | Scientific Writing and Presentations | 1 | 2 | 2 |
| Bot224 | Bot102 | Algal metabolism | 1 | 2 | 2 |
| Bot226 | Bot101 | Genotoxicity and biosafety | 2 | - | 2 |
| Total | | | | | 15 |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology – قسم النبات والميكروبيولوجى

Botany – Single – النبات (تخصص منفرد)

Level Three - First Semester – المستوي الثالث – الفصل الدراسي الأول

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |

| | | | | | |
|---|---|---|---|---|---|
| Bot311 | Bot101 | Molecular genetics | 1 | 2 | 2 |
| Bot313 | Bot101 | Archegoniate | 1 | 2 | 2 |
| Bot315 | Bot215 | Ecosystem Dynamics and Function | 2 | - | 2 |
| Bot317 | Bot218 | Plant Enzymology | 1 | 2 | 2 |
| Mic323 | Bot101 | Biology of Microorganisms | 1 | 2 | 2 |
| BCh301 | | Physical Biochemistry | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Bot319 | Bot101 | Fundamentals of Bioinformatics | 1 | 2 | 2 |
| Bot321 | Bot214 | Physiology of Algae | 1 | 2 | 2 |
| Bot323 | Bot101 | Genome and Epigenetics | 2 | - | 2 |
| Bot325 | Bot213 | Plant Stress Physiology | 1 | 2 | 2 |
| Total | | | | | 17 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجى– Department of Botany and Microbiology

النبات (تخصص منفرد) – Botany – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Bot310 | Bot218 | Plant biochemistry and metabolism | 1 | 2 | 2 |
| Bot312 | Bot214 | Algal Biotechnology | 1 | 2 | 2 |
| Bot314 | Bot216 | Advanced Plant Taxonomy | 1 | 2 | 2 |
| Bot316 | Bot315 | Soil Ecology | 1 | 2 | 2 |
| Bot318 | Bot315 | Environmental Biotechnology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Bot320 | Bot215 | Natural resources | 2 | - | 2 |
| Bot324 | Bot311 | Forensic biotechnology | 1 | 2 | 2 |
| Mic328 | Mic323 | Principles of Microbiological Techniques | - | 4 | 2 |
| Total | | | | | 14 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجى– Department of Botany and Microbiology

النبات (تخصص منفرد) – Single – Botany

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Bot490 | - | Research Project | 1 | - | 1 |
| Bot411 | Bot311 | Genetic Engineering and Genes Technology | 1 | 2 | 2 |
| Bot413 | Bot310 | Hormonal regulation of plant growth and Development | 1 | 2 | 2 |
| Bot419 | Bot314 | Plant diversity and species conservation | 1 | 2 | 2 |
| Bot417 | Bot310 | Plant propagation | 1 | 2 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Bot415 | Bot101 | Diversity of Gymnosperms | 1 | 2 | 2 |
| Bot421 | Bot311 | Genome Analysis and applications | 1 | 2 | 2 |
| Bot423 | Bot313 | Green Nanotechnology | 1 | 2 | 2 |
| Bot425 | Bot314 | The origin and diversification of Angiosperms | 1 | 2 | 2 |
| Bot427 | Bot215 | Ecological engineering | 2 | - | 2 |
| Bot429 | Bot310 | Primary plant metabolites | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجى– Department of Botany and Microbiology

النبات (تخصص منفرد) – Single – Botany

المستوي الرابع – الفصل الدراسي الثاني – Level four - Second Semester

| Level 4- Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Bot490 | - | Research Project | 1 | - | 1 |
| Bot412 | Bot413 | Plant tissue culture | 1 | 2 | 2 |
| Bot414 | Bot315 | Phytogeography and flora | 1 | 2 | 2 |
| Bot416 | Bot314 | Plant systematics and evolution | 1 | 2 | 2 |
| Mic418 | Mic323 | Plant pathology | 1 | 2 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Bot418 | Bot315 | Vegetation and plant communities | 1 | 2 | 2 |
| Bot420 | Bot311 | Applications of Molecular Genetics | 1 | 2 | 2 |
| Bot422 | Bot310 | Secondary plant metabolites | 2 | - | 2 |
| Bot424 | Bot216 | Systematic anatomy | 1 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Bot426 | Bot218 | Plant nitrogen metabolism and protein | 1 | 2 | 2 |
| BCh414 | ---- | Vitamins and Co-enzymes | 2 | - | 2 |
| Total | | | | | 15 |

## قسم النبات والميكروبيولوجى

## الميكروبيولوجيا (تخصص منفرد)

| | |
|---|---|
| Program Title | Microbiology |
| Program Type | Single |
| Department(s) | Botany and Microbiology |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجي – Department of Botany and Microbiology

الميكروبيولوجيا (تخصص منفرد) – Microbiology – Single

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic211 | Bot101 | Fundamental Microbiology | 2 | 3 | 3 |
| Mic213 | Bot101 | Microbial Cell Structure and Function | 2 | - | 2 |
| Mic215 | Bot101 | Biological Control | 1 | 2 | 2 |
| Chem211 | Chem101 | Organic Chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic219 | --------- | Biostatistics and Experimental Designs | 2 | 1(tu) | 2 |
| BCh205 | --------- | Biochemistry of Cells | 1 | 2 | 2 |
| CS215 | --------- | Computer and information security | 2 | 1(tu) | 2 |
| Total | | | | | 17 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجي – Department of Botany and Microbiology

الميكروبيولوجيا (تخصص منفرد) – Microbiology – Single

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Mic212 | Bot101 | Microbial Diversity | 1 | 3 | 2 |
| Mic214 | Mic211 | Microbiological Techniques | - | 4 | 2 |
| Mic216 | Bot101 | Biology of Algae | 1 | 3 | 2 |
| BCh214 | BCh207 | Metabolism of Biomolecules | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic218 | Mic211 | Microbial toxins | 1 | 2 | 2 |
| BCh208 | --------- | Biological Oxidation | 2 | - | 2 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Total | | | | | 13 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجي – Department of Botany and Microbiology

الميكروبيولوجيا (تخصص منفرد) – Microbiology – Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Mic311 | Mic211 | Bacteriology | 1 | 3 | 2 |
| Mic313 | Mic211 | Virology | 1 | 3 | 2 |
| Mic315 | Mic213 | Physiology and metabolism of Microbial cell | 2 | 3 | 3 |
| Mic317 | Mic211 | Molecular Microbiology | 1 | 3 | 2 |
| Zoo313 | Zoo102 | Parasitology and Medical Entomology | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic319 | Mic211 | Microbial secondary metabolites | 1 | 3 | 2 |
| Phys313 | ------ | Biophysical Foundations and Processes | 1 | 2 | 2 |
| BCh311 | --------- | Metabolism of inorganic compounds | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BCh307 | ------ | Analytical Biochemistry | 1 | 2 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجي – Department of Botany and Microbiology

الميكروبيولوجيا (تخصص منفرد) – Microbiology – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Mic312 | Mic211 | Mycology | 2 | 3 | 3 |
| Mic314 | Mic211 | Yeast and Yeast Biotechnology | 1 | 3 | 2 |
| Mic316 | Mic213 | Microbial Enzymes | 1 | 3 | 2 |
| Mic318 | Mic317 | Microbial Genetics | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic320 | Mic315 | Fermentation Technology | 1 | 3 | 2 |
| Phys314 | -------- | Radiological Biophysics | 1 | 2 | 2 |
| BCh306 | -------- | Cancer Biology | 2 | - | 2 |
| BCh314 | -------- | Environmental Pollution | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Total | | | | | 13 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجي – Department of Botany and Microbiology

الميكروبيولوجيا (تخصص منفرد) – Microbiology – Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Mic411 | Mic311 | Systematic Bacteriology | 1 | 3 | 2 |
| Mic413 | Mic211 | Medical Microbiology and Immunology | 2 | 3 | 3 |
| Mic415 | Mic211 | Microbial Remediation | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BCh401 | _____ | Clinical Biochemistry | 2 | 2 | 3 |
| Mic490 | - | Research Project | - | 3 | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Mic417 | Mic317 | Molecular Systematic | 1 | 2 | 2 |
| Mic419 | Mic313 | Viral Biotechnology | 1 | 2 | 2 |
| Mic421 | ---- | Laboratory Safety, management&Infection Control | 2 | - | 2 |
| BCh409 | ---- | Stem Cells & Cell Culture | 1 | 2 | 2 |
| Zoo413 | Zoo101 | Techniques of Electron Microscope | 1 | 2 | 2 |
| Chem417 | Chem221 | Topics in Organic Chemistry | 2 | - | 2 |
| Total | | | | | 16 |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology – قسم النبات والميكروبيولوجي

Microbiology – Single – الميكروبيولوجي (تخصص منفرد)

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4- Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Mic410 | Mic317 | Bioinformatics | 1 | 2 | 2 |
| Mic412 | Mic413 | Food and water Microbiology | 2 | 3 | 3 |
| Mic414 | Mic211 | Industrial Microbiology and Biotechnology | 1 | 3 | 2 |
| Mic416 | Mic211 | Microorganisms of Extreme Environments | 1 | 3 | 2 |
| Mic490 | - | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Mic418 | Mic312 | Plant pathology | 1 | 3 | 2 |
| Mic420 | - | Environmental Management and Impact Assessment | 2 | - | 2 |
| Mic422 | Mic211 | Actinomycetes | 1 | 3 | 2 |
| BCh404 | --- | Toxicology | 2 | - | 2 |
| BCh406 | ----- | Nanoscience Bioapplications | 1 | 2 | 2 |
| BCh408 | --- | Immunohistochemistry | 1 | 2 | 2 |
| BCh410 | --- | Cell Signaling | 2 | - | 2 |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Total | | | | | 15 |

## قسم النبات والميكروبيولوجى

## نبات – كيمياء ( تخصص مزدوج)

| | |
|---|---|
| Program Title | Botany- Chemistry |
| Program Type | Double Major |
| Department(s) | Botany and Microbiology |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي - الكيمياء

Botany /Chemistry (Double Major) – نبات /كيمياء (تخصص مزدوج)

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic217 | Bot101 | General Microbiology | 1 | 2 | 2 |
| Bot213 | Bot102 | Plant water relation and mineral nutrition | 1 | 2 | 2 |
| Bot215 | Bot102 | General Ecology and Advanced Anatomy | 1 | 2 | 2 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Bot211 | Bot101 | Cell and Genetics | 1 | 2 | 2 |
| Bot217 | Bot101 | Medicinal Plants | 1 | 2 | 2 |
| Bot219 | Bot102 | Economic Botany | 1 | 2 | 2 |
| Total | | | | | 18 |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي - الكيمياء

Botany /Chemistry (Double Major) – نبات /كيمياء (تخصص مزدوج)

Level Two - Second Semester – المستوي الثاني – الفصل الدراسي الثاني –

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Bot212 | Bot101 | Principles of Genetics | 1 | 2 | 2 |
| Bot216 | Bot101 | General Plant Taxonomy | 1 | 2 | 2 |
| Bot228 | Bot101 | Biology of algae and biotechnology | 1 | 2 | 2 |
| Bot218 | Bot213 | Plant molecular physiology and photosynthesis | 1 | 1 | 1 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |

| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
|---|---|---|---|---|---|
| Bot224 | Bot102 | Algal metabolism | 1 | 2 | 2 |
| Bot226 | Bot101 | Genotoxicity and biosafety | 2 | - | 2 |
| Bot230 | Bot215 | Soil Sciences | 1 | 2 | 2 |
| Total | | | | | 18 |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي - الكيمياء

نبات /كيمياء (تخصص مزدوج) – Botany /Chemistry (Double Major)

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Bot311 | Bot101 | Molecular genetics | 1 | 2 | 2 |
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Bot319 | Bot101 | Fundamentals of Bioinformatics | 1 | 2 | 2 |
| Bot321 | Bot228 | Physiology of Algae | 1 | 2 | 2 |
| Bot323 | Bot101 | Genome and Epigenetics | 2 | - | 2 |
| Bot325 | Bot213 | Plant Stress Physiology | 1 | 2 | 2 |
| Total | | | | | 14 |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي - الكيمياء

نبات /كيمياء (تخصص مزدوج) – Botany /Chemistry (Double Major)

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Bot310 | Bot213 | Plant biochemistry and metabolism | 1 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Bot314 | Bot216 | Advanced Plant Taxonomy | 1 | 2 | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem316 | Chem 212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي - الكيمياء

نبات /كيمياء (تخصص مزدوج) – Botany /Chemistry (Double Major)

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Bot411 | Bot311 | Genetic Engineering and Genes Technology | 1 | 2 | 2 |
| Bot431 | Bot215 | Ecosystem dynamics and environmental Biotechnology | 1 | 2 | 2 |
| Bot433 | Bot101 | Diversity of Archegoniate | 1 | 2 | 2 |
| Chem490 | ------ | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Total | | | | | 13 |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي - الكيمياء

Botany /Chemistry (Double Major) – نبات /كيمياء (تخصص مزدوج)

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Bot490 | ------- | Research Project | 1 | - | 1 |
| Bot414 | Bot431 | Phytogeography and flora | 1 | 2 | 2 |
| Bot428 | Bot310 | Introduction to Plant propagation | 1 | 2 | 2 |
| Mic418 | Bot101 | Plant pathology | 1 | 2 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Bot416 | Bot314 | Plant systematics and evolution | 1 | 2 | 2 |
| Bot418 | Bot431 | Vegetation and plant communities | 1 | 2 | 2 |
| Bot422 | Bot310 | Secondary plant metabolites | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | ---------- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Total | | | | | 13 |

# قسم النبات والميكروبيولوجى
# ميكروبيولوجي/كيمياء (تخصص مزدوج)

| | |
|---|---|
| Program Title | Microbiology/Chemistry |
| Program Type | Double Major |
| Department(s) | Botany and Microbiology & Chemistry |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry

قسم النبات والميكروبيولوجي – قسم الكيمياء

Microbiology /Chemistry (Double Major )– (تخصص مزدوج) ميكروبيولوجي/كيمياء

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic211 | Bot101 | Fundamental Microbiology | 2 | 3 | 3 |
| Mic213 | Bot101 | Microbial Cell Structure and Function | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry& phase rule | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Mic215 | Bot101 | Biological Control | 1 | 2 | 2 |
| Mic219 | --------- | Biostatistics and Experimental Designs | 2 | 1(tu) | 2 |
| BCh205 | --------- | Biochemistry of Cells | 1 | 2 | 2 |
| CS215 | --------- | Computer and information security | 2 | 1(tu) | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية - Biology Science Section

قسم النبات والميكروبيولوجي - قسم الكيمياء – Department of Botany and Microbiology& Department of Chemistry

ميكروبيولوجي/كيمياء (تخصص مزدوج) – Microbiology /Chemistry (Double Major )

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic212 | Bot101 | Microbial Diversity | 1 | 2 | 2 |
| Mic216 | Bot101 | Biology of Algae | 1 | 3 | 2 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic214 | Mic211 | Microbiological Techniques | - | 4 | 2 |
| Mic218 | Mic211 | Microbial toxins | 1 | 2 | 2 |
| BCh208 | --------- | Biological Oxidation | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry –

قسم النبات والميكروبيولوجي - قسم الكيمياء

Microbiology /Chemistry (Double Major )– ميكروبيولوجي/كيمياء (تخصص مزدوج)

Level Three - First Semester – المستوي الثالث – الفصل الدراسي الأول

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic311 | Mic211 | Bacteriology | 1 | 3 | 2 |
| Mic313 | Mic211 | Virology | 1 | 3 | 2 |
| Mic321 | Mic213 | Microbial Physiology | 1 | 3 | 2 |
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic317 | Mic211 | Molecular Microbiology | 1 | 2 | 2 |
| Mic319 | Mic211 | Microbial secondary metabolites | 1 | 3 | 2 |
| Phys313 | ------ | Biophysical Foundations and Processes | 1 | 2 | 2 |
| BCh307 | ------ | Analytical Biochemistry | 1 | 2 | 2 |
| Total | | | | | 18 |

Biology Science Section - شعبة العلوم البيولوجية

Department of Botany and Microbiology& Department of Chemistry –

قسم النبات والميكروبيولوجي - قسم الكيمياء

Microbiology /Chemistry (Double Major )– ميكروبيولوجي/كيمياء (تخصص مزدوج)

Level Three - Second Semester – المستوي الثالث – الفصل الدراسي الثاني

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic312 | Mic211 | Mycology | 2 | 3 | 3 |
| Mic316 | Mic213 | Microbial Enzymes | 1 | 3 | 2 |
| Mic318 | Mic317 | Microbial Genetics | 1 | 3 | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |

| Total | | | 19 |
|---|---|---|---|

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry –

قسم النبات والميكروبيولوجي - قسم الكيمياء

ميكروبيولوجي/كيمياء (تخصص مزدوج) –( Microbiology /Chemistry( Double Major

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic413 | Mic211 | Medical Microbiology and Immunology | 2 | 3 | 3 |
| Mic415 | Mic211 | Microbial Remediation | 1 | 3 | 2 |
| Chem490 | ---------- | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem421 | Chem 101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem435 | Chem 102 | Solution and colloidal chemistry | 2 | - | 2 |
| Total | | | | | 12 |

شعبة العلوم البيولوجية - Biology Science Section

Department of Botany and Microbiology& Department of Chemistry –

قسم النبات والميكروبيولوجي - قسم الكيمياء

ميكروبيولوجي/كيمياء (تخصص مزدوج) –( Microbiology /Chemistry (Double Major

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic414 | Mic211 | Industrial Microbiology& Biotechnology | 1 | 3 | 2 |
| Mic426 | Mic413 | Food Microbiology | 1 | 2 | 2 |
| Mic490 | - | Research Project | - | 3 | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Mic416 | Mic211 | Microorganisms of Extreme Environments | 1 | 3 | 2 |
| Mic418 | Mic312 | Plant pathology | 1 | 3 | 2 |
| Mic420 | - | Environmental Management and Impact Assessment | 2 | - | 2 |
| Mic422 | Mic211 | Actinomycetes | 1 | 3 | 2 |
| BCh404 | --- | Toxicology | 2 | - | 2 |
| BCh406 | | Nanoscience Bioapplications | 1 | 2 | 2 |
| BCh408 | --- | Immunohistochemistry | 1 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BCh410 | --- | Cell Signaling | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | ---------- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Total | | | | | 13 |

## قسم علم الحيوان

## علم الحيوان (تخصص منفرد)

| | |
|---|---|
| Program Title | Zoology |
| Program Type | Single |
| Department(s) | Zoology |

شعبة العلوم البيولوجية - Biological Science Section

قسم علم الحيوان – Department of Zoology

علم الحيوان (تخصص منفرد) – Zoology – Single

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo201 | Zoo102 | Invertebrates Biology (1) | 1 | 3 | 2 |
| Zoo203 | Zoo101 | Histology and zoo-techniques | 1 | 3 | 2 |
| Zoo205 | Zoo101 | Physiology (1) | 1 | 3 | 2 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Zoo207 | Zoo102 | Fauna of Egypt | 1 | 2 | 2 |
| Zoo209 | Zoo101 | Animal biotechnology | 1 | 2 | 2 |
| Zoo211 | Zoo101 | Basic Immunology | 1 | 2 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biological Science Section

قسم علم الحيوان – Department of Zoology

علم الحيوان (تخصص منفرد) – Zoology – Single

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo202 | Zoo102 | Invertebrates Biology (2) | 1 | 2 | 2 |
| Zoo204 | Zoo101 | Fundamentals of Chordates | 1 | 3 | 2 |
| Zoo206 | Zoo102 | Ecology and animal behavior | 2 | 3 | 3 |
| Zoo208 | Zoo102 | Desert Ecology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Zoo210 | Zoo101 | Cellular Immunology | 1 | 2 | 2 |
| Zoo212 | Zoo101 | Enzymology | 1 | 2 | 2 |
| Zoo214 | Zoo101 | Soil Ecotoxicology | 1 | 2 | 2 |
| Zoo216 | Zoo101 | Basic Genetics | 1 | 2 | 2 |
| Total | | | | | 13 |

شعبة العلوم البيولوجية - Biological Science Section

قسم علم الحيوان – Department of Zoology

علم الحيوان (تخصص منفرد) – Zoology – Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo301 | Zoo101 | Cell Biology and genetics | 2 | 3 | 3 |
| Zoo303 | Zoo205 | Physiology (2) | 1 | 3 | 2 |
| Zoo305 | Zoo102 | Invertebrates embryology | 1 | 2 | 2 |
| Zoo307 | Zoo206 | Soil Ecology | 1 | 2 | 2 |
| Ent301 | Zoo102 | Insect Structure and Function | 1 | 3 | 2 |
| BCh307 | ------ | Analytical Biochemistry | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Zoo309 | Zoo204 | Chordates Biodiversity | 2 | - | 2 |
| Zoo311 | …… | Stem cells programming | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Ent303 | Zoo201 | Applied Entomology | 1 | 2 | 2 |
| Total | | | | | 17 |

شعبة العلوم البيولوجية - Biological Science Section

قسم علم الحيوان – Department of Zoology

علم الحيوان (تخصص منفرد) – Zoology – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lec | Prac | Cred |
| Zoo302 | Zoo204 | Comparative anatomy of vertebrates | 2 | 3 | 3 |
| Zoo304 | Zoo204 | Vertebrates Embryology | 1 | 2 | 2 |
| Zoo306 | Zoo102 | Basics of Medical Parasitology | 1 | 3 | 2 |
| Zoo308 | Zoo101 | Neurophysiology and Endocrinology | 1 | 2 | 2 |
| Zoo310 | Zoo102 | Protozoology | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Zoo312 | ..... | Bioethics | 2 | - | 2 |
| Zoo314 | Zoo205 | Molecular biotechnology | 2 | - | 2 |
| Zoo316 | Zoo205 | Cancer Immunology | 2 | - | 2 |
| Zoo318 | Zoo201 | Invertebrates pathology | 1 | 2 | 2 |
| Zoo320 | Zoo102 | Diagnostic parasitology | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biological Science Section

قسم علم الحيوان – Department of Zoology

علم الحيوان (تخصص منفرد) – Zoology – Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo401 | Zoo101 | Fundamentals of Molecular Biology | 1 | 3 | 2 |
| Zoo403 | Zoo101 | Diagnostic Immunology | 1 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Zoo405 | Zoo203 | Histochemistry | 1 | 2 | 2 |
| Zoo407 | Zoo306 | Epidemiology & Medical Parasitology | 1 | 2 | 2 |
| Ent401 | Ent301 | Insect physiology | 1 | 2 | 2 |
| Zoo490 | -------- | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Zoo409 | ……. | Basics of in vitro fertilization | 2 | - | 2 |
| Zoo411 | Zoo203 | Histopathology | 1 | 2 | 2 |
| Zoo413 | …….. | Techniques of Electron Microscope | 2 | - | 2 |
| Zoo415 | Zoo206 | Ecological Pollution | 1 | 2 | 2 |
| Zoo417 | …….. | Bioinformatics | 2 | - | 2 |
| Zoo419 | Zoo101 | Physiology of cardiovascular | 1 | 2 | 2 |
| Ent403 | …….. | Forensic Entomology | 2 | - | 2 |
| Total | | | | | 17 |

Biological Science Section - شعبة العلوم البيولوجية

Department of Zoology – قسم علم الحيوان

Zoology – Single – علم الحيوان (تخصص منفرد)

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo402 | Zoo101 | Molecular biology of cancer | 1 | 2 | 2 |
| Zoo404 | | Advanced Molecular Biology | 1 | 2 | 2 |
| Zoo490 | -------- | Research Project | 1 | - | 1 |
| Ent402 | Ent301 | Medical Entomology | 1 | 2 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Zoo406 | Zoo306 | Immunology and parasitology | 1 | 3 | 2 |
| Zoo408 | Zoo304 | Advanced in vitro Fertilization | 1 | 2 | 2 |
| Zoo410 | Zoo205 | Hematology | 1 | 2 | 2 |
| Zoo412 | …….. | Toxicology | 2 | - | 2 |
| Zoo414 | Zoo403 | Molecular Immunology | 1 | 2 | 2 |
| Zoo416 | Zoo303 | Reproductive physiology | 1 | 2 | 2 |
| Ent410 | Ent301 | Aquatic Entomology | 1 | 2 | 2 |
| Total | | | | | 13 |

## قسم علم الحيوان

## علم الحيوان والكيمياء (تخصص مزدوج)

| | |
|---|---|
| program Title | Zoology and Chemistry |
| Program Type | Double Major |
| Department(s) | Zoology and Chemistry |

شعبة العلوم البيولوجية - Biological Science Section

قسم علم الحيوان-قسم الكيمياء– Department of Zoology &Department of Chemistry

علم الحيوان /الكيمياء (تخصص مزدوج) – Zoology / Chemistry – Double Major

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo201 | Zoo102 | Invertebrates Biology (1) | 1 | 3 | 2 |
| Zoo203 | Zoo101 | Histology and zoo-techniques | 1 | 3 | 2 |
| Zoo205 | Zoo101 | Physiology (1) | 1 | 3 | 2 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo207 | Zoo102 | Fauna of Egypt | 1 | 2 | 2 |
| Zoo211 | Zoo101 | Basic Immunology | 1 | 2 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biological Science Section

قسم الكيمياء - قسم علم الحيوان– Department of Zoology &Department of Chemistry

علم الحيوان /الكيمياء (تخصص مزدوج) – Zoology / Chemistry – Double Major

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo202 | Zoo102 | Invertebrates Biology (2) | 1 | 2 | 2 |
| Zoo204 | Zoo101 | Fundamentals of Chordates | 1 | 3 | 2 |
| Zoo206 | Zoo102 | Ecology and animal behavior | 2 | 3 | 3 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo210 | Zoo101 | Cellular Immunology | 1 | 2 | 2 |
| Zoo214 | Zoo101 | Soil Ecotoxicology | 1 | 2 | 2 |
| Total | | | | | 16 |

Biological Science Section - شعبة العلوم البيولوجية

Department of Zoology &Department of Chemistry– قسم علم الحيوان-قسم الكيمياء

Zoology / Chemistry – Double Major – علم الحيوان /الكيمياء (تخصص مزدوج)

Level Three - First Semester – المستوي الثالث – الفصل الدراسي الأول

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo301 | Zoo101 | Cell Biology and genetics | 2 | 3 | 3 |
| Zoo303 | Zoo205 | Physiology (2) | 1 | 3 | 2 |
| Ent301 | Zoo102 | Insect Structure and Function | 1 | 3 | 2 |
| Chem311 | Chem211 | Stereo and Physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo305 | Zoo102 | Invertebrates embryology | 1 | 2 | 2 |
| Zoo309 | Zoo204 | Chordates Biodiversity | 2 | - | 2 |
| Zoo311 | …….. | Stem cells programming | 2 | - | 2 |
| Total | | | | | 17 |

Biological Science Section - شعبة العلوم البيولوجية

Department of Zoology &Department of Chemistry– قسم علم الحيوان-قسم الكيمياء

Zoology / Chemistry – Double Major – علم الحيوان /الكيمياء (تخصص مزدوج)

Level Three - Second Semester – المستوي الثالث – الفصل الدراسي الثاني

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lec | Prac | Cred |
| Zoo322 | Zoo204 | Comparative anatomy of vertebrates and Embryology | 2 | 3 | 3 |
| Zoo306 | Zoo102 | Basics of Medical Parasitology | 1 | 3 | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |

| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
|---|---|---|---|---|---|
| Zoo308 | Zoo101 | Neurophysiology and Endocrinology | 1 | 2 | 2 |
| Zoo312 | ------ | Bioethics | 2 | - | 2 |
| Zoo314 | Zoo205 | Molecular biotechnology | 2 | - | 2 |
| Zoo318 | Zoo201 | Invertebrates pathology | 1 | 2 | 2 |
| Zoo320 | Zoo102 | Diagnostic parasitology | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 19 |

Biological Science Section - شعبة العلوم البيولوجية

Department of Zoology &Department of Chemistry– قسم علم الحيوان-قسم الكيمياء

Zoology / Chemistry – Double Major – علم الحيوان /الكيمياء (تخصص مزدوج)

Level Four - First Semester – المستوي الرابع – الفصل الدراسي الأول

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo401 | Zoo101 | Fundamentals of Molecular Biology | 1 | 3 | 2 |
| Zoo403 | Zoo101 | Diagnostic Immunology | 1 | 2 | 2 |
| Chem490 | --------- | Research Project | 1 | - | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo409 | ------- | Basics of in vitro fertilization | 2 | - | 2 |
| Zoo419 | Zoo101 | Physiology of cardiovascular | 1 | 2 | 2 |
| Ent403 | ------- | Forensic Entomology | 2 | - | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Total | | | | | 13 |

Biological Science Section - شعبة العلوم البيولوجية

Department of Zoology &Department of Chemistry– قسم علم الحيوان-قسم الكيمياء

Zoology / Chemistry – Double Major – علم الحيوان /الكيمياء (تخصص مزدوج)

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo402 | Zoo101 | Molecular biology of cancer | 1 | 2 | 2 |
| Zoo490 | — | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Zoo406 | Zoo306 | Immunology and parasitology | 1 | 3 | 2 |
| Zoo408 | Zoo304 | Advanced in vitro Fertilization | 1 | 2 | 2 |
| Zoo414 | Zoo403 | Molecular Immunology | 1 | 2 | 2 |
| Zoo416 | Zoo303 | Reproductive physiology | 1 | 2 | 2 |
| Ent402 | Ent301 | Medical Entomology | 1 | 2 | 2 |
| Ent410 | Ent301 | Aquatic Entomology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | ---- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Total | | | | | 11 |

# قسم علم الحيوان

## علم الحشرات والكيمياء (تخصص مزدوج)

| | |
|---|---|
| program Title | Entomology and Chemistry |
| Program Type | Double Major |
| Department(s) | Zoology and Chemistry |

شعبة العلوم البيولوجية- Biological Science Section

قسم علم الحيوان-قسم الكيمياء –Department ofZoology &Department of Chemistry

علم الحشرات /الكيمياء (تخصص مزدوج) – Entomology / Chemistry – Double Major

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo201 | Zoo102 | Invertebrates Biology (1) | 1 | 3 | 2 |
| Ent201 | Zoo102 | Introduction to Entomology | 2 | 3 | 3 |
| Zoo205 | Zoo101 | Physiology (1) | 1 | 3 | 2 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |

| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
|---|---|---|---|---|---|
| Zoo211 | Zoo101 | Basic immunology | 2 | - | 2 |
| Zoo203 | Zoo101 | Histology and zoo-technique | 1 | 2 | 2 |
| Total | | | | | 17 |

شعبة العلوم البيولوجية- Biological Science Section

قسم علم الحيوان-قسم الكيمياء– Department ofZoology &Department of Chemistry

علم الحشرات /الكيمياء (تخصص مزدوج) – Zoology / Chemistry – Double Major

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Ent202 | Zoo102 | Insect Ecology and behavior | 2 | 2 | 3 |
| Ent204 | Zoo102 | Insect Taxonomy | 1 | 3 | 2 |
| Zoo202 | Zoo102 | Invertebrates biology (2) | 1 | 3 | 2 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo204 | Zoo101 | Fundamentals of chordates | 1 | 2 | 2 |
| Ent206 | Zoo102 | Chemical Ecology of Insects | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية- Biological Science Section

قسم علم الحيوان-قسم الكيمياء– Department ofZoology &Department of Chemistry

علم الحشرات /الكيمياء (تخصص مزدوج) – Zoology / Chemistry – Double Major

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |

| | | | | | |
|---|---|---|---|---|---|
| Ent301 | Zoo102 | Insect structure and function | 1 | 2 | 2 |
| Zoo301 | Zoo101 | Cell biology and genetics | 2 | 2 | 2 |
| Ent303 | Zoo201 | Applied entomology | 1 | 2 | 2 |
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the followingModules | | | | | |
| Ent305 | Zoo102 | Apiculture and Honeybee biology | 1 | 2 | 2 |
| Zoo305 | Zoo102 | Invertebrates embryology | 1 | 2 | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية- Biological Science Section

قسم علم الحيوان-قسم الكيمياء– Department ofZoology &Department of Chemistry

علم الحشرات /الكيمياء (تخصص مزدوج) – Zoology / Chemistry – Double Major

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lec | Prac | Cred |
| Ent302 | Ent201 | Integrated pest management | 2 | 3 | 3 |
| Zoo306 | Zoo102 | Basics of medical parasitology | 1 | 3 | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo312 | --------- | Bioethics | 2 | - | 2 |
| Ent304 | Ent201 | Insect toxicology | 1 | 2 | 2 |
| Ent306 | Ent201 | Insect technique | 1 | 3 | 2 |
| Ent308 | Ent201 | Economic Entomology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 19 |

Biological Science Section- شعبة العلوم البيولوجية

Department ofZoology &Department of Chemistry– قسم علم الحيوان-قسم الكيمياء

Zoology / Chemistry – Double Major – علم الحشرات /الكيمياء (تخصص مزدوج)

Level Four - First Semester – المستوي الرابع – الفصل الدراسي الأول

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Ent401 | Ent301 | Insect Physiology | 1 | 2 | 2 |
| Ent403 | ------ | ForensicEntomology | 2 | - | 2 |
| Chem490 | ------ | Research Project | 1 | - | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Ent405 | Ent301 | Insect Immunology | 1 | 3 | 2 |
| Zoo401 | Zoo101 | Fundamentals of Molecular Biology | 1 | 3 | 2 |
| Ent407 | Ent301 | Insect Endocrinology | 1 | 3 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Total | | | | | 13 |

Biological Science Section- شعبة العلوم البيولوجية

Department ofZoology &Department of Chemistry– قسم علم الحيوان-قسم الكيمياء

Zoology / Chemistry – Double Major – علم الحشرات /الكيمياء (تخصص مزدوج)

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Ent402 | Ent301 | Medical Entomology | 1 | 2 | 2 |
| Ent490 | ------- | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Ent406 | Ent301 | Insect Genetics | 1 | 3 | 2 |
| Ent408 | Ent401 | Molecular Entomology | 1 | 3 | 2 |
| Ent410 | Ent301 | Aquatic Entomology | 1 | 2 | 2 |
| Ent412 | Ent301 | Insect biotechnology | 1 | 2 | 2 |
| Electives: Student selects two course (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | -------- | Bioanalytical chemistry | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Total | | | | | 11 |

## قسم علوم الأرض

## الجيولوجيا (تخصص منفرد)

| | |
|---|---|
| Program Title | Geology |
| Program Type | Single |
| Department(s) | Earth Science |

Earth Science Section - شعبة علوم الأرض

Department of Earth Science – قسم علوم الأرض

Geology– Single – الجيولوجيا (تخصص منفرد)

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo225 | — | Crystal Chemistry | 1 | 3 | 2 |
| Geo205 | — | Optical Mineralogy | 1 | 3 | 2 |
| Geo207 | - | Sedimentary Petrology (1) | 1 | 3 | 2 |
| Geo209 | — | Macropaleontology (1) | 1 | 3 | 2 |
| Chem207 | Chem101 | Chemistry of the main elements | 2 | - | 2 |
| Geo215 | ------- | Field Geology | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo213 | — | Vertebrate Paleontology | 1 | 3 | 2 |
| Geo227 | — | Field Training (1) | 1 | 3 | 2 |
| Geo201 | — | Crystallography | 1 | 3 | 2 |
| Total | | | | | 15 |

Earth Science Section - شعبة علوم الأرض

Department of Earth Science – قسم علوم الأرض

Geology– Single – الجيولوجيا (تخصص منفرد)

Level Two - Second Semester – المستوي الثاني – الفصل الدراسي الثاني

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo202 | Geo205 | Rock-forming Minerals | 1 | 3 | 2 |
| Geo222 | Geo205 | Igneous and Metamorphic Petrology | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo230 | — | Principles of Stratigraphy | 1 | 3 | 2 |
| Geo223 | Geo215 | Geological Survey | 1 | 3 | 2 |
| Geo208 | ~~Geo230~~ | Lithostratigraphy | 1 | 3 | 2 |
| Geo212 | ~~Geo230~~ | Micropaleontology (1) | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo214 | — | Applied Mineralogy | 1 | 3 | 2 |
| Geo216 | ~~Geo230~~ | Advanced Stratigraphy | 1 | 3 | 2 |
| Geo210 | Geo209 | Micropaleontology (2) | 1 | 3 | 2 |
| Geo218 | — | Paleoecology | 1 | 3 | 2 |
| Geo220 | Geo227 | Field Training (2) | 1 | 3 | 2 |
| Chem204 | Chem207 | Chemistry of transition elements | 2 | - | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا (تخصص منفرد) – Geology– Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo301 | Geo230 | Structural Geology (1) | 1 | 3 | 2 |
| Geo313 | Geo230 | Marine Geology | 1 | 3 | 2 |
| Geo315 | Geo230 | Ore Deposits | 1 | 3 | 2 |
| Geo308 | Geo207 | Sedimentary Petrology (2) | 1 | 3 | 2 |
| Geo319 | Geo209 | Photogeology | 1 | 3 | 2 |
| GPh325 | — | Geophysics (1) | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo311 | Geo230 | Field Geology and Field Studies | 1 | 3 | 2 |
| Geo317 | Geo230 | Rock Mechanics | 1 | 3 | 2 |
| Geo309 | Geo212 | Macropaleontology (2) | 1 | 3 | 2 |
| Geo321 | Geo209 | Trace Fossils | 1 | 3 | 2 |
| Geo323 | — | Instrumental Techniques | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا (تخصص منفرد) – Geology– Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo302 | Geo301 | Tectonic Geology | 1 | 3 | 2 |
| Geo304 | Geo230 | Subsurface Geology | 1 | 3 | 2 |
| Geo306 | Geo208 | Biostratigraphy | 1 | 3 | 2 |
| Geo310 | Geo207 | Engineering Geology | 1 | 3 | 2 |
| GPh326 | Gph325 | Geophysics (2) | 1 | 3 | 2 |
| Geo312 | Geo202 | Geology of Ores | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo314 | Geo301 | Structural Geology (2) | 1 | 3 | 2 |
| Geo316 | Geo207 | Quaternary Geology | 1 | 3 | 2 |
| Geo318 | Geo207 | Geology of Africa | 1 | 3 | 2 |
| Geo320 | Geo222 | Volcanology | 1 | 3 | 2 |
| Geo322 | Geo207 | Geoarcheology | 1 | 3 | 2 |
| Geo324 | — | Environmental Geology | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا ( تخصص منفرد) – Geology– Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo401 | Geo207 | Geology of Egypt | 1 | 3 | 2 |
| Geo405 | — | Geochemistry | 1 | 3 | 2 |
| Geo409 | Geo207 | Petroleum Geology | 1 | 3 | 2 |
| Geo411 | Geo207 | Hydrogeology | 1 | 3 | 2 |
| Geo403 | Geo230 | Remote Sensing | 1 | 3 | 2 |
| Geo490 | — | Research Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo413 | Geo207 | Clay Mineralogy | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo415 | Geo207 | Facies Analysis and Depositional Environments | 1 | 3 | 2 |
| Geo417 | Geo312 | Ore Dressing | 1 | 3 | 2 |
| Geo419 | Geo222 | Volcanoclastics | 1 | 3 | 2 |
| Geo421 | Geo303 | Isotope Geology | 1 | 3 | 2 |
| Geo423 | - | Geochemical Exploration and Prospecting | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا ( تخصص منفرد) – Geology– Single

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4- Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo424 | Geo405 | Organic Geochemistry | 1 | 3 | 2 |
| Geo404 | — | Palynology | 1 | 3 | 2 |
| Geo408 | Geo230 | Mining Geology | 1 | 3 | 2 |
| Geo420 | Geo405 | Hydrogeochemistry | 1 | 3 | 2 |
| Geo490 | — | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo416 | — | Application of RS in Natural Hazards | 1 | 3 | 2 |
| Geo418 | Geo409 | Reservoir modeling and simulation | 1 | 3 | 2 |
| Geo406 | — | Precambrian Geology | 1 | 3 | 2 |
| Geo410 | Geo207 | Basin Analysis | 1 | 3 | 2 |
| Geo422 | Geo405 | Advanced Geochemistry | 1 | 3 | 2 |
| Geo412 | Geo411 | Groundwater modeling | 1 | 3 | 2 |
| Geo426 | Geo312 | Ore Mineralogy | 1 | 3 | 2 |
| Geo428 | — | Geographic Information Systems | 1 | 3 | 2 |
| Geo430 | — | Selected Topics in Geology | 1 | 3 | 2 |
| Total | | | | | 15 |

# قسم علوم الأرض
# الجيولوجيا/الجيوفيزياء (تخصص مزدوج)

| | |
|---|---|
| Programme Title | Geology/Geophysics |
| Programme Type | Double Major |
| Department(s) | Earth Science |

Department of Earth Science – قسم علوم الأرض

Geology/Geophysics (Double Major) – الجيولوجيا/الجيوفيزياء (تخصص مزدوج)

Level Two - First Semester – المستوي الثاني – الفصل الدراسي الأول

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo205 | ------ | Optical Mineralogy | 1 | 3 | 2 |
| Geo207 | -- | Sedimentary petrology (1) | 1 | 3 | 2 |
| Geo209 | ------ | Macropaleontology (1) | 1 | 3 | 2 |
| Gph201 | Geo102 | Basic Geophysics | 1 | 3 | 2 |
| Gph205 | ---- | Principals of Earthquake Seismology | 1 | 2 | 2 |
| Gph207 | ---------- | Remote Sensing (1) | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo203 | ------ | Geomorphology | 1 | 3 | 2 |
| Geo225 | ------ | Crystal Chemistry | 1 | 3 | 2 |
| Geo211 | ------ | Gemstones | 1 | 3 | 2 |
| Geo213 | ------ | Vertebrate Paleontology | 1 | 3 | 2 |
| Geo227 | ------ | Field Training (1) | 1 | 3 | 2 |
| Gph203 | CS111 | Computer Application in Geophysics | 1 | 3 | 2 |
| Total | | | | | 16 |

Earth Science Section - شعبة علوم الأرض

Department of Earth Science – قسم علوم الأرض

Geology/Geophysics (Double Major) – الجيولوجيا/الجيوفيزياء (تخصص مزدوج)

Level Two - Second Semester – المستوي الثاني – الفصل الدراسي الثاني

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo222 | Geo205 | Igneous and Metamorphic Petrology | 2 | 3 | 3 |
| Geo212 | ~~Geo230~~ | Micropaleontology (1) | 1 | 3 | 2 |
| Gph202 | Gph201 | Gravity and Magnetic Methods | 2 | 3 | 3 |
| Gph204 | Gph201 | Seismic Methods | 1 | 3 | 2 |
| Math211 | Math112 | Mathematical Analysis (1) | 2 | 1 | 2 |
| Geo230 | ------ | Principles of Stratigraphy | 1 | 3 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Geo202 | Geo205 | Applied Minerals | 1 | 3 | 2 |
| Geo216 | ~~Geo230~~ | Advanced Stratigraphy | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo208 | ~~Geo230~~ | Lithostratigraphy | 1 | 3 | 2 |
| Geo218 | — | Paleoecology | 1 | 3 | 2 |
| Geo220 | Geo227 | Field Training (2) | - | 6 | 2 |
| Geo223 | ~~Geo215~~ | Geological Survey | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا/الجيوفيزياء (تخصص مزدوج) – Geology/Geophysics (Double Major)

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo301 | Geo230 | Structural Geology (1) | 1 | 3 | 2 |
| Geo308 | Geo205 | Sedimentary Petrology (2) | 1 | 3 | 2 |
| Gph301 | Gph201 | Geoelectrical and Electromagnetic Methods | 1 | 3 | 2 |
| Gph307 | Gph204 | Seismic data processing | 1 | 3 | 2 |
| Gph303 | Gph202 | Well Logging and Formation Evaluation | 1 | 3 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo309 | Geo212 | Macropaleontology (2) | 1 | 3 | 2 |
| Geo313 | Geo230 | Marine Geology | 1 | 3 | 2 |
| Geo323 | ---------- | Instrumental techniques | 1 | 3 | 2 |
| Geo317 | Geo230 | Rock Mechanics | 1 | 3 | 2 |
| Geo319 | | Photogeology | 1 | 3 | 2 |
| Gph311 | Gph205 | Paleomagnetism | 1 | 3 | 2 |
| Geo315 | Geo230 | Ore Deposits | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا/الجيوفيزياء (تخصص مزدوج) – Geology/Geophysics (Double Major)

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo310 | Geo207 | Engineering Geology | 1 | 3 | 2 |
| Geo304 | Geo230 | Subsurface Geology | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo306 | Geo208 | Biostratigraphy | 1 | 3 | 2 |
| Gph304 | Gph303 | Geophysical Exploration | 1 | 3 | 2 |
| Gph310 | Gph204 | Engineering and Environmental Geophysics | 1 | 3 | 2 |
| Gph302 | Gph301 | Interpretation of potential field methods | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Gph306 | Gph204 | Marine Seismic | 1 | 3 | 2 |
| Gph314 | Gph301 | Advanced Electromagnetic Methods | 1 | 3 | 2 |
| Gph312 | Gph205 | Advanced Earthquake Seismology | 1 | 3 | 2 |
| Gph308 | Gph202 | Marine Gravity and Magnetic Geophysics | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا/الجيوفيزياء (تخصص مزدوج) – Geology/Geophysics (Double Major)

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo409 | Geo207 | Petroleum Geology | 1 | 3 | 2 |
| Geo401 | Geo207 | Geology of Egypt | 1 | 3 | 2 |
| Gph401 | Gph307 | Seismic data interpretation | 1 | 3 | 2 |
| Gph490 | ---------- | Research Project | 1 | - | 1 |
| Electives: Student selects four courses (8 credit hours) from the following modules | | | | | |
| Geo417 | Geo312 | Ore Dressing | 1 | 3 | 2 |
| Gph416 | Gph207 | Application of RS in natural hazards | 1 | 3 | 2 |
| Geo405 | — | Geochemistry | 1 | 3 | 2 |
| Gph405 | ------- | Integration of Geophysical Data | 1 | 3 | 2 |
| Gph407 | Gph204 | Seismic Stratigraphy | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض – Department of Earth Science

الجيولوجيا/الجيوفيزياء (تخصص مزدوج) – Geology/Geophysics (Double Major)

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |

| | | | | | |
|---|---|---|---|---|---|
| Geo411 | Geo207 | Hydrogeology | 1 | 3 | 2 |
| Geo408 | Geo230 | Mining Geology | 1 | 3 | 2 |
| Geo490 | — | Research Project | 1 | - | 1 |
| Gph408 | Gph302 | Reservoir geophysics | 1 | 3 | 2 |
| Gph412 | ---- | Ground Penetrating Radar (GPR) | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Gph414 | ---- | Radioactive and Geothermal Methods | 1 | 3 | 2 |
| Geo404 | Geo209 | Palynology | 1 | 3 | 2 |
| Geo434 | — | Statistical Geology | 1 | 3 | 2 |
| Gph410 | ---- | Reservoir Correlation and Production | 1 | 3 | 2 |
| Total | | | | | 13 |

## قسم علوم الأرض

## الجيولوجيا/الكيمياء (تخصص مزدوج)

| Programme Title | Geology/Chemistry |
|---|---|
| Programme Type | Double Major |
| Department(s) | Earth Science and Chemistry |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض - قسم الكيمياء Department of Earth Science & Department of Chemistry

الجيولوجيا/الكيمياء (تخصص مزدوج) – Geology/Chemistry (Double Major)

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo205 | ------ | Optical Mineralogy | 1 | 3 | 2 |
| Geo207 | --- | Sedimentary petrology (1) | 1 | 3 | 2 |
| Geo209 | ------ | Macropaleontology (1) | 1 | 3 | 2 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Geo203 | ------ | Geomorphology | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo211 | ------ | Gemstones | 1 | 3 | 2 |
| Geo213 | ------ | Vertebrate Paleontology | 1 | 3 | 2 |
| Geo227 | ------ | Field Training (1) | 1 | 3 | 2 |
| Geo201 | ------ | Crystallography | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض - قسم الكيمياء Department of Earth Science & Department of Chemistry

الجيولوجيا/الكيمياء (تخصص مزدوج) – Geology/Chemistry (Double Major)

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo222 | Geo205 | Igneous and metamorphic Petrology | 2 | 3 | 3 |
| Geo212 | ~~Geo230~~ | Micropaleontology (1) | 1 | 3 | 2 |
| Geo230 | ----- | Principles of Stratigraphy | 1 | 3 | 2 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Geo202 | Geo205 | Rock-forming Minerals | 1 | 3 | 2 |
| Geo216 | — | Advanced Stratigraphy | 1 | 3 | 2 |
| Geo218 | — | Paleoecology | 1 | 3 | 2 |
| Geo220 | Geo227 | Field Training (2) | - | 6 | 2 |
| Geo223 | — | Geological Survey | 1 | 3 | 2 |
| Geo208 | — | Lithostratigraphy | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الأرض - قسم الكيمياء Department of Earth Science & Department of Chemistry

الجيولوجيا/الكيمياء (تخصص مزدوج) – Geology/Chemistry Double Major)

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo301 | Geo230 | Structural Geology (1) | 1 | 3 | 2 |
| Geo308 | Geo205 | Sedimentary Petrology (2) | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo315 | Geo230 | Ore Deposits | 1 | 3 | 2 |
| Geo309 | Geo212 | Macropaleontology (2) | 1 | 3 | 2 |
| Geo313 | Geo230 | Marine Geology | 1 | 3 | 2 |
| Geo323 | ---- | Instrumental techniques | 1 | 3 | 2 |
| Geo321 | Geo209 | Trace Fossils | 1 | 3 | 2 |
| GPh325 | — | Geophysics (1) | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض - Earth Science Section

قسم علوم الارض - قسم الكيمياء Department of Earth Science & Department of Chemistry

الجيولوجيا/الكيمياء (تخصص مزدوج) – Geology/Chemistry (Double Major)

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo310 | Geo207 | Engineering Geology | 1 | 3 | 2 |
| Geo306 | Geo208 | Biostratigraphy | 1 | 3 | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Geo304 | Geo207 | Subsurface Geology | 1 | 3 | 2 |
| Geo317 | Geo230 | Rock Mechanics | 1 | 3 | 2 |
| Geo319 | Geo209 | Photogeology | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 18 |

شعبة علوم الأرض - Earth Science Section

Department of Earth Science & Department of Chemistry قسم علوم الأرض - قسم الكيمياء

Geology/Chemistry (Double Major) – الجيولوجيا/الكيمياء (تخصص مزدوج)

Level Four - First Semester – المستوي الرابع – الفصل الدراسي الأول

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo401 | Geo207 | Geology of Egypt | 1 | 3 | 2 |
| Geo405 | — | Geochemistry | 1 | 3 | 2 |
| Geo409 | Geo207 | Petroleum Geology | 1 | 3 | 2 |
| Chem490 | ---------- | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem431 | Chem102 | Molecular , ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Total | | | | | 13 |

Earth Science Section - شعبة علوم الأرض

Department of Earth Science & Department of Chemistry قسم علوم الأرض - قسم الكيمياء

Geology/Chemistry (Double Major) – الجيولوجيا/الكيمياء (تخصص مزدوج)

Level Four - Second Semester – المستوي الرابع – الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo411 | Geo207 | Hydrogeology | 1 | 3 | 2 |
| Geo408 | Geo207 | Mining Geology | 1 | 3 | 2 |
| Geo490 | — | Resesrch Project | 1 | - | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Chem426 | ----- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Electives: Student selects two course (4 credit hours) from the following modules | | | | | |
| Geo404 | --- | Palynology | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo417 | Geo312 | Ore Dressing | 1 | 3 | 2 |
| Geo434 | — | Statistical Geology | 1 | 3 | 2 |
| Total | | | | | 13 |

## قسم الكيمياء الحيوية

## برنامج الكيمياء الحيوية (تخصص منفرد)

| | |
|---|---|
| Program Title | Biochemistry |
| Program Type | Single |
| Department(s) | Biochemistry |

Biological Science Section - شعبة العلوم البيولوجية

Department of Biochemistry – قسم الكيمياء الحيوية

Biochemistry – Single – الكيمياء الحيوية (تخصص منفرد)

Level two-First Semester -المستوى الثاني- الفصل الدراسي الأول

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem211 | Chem101 | Organic Chemistry 1 | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| BCh201 | --- | Biomolecules 1 | 2 | 2 | 3 |
| BCh203 | --- | Biomolecules 2 | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| BCh205 | --- | Biochemistry of Cells | 1 | 2 | 2 |
| Stat209 | --- | Introduction to Probability and Statistics | 2 | 1 | 2 |
| Mic245 | --- | Principles of biotechnology | 1 | 2 | 2 |
| Total | | | 16 | | |

Biological Science Section - شعبة العلوم البيولوجية

Department of Biochemistry – قسم الكيمياء الحيوية

Biochemistry – Single – الكيمياء الحيوية (تخصص منفرد)

Level two-Second Semester -المستوى الثاني- الفصل الدراسي الثاني

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem234 | Chem102 | Fundamentals of Physical Chemistry | 2 | 2 | 3 |
| BCh202 | --- | Principles of Molecular Biology | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BCh204 | BCh201/ BCh203 | Nutrition | 2 | - | 2 |
| Electives: Student selects four courses (8 credit hours) from the following modules | | | | | |
| BCh206 | | Biological Membranes & Transport | 2 | - | 2 |
| BPhy222 | | Biophysics | 2 | - | 2 |
| BCh208 | | Biological Oxidation | 2 | - | 2 |
| BCh210 | | Bioethics | 2 | - | 2 |
| Mic222 | | Basis of Microbiology | 1 | 2 | 2 |
| Total | | | 15 | | |

Biological Science Section - شعبة العلوم البيولوجية

Department of Biochemistry – قسم الكيمياء الحيوية

Biochemistry – Single – الكيمياء الحيوية (تخصص منفرد)

Level three-First Semester -المستوى الثالث- الفصل الدراسي الأول

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh301 | --- | Physical Biochemistry | 2 | 2 | 3 |
| BCh303 | BCh203 | Metabolism of Carbohydrates & Lipids | 2 | 1 | 2 |
| BCh305 | BCh201 | Metabolism of amino acids & Proteins | 2 | 1 | 2 |
| BCh307 | --- | Analytical Biochemistry | 1 | 2 | 2 |
| BCh309 | --- | Enzymology 1 | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| BCh311 | --- | Metabolism of Inorganic compounds | 2 | - | 2 |
| BCh331 | ------ | Food-Drug Interaction | 2 | - | 2 |
| BCh333 | ------ | Nutritional Diseases | 2 | - | 2 |
| Mic345 | --- | Soil and agriculture microbiology | 1 | 2 | 2 |
| BCh313 | --- | Drug & Xenobiotics Metabolism | 2 | - | 2 |
| Total | | | 16 | | |

شعبة العلوم البيولوجية - Biological Science Section
قسم الكيمياء الحيوية – Department of Biochemistry
الكيمياء الحيوية (تخصص منفرد) – Biochemistry – Single
المستوى الثالث- الفصل الدراسي الثاني- Level three-Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh302 | --- | Enzymology 2 | 2 | 3 | 3 |
| BCh304 | BCh303/ BCh305 | Metabolic Regulation | 2 | 3 | 3 |
| BCh306 | --- | Cancer Biology | 2 | - | 2 |
| BCh308 | --- | Natural Products & its applications | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| BCh310 | BCh202 | Genetic Engineering | 2 | - | 2 |
| BCh312 | --- | Neuroscience | 2 | - | 2 |
| BCh314 | --- | Environmental Pollution | 2 | - | 2 |
| Total | | | 15 | | |

شعبة العلوم البيولوجية - Biological Science Section
قسم الكيمياء الحيوية – Department of Biochemistry
الكيمياء الحيوية (تخصص منفرد) – Biochemistry – Single
المستوى الرابع- الفصل الدراسي الأول- Level Four-First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh401 | --- | Clinical Biochemistry | 2 | 2 | 3 |
| BCh403 | --- | Immunology | 2 | - | 2 |
| BCh405 | --- | Endocrinology & Hormones | 2 | 2 | 3 |
| BCh407 | | Instrumental Analysis | 2 | 2 | 3 |
| BCh490 | --- | Research Project | 1 | 1 | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| BCh411 | | Laboratory Safety & Infection Control | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BCh413 | --- | Scientific writing | 2 | - | 2 |
| BCh409 | ---- | Stem Cells & Cell Culture | 1 | 2 | 2 |
| Total | | | 16 | | |

Biological Science Section - شعبة العلوم البيولوجية

Department of Biochemistry – قسم الكيمياء الحيوية

Biochemistry – Single – الكيمياء الحيوية (تخصص منفرد)

Level Four-Second Semester - المستوى الرابع- الفصل الدراسي الثاني

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh402 | BCh401 | Advanced Clinical Biochemistry | 2 | 2 | 3 |
| BCh404 | --- | Toxicology | 2 | - | 2 |
| BCh410 | --- | Cell Signaling | 2 | - | 2 |
| BCh414 | | Vitamins & Co-enzymes | 2 | - | 2 |
| BCh490 | --- | Research Project | 1 | 1 | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| BCh412 | --- | Bioinformatics | 1 | 2 | 2 |
| BCh416 | ----- | Topics in Biochemistry | 2 | - | 2 |
| BCh406 | | Nanoscience Bioapplications | 1 | 2 | 2 |
| BCh408 | --- | Immunohistochemistry | 1 | 2 | 2 |
| Total | | | 14 | | |

# قسم الكيمياء الحيوية

## برنامج الكيمياء الحيوية والكيمياء (تخصص مزدوج)

| | |
|---|---|
| Program Title | Biochemistry- Chemistry |
| Program Type | Double Major |
| Department(s) | Biochemistry & chemistry |

Biological Science Section- شعبة العلوم البيولوجية

Department of Biochemistry &Department of Chemistry– قسم الكيمياء الحيوية-قسم الكيمياء

Biochemistry / Chemistry – Double Major – الكيمياء الحيوية /الكيمياء (تخصص مزدوج)

Level two-First Semester- المستوى الثاني- الفصل الدراسي الأول

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh201 | --- | Biomolecules 1 | 2 | 2 | 3 |
| BCh203 | --- | Biomolecules 2 | 2 | 2 | 3 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BCh205 | --- | Biochemistry of Cells | 1 | 2 | 2 |
| Stat209 | --- | Introduction to Probability and Statistics | 2 | 1 | 2 |
| Mic245 | --- | Principles of Biotechnology | 1 | 2 | 2 |
| Total | | | 16 | | |

Biological Science Section- شعبة العلوم البيولوجية

Department of Biochemistry &Department of Chemistry– قسم الكيمياء الحيوية-قسم الكيمياء

Biochemistry / Chemistry – Double Major – الكيمياء الحيوية /الكيمياء (تخصص مزدوج)

Level two-Second Semester- المستوى الثاني- الفصل الدراسي الثاني

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh202 | --- | Principles of Molecular Biology | 2 | --- | 2 |
| BCh204 | BCh201/ BCh203 | Nutrition | 2 | --- | 2 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of Representative Elements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| BCh206 | ---- | Biological Membranes & Transport | 2 | - | 2 |
| BCh208 | ---- | Biological Oxidation | 2 | - | 2 |
| BCh210 | ---- | Bioethics | 2 | --- | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BPhy222 | ---- | Biophysics | 2 | --- | 2 |
| Total | | | 15 | | |

شعبة العلوم البيولوجية- Biological Science Section

قسم الكيمياء الحيوية-قسم الكيمياء– Department of Biochemistry &Department of Chemistry

الكيمياء الحيوية /الكيمياء (تخصص مزدوج) – Biochemistry / Chemistry – Double Major

المستوى الثالث- الفصل الدراسي الأول- Level three-First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh303 | BCh201 | Metabolism of Carbohydrates & Lipids | 2 | 1 | 2 |
| BCh305 | BCh203 | Metabolism of amino acids & Proteins | 2 | 1 | 2 |
| BCh309 | --- | Enzymology 1 | 2 | 3 | 3 |
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Total | | | 15 | | |

شعبة العلوم البيولوجية- Biological Science Section

قسم الكيمياء الحيوية-قسم الكيمياء– Department of Biochemistry &Department of Chemistry

الكيمياء الحيوية /الكيمياء (تخصص مزدوج) – Biochemistry / Chemistry – Double Major

المستوى الثالث- الفصل الدراسي الثاني- Level three-Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh306 | --- | Cancer Biology | 2 | - | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BCh310 | BCh202 | Genetic Engineering | 2 | - | 2 |
| BCh312 | --- | Neuroscience | 2 | - | 2 |
| BCh314 | --- | Environmental Pollution | 2 | - | 2 |
| Total | | | 16 | | |

شعبة العلوم البيولوجية- Biological Science Section

قسم الكيمياء الحيوية-قسم الكيمياء– Department of Biochemistry &Department of Chemistry

الكيمياء الحيوية /الكيمياء (تخصص مزدوج) – Biochemistry / Chemistry – Double Major

المستوى الرابع - الفصل الدراسي الأول- Level Four-First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh401 | --- | Clinical Biochemistry | 2 | 2 | 3 |
| BCh403 | --- | Immunology | 2 | - | 2 |
| BCh405 | --- | Endocrinology & Hormones | 2 | 2 | 3 |
| Chem490 | ---------- | Research Project | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Total | | | 15 | | |

شعبة العلوم البيولوجية- Biological Science Section

قسم الكيمياء الحيوية-قسم الكيمياء– Department of Biochemistry &Department of Chemistry

الكيمياء الحيوية /الكيمياء (تخصص مزدوج) – Biochemistry / Chemistry – Double Major

المستوى الرابع- الفصل الدراسي الثاني- Level Four-Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh404 | --- | Toxicology | 2 | - | 2 |
| BCh410 | --- | Cell Signaling | 2 | - | 2 |
| BCh490 | --- | Research Project | 1 | 1 | 1 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | ---------- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| BCh412 | --- | Bioinformatics | 1 | 2 | 2 |
| BCh414 | | Vitamins & Co-enzymes | 2 | - | 2 |
| BCh416 | ----- | Topics in Biochemistry | 2 | - | 2 |
| BCh406 | | Nanoscience Bioapplications | 1 | 2 | 2 |
| BCh408 | --- | I mmunohistochemistry | 1 | 2 | 2 |
| Total | | | 15 | | |

# اللائحة الداخلية

لكلية العلوم. جامعة دمنهور

للعمل بنظام الساعات المعتمدة

# الفصل الرابع

# البرامج والخطط الدراسية المتخصصة (بمصروفات)

# Physics Department

## Renewable and sustainable Energy program

# قسم الفيزياء

## برنامج الطاقة المتجددة والمستدامة

## (برنامج بمصروفات )

| | |
|---|---|
| Program Title | Renewable and sustainable Energy |
| Program Type | Physics Main |
| Department(s) | Physics |

**Renewable and sustainable Energy program**

**رؤية برنامج بكالوريوس الطاقة المتجددة والمستدامة**

**1-** إعداد كوادر علمية وتطبيقية ذات مستوى رفيع ويتمتعون بخلفية أكاديمية وتدريبية ممتازة ومسلحين بالمعرفة والمهارات العلمية والعملية في علم **الطاقة المتجددة والمستدامة**.

2- إعداد كوادر مؤهلة لتلبية احتياجات سوق العمل الداخلي والخارجي ولديهم القدرة على المنافسة والتعامل مع المتطلبات الأكاديمية والبحثية والتطبيقية في إطار أخلاقي.

**رسالة بكالوريوس الطاقة المتجددة والمستدامة**

تم تصميم برنامج الطاقة المتجددة والمستدامة لتزويد الطلاب بمعرفة أساسية قوية في أنظمة الطاقة المتجددة وكذلك التقليدية وتأثيراتها الاقتصادية والاجتماعية والبيئية على المجتمع. يوفر البرنامج الفرصة للطلاب تطوير ونشر مجموعة مهارات شاملة في السعي وراء الحلول المتعلقة بالتحديات التقنية والاقتصادية والاجتماعية والبيئية المتعلقة بالطاقة والكفاءة وإدارة الموارد المتجددة. تشمل المجالات المحورية للدراسة تطوير المعرفة الأساسية في مجالات طاقة الرياح والطاقة الشمسية والطاقة الحيوية والمنتجات المتجددة والعمليات والخدمات اللوجستية وإدارة المشاريع في إطار الاستخدام المستدام للموارد. بالإضافة إلى تكنولوجيا تخزين الطاقة وتوصيلها بالشبكة الكهربائية. تقدم هذه المواد مجتمعة منهجاً متكاملاً نظرياً وعملياً يؤهل الطلاب لابتكار حلول عملية لتوليد وتوزيع واستخدام الطاقة الجديدة والمتجددة للتطبيقات المتصلة والمنفصلة عن شبكة الكهرباء.

و قد اتفقت هذه الرؤية والرسالة تماما مع رؤية ورسالة كلية العلوم خاصة وجامعة دمنهور عامة حيث أنها إحدى الجامعات المصرية الحكومية التي تتمحور رسالتها حول الإسهام فى البناء المعرفى والثقافى والإنسانى والمهارى والإبداعى والتقنى والاخلاق للطلاب ولأبناء المجتمع المصرى، ولإعدادهم لمواكبة التقدم فى المعارف وتأهيلهم للمشاركة فى تحقيق أهداف التنمية المستدامة فى إطار مناخ تحفيزى على التعلم والبحث والإبتكار والإبداع يقدم من خلاله نماذج للشراكة الفاعلة بين الجامعة وقطاعات المجتمع المصرى المختلفة، ويساهم فى إيجاد صيغ من التعاون والتبادل والتفاعل مع مصادر المعرفة والهيئات البحثية والشركات وبيوت الخبرة المحلية والإقليمية والعالمية فى إطار من التنافسية فى الجودة والتميز .

**و بناء على ذلك تم اقتراح إضافة برنامج بكالوريوس الطاقة المتجددة والمستدامة كبرنامج خاص بمصروفات للائحة البكالوريوس لقسم الفيزياء لكلية العلوم بجامعة دمنهور.**

**المخرجات التعليمية المستهدفة ومبررات فتح برنامج بكالوريوس الطاقة المتجددة والمستدامة:**

**1-** إكساب الطالب معارف ومهارات علمية وتطبيقية وتقنية فى مجال **الطاقة المتجددة والمستدامة** وتأهيله وتزويده بالنظريات الحديثة وإعداده لمواصلة التعليم في مجال الطاقه البديله والمتجدده، وفقا لاحتياجات المستقبل والتطورات الأخيرة في مصر والعالمفي اطار أزمة المناخ والطاقه.

2- إكمال رسالة الكلية بما تقدمه من برامج تعليمية تمد خريجي كلية العلوم بخلفية معرفية جيدة بفروع الطاقه المتجدده و المستدامه ومنح الطلاب شهادة علمية في مجالات جديدة لزيادة كفاءتهم وفرصهم في سوق العمل.

3- خريجو برنامج **الطاقة المتجددة والمستدامة** الذين يجدون وظائف مع شركات المرافق ، ومنتجي الطاقة ومراجعيها ، وشركات تصميم المباني والبناء ، ومستويات مختلفة من البلديات ، وأكثر من ذلك سوف يكونوا قادرين على حل المشكلات على مسار أكثر استدامة ونحو استخدامات أفضل وأكثر كفاءة للطاقة.

4- إثراء المعرفة والمساهمة في التطورات العلمية في مجال الطاقه المتجدده والبديله من خلال دراسة ومتابعة التطورات في مجالي الكيمياء الحيوية والتغذية.

5- استعمال المهارات النظرية والعملية من خلال التعلم فى مجموعات، وإجراء التجارب وتفسير المشاكل الخاصة بفيزياء **الطاقة المتجددة والمستدامة**.

6- توافر الإمكانات المادية والمعملية والبشرية في قسم الفيزياء بكلية العلوم – جامعة دمنهور المعملية والعلمية لفتح برنامج بكالوريوس **الطاقة المتجددة والمستدامة**.والوفاء بمتطلباته.

**الإمكانات المادية والبشرية في معامل الفيزياء:**

1- يتوافر في الكلية عدد اربع معامل طلابية ومعمل خاص بأبحاث علوم المواد مجهزين باجهزه معمليه تخدم الدارسين بالبرنامج بالاضافه الى عدد من أجهزه القياس ( الخواص الحراريه TGA وDSC) وكذلك (الخواص الكهربيه LCR Bridge) وعدد 2 من افرن التحضير ومنظومة *طلاء* الأغشية الرقيقة *(coating unit* Thin film) ووحده للتقطير الماء المضاعف (D*ouble distilled water*) وكذلك جهاز التحليل الطيفي في مجال الاشعه فوق البنفسجيه والمرئيه (UV/VIS) وجهاز (Gamry) وجاري حاليا الاتفاق علي شراء أجهزه قياس أخري تخدم البرنامج.

2- بالنسبة للإمكانات البشرية (2 أعضاء هيئة تدريس بدرجة أستاذ و5 بدرجه استاذ مساعد و8 بدرجه مدرس) و 10 من الهيئة المعاونة بالإضافة إلى الإستعانة بعدد مناسب من أعضاء هيئة التدريس من

3- المتخصصين من المنتدبين من جهات مختلفة مما يعد مناسبا للعبء التدريسي في البداية.

4- يتوافر أيضا في الكلية مكتبة إلكترونية تضم عدد متميز من الكتب بالإضافة إلى عدد من المراجع الورقية الحديثة.

**الإطار العام للبرنامج**

- لغة الدراسة بالبرنامج هي اللغة الإنجليزية
- تطبق لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة علي هذا البرنامج
- يشترط للحصول على درجة البكالوريوس أن يجتاز الطالب بنجاح عدد 136 ساعة معتمدة يتم توزيعها كالتالي :-

**(1) متطلبات جامعة:** 8 ساعات معتمدة ( 4 ساعات إجباري + 4 ساعات اختياري )

**(2) متطلبات الكلية:** 28 ساعة معتمدة إجبارية

**(3) مقررات إجبارية في التخصص :** 62 ساعة معتمدة

**(4) مقررات اختيارية في التخصص:** 28 ساعة معتمدة

**(5) مقررات حرة 6 ساعات معتمدة**

**(6) دراسات ميدانية وتطبيقية 2 ساعة معتمدة**

**(7) مشروع بحثي 2 ساعة معتمدة**

*** تتكون السنة الدراسية من ثلاث فصول دراسية:**

أ- فصل الخريف – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الثالث من شهر سبتمبر}.

ب- فصل الربيع – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الأول من شهر فبراير}.

ج- فصل الصيف – ومدته ستة أسابيع { يبدأ في الأسبوع الأول من شهر يوليو} مكثف.

السنة التأسيسية – Foundation Year

شعبة العلوم الطبيعية – Physical Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | .Prereq | Compulsory | .Lect | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Math111 | — | Calculus (1) | 2 | 1 | 2 |
| CS111 | — | Computer Applications | 1 | 2 | 2 |
| Math151 | — | Mechanics (1) | 2 | 1 | 2 |
| Phys111 | — | Physics (1) | 2 | 3 | 3 |
| Bot111 | — | General Botany | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة العلوم الطبيعية – Physical Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Math112 | — | Calculus (2) | 2 | 1 | 2 |
| Math152 | — | Mechanics (2) | 2 | 1 | 2 |
| CS112 | — | Computer Programming (1) | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Phys112 | — | Physics (2) | 2 | 3 | 3 |
| Zoo111 | — | General Zoology | 1 | 3 | 2 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 18 |

شعبة العلوم الطبيعية – Physical Science Section

Renewable and sustainable Energy Program–Expenses Program

برنامج الطاقةالمتجددة والمستدامة (برنامج بمصروفات)

المستوي الثاني – الفصل الدراسي الأول– Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys233 | Phys102 | Energy storage Materials and applications | 2 | - | 2 |
| Phys231 | | Introduction to green energy | 2 | - | 2 |
| Phys235 | | Power plant technology | 2 | 1 (tu) | 2 |
| Phys237 | | Environmental Climatology | 1 | 2 | 2 |
| Phys213 | Phys102 | Physical optics and optical instruments | 2 | 2 | 3 |
| Phys201 | Phys102 | Electromagnetism | 2 | 1 (tu) | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys215 | Phys102 | Waves and Vibrations | 2 | 1 (tu) | 2 |
| Phys219 | | Carbon Nanomaterials | 2 | - | 2 |
| Phys239 | | Advanced circuit design | 1 | 2 | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية – Physical Science Section

Renewable and sustainable Energy Program–Expenses Program

برنامج الطاقة المتجددة والمستدامة (برنامج بمصروفات)

المستوي الثانى – الفصل الدراسي الثاني– Level Three - Second Semester

| Level 2 - Semester 2 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
|---|---|---|---|---|---|
| Phys202 | Phys101 | Thermodynamics and statistical physics | 2 | 1 (tu) | 2 |
| Phys204 | Phys102 | Introduction to electronics and crystal physics | 2 | - | 2 |
| Phys206 | | Practical Physics (2) | - | 3 | 1 |
| Phys222 | | Managing renewable energy | 2 | - | 2 |
| Phys224 | | Nanoscience and Nanotechnology | 2 | - | 2 |
| Phys226 | | Biomass and Bioenergy | 2 | - | 2 |
| Phys228 | | Efficient energy generation & conversion | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys214 | | Energy resources | 2 | - | 2 |
| Phys216 | Phys203 | Radiation physics and applications | 2 | - | 2 |
| Phys230 | | Distribution power system | 2 | - | 2 |
| Total | | | | | 15 |

## شعبة العلوم الطبيعية – Physical Science Section

### Renewable and sustainable Energy Program–Expenses Program

### برنامج الطاقة المتجددة والمستدامة (برنامج بمصروفات)

### المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys333 | | Biomass conversion technologies | 2 | 1 (tu) | 2 |
| Phys335 | | Electric power generation | 2 | - | 2 |
| Phys305 | | Practical Physics (3) | - | 3 | 1 |
| Phys337 | | Introduction to Nanoscience | 2 | | 2 |
| Phys309 | | Nonrenewable & Renewable Energy Resources | 2 | - | 2 |
| Phys339 | | Heat transfer | 1 | 2 | 2 |
| Phys341 | | Gas sensors | 1 | 2 | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | 2 |
| Phys313 | | Semiconductor technology | 2 | - | 2 |
| Phys315 | Phys202 | Low temperature physics and vacuum energy | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Phys321 | | Nanomaterials and environmental applications | 2 | - | 2 |
| Phys343 | | Soft matter and biomaterials | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية – Physical Science Section

Renewable and sustainable Energy Program–Expenses Program

برنامج الطاقة المتجددة والمستدامة (برنامج بمصروفات)

المستوي الثالث – الفصل الدراسي الثانى– Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys332 | | Nuclear Energy | 2 | - | 2 |
| Phys334 | | Biofuels and biomass | 2 | - | 2 |
| Phys306 | | Practical Physics (4) | - | 3 | 1 |
| Phys336 | | Green technology | 2 | - | 2 |
| Phys342 | | Fluid mechanics | 2 | 1 (tu) | 2 |
| Phys346 | | Solar, wind and Marine Energy | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Phys344 | | Materials for energy applications | 2 | - | 2 |
| Phys338 | | hydroelectric Power | 2 | - | 2 |
| Phys348 | | Nanomaterials and environmental applications | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم الطبيعية – Physical Science Section

Renewable and sustainable Energy Program–Expenses Program

برنامج الطاقة المتجددة والمستدامة (برنامج بمصروفات)

المستوي الرابع – الفصل الدراسي الأول-Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys401 | Phys302 | Cosmic Rays and Elementary Particles | 2 | - | 2 |
| Phys455 | | Power energy and engineering | 2 | 1 (tu) | 2 |
| Phys405 | | Practical Physics (5) | - | 3 | 1 |
| Phys457 | | Photovoltaics | 2 | 1 (tu) | 2 |
| Phys490 | | Research Project / Seminar | 1 | - | 1 |
| Phys459 | | Technology of electric power plants | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Phys461 | | Trends in renewable Energy | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys411 | Phys212 | Microwaves | 2 | - | 2 |
| Phys415 | Phys201 | Detectors and accelerators | 2 | - | 2 |
| Phys463 | | Selected Topics in Renewable and sustainable Energy | 2 | - | 2 |
| Total | | | | | 16 |

شعبة العلوم الطبيعية – Physical Science Section

Renewable and sustainable Energy Program–Expenses Program

برنامج الطاقة المتجددة والمستدامة (برنامج بمصروفات)

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys448 | | Physics and energy of the earth | 2 | - | 2 |
| Phys404 | | Material science (2) | 2 | - | 2 |
| Phys406 | | Practical Physics (6) | - | 3 | 1 |
| Phys408 | Phys301 | Dielectric and electrical properties in solids | 1 | 2 | 2 |
| Phys410 | | Acoustic optics | 2 | | 2 |
| Phys490 | | Research Project / Seminar | 1 | - | 1 |
| Phys440 | | Wastewater treatment | 3 | - | 3 |
| Phys452 | | Solid and hazardous waste management | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys412 | Phys311 | Superconductivity | 2 | - | 2 |
| Phys454 | | Energy conservation and efficiency | 2 | - | 2 |
| Phys456 | | Water Purification and distillation | 2 | - | 2 |
| Total | | | | | 17 |

# Physics Department

## Biophysics program

# قسم الفيزياء

## برنامج الفيزياء الحيوية

## (برنامج بمصروفات )

| | |
|---|---|
| Program Title | Biophysics |
| Program Type | Physics Main |
| Department(s) | Physics |

## Biophysics program

**رؤية برنامج بكالوريوس الفيزياء الحيوية**

يتطلع قسم الفيزياء الحيوية للريادة محليا وعالميا في مجالات تطوير التعليم والبحث العلمي عالى المستوى، وخدمة جامعة دمنهور والمجتمع من خلال تقديم مشاريع بحثية متطورة، قادرة على تزويد المجتمع بالمعارف والكوادر المدربة عبر بيئة محفزة للتعليم والإبداع والبحث العلمي، وبجودة مستمرة تضمن التوظيف الأمثل للتقنية والشراكة العامة.

**رسالة برنامج بكالوريوس الفيزياء الحيوية**

1- تحقيق التميز في التعليم العالي والبحث العلمي وخدمة المجتمع عن طريق تطوير وتحقيق السبل الكفيلة بضمان جودة الأداء والمخرجات مع الاستخدام الأمثل للموارد والتقنية الحديثة.

2. تقديم المقررات العامة والتخصصية في شتى علوم الفيزياء الحيوية المختلفة بالقسم وبجامعة دمنهور.

3. التواصل العلمي البنّاء مع أقسام الكلية والكليات الأخرى (على المستويين المحلي والإقليمي) بهدف تبادل الخبرات العلمية والتدريسية، والإطلاع على كل ما هو جديد في فروع علم الفيزياء الحيوية.

4. إعداد كوادر مؤهلة علمياً لتلبية احتياجات سوق العمل بالقطاعين العام والخاص والمساهمة في حل المشكلات العلمية والصناعية التي تواجه خطط التنمية بجمهورية مصر العربية.

5. تشجيع أعضاء هيئة التدريس بالقسم على إنتاج البحوث العلمية المبتكرة والمشاركة في المؤتمرات العلمية الدولية؛ لتكوين منظومة علمية متكاملة لممارسات البحث العلمي في إطار التعاون المشترك بين القسم والأقسام المناظرة محليا وعالميا بهدف الارتقاء بالمستوى العلمي للقسم والمساهمة في تطوير جامعة دمنهور والمجتمع الدمنهورى والمصرى.

6. تأهيل الطلاب بعلوم متعمقة تمكنهم من المشاركة الفعالة في الجوانب العلمية والتقنية من برامج التنمية والتخطيط المصرية

**المخرجات التعليمية المستهدفة ومبررات فتح برنامج بكالوريوس الفيزياء الحيويه:**

1- يقوم البرنامج بتنظيم العديد من دورات الوقاية من الإشعاع و التي تؤهل الحاصلين عليها للحصول على رخصة تعامل مع المواد المشعة و أجهزة الإشعاع من وزارة الصحة المصرية.
2- خريجى هذا القسم مطلوبون في سوق العمل و بشكل واضح جدا في القطاع الطبي و الوقاية الإشعاعية بل وفي عمليات القلب المفتوح و تذخر بهم العديد من الجامعات و مراكز الأبحاث العلمية و الشركات.
3- كما أن خريجي القسم مؤهلين للعمل بعدد من جامعات الدول الأجنبية مثل الجامعات الغربية (جامعة لندن وجامعة استكهولم بالسويد ، جامعة ليدز بانجلترا، جامعة أوهايو وفلوريدا بالولايات المتحدة ، جامعة تورنتو والبرتا بكندا وجامعات باليابان والدنمارك و المجر والمانيا وغيرهم.)
4- اكمال رسالة الكلية بما تقدمة من برامج تعليمية تمد الطلاب بخلفية معرفية جيدة تشمل كل ما يخص الفيزياء الحيوية بفروعها المختلفة حيث ان هذة الشعبة غير موجودة بلائحة الكلية وتود الكلية فتح الشعبة (بنظام الساعات المعتمدة).
5- توافر الامكانيات البشرية والمادية والمعملية لفتح شعبة الفيزياء الحيوية.
6- عدم وجود جهة علمية بمحافظة البحيرة لتخريج كوادر متخصصة فى الفيزياء الحيوية.

**الإمكانات المادية والبشرية في معامل الكيمياء الحيوية:**

1- يتوافر فى الكلية معمل للفيزياء الحيوية .

2- يضم قسم الفيزياء بالكلية اثنين من أعضاء هيئة التدريس المتخصصين فى الفيزياء الحيوية علما بأن الجامعة ليس لديها مانع من دعم الشعبة بأعضاء هيئة التدريس ومعيدين جدد.

3- يحتوى قسم الفيزياء على العديد من الأجهزة التى تخدم الدراسة فى شعبة الفيزياء الحيوية.

4- يتوافر أيضا في الكلية مكتبة إلكترونية تضم عدد متميز من الكتب بالإضافة إلى عدد من المراجع الورقية الحديثة.

**الإطار العام للبرنامج**

- لغة الدراسة بالبرنامج هي اللغة الإنجليزية
- تطبق لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة علي هذا البرنامج
- يشترط للحصول على درجة البكالوريوس أن يجتاز الطالب بنجاح عدد 136 ساعة معتمدة يتم توزيعها كالتالي :-

**(1) متطلبات جامعة:** 8 ساعات معتمدة ( 4 ساعات إجباري + 4 ساعات اختياري )

**(2) متطلبات الكلية:** 28 ساعة معتمدة إجبارية

**(3) مقررات إجبارية في التخصص :** 62 ساعة معتمدة

**(4) مقررات اختيارية في التخصص:** 28 ساعة معتمدة

**(5) مقررات حرة 6 ساعات معتمدة**

**(6) دراسات ميدانية وتطبيقية 2 ساعة معتمدة**

**(7) مشروع بحثي 2 ساعة معتمدة**

*** تتكون السنة الدراسية من ثلاث فصول دراسية:**

أ- فصل الخريف – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الثالث من شهر سبتمبر}.

ب- فصل الربيع – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الأول من شهر فبراير}.

ج- فصل الصيف – ومدته ستة أسابيع { يبدأ في الأسبوع الأول من شهر يوليو} مكثف.

Foundation Year – السنة التأسيسية

Biology Science Section – شعبة العلوم البيولوجية

Level One - First Semester – المستوي الأول – الفصل الدراسي الأول

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Zoo101 | — | General Zoology (1) | 2 | 3 | 3 |
| Bot101 | — | General Botany(1) | 2 | 3 | 3 |
| Math101 | — | General Mathematics | 2 | 3 | 3 |
| Phys101 | — | General Physics (1) | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 18 |

Foundation Year – السنة التأسيسية

Biology Science Section – شعبة العلوم البيولوجية

Level One - Second Semester – المستوي الأول – الفصل الدراسي الثاني

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Zoo102 | — | General Zoology (2) | 2 | 3 | 3 |
| Bot102 | — | General Botany (2) | 2 | 3 | 3 |
| Phys102 | — | General Physics (2) | 1 | 3 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |

| | | | | | |
|---|---|---|---|---|---|
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 18 |

شعبة العلوم البيولوجية-Biology Science Section

برنامج الفيزياء الحيوية (برنامج بمصروفات –Biophysics Program–Expenses Program

المستوي الثاني – الفصل الدراسي الأول– Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys203 | Phys102 | Modern physics and special relativity | 2 | - | 2 |
| Zoo203 | Zoo102 | Histology and zoo techniques | 1 | 2 | 2 |
| BPhy205 | | Electronics integrated circuits | 2 | - | 2 |
| BPhy211 | | General Biophysics (1) | 1 | - | 1 |
| BPhy213 | | Biomathematices | 1 | - | 1 |
| BPhy215 | | Electric currents in biological system | 2 | 1 | 2 |
| BPhy203 | | Molecular biophysics and bio modeling | 2 | 2 | 2 |
| Phys205 | | Practical Physics (2) | - | 3 | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys215 | Phys102 | Waves and Vibrations | 2 | 1 (tu) | 2 |
| Zoo213 | Zoo102 | Animal biotechnology | 1 | 2 | 2 |
| Zoo215 | Zoo102 | Basic immunology | 1 | 2 | 2 |
| Bch205 | Chem101 | Biochemistry of cells | 1 | 2 | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية-Biology Science Section

برنامج الفيزياء الحيوية (برنامج بمصروفات Biophysics Program–Expenses Program

المستوي الثاني – الفصل الدراسي الثاني– Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BPhy214 | Phys112 | General Biophysics (2) | 2 | - | 2 |
| BPhy216 | Phys112 | Biophysics of ionizing radiation imaging | 2 | - | 2 |
| BPhy218 | BPhy207 | Biophysics measurements | 2 | 2 | 3 |
| BPhy212 | | Bioenergetics | 2 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Zoo206 | Zoo102 | Physiology 1 | 1 | 2 | 2 |
| BPhy220 | | Neurobiophysics | 2 | - | 1 |
| Phys206 | | Practical Physics (2) | - | 3 | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Bch202 | | Principle of molecular biology | 2 | - | 2 |
| Phys204 | Phys102 | Introduction to electronics and crystal physics | 2 | - | 2 |
| Zoo 208 | Zoo102 | Cellular immunology | 1 | 2 | 2 |
| Zoo212 | Zoo102 | Biological fluid analysis | 1 | 2 | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية-Biology Science Section

برنامج الفيزياء الحيوية (برنامج بمصروفات) –Biophysics Program–Expenses Program

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Phys303 | | Atomic and molecular physics | 1 | 2 | 2 |
| Phys307 | | Radiation protection and safty | 2 | - | 2 |
| Zoo307 | Zoo206 | Physiology 2 | 1 | 2 | 2 |
| BPhy307 | | Brachytherapy dosimetry | 2 | - | 2 |
| BPhy313 | | Cellular Biophysics | 2 | - | 2 |
| BPhy311 | | Magnetic properties of biomolecules | 2 | - | 2 |
| Phys305 | | Practical Physics (3) | - | 3 | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BPhy315 | | Biophysical calculations | 2 | - | 2 |
| Zoo303 | Zoo203 | Cell biology | 1 | 2 | 2 |
| BPhy317 | | Alternative Biophysics materials | 2 | - | 2 |
| Bot311 | Zoo102 | Molecular genetic | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية- Biology Science Section

برنامج الفيزياء الحيوية (برنامج بمصروفات) –Biophysics Program–Expenses Program

المستوي الثالث – الفصل الدراسي الثاني– Level Three - Second Semester

| Level 3 - Semester 2 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
|---|---|---|---|---|---|
| BPhy318 | | Biotechnology | 2 | - | 2 |
| Bch306 | | Cancer biology | 2 | | 2 |
| BPhy320 | | Technology of communications and control | 2 | 2 | 2 |
| BPhy314 | | Technology of drug &biomolecules carrier system | 2 | 2 | 2 |
| BPhy320 | | Ionizing radiation sources | 2 | - | 2 |
| BPhy322 | | Medical radiation protection | 2 | - | 2 |
| Phys306 | | Practical Physics (4) | - | 3 | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Zoo304 | Zoo202 | Evolution of invertebrates and vertebrates | 1 | 3 | 2 |
| Zoo322 | Zoo208 | Cancer immunology | 2 | - | 2 |
| Phys318 | | Semiconductors physics and devices | 2 | - | 2 |
| Total | | | | | 15 |

شعبة العلوم البيولوجية-Biology Science Section

برنامج الفيزياء الحيوية (برنامج بمصروفات)– Biophysics Program–Expenses Program

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BPhy415 | | Accelerator protection | 1 | 2 | 2 |
| Zoo407 | Zoo102 | Fundamentals of molecular biology | 1 | 2 | 2 |
| BPhy417 | | Radiobiology | 2 | | 2 |
| BPhy419 | | Measurements of doses | 2 | | 2 |
| Zoo409 | Zoo303 | Histopathology | 1 | 2 | 2 |
| Phys449 | | Digital electronics (1) | 1 | 2 | 2 |
| Phys405 | | Practical Physics (5) | - | 3 | 1 |
| Phys490 | | Research Project / Seminar | 1 | - | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| BPhy411 | | Selected Topics in Biophysics | 2 | - | 2 |
| Zoo411 | Zoo208 | Molecular imunology | 1 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Phys314 | Phys204 | Applied electronics | 2 | 1(tu) | 2 |
| Phys425 | | Fundamental of Quantum Optics | 2 | 1 (tu) | 2 |
| Total | | | | | 16 |

شعبة العلوم البيولوجية - Biology Science Section

برنامج الفيزياء الحيوية (برنامج بمصروفات) – Biophysics Program–Expenses Program

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BPhy416 | | Technology of nonionizing radiation dosimetery | 2 | - | 2 |
| Zoo412 | Zoo307 | Hematology | 1 | 2 | 2 |
| Phys409 | | Nano Science and Applications | 1 | 2 | 2 |
| BPhy418 | | Biophysics of nuclear medicine | 2 | - | 2 |
| BPhy407 | | planning Radiotherapy | 2 | - | 2 |
| Zoo410 | Zoo407 | Molecular biology of cancer | 1 | 2 | 2 |
| Phys490 | | Research Project / Seminar | 1 | - | 1 |
| Phys406 | | Practical Physics (6) | - | 3 | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Phys426 | | Laser Physics and Applications | 1 | 2 | 2 |
| Phys422 | Phys211 | Biophysical measurements | 2 | | 2 |
| Zoo414 | Zoo307 | Toxicology | 1 | 2 | 2 |
| Zoo420 | Zoo307 | Human biology | 1 | 2 | 2 |
| Total | | | | | 16 |

# قسم علم الحيوان والكيمياء

# برنامج المناعة والكيمياء (تخصص مزدوج)

# (برنامج بمصروفات)

| | |
|---|---|
| Program Title | Immunology and Chemistry |
| Program Type | Double Major |
| Department(s) | Zoology and Chemistry |

برنامج بكالوريوس علم المناعة والكيمياء

Immunology and Chemistry (IMCH)

برنامج خاص بالمصروفات للائحة البكالوريوس لقسم علم الحيوان وقسم الكيمياء

كلية العلوم – جامعة دمنهور

الإطار العام للبرنامج:

- لائحة البرنامج: لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة.
- لغة الدراسة بالبرنامج: اللغة الإنجليزية.
- متطلبات التخرج للبرنامج: يشترط للحصول على درجة البكالوريوس اجتياز الطالب عدد 136 ساعة معتمدة يتم توزيعها كالتالي:

1) متطلبات الجامعة: مقررات ثقافية وعلمية عامة بو اقع 8 ساعات معتمدة (4 ساعات إجبارية + 4 ساعات اختيارية).
2) متطلبات الكلية: مقررات علوم أساسية مساعدة أو مساندة لفهم التخصص: 28 ساعة إجبارية.
3) متطلبات التخصص - مقررات إجبارية: 62 ساعة معتمدة.
4) متطلبات التخصص - مقررات اختيارية: 28 ساعة معتمدة.
5) مقررات اختيارية حرة: 6 ساعات معتمدة من خارج مقررات التخصص.
6) مشروع التخرج: 2 ساعة معتمدة.
7) الدراسات التطبيقية والميدانية: 2 ساعة معتمدة.

رؤية برنامج بكالوريوس علم المناعة والكيمياء

1- إعداد كوادر علمية ومهنية تطبيقية وتدريبية متميزة ويتمتعون بالمعارف والمهارات والإتجاهات العلمية والعملية في علم المناعة وعلوم الكيمياء.
2- إعداد خريجين وكوادر مؤهلة تلبي احتياجات سوق العمل وتخدم المجتمع المحيط وتكون قادرة على المنافسة والتعامل في سوق العمل المحلي والإقليمي والدولي.

رسالة برنامج بكالوريوس علم المناعة والكيمياء

1- إعداد خريج متميز في مجال علم المناعة والكيمياء والتطبيقات المختلفة لهم في مجال الصحة والصناعة والزراعة والبيئة والبحث العلمي والتنمية.
2- المساهمة المجتمعية في حل مشكلات المجتمع المحلي بمحافظة البحيرة وما يجاورها مثل المشكلات الصحية والمجتمعية والبيئية ورصد المشاكل الصحية.

اتفاق رؤية ورسالة البرنامج مع رؤية ورسالة كلية العلوم – جامعة دمنهور

تتفق رؤية ورسالة هذا البرنامج برؤية الكلية والجامعة المرتبطة برؤية مصر 2030 وتستكملها بما تقدمه من برامج تعليمية متميزة تزود خريجي كلية العلوم بالمعرفة الحديثة بعلم المناعة والكيمياء وأهمية هذا المجال وخلق مجالات علمية وتعليمية متميزة لزيادة كفاءتهم وفرصهم في سوق العمل.

مبررات عمل برنامج بكالوريوس علم المناعة والكيمياء

1) علم المناعة هو فرع مهم جدًا من العلوم البيولوجية والطبية وكذلك علم الكيمياء ويعتبران من التخصصات الأكثر شهرة وتميّزاً على المستوى الدراسي والأكاديمي والتوظيفي.

2) لا يوجد برنامج بكالوريوس في علم المناعة في كليات العلوم بالجامعات المصرية انما يوجد فقط كبرنامج دراسات عليا في كليات قليلة جدا في صورة برنامج للماجستير أو الدكتوراة.

3) اتجاه العالم واهتمامه بإنتاج الأمصال واللقاحات مثل جائحة كورونا والعديد من الأمراض الفيروسية والسرطانات وأمراض المناعة الذاتية.

4) اهتمام الدولة المصرية و إنشاء المشروع القومي للدولة ومبادرة Egyvax معهد الأمصال واللقاحات وكذلك خطة الدولة لإنشاء خط إنتاج بمصانع فاكسيرا.

5) قيام العديد من شركات الأدوية العالمية بزيادة الإستثمار في مجال الأدوية الحيوية، مثل الأجسام المضادة والعديد من العقاقير المعدِّلة للمناعة و افقت عليها الولايات المتحدة الأمريكية في الأعوام الماضية، وكان هناك سيل من الأنباء الإيجابية عن علاجات السرطان القائمة على العلاج المناعي.

6) تخصص هذا البرنامج يدخل تطبيقاته في جميع المجالات بلا استثناء، سوآءا كانت طبية أو بحثية أو صناعية أو زراعية أو خدمية.

7) في ظل الظروف القاسية لسوق العمل، ما زال خريجي المناعة والكيمياء وعلماء المناعة مطلوبين في الوسط الأكاديمي وشركات التقنية الحيوية أو شركات الأدوية.

8) يضمن فرصاً توظيفية متميزة، لأن الكيمياء هي أساس كافة الصناعات والدو ائية تقريباً، وأساس الصناعات الكيميائية، وأساس الصناعات الزراعية، وتلعب دوراً كبيراً في الأبحاث المختلفة والعلوم الحديثة.

9) شدة احتياج سوق العمل بمحافظة البحيرة وما يجاورها للمتخصصين في مجال علم المناعة والكيمياء ورغبة عدد كبير من المستفيدين من البرنامج بناء على استطلاعات رأيهم والإستبيانات من الطلاب وأصحاب الشركات والقطاع الصحي والصناعي والزراعي.

10) تو افر الإمكانات المادية والبشرية في معامل قسمي علم الحيوان وقسم الكيمياء بكلية العلوم جامعة دمنهور لفتح برنامج بكالوريوس علم المناعة والكيمياء وتحقيق متطلباته.

<u>أهم الوظائف التي من الممكن أن يشغلها الطالب الحاصل على شهادة جامعية في تخصص علم المناعة والكيمياء هى كالآتي:</u>

الخريج الحاصل على درجة جامعية في علم المناعة الكيمياء يكون مستعداً ومؤهلاً لقطاع عريض من الوظائف في المجالات الصناعية والحكومية والأكاديمية:

1) الصناعات الدو ائية: جميع شركات الأدوية على مستوى العالم تستعين بالمتخصصين في مجال الكيمياء والمناعة للعمل في مؤسساتها، بسبب الإرتباط الوثيق بين المجالين، فجميع الأدوية بلا استثناء هي عبارة عن مركبات كيميائية مختلفة تم دمجها ببعضها البعض بتركيزات متفاوتة طبقاً لمنهجية بحثية وأكاديمية محددة.

2) فرص عمل كبيرة في مجال التكنولوجيا الحيوية مثل الشركة القابضة للمستحضرات الحيوية واللقاحات "فاكسيرا.

3) الصناعات الكيميائية: أما المنتجات الكيميائية الضرورية، فالأساس بها طبعا هو تطبيقات الكيمياء العضوية إلى جانب التخصصات الكيميائية الأخرى.

4) صناعات الكيماويات الزراعية ومدي تأثيرها على النباتات والحيو انات والإنسان والأمراض المصاحبة لها.

5) المستشفيات ومختبرات التحاليل الطبية.

6) المراكز البيئية ومختبرات العلوم التحليلية.

7) العلوم الجنائية والشرعية: هذا العلم شديد الحيوية والأهمية يقوم في معظمه على تطبيقات الكيمياء العضوية فالعلماء الشرعيين الذين يفحصون مسارح الجريمة لمحاولة التوصل الى مرتكبيها يستخدمون في الأساس تطبيقات مختلفة للكيمياء العضوية، وأدوات متنوعة ذات صلة بالتحلل العضوي والبصمات والسوائل والآثار العضوية وغيرها. لذلك فعادة ما يكون المتخصصين في هذا المجال من الكيميائيين.

8) الجامعات والخدمة المدنية العلمية والتدريس على جميع المستويات.

<u>الإمكانات المادية والبشرية في معامل قسم علم الحيوان وقسم الكيمياء</u>

1- الإمكانات المادية

- ❖ يتوافر عدد 3 معامل طلابية وعدد 2 معامل بحثية بقسم علم الحيوان، مجهزة بالكامل بأجهزة علمية متقدمة وتشمل علي وحدة كاملة لزراعة الخلايا وفصلها بإستخدام جهاز فصل الخلايا والخلايا الجذعية (AutoMACS) متضمنة ميكروسكوبات خاصة بالتشريح وعد الخلايا بوحدة تصوير متكاملة وجهاز PCR (Quant Studio 3D) وجهاز فصل الحمض النووي والبروتينات الأتوماتيك (KingFisher) وجهاز حقن الخلايا بالأحماض النووية (Neon Transfection System) وأجهزة سبكتروفوتوميتروأجهزة طرد مركزي وإليزا وخمسة أجهزة طحن أنسجة وحضانات و أفران حرارية وأجهزة حمامات مائية وموازين.
- ❖ يتوافر عدد 5 معامل طلابية بقسم علم الكيمياء.
- ❖ يتوفر عدد 1 معمل مركزي بالكلية مجهز بأجهزة علمية متقدمة.
- ❖ يتوفر مكتبة الكترونية بالكلية تحتوي على عدد متميز من الكتب بالإضافة إلى عدد من المراجع الورقية الحديثة.

2- الإمكانات البشرية

يتكون قسم علم الحيوان من 23 أعضاء هيئة التدريس ( 5 أستاذ و5 أستاذ مساعد و13 مدرس) وعدد 8 من الهيئة المعاونة بالإضافة إلى الإستعانة بعدد مناسب من أعضاء هيئة التدريس من المتخصصين من المنتدبين من جهات مختلفة مما يعد مناسبا للعبء التدريسي في البداية.

السنة التأسيسية – Foundation Year

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Zoo101 | — | General Zoology (1) | 2 | 3 | 3 |
| Bot101 | — | General Botany(1) | 2 | 3 | 3 |
| Math101 | — | General Mathematics | 2 | 3 | 3 |
| Phys101 | — | General Physics (1) | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Zoo102 | — | General Zoology (2) | 2 | 3 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| Bot102 | — | General Botany (2) | 2 | 3 | 3 |
| Phys102 | — | General Physics (2) | 1 | 3 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 18 |

شعب العلوم البيولوجية-Biological Science Section

قسم علم الحيوان-قسم الكيمياءDepartment of Zoology& Department of Chemistry

المناعة والكيمياء (تخصص مزدوج)– Immunology and Chemistry (DoubleMajor)

المستوي الثاني – الفصل الدراسي الأول– Level Two - First Semester

| Level 2 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo205 | Zoo101 | Physiology (1) | 1 | 3 | 2 |
| Zoo211 | Zoo101 | Basic Immunology | 1 | 2 | 2 |
| Zoo213 | Zoo101 | Genetics and Cell Biology | 2 | 2 | 3 |
| Chem211 | Chem101 | Organic chemistry (1) | 2 | 3 | 3 |
| Chem221 | Chem101 | Fundamentals of Analytical Chemistry | 2 | 3 | 3 |
| Chem231 | Chem102 | Thermodynamic Chemistry and phase rule | 2 | - | 2 |
| Electives: Student selectsone course (2 credit hours) from the following modules | | | | | |
| Zoo215 | Zoo102 | Human Biology | 1 | 2 | 2 |
| Zoo217 | ---------- | Immunohistochemistry | 1 | 2 | 2 |
| Zoo219 | ---------- | Molecular and Cellular Basis of Hematology | 1 | 2 | 2 |
| Total | | | | | 17 |

المناعة والكيمياء (تخصص مزدوج)– Immunology and Chemistry (Double Major)

المستوي الثاني – الفصل الدراسي الثاني– Level Two - Second Semester

| Level 2 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo210 | Zoo101 | Cellular Immunology | 1 | 2 | 2 |
| Zoo218 | Zoo102 | Medicinal and Economic Invertebrates | 2 | 3 | 3 |
| Chem212 | Chem211 | Organic chemistry (2) | 2 | - | 2 |
| Chem222 | Chem221 | Chemistry of RepresentativeElements | 2 | - | 2 |
| Chem232 | Chem231 | Kinetic Chemistry and catalysis | 2 | 3 | 3 |
| Electives: Student selectsone course (2 credit hours) from the following modules | | | | | |
| Zoo220 | -------- | Cellular Differentiation | 1 | 3 | 2 |
| Zoo222 | ---------- | Control of Gene Expression | 1 | 2 | 2 |
| Total | | | | | 14 |

شعب العلوم البيولوجية-Biological Science Section

قسم علم الحيوان- قسم الكيمياء Department of Zoology & Department of Chemistry

المناعة والكيمياء (تخصص مزدوج)– Immunology and Chemistry (Double Major)

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo313 | -------- | Viral Pathogens and Immunology | 2 | 3 | 3 |
| Zoo315 | ---------- | Immunotoxicology | 1 | 2 | 2 |
| Zoo317 | ---------- | Diagnostic Histopathology | 1 | 2 | 2 |
| Chem311 | Chem211 | Stereo and physical organic Chemistry | 2 | - | 2 |
| Chem321 | Chem221 | Transition Elements and Coordination Chemistry | 2 | - | 2 |
| Chem331 | Chem231 | Electrochemistry and surface chemistry | 2 | - | 2 |
| Chem313 | Chem211 | Petroleum and polymers chemistry | 2 | - | 2 |
| Electives: Student selectsone course (2 credit hours) from the following modules | | | | | |
| Zoo319 | ---------- | Biosafety and Bioethics | 1 | 2 | 2 |
| Zoo321 | ---------- | Genetic engineering and Biotechnology | 1 | 2 | 2 |

| Total | | | 17 |
|---|---|---|---|

شعب العلوم البيولوجية-Biological Science Section

قسم علم الحيوان- قسم الكيمياء Department of Zoology & Department of Chemistry

المناعة والكيمياء (تخصص مزدوج)– Immunology and Chemistry (Double Major)

المستوي الثالث – الفصل الدراسي الثاني– Level Three - Second Semester

| Level 3 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo306 | Zoo102 | Basics of Medical Parasitology | 1 | 3 | 2 |
| Zoo316 | Zoo205 | Cancer Immunology | 1 | - | 2 |
| Chem312 | Chem211 | Chemistry of Heterocyclic Compounds and Carbohydrates | 2 | 3 | 3 |
| Chem322 | Chem221 | Analytical chemistry (2) | 2 | 3 | 3 |
| Chem314 | Chem211 | Spectroscopy and natural products Chemistry | 2 | - | 2 |
| Electives: Student selectsone course (2 credit hours) from the following modules | | | | | |
| Zoo324 | ---------- | Cellular and Molecular Diagnosis | 1 | 2 | 2 |
| Zoo326 | ---------- | Nano-Biotechnology | 2 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem316 | Chem212 | Polyaromatic Hydrocarbons and Alicyclic Compounds | 2 | - | 2 |
| Chem332 | Chem231 | Physical Chemistry of Macromolecules | 2 | - | 2 |
| Chem326 | Chem221 | Result Treatments | 2 | - | 2 |
| Chem310 | Chem212 | Green Organic Chemistry | 2 | - | 2 |
| Total | | | | | 18 |

شعب العلوم البيولوجية-Biological Science Section

قسم علم الحيوان- قسم الكيمياء Department of Zoology & Department of Chemistry

المناعة والكيمياء (تخصص مزدوج)– Immunology and Chemistry (Double Major)

المستوي الرابع – الفصل الدراسي الأول– Level Four - First Semester

| Level 4 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo401 | Zoo101 | Fundamentals of Molecular Biology | 1 | 3 | 2 |
| Zoo403 | Zoo101 | Diagnostic Immunology | 1 | 2 | 2 |
| Chem490 | ---------- | Research Project | 1 | - | 1 |
| Electives: Student selectsone course (2 credit hours) from the following modules | | | | | |
| Zoo409 | ---------- | Basics of In Vitro Fertilization | 2 | - | 2 |
| Zoo421 | ---------- | Immunotherapy | 1 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Ent403 | -------- | Forensic entomology | 2 | - | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Chem411 | Chem211 | Chemistry of Dyes and amino acids | 2 | - | 2 |
| Chem421 | Chem101 | Combustion and Pollution Chemistry | 2 | - | 2 |
| Chem413 | Chem211 | Chemotherapy | 2 | - | 2 |
| Chem435 | Chem102 | Solution and colloidal chemistry | 2 | - | 2 |
| Chem433 | Chem231 | Combustion and Air Pollution | 2 | - | 2 |
| Chem431 | Chem102 | Molecular, ionic Spectroscopy and photochemistry | 2 | - | 2 |
| Total | | | | | 13 |

شعب العلوم البيولوجية-Biological Science Section

قسم علم الحيوان- قسم الكيمياء Department of Zoology & Department of Chemistry

المناعة والكيمياء (تخصص مزدوج)– Immunology and Chemistry (Double Major)

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Zoo404 | Zoo401 | Advanced Molecular Biology | 1 | 2 | 2 |
| Zoo414 | Zoo403 | Molecular Immunology | 1 | 2 | 2 |
| Zoo490 | ---------- | Research and assay | 1 | - | 1 |
| Electives: Student selectstwo courses (4 credit hours) from the following modules | | | | | |
| Zoo418 | ---------- | Autoimmune Diseases | 2 | - | 2 |
| Zoo420 | ---------- | Functional Genomics | 1 | 2 | 2 |
| Zoo422 | ---------- | Introduction to Genomics and Proteomics | 1 | 2 | 2 |
| Zoo424 | ---------- | Tumor Biology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Chem424 | Chem101 | Water Treatment Chemistry | 2 | - | 2 |
| Chem426 | ---- | Bioanalytical chemistry | 2 | - | 2 |
| Chem420 | Chem221 | Environmental Chemistry | 2 | - | 2 |
| Chem414 | Chem212 | Physical Organic Chemistry (2) | 2 | - | 2 |
| Chem422 | Chem222 | Nuclear and industrial Chemistry | 2 | - | 2 |
| Chem432 | Chem102 | Quantum Chemistry | 2 | - | 2 |
| Total | | | | | 13 |

# قسم علوم الارض

## (برنامج جيولوجيا الأثار)

## (برنامج خاص بمصروفات)

| | |
|---|---|
| Program Title | Geoarchaeology |
| Program Type | Specia |
| Department(s) | Earth Science |

**الهدف من طرح البرنامج الجديد**

تعتبر الأثار بجميع أنواعها ومختلف عصورها مرآة تروي لنا مراحل التقدم والرقي للشعوب كما تسجل أسباب التخلف والانهيار. أن جمهورية مصر العربية بها حوالي ثلث أثار العالم وتمتاز بتنوع كبير في الآثار فمنها الأثار الفرعونية والأغريقية والرومانية والمسيحية والأسلامية. وتعتبر الصخور والمعادن من أكثر المواد استخداماً من قبل الأنسان القديم لعمل الكثير من الآثار وهي تمثل حوالي 95% من الآثار الثابتة والمستمرة مع الزمن لفترات طويلة. ولذلك فإن علماء الجيولوجيا هم الأكثر معرفة بتأثير العوامل البيئية علي هذه الأثار من خلال تأثير البيئة الهوائية والمائية والبشرية والتي قد تؤدي إلي تلف أو تدمير الأثر. ولذلك يجب أن يكون هناك ادماج بين علم الجيولوجيا وعلم الآثار وهو ما يطلق عليه الآن علم جيولوجيا الآثار.

مع تقدم صناعة السياحة في مصر وما تلعبه من دور على خريطة العالم السياحية وعلى ما تتعرض له الآثار المصرية من تلف أو تدمير بفعل تأثير البيئة الهوائية والمائية والبشرية التي تقوم بعملية تحلل كيميائي وفيزيائي للآثر. لذلك أصبح بعداً قومياً وإلزاماً على الجامعة إمداد سوق العمل بكوادر من الجيولوجيين والجيوفيزيقيين المتخصصين في الدراسات الجيولوجية التطبيقية وكذلك في جيولوجيا الاثار.

ولما كان من أهداف كلية العلوم - جامعة دمنهور تطوير البرامج وإنشاء برامج جديدة تتواكب مع التغيرات والمعطيات الجديدة وتخريج علميين قادرين علي تحمل المسئولية وأعباء ومتطلبات أماكن وسوق العمل بمصر. فإن من أهداف هذا البرنامج إعداد خريج قادر علي تحمل المسئولية والعمل بمجال جيولوجيا الاثار بمصر ودول العالم العربي والافريقي.

علي أن يقوم بالتدريس بهذا البرنامج أساتذة متخصصين بالكلية والجامعة بالتعاون مع بعض المتخصصين من هيئة الاثار. كما إن الدراسة العملية الخاصة بمقررات الجيولوجيا في هذا البرنامج سوف تكون داخل المعامل بالكلية والدراسة العملية الخاصة بمقررات الاثار سوف تكون في الأماكن الأثرية التي يمكن زيارتها بسهولة وبدون تكاليف ونفقات مادية باهظة حيث أن مصر بها الكثير من هذه الأماكن الأثرية والمنتشرة في جميع أنحاء الجمهورية.

**المخرجات المتوقعة**

1- القدرة على استيعاب العلوم الأساسية في الكيمياء – الرياضيات – الفيزياء – الجيولوجيا – الجيوفيزياء.
2- القدرة علي الدراسة العملية واستخلاص وتحليل النتائج.
3- التدريب العملي بهيئة الاثار أثناء الدراسة.
4- القدرة علي العمل في فريق من تخصصات مختلفة.
5- الاقتناع بالحاجة إلى التعليم المستمر كأساس للتقدم المهني للخريج.
6- القدرة على استخدام الطرق التكنولوجية الحديثة والمهارات والتطبيقات العملية.

**الإطار العام للبرنامج**

- لغة الدراسة بالبرنامج هي اللغة الإنجليزية
- تطبق لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة علي هذا البرنامج
- يشترط للحصول على درجة البكالوريوس أن يجتاز الطالب بنجاح عدد 136 ساعة معتمدة يتم توزيعها كالتالي :-

**(1) متطلبات جامعة:** 8 ساعات معتمدة ( 4 ساعات إجباري + 4 ساعات اختياري )

**(2) متطلبات الكلية:** 28 ساعة معتمدة إجبارية ( العلوم الأساسية )

**(3) مقررات إجبارية في التخصص :** 80 ساعة معتمدة

**(4) مقررات اختيارية في التخصص:** 12 ساعة معتمدة

**(5) مقررات حرة 6 ساعات معتمدة**

**(6) تدريبات ميدانية وتطبيقية 2 ساعة معتمدة**

*** تتكون السنة الدراسية من ثلاث فصول دراسية:**

أ- فصل الخريف – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الثالث من شهر سبتمبر}.

ب- فصل الربيع – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الأول من شهر فبراير}.

ج- فصل الصيف – ومدته ستة أسابيع { يبدأ في الأسبوع الأول من شهر يوليو} مكثف.

ومن أجل الاستفادة القصوى وإعداد خريج يواكب المتغيرات في مجال العلوم والتكنولوجيا فقد تم تصميم هذا البرنامج على أن:

- يتيح الفرص لإعطاء المقررات التخصصية في مجال الجيولوجيا وجيولوجيا الاثار والمياه الجوفية والجيوفيزياء.
- يتيح عدد من المواد الاختيارية للدراسة لإبراز مواهب الطالب ومساعدته في التخصص.
- إتاحة الفرصة لتحديث البرنامج بما هو حديث وجديد في الدراسة النظرية والتطبيقية.
- الاستعانة بالمتخصصين من خارج الجامعة الأمر الذي سوف يزيد من توثيق العلاقة ما بين الحياة العلمية والتطبيقية وإعداد خريج علي دراية بالتطبيقيات.
- استحداث المشروع التطبيقي للتخرج.
- الاهتمام باللغات وعلوم الحاسب الآلي وتطبيقاته.

ومن ثم فأن الخريج سوف يكون قادراً علي مجابهة سوق العمل في مجال الجيولوجيا وجيولوجيا الاثار وكذلك الجيوفيزياء محلياً وإقليمياً ودولياً.

**نبذة عن الخطة الدراسية للبرنامج**

يختلف هذا البرنامج عن كافة البرامج التي تطرحها الكلية بل كليات العلوم بمصر والعالم العربي حيث أن خطة الدراسة وأسلوب التدريس سوف يعتمد علي أسلوب الساعات المعتمدة وكذلك علي استخدام الطرق الحديثة في التدريس وعلي أن يكون الطالب جزء مشارك وأساسي في العملية التعليمية وذلك من خلال :

1. استخدام مراجع حديثة عبر شبكة الانترنت.
2. الاعتماد علي الطالب في طرق البحث الحر
3. التقييم المستمر للطالب.
4. تغيير نظم تحديد مستوى الطالب.
5. الإرشاد العلمي والأكاديمي.

يتميز هذا البرنامج بالانفراد في تكوين وتوفير كوادر علمية تطبيقية في مجال جيولوجيا الاثار وهو مجال غير متوافر في أي من الجامعات المصرية والعربية والعالمية والجامعات الخاصة بمصر.

- شروط الالتحاق بهذا البرنامج هي نفس الشروط المعمول بها في مكتب التنسيق للقبول بكلية العلوم، فيما عدا الرسوم الدراسية التي نقترح أن تكون 300 جنية للساعة المعتمدة الواحدة.

**إمكانيات الكلية/الجامعة التي تساهم في إنجاح البرنامج**

- تضم كلية العلوم بدمنهور العديد من المعامل والتي يمكن أن تستخدم لخدمة العملية التعليمية بالبرنامج المقترح ولا تتعارض مع نظام الدراسة الحالي، كذلك يوجد بالكلية عدة مدرجات ذات قدرة استيعابية صغيرة يمكن الاستفادة منها للتدريس النظري بما لا يتعارض مع الدراسة النظرية للدراسة الحالية. كذلك فأن معامل الكلية بها بعض الأجهزة العلمية المتخصصة التي سوف تساهم إسهاماً كبيراً في الدراسة العملية.
- الاستفادة بشبكة الحاسب الآلي لجامعة دمنهور والمرتبطة بالشبكة الدولية للمعلومات
- الاستفادة من المكتبة الرئيسية للكلية وكذلك مكتبة الإسكندرية اضافة للمكتبة الرقمية المتاحة بالجامعة
- الدراسة العملية سوف تكون في معامل الكلية وفي الأماكن الأثرية والمنتشرة في جميع أنحاء الجمهورية والتي يمكن زياراتها بسهولة وبدون تكاليف مادية باهظة.
- الاستفادة من المعامل المركزية للتحليل والقياس الموجودة بالجامعة.
- ذلك بالإضافة إلي أن استخدام جزء من العائد المادي لتحديث المعامل وتطويرها وإنشاء معامل جديدة متخصصة وتحديث المكتبة بالكتب والمراجع.
- - الاستفادة من الإمكانيات البشرية - وخاصة السادة أعضاء هيئة التدريس بالأقسام العلمية بالكلية

**علاقة البرنامج بسوق العمل**

- نظراً للحاجة المتزايدة علي خريجي كلية العلوم وخاصة في مجالي الجيولوجيا والجيوفيزياء، وحيث أن نظام الدراسة الحالي غير قادر علي مواكبة التغيرات والتحديثات في مجال جيولوجيا الاثار فإن البرنامج المستحدث سوف يلبي حاجة سوق العمل من حيث أن الخريج سوف يكون متخصص في مجال جيولوجيا الاثار والجيوفيزياء ( معاً ).
- سوف يلبي الخريج حاجة سوق العمل المتزايد في مصر وفي الدول العربية لسبب أن معظم الأجانب الذين يعملون في هذا التخصص يعزفون عن العمل في هذه البلدان في الوقت الحالي، كما أن هذا التخصص غير متواجد بالجامعات الحكومية أو الخاصة بمصر والدول العربية.

وللحفاظ علي العلاقة المستمرة بين عدد الخريجين وسوق العمل تقترح الكلية قبول خمسين طالباً وطالبة بالبرنامج في السنة الأولي بزيادة 10% في السنوات التالية ويقترح أن تكون مصاريف الدراسة 300 جنية مصري للساعة المعتمدة أي أن تكاليف الفصل الدراسي الواحد حوالي 4500 جنيه مصري.

السنة التأسيسية – Foundation Year

شعبة علوم الأرض – Earth Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Geo101 | — | General Geology (1) | 1 | 3 | 2 |
| Bot111 | — | General Botany | 1 | 3 | 2 |
| Math101 | — | General Mathematics | 2 | 3 | 3 |
| Phys111 | — | Physics (1) | 2 | 3 | 3 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 17 |

السنة التأسيسية – Foundation Year

شعبة علوم الأرض – Earth Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Goe102 | — | General Geology (2) | 1 | 3 | 2 |
| Geo104 | — | Historical Geology | 1 | 3 | 2 |
| Phys112 | — | Physics (2) | 2 | 3 | 3 |
| Zoo111 | — | General Zoology | 1 | 3 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 19 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الارض – Department of Earth Science

جيولوجيا الاثار (تخصص منفرد)– Geoarchaeology – Single

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo207 | Geo205 | Sedimentary Petrology (1) | 1 | 3 | 2 |
| Geo203 | G102 | Geomorphology | 1 | 3 | 2 |
| Geo215 | G102 | Field Geology | 1 | 3 | 2 |
| Gph207 | G102 | Remote Sensing (1) | 1 | 2 | 2 |
| Gph201 | G102 | Basic Geophysics | 1 | 3 | 2 |
| GA201 | ------- | Principals of geoarchaeology | 2 | 2 | 3 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| GA203 | ------ | Historical archaeology | 2 | - | 2 |
| Geo224 | -------- | Environmental Geology | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الارض – Department of Earth Science

جيولوجيا الاثار (تخصص منفرد)– Geoarchaeology – Single

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo222 | Geo205 | Igneous Petrology and Metamorphic Petrology. | 1 | 3 | 2 |
| Geo230 | — | Principles of Stratigraphy | 1 | 3 | 2 |
| Geo208 | Geo230 | Lithostratigraphy | 1 | 3 | 2 |
| Geo223 | Geo215 | Geological Survey | 1 | 3 | 2 |
| GA202 | GA201 | Egyptian Geoarchaeology | 1 | 2 | 2 |
| GA204 | Geo215 | Geoarchaeology field techniques | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo214 | — | Applied Mineralogy | 1 | 3 | 2 |
| Geo202 | Geo205 | Rock-forming Minerals | 1 | 3 | 2 |
| Geo216 | Geo230 | Advanced Stratigraphy | 1 | 3 | 2 |
| Geo218 | -------- | Paleoecology | 1 | 3 | 2 |
| Geo220 | G102 | Natural Catastrophic | 2 | - | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الارض – Department of Earth Science

جيولوجيا الاثار (تخصص منفرد)– Geoarchaeology – Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo301 | Geo230 | Structural Geology (1) | 1 | 3 | 2 |
| Geo313 | Geo230 | Marine Geology | 1 | 3 | 2 |
| Geo317 | Geo230 | Rock Mechanics and archaeology studying | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo308 | Geo205 | Sedimentary Petrology (2) | 1 | 3 | 2 |
| Gph305 | Gph201 | Geophysics for archaeology | 1 | 3 | 2 |
| GA301 | GA201 | Advanced geoarchaeology | 2 | - | 2 |
| GA303 | GA201 | Geoarchaeology; Restoration, saving and marketing | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Geo304 | Geo230 | Subsurface Geology | 1 | 3 | 2 |
| Geo323 | -------- | Geographic Information Systems | 1 | 3 | 2 |
| Geo321 | --------- | Trace Fossils | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الارض – Department of Earth Science

جيولوجيا الاثار (تخصص منفرد)– Geoarchaeology – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo302 | Geo301 | Tectonic Geology | 1 | 3 | 2 |
| Geo316 | -------- | Water resources | 1 | - | 1 |
| Geo310 | Geo207 | Engineering Geology | 1 | 3 | 2 |
| Geo423 | - | Geochemical Explorationand Prospecting | 1 | 3 | 2 |
| Gph323 | Gph201 | Seismicity | 1 | 3 | 2 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo316 | Geo207 | Quaternary Geology | 1 | 3 | 2 |
| Geo306 | Geo208 | Biostratigraphy | 1 | 3 | 2 |
| Geo318 | --------- | Environmental Impact Assessment | 1 | 2 | 2 |
| Geo320 | Geo301 | Structural Interpretation | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة العلوم الجيولوجية Geological Science Section

قسم علوم الارض – Department of Earth Science

جيولوجيا الاثار (تخصص منفرد)– Geoarchaeology – Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo401 | Geo207 | Geology of Egypt | 1 | 3 | 2 |
| Geo405 | — | Geochemistry | 1 | 3 | 2 |
| Geo411 | Geo207 | Hydrogeology | 1 | 3 | 2 |
| GA401 | -------- | Prospect Evaluation of monuments | 1 | 2 | 2 |
| GA490 | — | Research and Essay | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo413 | Geo207 | Clay Mineralogy | 1 | 3 | 2 |
| Geo415 | Geo207 | Facies Analysis and Depositional Environments | 1 | 3 | 2 |
| Geo417 | Geo312 | Ore Dressing | 1 | 3 | 2 |
| Geo419 | Geo222 | Volcanoclastics | 1 | 3 | 2 |
| Geo403 | ------- | Climatic changes and its effects | 1 | 3 | 2 |
| Geo421 | Geo303 | Isotope Geology | 1 | 3 | 2 |
| Geo423 | ---------- | Geochemical Exploration and Prospecting | 1 | - | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الارض – Department of Earth Science

جيولوجيا الاثار (تخصص منفرد)– Geoarchaeology – Single

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4- Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo404 | — | Palynology | 1 | 3 | 2 |
| Geo408 | Geo230 | Mining Geology | 1 | 3 | 2 |
| Geo424 | Geo405 | Geochemistry of archaeology | 1 | 3 | 2 |
| GA490 | — | Research and Essay | 1 | - | 1 |
| Electives: Student selects four courses (8 credit hours) from the following modules | | | | | |
| Gph416 | GP207 | Application of Remote Sensing in natural hazard | 1 | 3 | 2 |
| Geo402 | ---- | Industrial Minerals | 1 | 3 | 2 |
| Geo420 | Geo405 | Hydrogeochemistry | 1 | 3 | 2 |
| Geo422 | Geo405 | Advanced Geochemistry | 1 | 3 | 2 |
| Geo426 | Geo312 | Ore Mineralogy | 1 | 3 | 2 |
| Geo406 | Geo316 | Precambrian Geology | 1 | 3 | 2 |
| Total | | | | | 15 |

# قسم علوم الارض

## (برنامج الغاز الطبيعي والثروات الطبيعية)

## (برنامج خاص بمصروفات)

| | |
|---|---|
| Program Title | The Gas and Natural Resources |
| Program Type | Single |
| Department(s) | Earth Science |

**الهدف من طرح البرنامج الجديد**

تعتبر الثروات الطبيعية من غاز طبيعي وبترول وخامات معدنية بجميع أنواعها ومدي استغلال الدول لهذه الثروات الطبيعية والاستفادة منها مرآة لمدي تقدم الدول وازدهارها اقتصاديا وعسكريا واجتماعيا. أن جمهورية مصر العربية بها الكثير من الثروات الطبيعية والتي لم تستغل بعد وذلك لعدم وجود متخصصين في مجال استغلال الثروات الطبيعية وكيفية الاستفادة القصوى من هذه الثروات. وتعتبر الخامات المعدنية والصخور من أكثر المواد استخداماً من قبل الأنسان القديم لعمل الكثير من الآثار والمعابد وهي تمثل حوالي 95% من الآثار الثابتة والمستمرة مع الزمن لفترات طويلة. وقد اهتمت دول العالم حديثا بالتصنيع في جميع المجالات الالكترونية والعسكرية والتي تعتمد اساسا علي المعادن والخامات المعدنية وهي أحدي الثروات الطبيعية التي انعم الله بها علي الانسانية. ولتشغيل هذه المصانع اهتمت الدول الصناعية بتنويع مصادر الطاقة من غاز طبيعي وبترول وطاقة شمسية وطاقة الرياح وغيرها من مصادر الطاقة المتجددة والغير متجددة.

مع تقدم الصناعات في المجالات المختلفة في مصر وزيادة الطلب علي الطاقة وتنويعها لذلك أصبح بعداً قومياً وإلزاماً على الجامعة إمداد سوق العمل بكوادر من الجيولوجيين والجيوفيزيقيين المتخصصين في الدراسات الجيولوجية التطبيقية وكذلك في مجال الطاقة واستغلال الموارد والثروات الطبيعية التي انعم الله بها علي مصر.

ولما كان من أهداف كلية العلوم - جامعة دمنهور تطوير البرامج وإنشاء برامج جديدة تتواكب مع التغيرات والمعطيات الجديدة وتخريج علميين قادرين علي تحمل المسئولية وأعباء ومتطلبات أماكن وسوق العمل بمصر. فإن من أهداف هذا البرنامج إعداد خريج قادر علي تحمل المسئولية والعمل بمجال الغاز الطبيعي والطاقة بمصر ودول العالم العربي والافريقي.

علي أن يقوم بالتدريس بهذا البرنامج أساتذة متخصصين بالكلية والجامعة بالتعاون مع بعض المتخصصين من شركات البترول والغاز الطبيعي والمحاجر. كما إن الدراسة العملية الخاصة بمقررات الجيولوجيا في هذا البرنامج سوف تكون داخل المعامل بالكلية وشركات البترول والغاز الطبيعي والمحاجر المنتشرة في جميع أنحاء الجمهورية وكذلك هيئة المواد النووية وهيئة المساحة الجيولوجية المصرية.

**المخرجات المتوقعة**

7- القدرة على استيعاب العلوم الأساسية في الكيمياء – الرياضيات – الفيزياء – الجيولوجيا – الجيوفيزياء.
8- القدرة علي الدراسة العملية واستخلاص وتحليل النتائج.
9- التدريب العملي بالشركات أثناء الدراسة.
10- القدرة علي العمل في فريق من تخصصات مختلفة.
11- الاقتناع بالحاجة إلى التعليم المستمر كأساس للتقدم المهني للخريج.
12- القدرة على استخدام الطرق التكنولوجية الحديثة والمهارات والتطبيقات العملية.

**الإطار العام للبرنامج**

- لغة الدراسة بالبرنامج هي اللغة الإنجليزية
- تطبق لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة علي هذا البرنامج

- يشترط للحصول على درجة البكالوريوس أن يجتاز الطالب بنجاح عدد 136 ساعة معتمدة يتم توزيعها كالتالي :-

**(1) متطلبات جامعة:** 8 ساعات معتمدة ( 4 ساعات إجباري + 4 ساعات اختياري )

**(2) متطلبات الكلية:** 28 ساعة معتمدة إجبارية ( العلوم الأساسية )

**(3) مقررات إجبارية في التخصص :** 80 ساعة معتمدة

**(4) مقررات اختيارية في التخصص:** 12 ساعة معتمدة

**(5) مقررات حرة 6 ساعات معتمدة**

**(6) تدريبات ميدانية وتطبيقية 2 ساعة معتمدة**

*** تتكون السنة الدراسية من ثلاث فصول دراسية:**

أ- فصل الخريف – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الثالث من شهر سبتمبر}.

ب- فصل الربيع – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الأول من شهر فبراير}.

ج- فصل الصيف – ومدته ستة أسابيع { يبدأ في الأسبوع الأول من شهر يوليو} مكثف.

ومن أجل الاستفادة القصوى وإعداد خريج يواكب المتغيرات في مجال العلوم والتكنولوجيا فقد تم تصميم هذا البرنامج على أن:

- يتيح الفرص لإعطاء المقررات التخصصية في مجال الجيولوجيا الاقتصادية والطاقة والبترول والغاز الطبيعي والمياه الجوفية والجيوفيزياء.
- يتيح عدد من المواد الاختيارية للدراسة لإبراز مواهب الطالب ومساعدته في التخصص.
- إتاحة الفرصة لتحديث البرنامج بما هو حديث وجديد في الدراسة النظرية والتطبيقية.
- الاستعانة بالمتخصصين من خارج الجامعة الأمر الذي سوف يزيد من توثيق العلاقة ما بين الحياة العلمية والتطبيقية وإعداد خريج علي دراية بالتطبيقيات.
- استحداث المشروع التطبيقي للتخرج.
- الاهتمام باللغات وعلوم الحاسب الآلي وتطبيقاته.

ومن ثم فأن الخريج سوف يكون قادراً علي مجابهة سوق العمل في مجال الجيولوجيا التطبيقية محلياً وإقليمياً ودولياً.

**نبذة عن الخطة الدراسية للبرنامج**

يختلف هذا البرنامج عن كافة البرامج التي تطرحها الكلية بل كليات العلوم بمصر والعالم العربي حيث أن خطة الدراسة وأسلوب التدريس سوف يعتمد علي أسلوب الساعات المعتمدة وكذلك علي استخدام الطرق الحديثة في التدريس وعلي أن يكون الطالب جزء مشارك وأساسي في العملية التعليمية وذلك من خلال:

1. استخدام مراجع حديثة عبر شبكة الانترنت.
2. الاعتماد علي الطالب في طرق البحث الحر
3. التقييم المستمر للطالب.
4. تغيير نظم تحديد مستوى الطالب.
5. الإرشاد العلمي والأكاديمي.

يتميز هذا البرنامج بالانفراد في تكوين وتوفير كوادر علمية تطبيقية في مجال الجيولوجيا التطبيقية وهو مجال محدود في بعض الجامعات المصرية والعربية والعالمية والجامعات الخاصة بمصر.

- شروط الالتحاق بهذا البرنامج هي نفس الشروط المعمول بها في مكتب التنسيق للقبول بكلية العلوم، فيما عدا الرسوم الدراسية التي نقترح أن تكون 300 جنية للساعة المعتمدة الواحدة.

**إمكانيات الكلية/الجامعة التي تساهم في إنجاح البرنامج**

- تضم كلية العلوم بدمنهور العديد من المعامل والتي يمكن أن تستخدم لخدمة العملية التعليمية بالبرنامج المقترح ولا تتعارض مع نظام الدراسة الحالي، كذلك يوجد بالكلية عدة مدرجات ذات قدرة استيعابية صغيرة يمكن الاستفادة منها للتدريس النظري بما لا يتعارض مع الدراسة النظرية للدراسة الحالية. كذلك فأن معامل الكلية بها بعض الأجهزة العلمية المتخصصة التي سوف تساهم إسهاماً كبيراً في الدراسة العملية.
- الاستفادة بشبكة الحاسب الآلي لجامعة دمنهور والمرتبطة بالشبكة الدولية للمعلومات
- الاستفادة من المكتبة الرئيسية للكلية وكذلك مكتبة الإسكندرية اضافة للمكتبة الرقمية المتاحة بالجامعة
- الدراسة العملية سوف تكون في معامل الكلية وفي شركات البترول والمحاجر والمنتشرة في جميع أنحاء الجمهورية والتي يمكن زياراتها بسهولة وبدون تكاليف مادية باهظة.
- الاستفادة من المعامل المركزية للتحليل والقياس الموجودة بالجامعة.
- ذلك بالإضافة إلي أن استخدام جزء من العائد المادي لتحديث المعامل وتطويرها وإنشاء معامل جديدة متخصصة وتحديث المكتبة بالكتب والمراجع.
- - الاستفادة من الإمكانيات البشرية - وخاصة السادة أعضاء هيئة التدريس بالأقسام العلمية بالكلية

**علاقة البرنامج بسوق العمل**

- نظراً للحاجة المتزايدة علي خريجي كلية العلوم وخاصة في مجالي الجيولوجيا التطبيقية والجيوفيزياء، وحيث أن نظام الدراسة الحالي غير قادر علي مواكبة التغيرات والتحديثات في مجال الطاقة واستغلال الثروات الطبيعية فإن البرنامج المستحدث سوف يلبي حاجة سوق العمل من حيث أن الخريج سوف يكون متخصص في مجال الغاز الطبيعي والطاقة والثروات الطبيعية.
- سوف يلبي الخريج حاجة سوق العمل المتزايد في مصر وفي الدول العربية في مجال الغاز الطبيعي والطاقة والثروات الطبيعية كما أن هذا التخصص غير متواجد بالجامعات الحكومية أو الخاصة بمصر والدول العربية.
- وللحفاظ علي العلاقة المستمرة بين عدد الخريجين وسوق العمل تقترح الكلية قبول خمسين طالباً وطالبة بالبرنامج في السنة الأولي بزيادة 10% في السنوات التالية ويقترح أن تكون مصاريف الدراسة 300 جنية مصري للساعة المعتمدة أي أن تكاليف الفصل الدراسي الواحد حوالي 4500 جنيه مصري.

السنة التأسيسية – Foundation Year

شعبة علوم الأرض – Earth Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Geo101 | — | General Geology (1) | 1 | 3 | 2 |
| Bot111 | — | General Botany | 1 | 3 | 2 |
| Math101 | — | General Mathematics | 2 | 3 | 3 |
| Phys111 | — | Physics (1) | 2 | 3 | 3 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 17 |

السنة التأسيسية – Foundation Year

شعبة علوم الأرض – Earth Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| Goe102 | — | General Geology (2) | 1 | 3 | 2 |
| Geo104 | — | Historical Geology | 1 | 3 | 2 |
| Phys112 | — | Physics (2) | 2 | 3 | 3 |
| Zoo111 | — | General Zoology | 1 | 3 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 19 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الأرض – Department of Earth Science

الغاز الطبيعي والثروات الطبيعية (تخصص منفرد) – Gas and Natural Resources – Single

المستوي الثاني – الفصل الدراسي الأول – Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Geo219 | Geo102 | Facies and Sedimentary Environments | 1 | 3 | 2 |
| Geo205 | — | Optical Mineralogy | 1 | 3 | 2 |
| Geo230 | — | Principles of Stratigraphy | 1 | 3 | 2 |
| Geo209 | — | Macropaleontology (1) | 1 | 3 | 2 |
| Geo235 | ----- | Field Geology and remote sensing | 1 | 3 | 2 |
| Geo201 | - | Crystallography | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo217 | ------ | Characterization and Property of Natural Gas | 1 | - | 1 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| Geo213 | — | Vertebrate Paleontology | 1 | 3 | 2 |
| Geo227 | — | Field Training (1) | 1 | 3 | 2 |
| Geo221 | -------- | History and Sources of The Natural Gas | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الأرض– Department of Earth Science

الغاز الطبيعي والثروات الطبيعية (تخصص منفرد) – Gas and Natural Resources – Single

المستوي الثاني – الفصل الدراسي الثاني – Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo222 | Geo205 | Igneous and Metamorphic Petrology | 1 | 3 | 2 |
| Geo228 | -------- | Natural Gas in Egypt and Middle East | 1 | 2 | 2 |
| Geo208 | Geo230 | Lithostratigraphy | 1 | 3 | 2 |
| Gph201 | G102 | Basic Geophysics | 1 | 3 | 2 |
| Geo212 | Geo230 | Micropaleontology (1) | 1 | 3 | 2 |
| Geo223 | Geo235 | Geological Survey | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo202 | Geo205 | Rock-forming Minerals | 1 | 3 | 2 |
| Geo216 | Geo230 | Advanced Stratigraphy | 1 | 3 | 2 |
| Geo218 | — | Paleoecology | 1 | 3 | 2 |
| Geo214 | — | Applied Mineralogy | 1 | 3 | 2 |
| Geo224 | ---------- | Natural Gas in The World | 1 | 2 | 2 |
| Geo226 | ---------- | Natural Gas Uses and Applications | 2 | - | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الأرض– Department of Earth Science

الغاز الطبيعي والثروات الطبيعية (تخصص منفرد) – Gas and Natural Resources – Single

المستوي الثالث – الفصل الدراسي الأول – Level Three - First Semester

| Level 3 - Semester 1 | Course Title | Credits |
|---|---|---|

| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
|---|---|---|---|---|---|
| Geo301 | Geo230 | Structural Geology (1) | 1 | 3 | 2 |
| Geo333 | --------- | Reservoir Properties | 1 | 3 | 2 |
| Geo207 | Geo205 | Sedimentary Petrology (1) | 1 | 3 | 2 |
| Geo319 | Geo209 | Photogeology | 1 | 3 | 2 |
| Geo313 | Geo230 | Marine Geology | 1 | 3 | 2 |
| GPh303 | GPh201 | Geophysical Exploration | 1 | 3 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules | | | | | |
| Geo315 | — | Ore Deposits | 1 | 3 | 2 |
| Geo321 | Geo209 | Trace Fossils | 1 | 3 | 2 |
| Geo317 | Geo230 | Rock Mechanics | 1 | 3 | 2 |
| Geo323 | — | Instrumental Techniques | 1 | 3 | 2 |
| Geo337 | Geo203 | Natural gas formation | 1 | 3 | 2 |
| Total | | | | | 16 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الأرض – Department of Earth Science

الغاز الطبيعي والثروات الطبيعية (تخصص منفرد) – Gas and Natural Resources – Single

المستوي الثالث – الفصل الدراسي الثاني – Level Three - Second Semester

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo302 | Geo301 | Tectonic Geology | 1 | 3 | 2 |
| Geo304 | Geo230 | Subsurface Geology | 1 | 3 | 2 |
| Geo306 | Geo208 | Biostratigraphy | 1 | 3 | 2 |
| Geo326 | Geo333 | Petroleum traps and Maturation | 1 | 3 | 2 |
| Geo328 | Geo228 | Manufacturing and Refining of Natural Gas | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo314 | Geo301 | Structural Geology (2) | 1 | 3 | 2 |
| Geo310 | Geo207 | Engineering Geology | 1 | 3 | 2 |
| Geo316 | Geo207 | Quaternary Geology | 1 | 3 | 2 |
| Geo318 | Geo207 | Geology of Africa | 1 | 3 | 2 |
| Geo324 | — | Environmental Geology | 1 | 3 | 2 |
| Geo330 | ------ | Prospect evaluation and appraisal | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الأرض– Department of Earth Science

الغاز الطبيعي والثروات الطبيعية (تخصص منفرد) – Gas and Natural Resources – Single

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo401 | Geo207 | Geology of Egypt | 1 | 3 | 2 |
| Geo427 | Geo326 | Reservoir dynamics and mechanics | 1 | 3 | 2 |
| Geo409 | Geo207 | Petroleum Geology | 1 | 3 | 2 |
| Geo411 | Geo207 | Hydrogeology | 1 | 3 | 2 |
| Geo490 | — | Research and Essay | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo413 | Geo207 | Clay Mineralogy | 1 | 3 | 2 |
| Geo425 | ------- | Organic Geochemistry | 1 | 3 | 2 |
| Geo421 | Geo303 | Isotope Geology | 1 | 3 | 2 |
| Geo429 | ---- | Environmental Impact of The Energy Industry | 1 | 3 | 2 |
| Geo405 | — | Geochemistry | 1 | 3 | 2 |
| Geo431 | Geo326 | Production of Non-Metallic Deposits | 1 | 3 | 2 |
| Total | | | | | 15 |

شعبة علوم الأرض – Earth Science Section

قسم علوم الأرض– Department of Earth Science

الغاز الطبيعي والثروات الطبيعية (تخصص منفرد) – Gas and Natural Resources – Single

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4- Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Pract. | Total |
| Geo423 | — | Geochemical Exploration and Prospecting | 1 | 3 | 2 |
| Geo408 | Geo230 | Mining Geology | 1 | 3 | 2 |
| Geo410 | Geo207 | Basin Analysis | 1 | 3 | 2 |
| Geo432 | Geo328 | Natural Gas and Petroleum Processing | 1 | 3 | 2 |
| Geo490 | — | Research and Essay | 1 | - | 1 |
| Electives: Student selects three courses (6 credit hours) from the following modules | | | | | |
| Geo418 | Geo409 | Reservoir modeling and simulation | 1 | 3 | 2 |
| Geo402 | ---------- | Industrial Minerals | 1 | 3 | 2 |
| Geo420 | Geo405 | Hydrogeochemistry | 1 | 3 | 2 |
| Geo422 | Geo405 | Advanced Geochemistry | 1 | 3 | 2 |
| Geo426 | Geo312 | Ore Mineralogy | 1 | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Geo428 | — | Geographic Information Systems | 1 | 3 | 2 |
| Geo430 | — | Selected Topics…….. | 1 | 3 | 2 |
| Total | | | | | 15 |

## برنامج الكيمياء الحيوية (تخصص منفرد)

## (برنامج الكيمياء الحيوية والتغذية)

## (برنامج خاص بمصروفات)

| | |
|---|---|
| Program Title | Biochemistry & Nutrition (BCNT) |
| Program Type | Single |
| Department(s) | Biochemistry |

**Biochemistry & Nutrition (BCNT)**

**رؤية برنامج بكالوريوس الكيمياء الحيوية والتغذية**

**3-** إعداد كوادر علمية وتطبيقية ذات مستوى رفيع ويتمتعون بخلفية أكاديمية وتدريبية ممتازة ومسلحين بالمعرفة والمهارات العلمية والعملية في علم الكيمياء الحيوية والتغذية.

4- إعداد كوادر مؤهلة لتلبية احتياجات سوق العمل الداخلي والخارجي ولديهم القدرة على المنافسة والتعامل مع المتطلبات الأكاديمية والبحثية والتطبيقية في إطار أخلاقي.

**رسالة برنامج بكالوريوس الكيمياء الحيوية والتغذية**

1- المساهمة في حل المشكلات الصحية والمجتمعية والبيئية ورصد المشاكل الصحية المتعلقة بالتغذية بالمجتمع المحلي بمحافظة البحيرة وما يجاورها.

2- إكساب الطالب القواعد الأساسية في علم التغذية فهماً ومهارةً، بالإضافة إلى التعمق في مجالي الكيمياء الحيوية والتغذية.

3- التعرف على العناصر الغذائية المختلفة وأسس تخطيط الوجبات الغذائية للأصحاء والمرضى بالإضافة إلى تخطيط وتطبيق البرامج الغذائية المناسبة للفئات العمرية المختلفة.

و قد اتفقت هذه الرؤية والرسالة تماما مع رؤية ورسالة كلية العلوم خاصة وجامعة دمنهور عامة حيث أنها إحدى الجامعات المصرية الحكومية التي تتمحور رسالتها حول الإسهام فى البناء المعرفى والثقافى والإنسانى والمهارى والإبداعى والتقنى والاخلاق للطلاب ولأبناء المجتمع المصرى، ولإعدادهم لمواكبة التقدم فى المعارف وتأهيلهم للمشاركة فى تحقيق أهداف التنمية المستدامة فى إطار مناخ تحفيزى على التعلم والبحث والإبتكار والإبداع يقدم من خلاله نماذج للشراكة الفاعلة بين الجامعة وقطاعات المجتمع المصرى المختلفة، ويساهم فى إيجاد صيغ من التعاون والتبادل والتفاعل مع مصادر المعرفة والهيئات البحثية والمستشفيات وبيوت الخبرة المحلية والإقليمية والعالمية فى إطار من التنافسية فى الجودة والتميز.

**و بناء على ذلك تم اقتراح إضافة برنامج بكالوريوس الكيمياء الحيوية والتغذية كبرنامج خاص بمصروفات للائحة البكالوريوس لقسم الكيمياء الحيوية لكلية العلوم بجامعة دمنهور.**

**تم استطلاع رأي المستفيدين من جهات مختلفة:**

و قد شمل الاستبيان عدد 5 أخصائيين من عدة مستشفيات حكومية وخاصة بمدينة دمنهور وعدد 5 أخصائي أغذية في شركات أغذية متعددة مثل الشركة المصرية للمعلبات وشركة الأهرام الغذائية وعدد 5 باحثين من عدة مراكز ومعاهد بحثية مثل المركز القومي للبحوث ومركز البحوث الزراعية وقد تم تحليل نتائج الاستبيانات التي أفادت:

- أهمية إضافة برنامج بكالوريوس الكيمياء الحيوية والتغذية للبرامج التعليمية لجامعة دمنهور على أن تشتمل على مقررات لأساسيات التغذية السليمة وكيفية تصميم وجبة متكاملة وتخمر الغذاء والبكتيريا النافعة والمواد الغذائية المضافة والمكملات الغذائية والفيتامينات وعلاقتهم بالأمراض وتحليل الغذاء وكيفية استخلاص منتجات طبيعية غذائية وكيفية المساهمة في علاج الأمراض بالغذاء.

- إمكانية أن يستوعب برنامج بكالوريوس الكيمياء الحيوية والتغذية عددا كبيرا من الطلاب في منطقة البحيرة حيث يوجد عدد لا بأس به من المستشفيات والمراكز الصحية الخاصة وشركات الأغذية والجهات المعنية التي من الممكن أن تستفيد من هؤلاء الخريجين.

**المخرجات التعليمية المستهدفة ومبررات فتح برنامج بكالوريوس الكيمياء الحيوية والتغذية:**

7- إكساب الطالب معارف ومهارات علمية وتطبيقية وتقنية فى مجال التغذية ووالكيمياء الحيوية وتأهيله وتزويده بالنظريات الحديثة وإعداده لمواصلة التعليم في مجال التغذية، وفقا لاحتياجات المستقبل والتطورات الأخيرة في مصر والعالم.

8- إكمال رسالة الكلية بما تقدمه من برامج تعليمية تمد خريجي كلية العلوم بخلفية معرفية جيدة بفروع الكيمياء الحيوية _و من ضمنها التغذية_ ومنح الطلاب شهادة علمية في مجالات جديدة لزيادة كفاءتهم وفرصهم في سوق العمل.

9- شدة احتياج سوق العمل بمحافظة البحيرة وما يجاورها للمتخصصين في مجالات التغذية ورغبة عدد كبير من من المستفيدين من البرنامج من الطلاب وأصحاب المستشفيات والمراكز الصحية الخاصة طبقا لاستطلاعات الرأي لدراسة هذا المجال.

10- إثراء المعرفة والمساهمة في التطورات العلمية في مجال الكيمياء الحيوية والتغذية من خلال دراسة ومتابعة التطورات في مجالي الكيمياء الحيوية والتغذية.

11- استعمال المهارات النظرية والعملية من خلال التعلم فى مجموعات، وإجراء التجارب وتفسير المشاكل الخاصة بكيمياء التغذية الحيوية وإكساب الطلاب مجموعة من المهارات العامة لتنمية مهاراتهم العلمية والشخصية (مهارات التواصل والاقتباس وأخلاق البحث العلمي).

12- توافر الإمكانات المادية والمعملية والبشرية في قسم الكيمياء الحيوية بكلية العلوم – جامعة دمنهور المعملية والعلمية لفتح برنامج بكالوريوس الكيمياء الحيوية والتغذية والوفاء بمتطلباته.

**الإمكانات المادية والبشرية في معامل الكيمياء الحيوية:**

5- يتوافر في الكلية عدد خمسة معامل طلابية ومعمل خاص بأبحاث لكيمياء الحيوية مجهزين بوحدة كاملة لزراعة الخلايا متضمنة ميكروسكوب خاص بتصوير الخلايا ووحدة كاملة للفصل الإلكتروني للبروتينات والمادة الوراثية متضمنة جهاز التصوير والتقدير شبه الكمي للجل وعدد خمسة أجهزة سبكتروفوتوميتر (طيف غير المرئي ومرئي) وجهاز إليزا وستة أجهزة طرد مركزي وخمسة أجهزة طحن انسجة وحضانات وأفران حرارية وثمانية ميكروسكوبات ضوئية وحمامات مائية وموازين ومكثفات وماصات دقيقة بمختلف سعاتها وسحاحات؛ بالإضافة إلى بعض الأجهزة المتقدمة المتوفرة في المعمل المركزي بالكلية مثل جهاز فصل الخلايا الجذعية وجهاز القياس الكمي لتفاعلات البلمرة المتسلسلة وحضان يحتوي على ثاني أكسيد الكربون .

6- بالنسبة للإمكانات البشرية (ثلاثة أعضاء هيئة تدريس أحدهم بدرجة أستاذ وستة من الهيئة المعاونة وجاري تعيين عدد 2 معيدين وفقا للخطة الخمسية للجامعة) بالإضافة إلى الإستعانة بعدد مناسب من أعضاء هيئة التدريس من المتخصصين من المنتدبين من جهات مختلفة مما يعد مناسبا للعبء التدريسي في البداية.

7- يتوافر أيضا في الكلية مكتبة إلكترونية تضم عدد متميز من الكتب بالإضافة إلى عدد من المراجع الورقية الحديثة.

**الإطار العام للبرنامج**

- لغة الدراسة بالبرنامج هي اللغة الإنجليزية
- تطبق لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة علي هذا البرنامج
- يشترط للحصول على درجة البكالوريوس أن يجتاز الطالب بنجاح عدد 136 ساعة معتمدة يتم توزيعها كالتالي :-

**(1) متطلبات جامعة:** 8 ساعات معتمدة ( 4 ساعات إجباري + 4 ساعات اختياري )

**(2) متطلبات الكلية:** 28 ساعة معتمدة إجبارية

**(3) مقررات إجبارية في التخصص :** 62 ساعة معتمدة

**(4) مقررات اختيارية في التخصص:** 28 ساعة معتمدة

**(5) مقررات حرة 6 ساعات معتمدة**

**(6) دراسات ميدانية وتطبيقية 2 ساعة معتمدة**

**(7) مشروع بحثي 2 ساعة معتمدة**

*** تتكون السنة الدراسية من ثلاث فصول دراسية:**

أ- فصل الخريف – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الثالث من شهر سبتمبر}.

ب- فصل الربيع – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الأول من شهر فبراير}.

ج- فصل الصيف – ومدته ستة أسابيع { يبدأ في الأسبوع الأول من شهر يوليو} مكثف.

السنة التأسيسية – Foundation Year

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الأول – Level One - First Semester

| Level 1 Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Zoo101 | — | General Zoology (1) | 2 | 3 | 3 |
| Bot101 | — | General Botany (1) | 2 | 3 | 3 |
| Math101 | — | General Mathematics | 2 | 3 (tu) | 3 |
| Phys101 | — | General Physics | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | 18 | | |

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One – Second Semester

| Level 1 Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| BCh102 | — | Biochemistry of amino acids & Proteins | 2 | 3 | 3 |
| BCh104 | — | Biochemistry of Carbohydrates & Lipids | 2 | 3 | 3 |
| Mic140 | — | Fundamentals of Microbiology | 1 | 2 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | 18 | | |

قسم الكيمياء الحيوية – Department of Biochemistry

المستوي الثاني – الفصل الدراسي الأول – Level Two – First Semester

| Level 2 – Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh231 | BCh102/BCh104 | Principles of Nutrition | 2 | 3 | 3 |
| BCh233 | ---------- | Food Fermentation | 2 | 3 | 3 |
| BCh205 | ---------- | Biochemistry of Cells | 1 | 2 | 2 |
| BCh239 | | Food Quality Control | 2 | - | 2 |
| BCh235 | BCh102/BCh104 | Food additives & analysis | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| Stat209 | --- | Introduction to Probability and Statistics | 2 | 1 | 2 |
| BCh237 | | Meal planning | 2 | - | 2 |
| CS215 | --------- | Computer and information security | 2 | 1 | 2 |
| BCh241 | | Flavor Chemistry | 2 | - | 2 |

| Total | 16 |
|---|---|

Department of Biochemistry – قسم الكيمياء الحيوية

Level Two – Second Semester – المستوي الثاني – الفصل الدراسي الثاني

| Level 2 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh202 | ---------- | Principles of Molecular Biology | 2 | - | 2 |
| BCh232 | ---------- | Probiotics | 2 | 2 | 3 |
| BCh208 | ---------- | Biological Oxidation | 2 | - | 2 |
| Electives: Student selects four courses (8 credit hours) from the following modules: | | | | | |
| BPhy222 | ---- | Biophysics | 2 | - | 2 |
| BCh234 | ----- | Weight management & Sport nutrition | 2 | - | 2 |
| BCh236 | BCh233 | Advanced Food Microbiology | 2 | - | 2 |
| Mic244 | ----- | Microbial growth | 1 | 2 | 2 |
| BCh206 | ----- | Biological Membranes & Transport | 2 | - | 2 |
| BCh210 | ---- | Bioethics | 2 | - | 2 |
| Total | | | | | 15 |

Department of Biochemistry – قسم الكيمياء الحيوية

Level Three - First Semester – المستوي الثالث – الفصل الدراسي الأول

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh301 | --- | Physical Biochemistry | 2 | 2 | 3 |
| BCh303 | BCh203 | Metabolism of Carbohydrates & Lipids | 2 | 1 | 2 |
| BCh305 | BCh201 | Metabolism of amino acids & Proteins | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| BCh309 | --- | Enzymology 1 | 2 | 3 | 3 |
| BCh311 | --- | Metabolism of Inorganic compounds | 2 | - | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh333 | ------ | Nutritional Diseases | 2 | - | 2 |
| BCh307 | --- | Analytical Biochemistry | 1 | 2 | 2 |
| BCh331 | ------ | Food-Drug Interaction | 2 | - | 2 |
| BCh313 | --- | Drug & Xenobiotics Metabolism | 2 | - | 2 |
| Total | | | | | 16 |

Department of Biochemistry – قسم الكيمياء الحيوية

Level Three - Second Semester – الفصل الدراسي الثاني – المستوي الثالث

| Level 3 – Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh302 | --- | Enzymology 2 | 2 | 3 | 3 |
| BCh304 | BCh303/ BCh305 | Metabolic Regulation | 2 | 2 | 3 |
| BCh306 | --- | Cancer Biology | 2 | - | 2 |
| BCh308 | --- | Natural Products & its applications | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh312 | --- | Neuroscience | 2 | - | 2 |
| BCh332 | -------- | Nutrition in life span | 2 | - | 2 |
| BCh310 | BCh202 | Genetic Engineering | 2 | - | 2 |
| BCh314 | --- | Environmental Pollution | 2 | - | 2 |
| Total | | | | | 15 |

المستوي الرابع – الفصل الدراسي الأول – Level Four - First Semester

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh401 | --- | Clinical Biochemistry | 2 | 2 | 3 |
| BCh403 | --- | Immunology | 2 | - | 2 |
| BCh405 | --- | Endocrinology & Hormones | 2 | 2 | 3 |
| BCh431 | | Therapeutic Nutrition (1) | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh411 | ---- | Laboratory Safety & Infection Control | 2 | - | 2 |
| BCh413 | --- | Scientific writing | 2 | - | 2 |
| BCh409 | | Stem Cells & Cell Culture | 1 | 2 | 2 |
| Total | | | | | 15 |

قسم الكيمياء الحيوية – Department of Biochemistry

المستوي الرابع – الفصل الدراسي الثاني – Level Four - Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh402 | BCh401 | Advanced Clinical Biochemistry | 2 | 2 | 3 |
| BCh406 | | Nanoscience Bioapplications | 2 | - | 2 |
| BCh410 | --- | Cell Signaling | 2 | - | 2 |
| BCh404 | --- | Toxicology | 2 | - | 2 |
| BCh430 | --- | Research Project in Nutriotion | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh412 | --- | Bioinformatics | 1 | 2 | 2 |
| BCh434 | BCh431 | Therapeutic Nutrition (2) | 2 | - | 2 |
| BCh416 | ----- | Topics in Biochemistry | 2 | - | 2 |
| BCh414 | | Vitamins & Co-enzymes | 2 | - | 2 |
| Total | | | | | 15 |

## برنامج الكيمياء الحيوية (تخصص منفرد)

## (برنامج الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية)

## (برنامج خاص بمصروفات)

| | |
|---|---|
| Program Title | Biochemistry & Microbial Biotechnology (BCMB) |
| Program Type | Single |
| Department(s) | Biochemistry |

**Biochemistry &Microbial Biotechnology**

**(BCMB)**

**رؤية برنامج بكالوريوس برنامج الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية**

**1-** إعداد كوادر علمية وتطبيقية ذات مستوى رفيع ويتمتعون بخلفية أكاديمية وتدريبية ممتازة ومسلحين بالمعرفة والمهارات العلمية والعملية في علوم الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية.

**2-** إعداد كوادر مؤهلة لتلبية احتياجات سوق العمل الداخلي والخارجي ولديهم القدرة على المنافسة والتعامل مع المتطلبات الأكاديمية والبحثية والتطبيقية في إطار أخلاقي.

**رسالة برنامج برنامج بكالوريوس برنامج الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية**

المساهمة في حل المشكلات الصحية والمجتمعية والبيئية ورصد المشاكل الصحية المتعلقة بالمجتمع المحلي بمحافظة البحيرة وما يجاورها.

1- إكساب الطالب القواعد الأساسية في الكمياء الحيوية والتطبيقات المختلفة لها وللعلوم الأخرى في التكنولوجيا الحيوية الميكروبية.

2- التعرف على التطبيقات العملية المختلفه لهذه العلوم في مجال الصحة والصناعة والزراعة والبيئة.

و قد اتفقت هذه الرؤية والرسالة تماما مع رؤية ورسالة كلية العلوم خاصةو جامعة دمنهور عامة حيث أنها إحدى الجامعات المصرية الحكومية التي تتمحور رسالتها حول الإسهام فى البناء المعرفى والثقافى والإنسانى والمهارى والإبداعى والتقنى والاخلاق للطلاب ولأبناء المجتمع المصرى، ولإعدادهم لمواكبة التقدم فى المعارف وتأهيلهم للمشاركة فى تحقيق أهداف التنمية المستدامة فى إطار مناخ تحفيزى على التعلم والبحث والإبتكار والإبداع يقدم من خلاله نماذج للشراكة الفاعلة بين الجامعة وقطاعات المجتمع المصرى المختلفة، ويساهم فى إيجاد صيغ من التعاون والتبادل والتفاعل مع مصادر المعرفة والهيئات البحثية والمستشفيات وبيوت الخبرة المحلية والإقليمية والعالمية فى إطار من التنافسية فى الجودة والتميز.

**و بناء على ذلك تم اقتراح إضافة برنامج بكالوريوس الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية كبرنامج خاص بمصروفات للائحة البكالوريوس لقسم الكيمياء الحيوية وقسم النبات والميكروبيولوجى بكلية العلوم بجامعة دمنهور.**

**تم استطلاع رأي المستفيدين من جهات مختلفة:**

و قد شمل الاستبيان عدد 5 أخصائيين من عدة مصانع خاصة وحكومية بمدينة دمنهور وعدد 5 أخصائي في شركات أغذية وأدوية واستصلاح الأراضى وعدد 5 باحثين من عدة مراكز ومعاهد بحثية مثل المركز القومي للبحوث ومركز البحوث الزراعية وقد تم تحليل نتائج الاستبيانات التي أفادت:

- أهمية إضافة برنامج **بكالوريوس الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية** للبرامج التعليمية لجامعة دمنهور على أن تشتمل على مقررات لأساسيات الكمياء الحيويه والميكروبيولوجى والتكنولوجيا الحيويه المرتبطه بعلم الميكروبات
- إمكانية أن يستوعب برنامج بكالوريوس الكيمياء الحيوية و**والتكنولوجيا الحيوية** عددا كبيرا من الطلاب في منطقة البحيرة حيث يوجد عدد لا بأس به المنشات الإنتاجية الصناعية الزراعية المختلفة بالإضافه لعدد من المنشات الصحية.

**المخرجات التعليمية المستهدفة ومبررات فتح بكالوريوس الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية**

- إكساب الطالب معارف ومهارات علمية وتطبيقية وتقنية فى والكيمياء الحيوية والميكروبيولوجى والتكنولوجيا الحيويه وتزويده بالنظريات الحديثة وإعداده لمواصلة التعليم والبحث العلمى في المجالات التى سبق ذكرها، وفقا لاحتياجات المستقبل والتطورات الأخيرة في مصر والعالم.
- إكمال رسالة الكلية بما تقدمه من برامج تعليمية تمد خريجي كلية العلوم بخلفية معرفية جيدة بفروع الكيمياء الحيوية والميكروبيولوجى والتكنولوجيا الحيويه وخلق مجالات علميه وتعليميه جديدة لزيادة كفاءتهم وفرصهم في سوق العمل.
- شدة احتياج سوق العمل بمحافظة البحيرة وما يجاورها للمتخصصين في الكيمياء الحيوية والميكروبيولوجى والتكنولوجيا الحيويه ورغبة عدد كبير من من المستفيدين من البرنامج من الطلاب واصحاب المصانع والمزارع والقطاع الصحى.
- إثراء المعرفة والمساهمة في التطورات العلمية في مجال الكيمياء الحيوية والميكروبيولوجى والتكنولوجيا الحيويه من خلال دراسة ومتابعة التطورات في هذه المجالات شديده الإرتباط وسريعه النمو والتطور.
- استعمال المهارات النظرية والعملية من خلال التعلم فى مجموعات، وإجراء التجارب وتفسير المشاكل الخاصة الكيمياء الحيوية والميكروبيولوجى والتكنولوجيا الحيويه وإكساب الطلاب مجموعة من المهارات العامة لتنمية مهاراتهم العلمية والشخصية (مهارات التواصل والاقتباس وأخلاق البحث العلمي).
- توافر الإمكانات المادية والمعملية والبشرية في قسمي الكيمياء الحيوية والنبات والميكروبيولوجي بكلية العلوم جامعة دمنهور لفتح الكيمياء الحيوية والتكنولوجيا الحيوية الميكروبية والوفاء بمتطلباته.

**الإمكانات المادية والبشرية في معامل الكيمياء الحيوية ومعامل النبات والميكروبيولوجي:**

- يتوافر في الكلية عدد خمسة معامل طلابية ومعمل خاص بأبحاث لكيمياء الحيوية وعدد ثلاث معامل طلابية بقسم النبات والميكروبيولوجى ومعمل ابحاث مجهزين بوحدة كاملة لزراعة الخلايا متضمنة ميكروسكوب خاص بتصوير الخلايا ووحدة كاملة للفصل الإلكتروني للبروتينات والمادة الوراثية متضمنة جهاز التصوير والتقدير شبه الكمي للجل وعدد خمسة أجهزة سبكتروفوتوميتر (طيف غير المرئي ومرئي) وجهاز إليزا وستة أجهزة طرد مركزي وخمسة أجهزة طحن انسجة وحضانات وأفران حرارية وثمانية ميكروسكوبات ضوئية وحمامات مائية وموازين ومكثفات وماصات دقيقة بمختلف سعاتها وسحاحات؛ بالإضافة إلى بعض الأجهزة المتقدمة المتوفرة في المعمل المركزي بالكلية مثل جهاز فصل الخلايا الجذعية وجهاز القياس الكمي لتفاعلات البلمرة المتسلسلة وحضان يحتوي على ثاني أكسيد الكربون .
- بالنسبة للإمكانات البشرية لقسم الكيمياء الحيوية (ثلاثة أعضاء هيئة تدريس أحدهم بدرجة أستاذ وستة من الهيئة المعاونة وجاري تعيين عدد 2 معيدين وفقا للخطة الخمسية للجامعة) بالإضافة إلى عدد 2 استاذ ميكروبيولوجى وعدد 3 استاذ مساعد وعدد 6 مدرسين وعدد 4 معيدين بقسم النبات والميكروبيولوجي والإستعانة بعدد مناسب من أعضاء هيئة التدريس من المتخصصين من المنتدبين من جهات مختلفة مما يعد مناسبا للعبء التدريسي في البداية.

- يتوافر أيضا في الكلية مكتبة إلكترونية تضم عدد متميز من الكتب بالإضافة إلى عدد من المراجع الورقية الحديثة.

**الإطار العام للبرنامج**

- لغة الدراسة بالبرنامج هي اللغة الإنجليزية
- تطبق لائحة الكلية لمرحلة البكالوريوس بنظام الساعات المعتمدة علي هذا البرنامج
- يشترط للحصول على درجة البكالوريوس أن يجتاز الطالب بنجاح عدد 136 ساعة معتمدة يتم توزيعها كالتالي :-

**(1) متطلبات جامعة:** 8 ساعات معتمدة ( 4ساعات إجباري + 4ساعات اختياري )

**(2) متطلبات الكلية:** 28 ساعة معتمدة إجبارية

**(3) مقررات إجبارية في التخصص :** 62 ساعة معتمدة

**(4) مقررات اختيارية في التخصص:** 28ساعة معتمدة

**(5) مقررات حرة 6 ساعات معتمدة**

**(6) دراسات ميدانية وتطبيقية 2 ساعة معتمدة**

**(7) مشروع بحثي 2 ساعة معتمدة**

*** تتكون السنة الدراسية من ثلاث فصول دراسية:**

أ- فصل الخريف – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الثالث من شهر سبتمبر}.

ب- فصل الربيع – ومدته خمسة عشر أسبوعاً { يبدأ في الأسبوع الأول من شهر فبراير}.

ج- فصل الصيف – ومدته ستة أسابيع { يبدأ في الأسبوع الأول من شهر يوليو} مكثف.

**السنة التأسيسية – Foundation Year**

**شعبة العلوم البيولوجية – Biology Science Section**

**المستوي الأول – الفصل الدراسي الأول– Level One - First Semester**

| Level 1 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem101 | — | General Chemistry (1) | 2 | 3 | 3 |
| Zoo101 | — | General Zoology (1) | 2 | 3 | 3 |
| Bot101 | — | General Botany (1) | 2 | 3 | 3 |
| Math101 | — | General Mathematics | 2 | 3 (tu) | 3 |
| Phys101 | — | General Physics | 1 | 3 | 2 |
| UN101 | — | Scientific English | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN103 | — | تاريخ وفلسفة العلوم | 2 | - | 2 |
| UN105 | — | الولاء والانتماء والمواطنة | 2 | - | 2 |
| UN107 | — | الثقافة البيئية | 2 | - | 2 |
| Total | | | | | 18 |

السنة التأسيسية – Foundation Year

شعبة العلوم البيولوجية – Biology Science Section

المستوي الأول – الفصل الدراسي الثاني – Level One - Second Semester

| Level 1 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Chem102 | — | General Chemistry (2) | 2 | 3 | 3 |
| BCh102 | — | Biochemistry of amino acids & Proteins | 2 | 3 | 3 |
| BCh104 | — | Biochemistry of Carbohydrates & Lipids | 2 | 3 | 3 |
| Mic140 | — | Fundamentals of Microbiology | 1 | 2 | 2 |
| CS114 | — | Computer Science | 2 | 3 | 3 |
| UN102 | — | Information Technology | 2 | - | 2 |
| Electives: Student selects one course (2 credit hours) from the following modules: | | | | | |
| UN104 | — | الامان المعملي | 2 | - | 2 |
| UN106 | — | مهارات التواصل | 2 | - | 2 |
| UN108 | — | أساليب البحث العلمي | 2 | - | 2 |
| Total | | | | | 18 |

قسم الكيمياء الحيوية – Department of Biochemistry

المستوي الثاني – الفصل الدراسي الأول– Level Two - First Semester

| Level 2 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic241 | ------ | Microbial diversity | 2 | 3 | 3 |
| Mic243 | ------ | Microbial physiology | 2 | 2 | 3 |
| BCh205 | ------ | Biochemistry of Cells | 1 | 2 | 2 |
| Mic245 | ------ | Principles of biotechnology | 1 | 2 | 2 |
| Mic247 | ------ | Microbiological Techniques | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| Stat209 | ------ | Introduction to Probability and Statistics | 2 | 1 | 2 |
| CS215 | ------ | Computer and information security | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Mic249 | ------ | Microbial secondary metabolites | 1 | 2 | 2 |
| Total | | | | | 16 |

قسم الكيمياء الحيوية – Department of Biochemistry

المستوي الثاني – الفصل الدراسي الثاني– Level Two - Second Semester

| Level 2 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh202 | ---------- | Principles of Molecular Biology | 2 | - | 2 |
| Mic242 | Mic247 | Fermentation techniques | 2 | 2 | 3 |
| Mic244 | -------- | Microbial growth | 1 | 2 | 2 |
| Electives: Student selects four courses (8 credit hours) from the following modules: | | | | | |
| BPhy222 | ---- | Biophysics | 2 | - | 2 |
| BCh208 | ----- | Biological Oxidation | 2 | - | 2 |
| BCh206 | ----- | Biological Membranes & Transport | 2 | - | 2 |
| BCh210 | ---- | Bioethics | 2 | - | 2 |
| Mic244 | ----- | Microbial growth | 1 | 2 | 2 |
| Total | | | | | 15 |

قسم الكيمياء الحيوية – Department of Biochemistry

المستوي الثالث – الفصل الدراسي الأول– Level Three - First Semester

| Level 3 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh301 | --- | Physical Biochemistry | 2 | 2 | 3 |
| BCh315 | BCh102 & BCh104 | General Metabolism | 2 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Mic341 | Mic244 | Industrial microbiology | 2 | - | 2 |
| BCh309 | --- | Enzymology 1 | 2 | 3 | 3 |
| Mic343 | Mic244 | Applied medical microbiology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh311 | --- | Metabolism of Inorganic compounds | 2 | - | 2 |
| BCh307 | --- | Analytical Biochemistry | 1 | 2 | 2 |
| Mic345 | --- | Soil and agriculture microbiology | 1 | 2 | 2 |
| Mic347 | --- | Microtechniques and cell photography | 1 | 2 | 2 |
| Total | | | | | 16 |

Department of Biochemistry – قسم الكيمياء الحيوية

Level Three - Second Semester –المستوي الثالث – الفصل الدراسي الثاني

| Level 3 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic342 | Mic244 | Food microbiology | 2 | 3 | 3 |
| BCh304 | BCh315 | Metabolic Regulation | 2 | 3 | 3 |
| BCh306 | --- | Cancer Biology | 2 | - | 2 |
| Mic344 | Mic341 | Biofuel microbiology | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh312 | --- | Neuroscience | 2 | - | 2 |
| BCh310 | BCh202 | Genetic Engineering | 2 | - | 2 |
| BCh314 | --- | Environmental Pollution | 2 | - | 2 |
| Total | | | | | 15 |

Department of Biochemistry – قسم الكيمياء الحيوية

Level Four - First Semester –المستوي الرابع – الفصل الدراسي الأول

| Level 4 - Semester 1 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| BCh401 | --- | Clinical Biochemistry | 2 | 2 | 3 |
| BCh403 | --- | Immunology | 2 | - | 2 |
| BCh405 | --- | Endocrinology & Hormones | 2 | 2 | 3 |
| Mic441 | --- | Biocontrol &Microbial fertilizers | 2 | 2 | 3 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh411 | ---- | Laboratory Safety & Infection Control | 2 | - | 2 |
| BCh413 | --- | Scientific writing | 2 | - | 2 |
| BCh409 | ---- | Stem Cells& Cell Culture | 1 | 2 | 2 |
| Total | | | | | 15 |

قسم الكيمياء الحيوية – Department of Biochemistry

المستوي الرابع – الفصل الدراسي الثاني– Level Four - Second Semester

| Level 4 - Semester 2 | | Course Title | Credits | | |
|---|---|---|---|---|---|
| Code | Prereq. | Compulsory | Lect. | Prac. | Total |
| Mic442 | --- | Environmental biotechnology Technical | 2 | 2 | 3 |
| BCh410 | --- | Cell Signaling | 2 | - | 2 |
| BCh404 | --- | Toxicology | 2 | - | 2 |
| Mic444 | --- | Pharmaceutical Microbiology | 1 | 2 | 2 |
| BCh440 | --- | Research Project in Biotechnology | 1 | 2 | 2 |
| Electives: Student selects two courses (4 credit hours) from the following modules: | | | | | |
| BCh412 | --- | Bioinformatics | 1 | 2 | 2 |
| BCh406 | --- | Nanoscience Bioapplications | 2 | - | 2 |
| BCh414 | --- | Vitamins & Co-enzymes | 2 | - | 2 |
| Total | | | | | 15 |

اللائحة الداخلية

لكلية العلوم. جامعة دمنهور

للعمل بنظام الساعات المعتمدة

# الفصل الخامس
# محتوي المقررات

# Courses Contents

# Department of Mathematics and Computer Science

| Code | Prereq. | Course Title | Contents |
|---|---|---|---|
| Math101 | — | General Mathematics<br>رياضيات عامة | Functions - Derivatives and Applications - Methods of Indefinite Integration - Definite integrals – Applications - Determinants - Complex Numbers - Polynomials and Theory of Equations - Polar coordinates - Review of the Equations of Straight Lines in the Plane - Circles - Conic Sections. |
| Math111 | — | Calculus (1)<br>تفاضل وتكامل (1) | Functions and their inverses, Limits and continuity, Derivatives, Review of differentiation formulae, Implicit differentiation, Parametric differentiation, Logarithmic differentiation, Leibnitz's theorem, The Mean Value Theorem, Maxima and minima, How derivatives affect the shape of a graph, L'Hospital's Rule, Taylor and Maclaurin expansions. |
| Math112 | — | Calculus (2)<br>تفاضل وتكامل (2) | Indefinite integral, Rules of integration, Definite integral –Fundamental Theorem of Calculus, Integration by parts, Integration by trigonometric substitutions, Partial fraction, Integration by partial fraction, Reduction formulae, Applications of definite integral. |
| Math151 | — | Mechanics (1)<br>ميكانيكا (1) | Vector algebra, Applications on equilibrium of two-dimensional force systems, Friction, Center of gravity and centroid, Virtual work, Moments and Products of Inertia, Flexible chain and strings, Stability. |
| Math152 | — | Mechanics (2)<br>ميكانيكا (2) | Kinematics of Motion of a particle in a straight line, Dynamics of Motion, Simple Harmonic Motion, Hooke's law, Plane motion of a particle in Cartesian coordinates, Projectiles, Impulsive Motion, Constrained Motion, Central Motion, Motion of Planets, Vibrations |
| Math211 | Math112 | Mathematical Analysis (1)<br>تحليل رياضي (1) | Function of several variables, Differentiation under integral sign, Mean value Theorem for functions of two variables, Maxima and minima, Lagrange |

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| | | | multipliers, Multiple integrals, Line integrals, Green's theorem in plane, Surface integrals, The divergence theorem, Stokes' theorem. |
| **Math212** | **Math211** | **Mathematical Analysis (2)**<br>**تحليل رياضي (2)** | Sequences and series of real numbers, Convergence and absolute convergence, Tests for convergence, Power series, Radius of convergence, Infinite products of series, Improper integrals |
| **Math213** | — | **Advanced Algebra and Fundamental of Mathematics**<br>**جبر متقدم واساسيات رياضيات** | Basic set theory, Relations and functions, Mathematical induction, Techniques of counting, Complex number system, Sum of finite series, Binomial Theorem, Remainder Theorem of polynomials, Theory of Equations. |
| **Math214** | — | **Analytic Geometry (Plane and Solid Geometry)**<br>**هندسة تحليلة (هندسة مستوية وفراغية)** | In the plane: Cartesian and polar coordinates, Equations of straight lines, Circle, Conic Sections (Parabola, ellipse and hyperbola), Translation and rotation of axes, The general second degree equation in two variables. In the space: Planes and straight lines, Quadratic surfaces, The general equation of the second degree in three variables |
| **Math215** | — | **Theory of Matrices**<br>**نظرية المصفوفات** | Matrices, Operations with matrices, Properties of matrix operations, The inverse of a matrix, Elementary matrices, The determinants, Determinants and the inverse of a matrix, Rank of matrix, Equivalence matrices, Systems of linear equations, Characteristic roots and vectors of matrix, Cayley–Hamilton theorem. |
| **Math216** | **Math215** | **Linear Algebra**<br>**جبر خطي** | Gauss-Jordan elimination method, Vectors in \R^3, Vectors spaces, Subspaces, Spanning sets and linear independence, Basis and dimension, Coordinates and change of basis, Linear transformations, The kernel and the range of a linear transformation, Matrices for linear transformations, Eigenvalues and eigenvectors, Diagonalization of matrices. |
| **Math217** | **Math112** | **Ordinary Differential Equations**<br>**معادلات تفاضلية عادية** | Definitions and Terminology, initial-value problems, First-order differential equations, Separable equations, Linear equations, Exact equations, Solutions by substitutions (Homogeneous equation, Bernoulli equation), Linear higher-order differential equations, Preliminary theory, Reduction of order – Homogeneous linear equations with constant coefficients, Undetermined coefficients (superposition approach), Undetermined coefficients (Annihilator approach), Variation of parameters, Cauchy-Euler Equation, Solving systems of linear DEs by elimination, The Laplace transform, Applications of Laplace transform to solve ordinary differential equations. |
| **Math218** | — | **Mathematical Logic (1)**<br>**المنطق الرياضي (1)** | Algebra of propositions, Propositions and logical connectives, Truth tables, Validity, Equivalence of formulas, Duality law, Tautological conditionals, Tautological bi-conditionals, Consequence, Decision problem, The Conjunctive and Disjunctive normal forms, Principal normal form, The predicates, The Quantifiers, The predicate logic, The Boolean algebra, Sub-algebra, Partial orders, Isomorphism, Boolean expressions and functions, Switching circuits, Simplification of circuits, The bridge circuits, The logic circuits, The binary number system, Multiple output logic circuits |

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| **Math219** | — | **Mathematical Software and Programming**<br>**حزم وبرمجة رياضية** | Scientific Workplace: writing text (Using Latex), computing and drawing graphs. Mathematical Software (Maple, Mathematica or MATLAB). Microsoft Excel: preparation of worksheets, using formula, compute and drawing graphs. |
| **Math231** | — | **Theory of Numbers**<br>**نظرية الأعداد** | Fundamental theorem of arithmetic, Euclidean algorithm, Divisibility theorem in the integers, Primes and their distribution, The theory of congruencies, Fermat's theorem, Wilson's theorem and their applications, Primitive roots, Applications of congruencies, The quadratic reciprocity law |
| **Math232** | — | **Biomathematics**<br>**رياضيات حيوية** | Mathematical modeling and data analysis for biological and biomedical systems. Examples include: The formation of animal coat patterns, The interaction between pathogens and The immune system of the body, The growth of tumours, The spread of diseases through the community population dynamics, Pharmacokinetics and bacterial growth, Mathematical methods for solving the model equation. |
| **Math233** | — | **History of Mathematics**<br>**تاريخ الرياضيات** | Evolution of some mathematical concepts, facts and algorithms in arithmetic, algebra, trigonometry, Euclidean geometry, analytic geometry and calculus through early civilizations (Egyptians, Babylonians, Greeks, Indians, Chinese, Muslims and Europeans), Evolution of solutions of some conjectures and open problems. |
| **Math234** | **Math117** | **Difference Equations**<br>**معادلات الفروق** | The Difference calculus, Linear difference equation, Solution of homogeneous linear difference equation with constant coefficients, Finding particular solution of non-homogeneous difference equations– First order difference equation with variable coefficients, System of first order difference equations |
| **Math236** | — | **Mathematical Modeling**<br>**نمذجة رياضية** | Basic concepts of mathematical modeling, Classifications of models, Stages of building models, Systems analysis, Flow diagrams, Analogies from physics, Solving equations analytically and numerically, Asymptotic behavior, Testing models, Model structure, Prediction of previously unused data, Estimating model parameters, Comparing two models for the same system. |
| **Math251** | **Math152** | **Mechanics (3)**<br>**(3) ميكانيكا** | General curvilinear coordinates, Divergence, Curl and gradient, Gauss, Green and Stokes' theorems, Applications, Theory of potential, Tangential and normal accelerations, constrained motion, Dynamic of a particle in a plane, Motion of a particle under a central filed (central orbits), Angular momentum. |
| **Math252** | **Math251** | **Dynamics of Rigid Body**<br>**ديناميكا الجسم الصلب** | Types of motion of rigid bodies, Translation, Rotation about a fixed axis, Planar motion, General motions, Instantaneous centers, General motions in two dimension and three dimensions, Euler's equation – Force, linear momentum principle, Moment, Angular momentum principles. |
| **Math253** | **Math111** | **Vectors Analysis**<br>**تحليل المتجهات** | Vector calculus, Ordinary derivatives of vectors, Space curves, Continuity and differentiability, Partial derivatives of vectors, The vector Differential operator, Ordinary integrals of vectors, Line and surface integrals, volume Integrals, applications– Orthogonal curvilinear coordinates, Unit vectors in curvilinear systems, cylindrical coordinates, spherical Coordinates. |
| **Math254** | **Math253** | **Tensor Analysis**<br>**تحليل الممتدات** | Tensor fields, Contravariant and covariant vectors, Tensors of rank greater than two, Scalars or invariants, Tensor fields –Tensors operations– The line element and metric Tensor, Conjugate or reciprocal tensors, Associated tensors, Length |

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| | | | of a vector, Angle between vectors, Physical components, Christoffel's symbols, Transformation laws of Christoffel's Symbols, Geodesics. |
| **Math271** | — | **Advanced Algebra and Analytical Geometry**<br>جبر متقدم وهندسة تحليلية | Basic set theory, Relations and functions, Mathematical induction, Complex number system, Binomial theorem, Remainder theorem of polynomials, Theory of equations. Cartesian and Polar Coordinates, Equations of straight lines, Circles, Conic sections (Parabola- Ellipse- Hyperbola), Translation and rotation of axes. |
| **Math272** | — | **Matrices and Linear Algebra**<br>مصفوفات وجبر خطي | Matrices, Operations with matrices, Properties of matrix operations, The inverse of a matrix, Elementary matrices, The determinants, Rank of matrix, Equivalence matrices, Systems of linear equations, Eigenvalues and Eigenvectors, Cayley–Hamilton theorem. Vectors spaces, Subspaces, Spanning sets and linear independence, Basis and dimension, Coordinates and change of basis, Linear transformations, The kernel and the range of a linear transformation |
| **Math274** | **Math112** | **Mathematical Analysis**<br>تحليل رياضي | Function of several variables, Differentiation under integral sign, Mean value theorem for functions of two variables, Maxima and minima– Multiple integrals, Line integrals, Green's theorem in plane, Surface integrals, The divergence theorem, Stokes' theorem- Sequences and series of real numbers, Convergence and absolute convergence, Tests for convergence, Power series, Radius of convergence. |
| **Math311** | **Math212** | **Real Analysis**<br>تحليل حقيقي | The algebraic properties of, The order properties, completeness axiom and its consequences, Convergent sequences, Limit theorems, Monotone sequences, subsequences, Limit superior and inferior of a sequence, Cauchy sequences, Open and closed sets, Limit point of a set, Bolzano-Weierstrass theorem, Compact sets, Heine-Borel theorem, Limit, continuity and uniform continuity of real functions, The derivative, Applications. |
| **Math312** | **Math212** | **Complex Analysis (1)**<br>تحليل مركب (1) | Complex functions, Special power functions, Reciprocal function, Limits and continuity, Differentiability and analyticity, Cauchy-Riemann equations, Harmonic functions, Elementary functions, Complex integrals, Cauchy-Goursat theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives, Sequences and series, Taylor series, Laurent Series, Zeros and poles, Residues and residue theorem, Evaluation of real trigonometric integrals, Evaluation of real improper integrals |
| **Math313** | **Math112** | **Numerical Analysis (1)**<br>تحليل عددي (1) | Error Analysis, Numerical solution of nonlinear equations by using (bisection, fixed point, Newton method), Interpolation Polynomial approximation (Lagrange, Newton's formulas), Numerical differentiation and integration, Trapezoidal, Simpson's and Gaussian Quadrature |
| **Math314** | **Math217** | **Partial Differential Equations**<br>معادلات تفاضلية جزئية | Some definitions for partial differential equations and form these equations, Partial differential equations of the first order, Second order partial differential equations and its classifications, Canonical forms, Types of initial and boundary conditions and physical examples, Heat transfer equation in several forms, Wave equation and D'Alembert method, Laplace equation, Spherical means, Harmonic functions, Extremum principle |
| **Math315** | **Math217** | **Special Functions**<br>دوال خاصة | Series solutions of linear differential equations, Solutions about ordinary points, Solutions about singular points and the method of Frobenius, Gamma and beta |

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|---|---|---|---|
| | | | functions, Legendre polynomials and functions, Bessel functions, Hermite polynomials, Laguerre polynomials, Chebyshev polynomials, Hypergeometric functions. |
| **Math316** | **Math213** | **Theory of Groups**<br>**نظرية المجموعات** | Groups, Permutation group, Subgroup, Normal subgroup, Cyclic groups, Factor groups, Co-sets, Lagrange's theorem, Direct product and finite element, Decomposition of groups, Homomorphism, Isomorphism |
| **Math331** | **Math217** | **Fourier Analysis and Transforms**<br>**تحليل وتحويلات فوريه** | Fourier Series, Fourier integral, Fourier transforms, Convolution theorem, Applications, Mellin transform and applications |
| **Math332** | **Math217** | **Introduction to Chaos**<br>**مقدمة في التشوش** | Introduction to Chaos, Examples from natural phenomena, Basic iteration, Iteration rules orbit, cycle time series and graphs, Numerical methods of linear iterations, Graphical iteration, Nonlinear iterations, General theory of equations, Approximate solutions for nonlinear equations. |
| **Math333** | **Math216** | **Operations Research**<br>**بحوث العمليات** | Introduction to the linear programming problem and operations research, Simplex algorithm, Duality theory, Sensitivity analysis, Geometry of linear programing, Transportation problem. |
| **Math334** | **Math217** | **Numerical Optimization**<br>**الأمثلية العددية** | Basic concepts of optimization, Global and local optimization, Convexity, Rates of convergence, Unconstrained optimization problem: optimality conditions, Line search method, Trust region method, Gradient methods, Newton's method, Least square method Constrained optimization problem: Lagrange multipliers, Karush-Kuhn-Tucker conditions, Active set, Penalty method |
| **Math351** | **Math252** | **Analytical Dynamics**<br>**ديناميكا تحليلية** | Generalized coordinates, Holonomic and non-holonomic dynamical systems, Lagrange's equation, Hamiltonian theory, Lagrange's equation for impulsive motion, Dynamics of oscillating systems, Hamilton's principle, Canonical transformations and Hamilton-Jacobi equation, Small oscillations |
| **Math352** | **Math251** | **Theory of Linear Elasticity**<br>**نظرية المرونة الخطية** | Introduction to Cartesian Tensors, Analysis of Stress, Stress Tensor, Equations of Motion, Symmetry of the Stress Tensor, Principal Stress. Analysis of Strain, Physical Interpretation, Strain Compatibility Equations. Relation Between Stress and Strain, Generalized Hooke's Law, Hooke's Law for Anisotropic Materials, Hooke's Law for Isotropic Materials, Boundary Value Problems, Boundary Conditions, Stress Formulation for BVP, Displacement Formulation for BVP, Saint–Venant's Principle, Solved Problems |
| **Math353** | **Math251** | **Fluid Dynamics (1)**<br>**ديناميكا الموائع (1)** | Kinematics of fluids, Ideal flow, Acceleration vector, Streamlines and path lines, Conservation of mass, Irrotational motion, Vorticity and circulation, Boundary value problems for potential flows, Uniqueness theorem, Kinetic energy, Kelvin's theorem, Symmetric motion about a point, Axisymmetric motion, Dynamics of fluids, Euler's momentum equation, Bernoulli's equation, Impulsive motion, Two dimensional irrotational motion of incompressible fluids, Complex potential, Potential flow and its application, Blasius's theorem, Sources, Sinks and doublets, Streaming motion past a circular cylinder method of images |
| **Math354** | **Math351** | **Quantum Mechanics (1)**<br>**ميكانيكا الكم (1)** | Elements of Wave and Matrix Mechanics, Schrödinger's Wave Equation, The Free Particle, The Square Well, Step and Square Barrier Potentials, Simple Harmonic Oscillator, The Hydrogen Atom. The Schrödinger's Wave Equation in Three Dimensions, The Three Dimensional Harmonic Oscillator, The Particle in |

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|---|---|---|---|
| | | | a Box, Angular Momentum in Quantum Mechanics, The Isotropic Harmonic Oscillator in Spherical Polar Coordinates, Angular Momentum |
| **Math355** | **Math251** | **Electromagnetism**<br>**الكهرومغناطيسية** | Gauss's theorem, Invariance of electric charge, Poisson's equation, Force exerted on a moving charge by another charge, Moving at the same constant velocity, Laplace's equation- Transformation of electric and magnetic fields, Condensers and method of electrical images, The vector potential, Dielectrics, The scalar potential, The electric field intensity, Magnetism, The Lorentz condition |
| **Math356** | **Math251** | **Electrodynamics**<br>**ديناميكا كهربية** | The electromagnetic field and Maxwell's equations. Boundary conditions. Energy of the field. Poynting's theorem. Solutions of Field Equations in Various coordinate Systems. The magnetic field produced by steady electric currents. Electromagnetic waves, plane wave, reflection and refraction, polarized waves. Principle of Electromagnetic Radiation & Interaction with Matter, Waveguides, Applications |
| **Math357** | — | **Methods of Applied Mathematics**<br>**طرق الرياضيات التطبيقية** | Boundary value problems– Mathematical modeling of physical phenomena, Methods of solution of boundary value problems, Eigenfunction expansions, Laplace Transform, Laplace Transform of Derivative, Inverse Laplace transform, Dirac Delta function, Heaviside unit step function, Application of Laplace Transform to BVP, Complex inversion formula Fourier Transforms, Hankel Transform, Milne Transform, Finite Fourier and Hankel Transforms, Applications |
| **Math358** | — | **Selected Topics in Applied Mathematics**<br>**موضوعات مختارة في الرياضيات التطبيقية** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis |
| **Math372** | **Math217** | **Integral and Partial Differential Equations**<br>**معادلات تفاضلية وتكاملية** | Definitions and basic properties of integral equations, Voltra and Fredholm theorems for degenerate arbitrary kernels, Applications of Abel's integral equations. Some definitions for partial differential equations and form these equations, Partial differential equations of first order, Second order partial differential equations and its classifications, Canonical forms, Types of initial and boundary conditions and physical examples, Heat transfer equation in several forms, Wave equation and D'Alembert method, Laplace equation, Harmonic functions |
| **Math411** | **Math311** | **Functional Analysis (1)**<br>**تحليل دالي (1)** | Metric spaces, Inner product space, Normed linear space, Hilbert space, Banach space, Adjoint of bounded linear operators in Hilbert space, Applications. |
| **Math412** | **Math311** | **General Topology**<br>**توبولوجي عام** | Topological spaces, Discrete and indiscrete topologies, Open, closed and clopen sets, The finite closed topology, Accumulation point and derive sets, Closure and dense sets, Interior, exterior and boundary points, The Euclidean topology, Base for a topology, Continuity in topological spaces, Open and closed functions, Homeomorphism and homeomorphic spaces, Separation axioms, Hausdorff space, Regular and normal spaces, Connectedness, Connected spaces, Compactness. |
| **Math413** | **Math217** | **Integral Equations**<br>**معادلات تكاملية** | Integral equation, Classification of integral equations, Volterra Integral Equations of the second kinds: resolvent kernel method, Method of Laplace transformation. Fredholm integral equations of the second kind: degenerate |

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| | | | kernel method, Method of Fredholm determinants, Iterated kernel method, Resolvent kernel method, Dual integral equations, Applications. |
| Math414 | Math316 | **Rings and Fields**<br>الحلقات والحقول | Definition of rings and fields with examples, Subrings, Factor rings, Ring homomorphism, Integral domain, Division rings, Rings of polynomials, Rings of Matrices, Rings of quaternion, Rings of power series, Ideals, The principle of ideals, Homomorphism between rings, Fields theory and quotient fields. |
| Math415 | Math214 | **Differential Geometry**<br>هندسة تفاضلية | Curves in the space, Curvature and torsion, Frenet-Serret formulae, Isoperimetric inequality, Total curvature and the global geometry of curves, Surfaces in the space, First fundamental form, Length and area, Line of curvature geodesics, Second fundamental form, Introduction to manifolds, Differentiable manifolds, Vector fields on manifolds |
| Math431 | — | **Selected Topics in Pure Mathematics**<br>موضوعات مختارة في الرياضيات البحتة | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| Math432 | Math411 | **Functional Analysis (2)**<br>تحليل دالي (2) | Compact sets in Banach spaces, Equicontinuity, Arzela's-Ascoli theorem, Convex sets and convex functions, Linear functional and dual spaces, Reflexive spaces, Hahn-Banach theorem, The closed graph theorem, Weak and strong Topologies, Compact linear operators, Properties of compact operators, Self-adjoint compact operators, Fixed point Theorems, Applications. |
| Math433 | Math218 | **Mathematical Logic (2)**<br>منطق رياضي (2) | The propositional calculus, Deduction theorem, Equivalent formulae, Monotonicity and completeness for propositional calculus, The predicate calculus, The quantifiers, The converse, inverse and contrapositive formulas in the predicates calculus, Axioms and rules of the predicate calculus, Skolem's theorem, Skolemization and extension, Multsev's theorem, Godel's completeness theorem, Decidability and Godel mumbering, Church's theorem. |
| Math434 | Math311 | **Measure Theory**<br>نظرية القياس | sigma- rings, Set functions, Lebesgue measure, Measurable functions, Measure space, Lebesgue integration, Properties of Lebesgue integration |
| Math435 | Math313 | **Numerical Analysis (2)**<br>تحليل عددي (2) | Numerical solution of linear systems (direct and iterative methods), Approximation theory and orthogonal polynomials, Curve fitting, Numerical Methods of the Initial and boundary value problems, and the Eigenvalue problems. |
| Math436 | Math312 | **Complex Analysis (2)**<br>تحليل مركب (2) | Conformal mappings, Linear fractional transformations, Schwarz-Christoffel transformations, Poisson integral formulas, Functions with the mean-value property, Harnack's principle, The Weierstrass theory, The zeta function, The product development, Extension of zeta function to the whole plane, The functional equation, The zeros of the zeta function |
| Math451 | Math351 | **Special Theory of Relativity**<br>نظرية النسبية الخاصة | Tensor Analysis, Geodesics, Galilean Frames of References, Space-Time Metrics, Lorentz Transformation, Length Contraction and Time Dilation, Relativity of Simultaneity, Time Travel, Causality, Unification of Momentum and Energy, Transformation of Mass and Energy, Transformation of Trajectories, Kinematics of Moving Particles, Propagation of Light, Relativistic Dynamics, Collisions. |
| Math452 | — | **Statistical Mechanics**<br>الميكانيكا الإحصائية | Some Thermodynamic Derivation, Thermodynamic Functions for open Systems, Euler's Theorem and Gibbs-Duhem Relation, The Fundamental Distribution |

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| | | | Laws for Fermi-Dirac, Bose-Einstein and Boltzmann, Thermodynamic Functions for a System of Corrected Boltzons, Dirac and Bose-Einstein Statistics, Classical Statistical Mechanics, Canonical Ensemble, Grand Canonical Ensemble. Quantum statistical mechanics. |
| **Math453** | **Math352** | **Advanced Theories of Elasticity**<br>**نظريات المرونة المتقدمة** | Strain Energy, Uniqueness– Bounds on the Elastic Constants, Related Integral Theorems. Principle of Virtual Work, Euler–Bernoulli Beam Theory, Rayleigh–Ritz Method, Two–Dimensional Formulation, Plane Strain, Plane Stress, Generalized Plane Stress, Antiplanet Strain, Airy Stress Function, Polar Coordinate Formulation. Cartesian Coordinate Solutions Using Polynomials, Cartesian Coordinate Solutions Using Fourier Methods, Applications Involving Fourier Series, General Solutions in Polar Coordinates, Polar Coordinate Solutions, Solved Problems. |
| **Math454** | **Math353** | **Fluid Dynamics (2)**<br>**(2) ديناميكا المو ائع** | Viscous Fluids: Stokes' Principles and Stokesian Fluids, Newtonian Fluid, Dimensional Analysis Applied to Navier-Stokes Equation, Boundary Layers, Matching Asymptotic Expansions, Prandtl's Equations, Boundary Layer on Flat Plane, Flows at Small Reynolds Numbers, Drag Coefficient as Function of Reynolds Number, Idea of Turbulence. Surface Waves: Kinematic and Dynamic Boundary Conditions, Procedure of Linearization, Linear Waves, Dispersion Relation and Phase Velocity, Standing Surface Waves and Stationary Surface Waves, The Group Velocity, Stability Problem, Kelvin-Helmholtz Instability, Shallow Water Theory. |
| **Math455** | **Math354** | **Quantum Mechanics (2)**<br>**(2) ميكانيكا الكم** | The Schrödinger's Wave Equation in Three Dimensions, General Treatment and Separation of Variables, Particle in a 3D Box, 3D Harmonic Oscillator, 3D Problems in Spherical Coordinates, Central Potentials, Spherical Square Well Potential, Isotropic Harmonic Oscillator, The Hydrogen Atom, Angular Momentum Theory, Rotations in Quantum Mechanics, Orbital Angular Momentum, Radial Equation and Operator Methods, Spin Angular Momentum, Addition of Angular Momenta. Approximation Methods and Scattering Theory, Time–independent Perturbation Theory, Nondegenerate Perturbation Theory, Degenerate Perturbation Theory, The Variational Method, Time–dependent Perturbation Theory, Scattering Theory. |
| **Math456** | **Math451** | **General Theory of Relativity**<br>**نظرية النسبية العامة** | Covariant Derivatives, Christoffel Symbols, Evaluating the Christoffel Symbols–Transformation to Locally Fat Coordinates, Gauss's Law. Differentiation Along a Curve, Geodesics and Curvature Tensors, Killing Vectors, Bianchi identities, Ricci Tensor and Einstein Tensor. Newtonian Mechanics and Special Relativity, Einstein Theory of Gravitation, Einstein Field Equations, The Newtonian Limit, The classical Test of General Relativity. The Schwarzschild Solution, The Metric for a Static Spherically–symmetric Field, The Christoffel Symbols, The Field Equations and their Solution, Planetary Motion, Deflection of Light. |
| **Math471** | **Math274+ Math217** | **Complex and Special Functions**<br>**دوال خاصة ومركبة** | Complex functions- Limits and continuity, Differentiability and analyticity, Cauchy-Riemann equations, Harmonic functions, Complex integrals, Cauchy's integral formulae, Taylor and Laurent expansions, Zeros and poles, Residues and residue theorem, Contour Integration. Gamma and beta functions, Legendre polynomials and functions, Bessel functions, Hermite polynomials, Laguerre polynomials, Chebyshev polynomials. |

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| Math472 | Math271 | **Solid and Differential Geometry**<br>هندسة تفاضلية وفراغية | Cartesian and polar coordinates, Translation and rotation of axes, Planes- Straight lines, Quadratic surfaces, The general equation of the second degree in three variables. Curves in the space, Curvature and torsion, Frenet-Serret formulae, Surfaces in the space, First fundamental form, Second fundamental form. |
| Math490 | — | **Research Project**<br>مشروع بحثي | Student is supposed to write a graduation project in actuarial sciences, after introducing him to different problems and issues in actuarial studies. The course also enables the student to write reports about actuarial problems, to draw conclusions, and to prepare recommendations concerning them. |
| **Courses contents of Computer Science (CS)** | | | |
| CS111 | — | **Computer Applications**<br>تطبيقات الحاسب الآلي | Computer concepts, including fundamental functions and operations of the computer, Topics include basic computer concepts in hardware, software, networking, Computer security, Programming, Database, Use of software applications. |
| CS112 | — | **Computer Programming (1)**<br>برمجة الحاسب الآلي (1) | Problem-solving strategies, Debugging strategies, Structured decomposition, The concept and properties of algorithms, The role of algorithms in the problem-solving process, Basic syntax and semantics of a higher-level language, Variables, types and assignment, Conditional and iterative control structures. |
| CS114 | — | **Computer Science**<br>علوم الحاسب الآلي | Introductory chapter, Computer history, Computer hardware, Computer software- Computer networks and Internet, Numerical systems in computer - Microsoft word, Microsoft Excel and Microsoft power point. |
| CS203 | CS111 | **Data Security**<br>سرية البيانات | Analysis of the underlying law, including a detailed review of the data security obligations- The latest guidance from regulators- Data security implications of using external contractors and outsourced service providers, as well as sub-contractors examination of the regulator's power to issue fines for security breaches and other legal and commercial consequences of such breaches- Managing a data security breach, law and best practice relevant information security standards, including ISO27001. |
| CS205 | CS112 | **Introduction to Python Programming**<br>مقدمة في البرمجة بلغة بايثون | The Context of Software Development: Software, Learning Programming with Python. Values and Variables: Integer and String Values: Identifiers, User Input, String Formatting. Expressions and Arithmetic: Expressions, Arithmetic Examples. Conditional Statements: Boolean expressions, If/Else statement, Other Conditional Expressions. Iteration: Loops. Using Functions: Introduction to Using Functions, Functions and Modules. Writing Functions: Function Basics, Parameter Passing, Custom Functions vs Standart Functions, Refactoring. Writing Functions: Global Variables, Making Functions Reusable, Functions as Data. Objects: Using Objects, String, File Objects. Lists: Using Lists, Building Lists, List Traversal. Tuples, Dictionaries, and Sets: Storing Aggregate Data, Enumerating the Elements of a Data Structure. Class Design: Composition and Inheritance. |
| CS211 | CS112 | **Computer Programming (2)**<br>برمجة الحاسب الآلي (2) | Functions and parameter passing. Simple I/O. Exception handling. Primitive types. Arrays. Records. Strings and string processing. Data representation in memory. Pointers (or the notion of a reference in an object-oriented language). The concept of recursion. Recursive mathematical functions. Simple recursive |

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| | | | procedures (Towers of Hanoi, generating permutations). Divide-and-conquer strategies Recursive backtracking |
| CS212 | CS211 | **Advanced Programming**<br>برمجة متقدمة | Object-oriented design. Classes- subclasses- and inheritance. Class hierarchies. Polymorphism- Fundamental design patterns. Event-handling methods- Event propagation. Managing concurrency in event handling-API programming-Class browsers and related tools. Programming by example- Debugging in the API environment. |
| CS213 | CS111 | **Discrete Structures**<br>تراكيب البيانات | Functions: surjection's, injections, inverses, composition. Relations: Equivalence relations. Pigeonhole principle. Cardinality and countability. Propositional logic. Logical connectives. Truth tables. Validity. Implication, converse, inverse, negation, contradiction. Predicate logic. Universal and existential quantification. Modus ponens and modus Mathod of proofs. Direct proofs. Proof by counterexample. Proof by contraposition. Proof by contradiction. Well orderings. Counting arguments. Permutations and combinations. Solving recurrence relations. Trees. Undirected graphs. Directed graphs. Spanning trees. |
| CS214 | CS213 | **Theory of Computation**<br>نظرية الحسابات | Deterministic Finite Automata (DFA) and Regular Languages Non-deterministic Finite Automata (NFA). Equivalence of NFAs and DFAs. Closure Properties. Regular Expressions. The Pumping Lemma. Pushdown Automata. Pushdown Automata. Context Free Languages. Ambiguity and Chomsky Normal Form. Turing Machines. Turing Machines Variants. Enumerators. Decidability. Diagonalization. The Halting Problem. Reducibility. Time Complexity. P and NP. Polytime reductions. NP-Completeness. |
| CS215 | — | **Computer and Information Security**<br>سرية الحاسب والمعلومات | Introduction to the protection of computer systems and networks. Authentication, access controls, malicious software, formal security methods, firewalls, intrusion detection, cryptography and information hiding, risk management, computer forensics, and ethics. Defense techniques, intrusion detection, scan techniques and detection, forensics, denial of service techniques and defenses, libpcap, libdnet and libnet programming. public-key cryptosystems, signatures, pseudo-random sequences, hash functions, key management, and threshold schemes. |
| CS216 | CS211 | **Artificial Intelligence**<br>ذكاء اصطناعي | Definitions of intelligent systems, basic knowledge representation, problem solving, and learning method of artificial intelligence. develop intelligent systems by assembling solutions to concrete computational problems; the role of knowledge representation, problem solving, and learning in intelligent-system engineering; and appreciate the role of problem solving, vision, and language in understanding human intelligence from a computational perspective. |
| CS217 | CS112 | **Introduction to Database Systems**<br>مقدمة في نظم قواعد البيانات | An introduction to the basic theoretical aspects of database systems, file organization, search methodologies, language design and performance evaluation techniques, initial modeling concepts and their use in hierarchical, network, relational and object-oriented database designs. |
| CS218 | CS213 | **Introduction to Image Processing**<br>مقدمة في معالجة الصور | Visual Perception, Sampling and Quantization, Digital. Topography, Regions, Boundaries, Connected Components. Sensors. Inner Products, Orthogonal Transformations, Introduction to the Fourier Transform. Linear Systems, |

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| | | | Convolution, Correlation, Impulse Response. Matched Filtering, Sampling. Karhounen Loeve Transformation. Point Operators, Histogram Transformations. |
| CS219 | CS112 | **Introduction to Object Oriented Programming**<br>مقدمة في البرمجة الشيئية | Programming environment including a text editor, command-line interface, an IDE, e.g., Eclipse. Functions including parameter passing mechanisms. Introduction to formal methods (pre-conditions, post-conditions, loop invariants). Control structures (conditionals and loops). Arrays. Objects using predefined classes, e.g., String. Writing user-defined classes including some fairly complex ones. Interface, inheritance, polymorphism, abstract classes. The Java class hierarchy. Exceptions and file I/O. Recursive programming. The ArrayList class. |
| CS220 | — | **Computer Programming (Practical)**<br>برمجة الحاسب الآلي (عملي) | Object-oriented design, Classes, Subclasses and inheritance, Class hierarchies, Polymorphism, Fundamental design patterns, Event-handling methods, Event propagation, Managing concurrency in event handling, API programming-class browser and related tools, Programming by example-Debugging in the API environment. |
| CS221 | CS112 | **Introduction to Software Engineering**<br>مقدمة لهندسة البرمجيات | Fundamentals of software engineering using group project as the basic vehicle. Topics covered include the software crisis, managing complexity, requirements specification, architectural and detailed design, testing and analysis, software process, and tools and environments. |
| CS222 | CS219 | **Concepts of Programming Languages**<br>مفاهيم لغات البرمجة | Data Procedures, Local variables, Data Driven Programming. BNF, Recursion, Properties of variables. Data abstraction. Abstract syntax. Transformational Languages. Environment Passing Interpreters. Local binding. Variable assignment. Parameter passing. Aggregate data implementations. Statements. Type inference and type abstractions. Polymorphism. Object oriented language. Inheritance. Control Context and Continuations. A continuation passing interpreter. Procedural representation of continuations. Exceptions and control flow. Logic programming. |
| CS223 | — | **Introduction to Information Systems**<br>مقدمة لنظم المعلومات | Types of information systems, Information systems development life cycle, Analytical skills, Managing the information systems project, Gantt and pert charts, Automated tools for systems development, Identifying and selecting systems development projects, Corporate strategic planning, Information systems planning, Project initiation and planning process, Evaluating the technical risks, Approaches to system development, Investigating system requirements, Modeling system requirements, Process modeling, Logic modeling, Conceptual data modeling. |
| CS224 | CS112 | **Human-Computer Interaction (HCI)**<br>تفاعل الأنسان والحاسب | Human-Computer Interaction (HCI) theory and techniques. Methods for designing, prototyping, and evaluating user interfaces to computing applications. Human capabilities, interface technology, interface design methods, and interface evaluation tools and techniques. |
| CS311 | CS213+ CS211 | **Data Structures and File Processing**<br>تراكيب بيانات ومعالجة ملفات | Fundamental algorithms and data structures for implementation. Techniques for solving problems by programming. Linked lists, stacks, queues, directed graphs. Trees: representations, traversals. Searching (hashing, binary search trees, multiway trees). Garbage collection, memory management. Internal and external sorting. |

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| CS312 | CS213 | **Digital Circuits**<br>**الدوائر الرقمية** | Number systems, Boolean algebra and logic gates, combinational switching circuits (half adder and full adder, Two's complement adder/substractor, multiplexers ,decoder, encoder, code converter), programmable logic devices, logic families, Flip-flops, shift registers, counters, digital to analog conversion and digital memories. |
| CS313 | CS212+<br>CS214 | **Introduction to Algorithms Analysis**<br>**مقدمة في تحليل الخوارزميات** | Introduces methods for algorithm design, paradigms such as divide and conquer, greedy, and dynamic programming, and techniques for algorithm analysis, such as asymptotic notations and estimates, as well as time/space tradeoffs. Topics include sorting, searching, scheduling, string matching, graph algorithms computational geometry, and more. |
| CS314 | CS214 | **Operating Systems**<br>**نظم تشغيل** | Structuring methods and the layered model. Evolution of hardware/software techniques. Device organization. Interrupts. User/system state and protection. State diagrams. Structures (ready list, process control blocks, and so forth). Dispatching and context switching. Concurrent execution. Mutual exclusion Deadlock and starvation. Models and mechanisms (semaphores, monitors, rendezvous). Producer-consumer problems. Preemptive and non-preemptive scheduling. Schedulers and policies. Processes and threads. Deadlines and real-time issues. Overlays, swapping, and partitions. Paging and segmentation. Memory mapped files. Placement and replacement policies. Serial or parallel device. Servers and interrupts |
| CS315 | CS216 | **Machine Learning**<br>**تعليم الآلة** | Provides practical introduction to machines learning. Modules include regression, classification, clustering, retrieval, recommender systems, and deep learning, with a focus on an intuitive understanding grounded in real-world applications. Intelligent applications are designed and used to make predictions on large, complex datasets. Methods for designing systems that learn from data and improve with experience |
| CS316 | CS216 | **Introduction to Deep Learning**<br>**مقدمة للتعلم العميق** | Deep learning is driving advances in artificial intelligence. This is an introductory course on deep learning methods with applications to computer vision, natural language processing, biology, and more. foundational knowledge of deep learning algorithms and practical experience in building neural networks in TensorFlow. Course concludes with a project proposal competition with feedback from staff and panel of industry sponsors. Prerequisites assume calculus (i.e. taking derivatives) and linear algebra (i.e. matrix multiplication), we'll try to explain everything else along the way! Experience in Python is helpful but not necessary. |
| CS317 | CS211 | **Online Multimedia and Information Access**<br>**وسائط متعددة والوصول للمعلومات** | Organizing multimedia content, physical storage and retrieval of multimedia data, Content- based Search and retrieval, creating and delivering networked and multimedia presentations. Different types of multimedia data, different techniques to store, manipulate, and retrieve multimedia data residing across global computer networks. |
| CS318 | CS311 | **Information Storage and Retrieval**<br>**تخزين واسترداد المعلومات** | Basic principles and tools for analysis and retrieval of documents in bibliographic information systems. Acquisition of information, subject analysis, terminology control, coding and recording of results of analysis on a searchable medium, and question analysis and search strategy development. |

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| CS319 | CS212 | **Object Oriented Design**<br>تصميم برامج شيئية | Design Paradigms. OO Design. Class basics. Identifying classes. Designing classes. Evaluating class design. Association. Aggregation. Communication. Operator overloading. Templates. Exceptions. Inheritance. Controlling Inheritance. Polymorphism. Type conversions. STL. Templates and inheritance. |
| CS320 | CS313 | **Advanced Algorithms**<br>الخوارزميات المتقدمة | This course is a first-year graduate course in algorithms. Emphasis is placed on fundamental algorithms and advanced methods of algorithmic design, analysis, and implementation. Techniques to be covered include amortization, randomization, fingerprinting, word-level parallelism, bit scaling, dynamic programming, network flow, linear programming, fixed-parameter algorithms, and approximation algorithms. Domains include string algorithms, network optimization, parallel algorithms, computational geometry, online algorithms, external memory, cache, and streaming algorithms, and data structures. |
| CS321 | CS216 | **Intelligent Machines**<br>الآلات الذكية | Decision trees, Neural networks, Perception networks, Multi-layer perception networks, Self-organizing maps, Radial basis function networks, Fuzzy systems, sets, logic, interface,. Rough sets, Evolutionary algorithms and strategies. Genetic algorithms and programming, Particle swarm optimization, Hybrid intelligent methods, Topologies of multi-classifier systems, Evaluating models and algorithms, Models and Feature selection, Roc analysis, Pac learn-ability. |
| CS322 | CS221 | **Software Testing and Quality**<br>اختباروجودة البرمجيات | Critical aspects of the software lifecycle. Quality of software system. Techniques and approaches to software design, Quality and Reliability, Domain Engineering and Software Reuse. |
| CS323 | CS221 | **Selected topics in Software Design and Engineering**<br>موضاعات مختارة في هندسة وتصميم البرمجيات | Socio-technical systems. Software processes. Software requirements. Requirements engineering processes. Use cases. System models. Architectural design. Distributed systems architectures. Object-oriented design. Real-time software design. User interface design. Software reuse. Component-based software engineering. Project management. Process improvement. Verification and validation. Software testing. Critical systems validation. |
| CS324 | CS219 | **System Programming**<br>برمجة نظم | Includes substantial programming experience in languages that expose machine characteristics and low-level data representation (e.g., C and C++); explicit memory management; interacting with operating-system services; and cache-aware programming. |
| CS326 | CS313 | **Algorithms in Bioinformatics**<br>خوارزميات فى المعالجة الحيوية | Sequence analysis microarray expression analysis, Bayesian methods, control theory, scal-free networks, and biotechnology applications,. Current real-world examples, actual implementations, and engineering design issues. Where applicable, engineering issues from signal processing, network theory, machine learning, robotics and other domains will be expounded upon |
| CS411 | CS311 | **Database Management Systems**<br>نظم قواعد البيانات | Introduction to the principles of database management systems. Topics include database system architecture, data models, theory of database design, query optimization, concurrency control, crash recovery, and storage strategies. CSE majors only |
| CS412 | CS314 | **Network and Internet Programming**<br>برمجة الشبكات والانترنت | Covers languages, tools, and techniques for developing interactive and dynamic web pages. Topics include page styling, design, and layout; client and server side scripting; web security; and interacting with data sources such as databases. |

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| **CS413** | **CS312** | **Computer Architecture and Organization**<br>**عمارة الحاسب وتنظيمه** | Computer systems and architecture, instruction set design; processor micro-architecture and pipelining; cache and virtual memory organizations; protection and sharing; I/O and interrupts; in-order and out-of-order super-scalar architecture; VLIW machines; vector supercomputers; multithreaded architecture; symmetric multiprocessors and parallel computers. |
| **CS414** | **CS311+ CS319** | **Data Mining**<br>**تنقيب البيانات** | Basic concepts behind data mining. Data mining applications, techniques and models. Data mining software suite. Exploration of data mining methodologies. Decision tables, decision trees, classification rules, association rules, clustering, statistical modeling, and linear models. More extensive use of SPSS' Clementine data mining suite. |
| **CS415** | **—** | **Selected topic in computer science**<br>**موضاعات مختارة في الحاسب** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| **CS416** | **CS413** | **Distributed Systems**<br>**أنظمة موزعة** | Basic Distributed Systems Architecture. Hardware. Software Systems. Parallel Computers. Parallel and Grid Computing. Communication in Distributed Systems. Communication in Parallel systems. Performance/Scalibility. Client-Server model, Remote Procedure Calls. Synchornization problems in Distributed systems. Processes and processors in Distributed systems. Distributed File Systems. Distributed Shared Memory. Parallel Algorithms. Programming Languages. |
| **CS417** | **CS314** | **Parallel Computation**<br>**حاسبات متوازية** | Parallel configurations and paradigms, speedup, efficiency. Message passing, programming MPI and PVM. Embarrassingly parallel applications. Mandelbrot set, geometrical transformations, Monte Carlo methods. Partitioning and divide and conquer methods. Bucket sort, numerical integration, and gravitational N-body problem. Hardware configuration. Inter-process communication. Visualization and performance evaluation tools. Load balancing. PVM. Synchronous computations, barriers, data dependencies, deadlock. Shared memory parallelism. Sorting algorithms. Numerical algorithms. Computational complexity of parallel algorithms. |
| **CS418** | **CS411** | **Digital Libraries**<br>**المكتبات الرقمية** | Foundations, search, retrieval, resource discovery, multimedia, representations, architectures, interfaces, metadata, electronic publishing, database issues, agents, commerce, economics, publishers, intellectual property rights, security, social issues. |
| **CS419** | **CS313** | **System Simulation and Modeling**<br>**محاكاة ونمذجة النظم** | Types of systems. Types of models. Stages of a typical simulation study. Concepts of system clocks. Inverse transformation techniques with exponential distributions and empirical continuous distributions. Object oriented simulation. Input Modeling. Data collection. Distribution functions (normal-Poisson-exponential). Goodness of fit tests, Length of simulation run, static and dynamic stochastic simulations, Elimination of transients. Auto correlated observations, variance reduction techniques. |
| **CS420** | **CS411** | **System Analysis and Design**<br>**تحليل وتصميم النظم** | Types of information systems. Information systems development life cycle. Analytical skills. Managing the information systems project. Gantt and pert charts. Automated tools for systems development. Identifying and selecting |

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| | | | systems development projects. Corporate strategic planning. Information systems planning. Project initiation and planning process. Evaluating the technical risks. Approaches to system development. Investigating system requirements. Modeling system requirements. Process modeling. Logic modeling. Conceptual data modeling. The object-oriented approach to requirements. Evaluating requirements. Designing databases. Designing the user interface. |
| **CS421** | **CS314** | **Computer Vision**<br>**الرؤية الحاسوبية** | Interpreting Intensity: Light, shading, and color, Image filters, template matching, and image pyramids, Edge detection. Correspondence and Alignment: Interest point detection and feature tracking, Fitting and registration of objects and images. 3D Geometry: Camera models, Single-view and multi-view geometry, Stereo and structure-from-motion. Grouping and Segmentation: Clustering, EM, Segmentation. Recognition: Face recognition, Categorization, classifiers, and CNNs (deep networks), Object recognition and semantic segmentation with CNNs, Object tracking. Special Topics: Action recognition, 3D scene interpretation, VQA. |
| **CS422** | **CS314** | **Advanced Computer Networks**<br>**شبكة الحاسب المتقدمة** | Layered communication architecture: layers, services, protocols, layer entities, service access points, protocol functions. Advanced Routing algorithms, Advanced Network Congestion Control algorithms, Quality of service, Real Time Transport Protocol, Internetworking, Performance Issues, Overview on VPN networks, Wireless Networks and Mobile Networks: LAN, PAN, Sensor Networks, Ad_hoc Networks, Mobile IP, Mobile TCP, IP Security. |
| **CS423** | **CS314** | **Advanced Operating Systems**<br>**نظم تشغيل متقدمة** | General issues of design and implementation of advanced modern operating systems, applications of distributed systems and computer networks, interprocess communication, distributed processing, sharing and replication of data and files. |
| **CS424** | **CS218** | **Digital Image Processing**<br>**معالجة الصور الرقمية** | Visual Perception, Sampling and Quantization, Digital. Topography, Regions, Boundaries, Connected Components. Sensors. Inner Products, Orthogonal Transformations, Introduction to the Fourier Transform. Linear Systems, Convolution, Correlation, Impulse Response. Matched Filtering, Sampling. Karhounen Loeve Transformation. Point Operators, Histogram Transformations. Color, Color Quantization. Point, Edge, Region Analysis, Shape. Segmentation, Relaxation, Hough Transforms. Surface Approximation. Image Texture Analysis and Classification. Image Morphology. |
| **CS490** | **—** | **Research Project**<br>**مشروع بحثي** | Each student is assigned a Research Project in Computer science to analyze and give appropriate inference about it using the appropriate ideas and tools of Computer science, mathematical and statistical analysis they covered through their studies |
| **Courses contents of Statistics and Data Science (Stat)** | | | |
| **Stat201** | **—** | **Fundamentals of Statistics and Probability**<br>**أساسيات الإحصاء والاحتمالات** | Introduction to statistics and the definition of some statistical terms, Organization and presentation of statistical data, Measures of central tendency (mean, median, mode...ect) for single data and in the case of frequency distributions, Measures of dispersion (range, mean deviation, standard deviation and variance, coefficient of variation....ect) for single data and |

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| | | | frequency distributions, groups, algebraic operations on groups, definition of sample space, accident, counting methods (basic rules, multiplication rule, addition rule, permutations, combinations), definition of probability, general law of probability, applications on probability, conditional probability, independence, Bayes theory and its applications, Definition of a random variable, probability function (distribution of my probability), expectation and variance of a discrete and continuous random variable, discrete probability distributions (Bernoulli, binomial, Poisson), normal distribution and its applications. |
| **Stat202** | **Stat201** | **Regression Analysis**<br>**تحليل الانحدار** | Simple and multiple linear regression and correlation- analysis of variance and covariance. Assumptions of regression- variable selection; prediction- multicolinearity- model diagnostics- dummy variables- transformations- logistic and non-linear regression-Emphasizes use of computer with R program |
| **Stat203** | — | **Programming with R**<br>**البرمجة بلغةR** | Introduction to R Importing and installing, R environment, help, packages and installing, data types, matrices and arrays, lists, import files. Programing with R Variables, arithmetic operators, logical and relational operators, loops, built in functions, user functions, creating packages. Exploratory Data Analysis Data functions, graphics and graphic packages. Correlation and Regression Linear correlation and simple linear regression. |
| **Stat204** | **Stat201** | **Probability Theory (1)**<br>**نظرية الاحتمالات (1)** | Probability mass function and its properties [mathematical expectation, variance, standard deviation, moment-generating functions for discrete distributions]. Probability density function and its properties [ mathematical expectation, variance, standard deviation, moment-generating functions for continuous distributions]. Bivariate random variables, covariance (covariance), correlation coefficient of a binary random variable, variance of the sum or difference between two variables, moment-generating functions of a binary random variable). Bivariate distributions (marginal and conditional distributions, independence of random variables, conditional expectation). Distributions of functions. In random variables. Random samples (distribution of sample mean, law of large numbers, central limit theorem |
| **Stat205** | — | **Data visualization**<br>**تصوير البيانات** | Fundamental concepts of data visualization; information visualization types; design principles of data visualization; tools for static data visualization; tree and network visualizations; big data visualizations. |
| **Stat206** | **Stat203** | **Statistical Inference (1)**<br>**الإستدلال الإحصائي (1)** | Sampling distributions, Central limit theorem, Point estimation, Properties of estimators (unbiased, mean squared error, consistency, adequacy, minimization sufficiency) Exponential family, Regular least variance estimator, Kramer-Raue inequality, Fisher information, Rau-Blackwell theorem, adequacy Perfection, Lehmann -Estimation methods moments method, Maximum likelihood estimators and their properties, Bayesian method usingprior density functions, Bayesian estimators using squared loss functions, Estimation by interval- Confidence interval estimators, Pivotal methods, Bayesian crediable intervals. |
| **Stat207** | — | **Statistical Software**<br>**حزم إحصائية** | The MATLAB working environment-Variables, constants and reserved words- Arrays and matrices, Scripts, The debugger-Generating 2D and 3D Graphics |

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| | | | Simple statistical analysis-String manipulation-Boolean logic and if statements-Loops (while, for)-Functions –Files and Program design |
| **Stat208** | ..... | **Statistical Learning and Data Mining (1)**<br>**التعلم الإحصائي وتنقيب البيانات (1)** | Statistical learning and model selection-resampling methods such as cross-validation and bootstrap- linear regression methods- regression models-dimension reduction methods, Methods for modeling non-linear relationships-classification methods such as logistic regression, discriminant analysis, and nearest-neighbors- support vector machines |
| **Stat209** | — | **Introduction to Probability and Statistics**<br>**مقدمة فى الاحتمالات والإحصاء** | Presenting and summarizing data, Correlation and regression, Principles of probability, Random variables and distribution functions, Binomial, Bernoulli, normal and standard normal random variables. |
| **Stat210** | **Stat203** | **Fundamentals of Data Science**<br>**أساسيات علم البيانات** | Introduction to the fundamentals of the data science domain. Fundamentals of the R programming language and related tools for use in Data Science. Problem Solving using R. Basic statistics, data gathering, preparation, and analysis, data visualization, case studies, and some ethical issues. |
| **Stat212** | — | **Introduction to Mathematical Statistics**<br>**مقدمة في الإحصاء الرياضي** | Discrete and continuous sample spaces, Moments and generating functions, Binomial, Bernoulli, negative binomial, geometric, hypergeometric and Poisson random variable, Uniform, exponential, gamma, beta, normal and standard normal random variable, Jointly distributed random variables, Functions of random variables. |
| **Stat214** | **Stat205** | **Data visualization with Python**<br>**تصوير البيانات بلغة بايثون** | Matplotlib Library: Axes and Subplots, Customization of a plot, Main type of charts. Matplotlib: Time Series Visualization, Visualization of Categorical variables, Visualization of multivariate Distributions. Advanced Visualization Tools: Highlight data, Statistical Analysis, Data Flow. Dynamic Plots: Gliphs, line and patches, Case study. |
| **Stat216** | — | **Selected Topics in Statistics (1) "Applied Statistic"**<br>**موضوعات مختارة في الإحصاء (1)** | Concepts Random variables and probability distributions, Special probability distributions, Use of samples, Confidence intervals and tests of hypotheses, Analysis of variance, Regression and correlation, Chi-square tests, Emphasizes use of computer. |
| **Stat301** | — | **Mathematical Statistics**<br>**الإحصاء الرياضي** | The single random variables, distributions and the (expectation, moments about zero, about mean, moments generating functions. skewness and kurtosis coefficients, characteristic function, and cumulant function), Jointly random variables distributions and properties (expected values and moments, moments generating function, covariance and correlation coefficient, conditional probability and density functions, conditional expectation and Independent random variables, n-dimensional random variables, independent random variables, Chebychev's inequality and law of large numbers), marginal distributions and functions of random variables |
| **Stat302** | **Stat301** | **Time series (1)**<br>**السلاسل الزمنية (1)** | Introduction- Markov Chains, Data Transformation Methods- Forecasting, How to predict to the future, degree of accuracy possible to forecast, forecasting using regression versus time series forecasting. Some numerical measures useful in |

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| | | | measuring prediction accuracy MAD, MSE, MAPE Time series smoothing and disassembling methods Smoothing methods using averages, Exponential smoothing methods Simple exponential smoothing, Weighted exponential smoothing, Different types of moving averages. Box-Jenkins ARIMA(p,d,q) models for predicting time series Identifying the characteristics of these models and the forms of autocorrelation functions and their partial autocorrelation. Dealing with data with seasonal compounds, matching these models to computer-generated data and real data. Diagnostic tests on residual models and model selection criteria. Practical exercises on data analysis and writing integrated reports using ready-made statistical programs (R). |
| **Stat303** | **Stat204** | **Stochastic Processes ( 1)**<br>**عمليات عشوائية (1)** | Random processes and their applications. Firstly, consider the probability generating functions and the concept of using conditioning for calculating expectation, variance and then probabilities. Then, present stochastic processes and their types. After that, look at both discrete-time Markov chains and continuous ones. Then, study in some details one of the most common continuous-time process, that is the Poisson process. Lastly, apply these stochastic processes to some real world. |
| **Stat304** | **Stat206** | **Statistical Inference (2)**<br>**الإستدلال الإحصائي (2)** | Interval estimation (two populations) Confidence interval estimators, Pivotal methods Hypothesis tests Type I error and Type II error Test power, Unbiased test Convergence Tests, Niemann-Pearson theorem, Probability ratio tests, Asymptotic distributions of probability ratio statistics, Sequential probability ratio test, Bayes hypothesis tests. |
| **Stat305** | **Stat201** | **Probability Theory (2)**<br>**نظرية الاحتمالات (2)** | Joint and conditional distributions, independence, covariance and correlation, Bivariate normal distribution, Special probability distributions (Gamma, Beta, Weibul and Lognormal distributions), distributions of functions of random variables, Probability laws and transformations, Order statistics, Modes of convergence and limit theorems, The central limit theorem, Law of large numbers, Sampling and derivation of many sampling distributions. |
| **Stat306** | **Stat305** | **Statistical Learning and Data Mining (2)**<br>**التعلم الإحصائي وتنقيب البيانات (2)** | Approaches to finding the unexpected in data- pattern recognition, classification, association rules, graphical methods, classical and computer-intensive statistical techniques, and problem solving. Emphasis is on data-centered- non-inferential statistics for large or high-dimensional data- topical problems- and building report writing skills. |
| **Stat307** | **Stat206** | **Experimental Design**<br>**تصميم التجارب** | A Quick History of the Design of Experiments, Steps for Planning, Conducting, and Analyzing an Experiment, Simple Comparative Experiments, Experiments with a Single Factor, the One-way ANOVA, in the Completely Randomized Design (CRD), Sample Size Determination. |
| **Stat308** | **Stat201** | **Order Statistics**<br>**الإحصاءات المرتبة** | Distribution of order statistics, Joint distribution of two order statistics or more, some properties of order statistics, Distribution of the median, range and some other statistics, Discrete order statistics, Dependence structure of order statistics from some specific distributions (e.g. Bernoulli, binomial, Poisson, exponential, uniform, logistic and normal distributions), Moment relations, bounds and approximations, type of order statistic data, order statistics in statistical |

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| | | | inference, Asymptotic theory (exponential order statistics & sample maximum, minimum and other extreme order statistics). |
| Stat309 | Stat201 | Statistical Methods<br>طرق إحصائية | Sampling distributions- Point and confidence estimation- one- and two- sample tests- one- and two- ways ANOVA, \chi^2 Goodness of fit tests, Tests of independence in Contingency tables. Emphasizes use of computer. |
| Stat310 | Stat301 | Theory of statistical decision<br>نظرية القرار الإحصائي | Scaler and descriptive decision- types of decisions- Choice under uncertainty- Time selection- cases of decision making- Decision under the principle of safety- Decision under the principle of insecurity- Decision under the principle of risk- Decision under the uncertainty principle |
| Stat311 | Stat212 | Statistical Analysis<br>التحليل الإحصائي | Sampling distribution, Estimation, Testing of hypotheses, Analysis of variance, Chi-square Testes. |
| Stat312 | Stat301 | Analysis of Categorical Data<br>تحليل البيانات النوعية | Varieties of categorical data- cross-classifications- and contingency tables. Tests for independence. Combining 2x2 tables. Multidimensional tables and log linear models- maximum-likelihood estimation and tests for goodness of fit. Logistic regression, generalized linear models and multinomial response models |
| Stat313 | Stat206 | Nonparametric Statistics<br>الإحصاء اللامعلمي | Nonparametric statistical procedures (hypothesis test), ranking data, testing data for normality, u-test and the kolmogorov–smirnov, two-sample test, tests for nominal scale data chi-square and fisher exact tests. |
| Stat314 | — | Selected topic in statistics (2)<br>موضوعات مختارة في الإحصاء (2) | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis |
| Stat315 | — | Reliability Theory (1)<br>نظرية الصلاحية (1) | Basic concepts in reliability theory, statistical models for of failure, system of reliability, hardware lifetime data analysis, life testing experiments, backup systems. |
| Stat401 | Math333 | Advanced Operations Research<br>بحوث العمليات المتقدمة | Integer programming, Dynamic programming, Inventory models. Simulation techniques -Uses of simulation- Sampling probability distributions- Examples of computer programs. Reliability theory, Failure rate and survival distributions, Reliability of systems of independent components, System lives and expected system lifetime, Redundancy. |
| Stat402 | Stat401 | Sequential Analysis<br>التحليل التتابعي | Sequential test of a statistical hypothesis and its efficiency, The OC (operating characteristic) function, The Sequential Probability Ratio Test (SPRT), Sequential test for simple and composite hypotheses against a set of alternatives, Applications to the binomial and normal distributions. |
| Stat403 | — | Applied Social Statistics<br>الإحصاء الاجتماعي التطبيقي | Basic statistical processes in social research[Data collection, data organization, statistical description, statistical inference- Definition of Applied (Inferential) Statistics -The concept of statistical significance, Parametric and non-parametric statistics-Equilibrium distribution curve, Skewness and Kurtosis]- Introduction of SPSS program- Basic steps and rules for data analysis in SPSS- Extracting simple and double frequency tables-Graphs-Descriptive statistics using the program- Wilcoxon test- Kruskal Wallis test- Pearson and Spearman correlation coefficient- Chi-square test |
| Stat404 | Stat305 | Multivariate statistics | Multivariate probability distributions- Important probability distributions (Multivariate normal distribution, Wishart distribution, Multivariate Student-t |

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| | | المتغيرات المتعددة الإحصائية | distribution.)- Observation and analysis of more than one outcome variable. Application of multivariate statistics to a particular problem may involve several types of univariate and multivariate analyses- simple linear regression and multiple regression, Applications. |
| Stat405 | Stat301 | **Statistics and Analysis of Variance** تحليل التباين الإحصائي | Numerical Descriptive Measures review, Simple Linear correlation, Simple Linear Regression, Simple Linear Regression- Continued, Correlations non parametric Test 1+ Sampling and Sampling Distributions, Sampling and Sampling Distributions- Continued -Confidence Interval Estimation, Confidence Interval Estimation, Continued, Fundamentals of Hypothesis Testing One-Sample, Fundamentals of Hypothesis Testing, Continued Tests, Two-Sample Tests, Analysis of variance ANOVA -Chi-Square Tests -Bart lite-One-way analysis of variance- Two-way analysis of variance- Assumptions of one-way analysis of variance |
| Stat406 | — | **Statistical Quality Control** الرقابة الإحصائية للجودة | Historical definition of the science of quality control, Understanding the meaning of the word quality, Developments of quality science (quality planning, total quality control, quality improvement, quality assurance, and total quality management), Identifying the required quality limits for the product, A review of statistical distributions used in quality control, Statistical inference and hypothesis testing, Statistical methods for quality control, Schuhart quality control maps and types, Quality mapping methods, Statistical methods for quality improvement, Pareto diagram, Fishbone (Ishikawa diagram), Quality control maps or graphs for related variables, Estimated Production processes, Quality control maps or drawings for discrete and descriptive variables, Acceptance inspections and the risks of errors in them, Work characteristics curve |
| Stat407 | Stat206 | **Bayesian Inferences** الاستدلال البايزي | This Course Introduces Hierarchical Bayesian Statistical Methods That Enable Investigators to Combine Information from Similar Experiments- Account For Complex Spatial- Temporal- And Other Correlations- And Also Incorporate Prior Information Or Expert Knowledge (When Available) Into A Statistical Analysis- The Lecture Behind Bayesian Methods and Their Practical Implementation- and Also Compares Them With Classical (Frequentist) Methods. The Course Emphasizes Data Analysis Via Modern Computer Simulation Methods Using Win bugs and R (Free Statistical Software) That Are Introduced and Used in The Course. |
| Stat408 | | **Data processing and analysis** تحليل ومعالجة البيانات | Introduction to data analysis, Introduction to statistical packages, Data registration, Study of descriptive and quantitative variables, Data design, Sample and double sample study, Descriptive and quantitative correlation coefficient, Analysis of variance, Regression analysis, Logistic regression analysis, K-classification technique of averages, Analysis time series. Note This course is based mainly on the statistical packages, Minitab- SAS-SPSS. |
| Stat409 | Stat206 | **Practical Machine Learning** تقنيات تعلم الآلة | Mathematical Foundations of Machine Learning- Overview of Machine Learning- Basics of Parameter Estimation, Classification Algorithms- Linear and Non-Linear Algorithms, Kernel Methods, Representation Learning and Matrix Factorization- Basics of Graphical Models- Ensemble Methods- Practical Aspects |

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| | | | in Machine Learning- Introduction to PAC Learning- Sample Selection- Bias- Learning From Graph Data- Learning From Sequential Data. |
| **Stat410** | **Stat315** | **Reliability Theory (2)**<br>**نظرية الصلاحية (2)** | System Reliability Theory Models, Statistical Methods, and Applications, Qualitative System Reliability Analysis, Probability Distributions in Reliability Analysis, System Reliability Analysis, Markov Analysis. |
| **Stat411** | **Stat303** | **Statistical Computing**<br>**إحصاء حسابي** | Modern statistical computing. Data management; spread sheets, verifying data accuracy- transferring data between systems. Data and graphical analysis with microcomputer statistical software packages. Macro programming. Algorithmic programming concepts and applications. Topics including analysis of covariance, random number generation, simulation and Monte Carlo methods, non-linear regression computations and application to statistical methods of optimization, reliability. |
| **Stat412** | **Stat312** | **Simulation and Sampling Techniques**<br>**أساليب المحاكاة والمعاينة** | Modeling and principles of simulation- Role of random numbers- generation of Pseudo random numbers, techniques for generating r.v.'s having known distributions. Assumptions and the use of simulation in experimentation. Design of finite population sample surveys- Stratified- systematic- and multistage cluster sampling designs- Sampling with probability proportional to size. Class project on design and execution of an actual sample survey. |
| **Stat413** | **Stat303** | **Optimization**<br>**الأمثلية** | How to deal with non-linear programs- Formulation of linear programs-Solve different models, Graphical solutions- Simplex solutions- Duality in linear models, Transportation methods- Solve different transportation methods in statistic with different applications |
| **Stat414** | — | **Applications of Statistics in Bioscience**<br>**تطبيقات الإحصاء في العلوم الحيوية** | Introduction to Bio-Statistics-Variables and their types-Data collection; Sources of data used in medical field, Methods of data collection and types of questionnaires-Sampling Design; Steps in sample selection & Sampling frame-Sampling techniques & Sample size-Tabular presentation of data-Graphical presentation of data-Descriptive statistics for numerical data; measures of central tendency (mean, median, mode) -Descriptive statistics for nominal data; ratios, proportions, percentages and rates-Measures of Dispersion (variability); the range, the variance, the standard deviation, standard error and coefficient of variation-Types and characters of distribution curves & Applications on normality of distribution-Estimation(Point and Interval)-Hypothesis testing,-Correlation and regression. |
| **Stat415** | | **Linear Statistical Models**<br>**النماذج الإحصائية الخطية** | Multifactor analysis of variance analysis and planning of two factor studies-equal sample sizes. Unequal sample sizes in two factor studies- Randomized block design RBD-Nested design and sub-sampling-Rules for developing ANOVA models and tables for balanced design-Repeated measures and related designs-Latin square and related designs |
| **Stat416** | — | **Selected Topics in Statistics (4)**<br>**موضوعات مختارة في الإحصاء (4)** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| **Stat417** | — | **Selected topic in Statistics (3)** | Statistical methods for analyzing life-testing data and accessing system reliability. Grouped and time-censored data, order statistics. Classical and |

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| | | **[Life-Testing and Reliability]**<br>**موضوعات مختارة في الإحصاء (3)** | Bayesian inference for univariate and multivariate exponential, Weibull, lognormal and gamma distributions. Experimental designs and sampling plans for accelerated testing and burn-in procedures. Taguchi's reliability improvement philosophy. Field performance and software reliability analysis. |
| **Stat418** | — | **Theory of Algorithms**<br>**نظرية الخوارزميات** | Definition of an Algorithm; Algorithm design and techniques, such as sequential versus divideand-conquer; Algorithm analysis; Concept of basic operations; Concept of worst, best, and average-case analysis; Complexity analysis: big O, Omega and Theta notations; Recurrence equations and recursive algorithms; Searching and sorting algorithms; Concept of graphs; Graph algorithms |
| **Stat419** | — | **Ethics and Society**<br>**الأخلاق والمجتمع** | Introduction to Ethics is a study of the basic theories, methods, and problems of moral philosophy. Topics may include the study of the moral theories of Aristotle, Aquinas, Hobbes, Kant, Mill, and Rawls; the relationship of ethics and morality to religious belief; morality and evolution; the nature and meaning of moral terms; moral absolutism and relativism; egoism and altruism; the nature of moral reasoning; conceptions of the good life; free will and moral responsibility. |
| **Stat490** | — | **Research Project**<br>**مشروع بحثي** | Define the research problem (selected from real life problems) under study. Collecting references and data related to the research problem under the supervision of a faculty member. The student formulates and studies the solution to the problem, he knows and submits a report (graduation research) under the supervision of a faculty member. |

# Courses Contents

# Department of physics

| Code | Prereq. | Course Title | Contents |
|---|---|---|---|
| Phys101 | | General Physics (1) | **Heat:** Temperature, thermal expansion, heat transfer, heat and the first law of thermodynamics, the kinetic theory of gases. Specific heats of gases, thermodynamical processes, entropy and the second law of thermodynamics. **Properties of matter:** Measurements and units, vectors, circular motion, force and motion, Newton's laws of motion, work and energy, conservation of energy, collisions, rotational motion, rolling, torque and angular momentum. Equilibrium and elasticity, gravitation, fluids at motion, viscosity, moment of inertia, osmosis |
| Phys102 | Phys101 | General Physics (2) | **Geometrical optics:** reflection and refraction at plane and curved surfaces, images formation, mirrors, thin and thick lenses, optical systems, chromatic and spherical aberrations, prisms and fiber optics. **Electricity and magnetism:** Electric charges, electric field, gauss' law, electric potential, capacitance, current and resistance, circuits. Magnetic field, Biot-Savart law, Ampere's law, Faraday's law of induction, Inductance, Alternating Current, Maxwell's Equations. **Modern and atomic Physics:** Concept of atom, Positive rays, Electron spin, The Stern-Gerlach experiment, Thermionic emission, The Rutherford-Bohr atom, The mass spectrograph, Atomic structure, Atomic emission and absorption spectra, Photoelectric effect, Photoemissivity, Diffraction, Compton effect, Wave and particles, DeBrogli's hypothesis, Thomson experiment, Hydrogen atom, Angular momentum and vector model. |
| Phys111 | ------- | Physics (1) | **Heat:** Temperature, thermal expansion, heat transfer, heat and the first law of thermodynamics, the kinetic theory of gases. Specific heats of gases, thermodynamical processes, entropy and the second law of thermodynamics. **Properties of matter:** Measurements and units, vectors, circular motion, force and motion, Newton's laws of motion, work and energy, conservation of energy, collisions, rotational motion, rolling, torque and angular momentum. Equilibrium and elasticity, gravitation, fluids at motion, viscosity, moment of inertia, osmosis |
| Phys112 | Phys111 | Physics (2) | **Geometrical optics:** reflection and refraction at plane and curved surfaces, images formation, mirrors, thin and thick lenses, optical systems, chromatic and spherical aberrations, prisms and fiber optics. **Electricity and magnetism:** Electric charges, electric field, gauss' law, electric potential, capacitance, current and resistance, circuits. Magnetic field, Biot-Savart law, Ampere's law, Faraday's law of induction, Inductance, Alternating Current, Maxwell's Equations. **Modern and atomic Physics:** Concept of atom, Positive rays, Electron spin, The Stern-Gerlach experiment, Thermionic emission, The Rutherford-Bohr atom, The |

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| | | | mass spectrograph, Atomic structure, Atomic emission and absorption spectra, Photoelectric effect, Photoemissivity, Diffraction, Compton effect, Wave and particles, DeBrogli's hypothesis, Thomson experiment, Hydrogen atom, Angular momentum and vector model. |
| **Phys201** | **Phys102** | **Electromagnetism** | static electricity, alternating current, direct current, magnet, magnetism, magnetization, magnetic moment, magnetic field, paramagnetism, diamagnetism, conductor, insulator, solenoid, flux, voltage, resistance, Ohm's law, Faraday's law, Ampere's law, Maxwell's equations, Gauss's law, conductance, impedance, inductance, capacitance, electromagnetism, Ferromagnetism, Lorentz force law, electrodynamics, electromotive force, Lenz's law, |
| **Phys202** | **Phys101** | **Thermodynamics and statistical physics** | **Thermodynamics:** Ideal gases, Equation of state, First law of thermodynamics, Internal energy, Thermodynamic processes, Elastic model of gas, Thermodynamic cycles, Second law of thermodynamic, Entropy of ideal gas. Real gases, Van der waal's equation, Intermolecular forces, Joule-Thomson experiment, Liquefaction of gases, Negative temperature, Entropy of a gas in a magnetic field, nuclear magnetism, and temperature applications.<br>**Statistical Thermodynamics:** Statistical Ensemble, Fundamental postulate of equilibrium statistics, Interactions between macroscopic systems: thermal and mechanical interactions, equilibrium between interacting systems, Boltzmann's entropy relation.<br>Ensembles Micro-canonical, canonical and grand-canonical ensembles and partition functions; chemical potential, Free energy and its connection with thermodynamic quantities. Application of statistical thermodynamics formulation Classical and quantum statistics; Blackbody radiation and Planck's distribution law; Ideal Bose and Fermi gases; Bose-Einstein condensation. Phase transitions and non-equilibrium systems First and second order phase transitions; Diffusion equation: random walk and Brownian motion; introduction to non-equilibrium processes. |
| **Phys203** | **Phys102** | **Modern physics and special relativity** | Quantum theory of light, blackbody radiation, Compton scattering, photoelectric effect. Wave particle duality and a review of wave phenomena. Schrodinger wave equation (i.e. intro to quantum mechanics). Quantum mechanics in one dimension, the particle in a box and oscillators (i.e. quantum wells).<br>Galileau transformation, Lorentz transformation, Length Contraction and Time Dilation, Transformation of a length, Relativity of Simultaneity, Causality, Velocity, acceleration and mass, Transformation of a momentum and of a relativistic energy, transformation of a force, The four-current density, the conservation of a charge, Tensor Analysis, Geodesics and Minkowski space. |
| **Phys204** | **Phys102** | **Introduction to electronics and crystal physics** | Crystal structures: Crystal lattice – basis – unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic, NaCL, ZnS structures – crystal planes, directions and Miller indices – distance between successive planes – linear and planar densities – crystalline and noncrystalline materials<br>Basics of semiconductor physics – Fermi-Dirac distribution – Carriers concentrations – Intrinsic and Extrinsic materials – Charge neutrality – Currents in Semiconductors (drift current – diffusion current) – Semiconductor parameters (mobility, Scattering, |

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| | | | lifetime) – Hall effect. – PN junction theory – Diode IV characteristics – large and small analysis – Analog and digital diode applications (Rectifiers, Clipping circuits, Clamping Circuits, multipliers) – Special purpose diodes (Light emitting diodes, photo diodes, Zener diode and its applications)- Basics of Bipolar junction transistors (BJT) and field effect transistors (FET) – physical operations, characteristics, specifications. |
| **Phys205** | | **Practical physics (1)** | Polarization of Light-Grating Diffraction-Photoelectric Effect-Light dependent resistor -Diffraction Pattern of Light with a Single-SlitDiffraction Pattern of Light with a Double-Slit-Determination of the dispersive power of a prism-Verification of Newton's formula for a combination of two thin lenses |
| **Phys206** | | **Practical physics (2)** | (A.C) Series Circuits-(A.C) Parallel Circuits Rayleigh potentiometer-CARY-FOSTER BRIDGE Study of coupled pendulum-Study moment of inertia of flywheel-Semiconductor Diode Characteristics Study self-inductance of the coil. |
| **Phys207** | | **Mathematical physics 1** | Vector Calculus, Tensors- :Summation Convention: Scalar, Vector Products, Determinants-Gradient, Divergence, Curl, Gauss and Stokes Theorems Laplacian, Potential and Rotational Fields, Helmholtz Theorem Non-Cartesian Coordinate Systems, Introduction to Tensors, Eigenvalues, Eigenvectors-Dirac Delta and Complex Analysis- Dirac Delta Function: singular distributions--Complex Analysis: Analytic Functions, Derivatives, Cauchy Theorem-- Complex Analysis: Laurent Series, Residues, Residue Theorem, Contour Integrals. |
| **Phys208** | **Phys207** | **Mathematical physics 2** | Differential Equations :Ordinary Differential Equations: First Order, Second Order Frobenius Method, Legendre Polynomials, Fuch's Theorem, Bessel Functions, Partial Differential Equations: Laplace, Diffusion and Wave Equations, Special functions, Separation of Variables in Cartesian, Cylindrical and Spherical Coordinates. |
| **Phys209** | | **Kinetic and phase transformation** | Thermodynamics and Kinetics of Phase Transitions: an Introduction-Interaction of Stresses and Strains with Phase Changes in Metals -Physical Aspects-Experimental Observations for Shape Memory Alloys-and Transformation Induced Plasticity Phenomena-Interactions Between Stresses and Diffusive Phase Transformations - with Plasticity -Micromechanical Modelling of the Thermomechanical Behavior of Shape-Memory Alloys<br>Modelling and Simulation of Transformation Induced Plasticity<br>in Elasto-Plastic Materials-Theory of Pressure Solution Creep in Wet Compacting Sediments-Application to Shape Memory Devices-Application to Heat Treatment and Surface Treatment<br>Considering Stress-Phase Transformation Interactions in<br>the Calculation of Heat Treatment Residual Stresses- |
| **Phys210** | | **Fourier optics** | Diffraction, Fourier Optics and maging-Introduction-Examples of Emerging Applications with Growing-Significance-Dense Wavelength Division-Multiplexing/Demultiplexing(DWDM)-Optical and Microwave DWDM Systems-Diffractive and Subwavelength Optical Elements-Nanodiffractive Devices and Rigorous Diffraction Theory-Modern Imaging Techniques-Linear Systems and Transforms-Linear Systems and Shift Invariance-Continuous-Space Fourier Transform-Existence of Fourier –Transform-Properties of the Fourier Transform1-Real Fourier Transform-Amplitude and Phase Spectra-Hankel –Transforms- |

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| | | | Fundamentals of Wave Propagation-Waves-Electromagnetic-Waves-Phasor Wave Equations in a Charge-Free Medium-Wave Equations in Phasor Representationin a Charge-Free Medium. |
| **Phys211** | | **Introduction to biophysics** | **Part I: Introduction to Human Movement Studies**: Human Movement Studies as a Discipline and a Profession What is Human Movement Studies and Why is it Important? Disciplines and Professions Is Human Movement Studies a Discipline? Structure of a Discipline of Human Movement Studies What Should the Discipline of Human Movement Studies Be Called? **Part II: Anatomical Bases of Human Movement: Functional Anatomy**: Basic Concepts of the Musculoskeletal System Tools for Measurement Skeletal System Articular System Muscular System- Basic Concepts of Anthropometry - Definition of Anthropometry Tools for Measurement Body Size- Determination of Body Shape Tissues Composing the Body Somatotyping as a Description of Body Build Human- Variation Musculoskeletal Changes Across the Life Span- Definitions of Auxology and Gerontology Tools for Measurement Physical Growth, Maturation, and Ageing Age-Related Changes in the Skeletal and Articular Systems Age-Related Changes in the Muscular System- Changes in Body Dimensions Across the Life Span- Methods of Determining Age- Musculoskeletal Adaptations to Training Effects of Physical Activity on Bone Effects of Physical Activity on Joint Structure and Ranges of Motion Effects of Physical Activity on Muscle-Tendon Units Effects of Physical Activity on Body Size, Shape, and Composition |
| **Phys212** | **Phys102** | **Alternating current** | Ac waveforms - measurements of ac magnitude - simple ac circuit calculations - ac phase - principles of radio ontributors complex numbers-- vectors and ac waveforms - simple vector addition - complex vector addition - polar and rectangular notation - complex number arithmetic - more on ac "polarity" -some examples with ac circuits - contributors --reactance and impedance – inductive - ac resistor circuits - ac inductor circuits - series resistor-inductor circuits - parallel resistor-inductor circuits - inductor quirks - more on the "skin effect" - contributors - reactance and impedance – capacitive - ac resistor circuits - ac capacitor circuits series resistor-capacitor circuits - parallel resistor-capacitor circuits capacitor quirks - contributors - reactance and impedance - susceptance and admittance |
| **Phys213** | **Phys102** | **physical optics and optical instruments** | Superposition of waves. Interference: Coherent sources- Two Sources Interference of Light. Intensity in Interference Patterns. Phase change in Reflection. Interference in Thin Films. Newton's Rings. Thin Coating on Glass. Michelson Interferometer. Diffraction: Fresnel and Fraunhofer diffraction. Diffraction from single slit. Intensity in the single slit pattern. Multiple slits. The Diffraction Grating. X-Ray Diffraction. Circular Apertures and Resolving Power of Optical Instruments. Polarization: Introduction. Polarization by Reflection. Double Refraction. Polarizer. Percentage Polarization (Malus Law). The Scattering of Light. Circular and Elliptic Polarization. Optical Activity. Polar- meter Microscopes -Telescopes_ Refractometers and Optical fiber. |
| **Phys214** | **Phys102** | **Energy resources** | Generation of Electrical Energy-Classification of Energy-Solar Energy-Wind Power-Water Motion Tidal Energy.Water Motion Hydropower-Biomass Energy-Geothermal Energy-Thermal Energy-Nuclear Energy-Energy Sources in World-Energy in Egypt. |
| **Phys215** | **Phys102** | **Waves and Vibration** | Theory of free vibrations: Periodic motion, simple harmonic motion, equation of a simple harmonic oscillator, expressions for period and frequency, energy |

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| | | | considerations-total energy, conversion of energy from kinetic to potential in SHM, electric to magnetic in an LC circuit.Problems. Theory of damped vibrations: Resistive forces, equation of motion-expression for decaying amplitude, cases of damping. Logarithmic decrement, relaxation time and quality factor.Problems.Theory of forced vibrations and resonance: Equation of motion expression for amplitude, mechanical impedance, expression for maximum amplitude. Problems. Examples of resonance-ESR and NMR |
| **Phys216** | | **Radiation physics and applications** | radiation and atom - nuclear medicine- imaging systems- imaging with ultrasound-magnetic resonance imaging- radiation hazards and protection- magnetic resonance imaging. |
| **Phys217** | | **Classical mechanics** | Particle Kinematics -Introduction – Single Particle Kinematics - Motion in configuration space - Conserved Quantities - Systems of Particles - External and internal forces - Constraints - Generalized Coordinates for Unconstrained Systems - Kinetic energy in generalized coordinates Phase Space - Dynamical Systems - Phase Space Flows Lagrange's and Hamilton's Equations - Lagrangian for unconstrained systems -Lagrangian for Constrained Systems -Some examples of the use of Lagrangians Hamilton's Principle - Examples of functional variation - Conserved Quantities -Ignorable Coordinates -Energy Conservation -Hamilton's Equations - Velocity-dependent forces - Two Body Central Forces -Reduction to a one dimensional problem - Reduction to a one-body problem - Reduction to one dimension-Integrating the motion. |
| **Phys218** | **Phys213** | **Electron microscope and fiber optics** | Historical Facts towards Introduction to Fiber-Optics and Photonics - Photonics: A Dream of Modern Technology - Optical Fiber and Its Application in Communication - Progress on Optical Fiber Sensor for the Measurement of Physical Parameters and Chemical Sensing - Laser Applications in Medicine and Photodynamic Therapy Attempts to Build Light Energy Conversion Devices –Fluorescence-undamental and Applications -Nonlinear Frequency Conversion : A Versatile Approach to Achieve Broadly Tunable Coherent Radiation - Photonics and Its Application in High Voltage Engineering-Techniques of Measurements of Linear and Nonlinear Optical Properties of Layered Nanomaterials for Applications in Photonics.TiO2 Nanowire-Based Optical Sensor Computation of Electromagnetic Bandgap in Two-Dimensional Photonic Crystal. |
| **Phys219** | | **Carbon nanomaterials** | Information on synthesis, properties, and applications of carbon nanomaterials. With novel materials, such as graphene (atomically flat carbon) or carbon onions (carbon nanospheres), the family of carbon nanomaterials is rapidly growing. Carbon nanomaterials. Graphene: Synthesis, Properties, and ApplicationsFullerene C60 Architectures in Materials Science, Graphite Whiskers, Cones, and Polyhedral Crystals, Epitaxial Graphene and Carbon Nanotubes on Silicon Carbide, Cooperative Interaction, Crystallization, and Properties of Polymer–Carbon Nanotube Nanocomposites, Carbon Nanotube Biosensors, Carbon Nanostructures in Biomedical Applications, Field Emission from Carbon Nanotubes, Nanocrystalline Diamond. |
| **Phys220** | | **Physics of alloys and composite material** | Graphene-Boron Nitride Composite: A Material with Advanced Functionalities-In this chapter, thermodynamics stability and electronic properties of boron nitride-graphene nanocomposite have been presen ted. Among several possible isomers, |

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| | | | stability of a desired composite are discussed and analysed.Graphene Nanocomposites, This chapter focuses on the recent development in the research field of graphene and graphene-polymer nanocomposites. The description of mechanical, electrical and thermalproperties of graphene and graphene-polymer nanocomposites have been presented along with the detailed discussio n on the influences of some important factors. Some fabrication techniques of graphene-polymer nanocomposites are also briefly introduced. Properties of MWNT-containing Polymer Composite Materials Depending on Their Structure In this chapter, the electrical and electromagnetic properties of polymethylmethacrylate and polystyrene matrix based composites using multiwall carbon nanotubes as fillers are investigated and discussed in detail. |
| **Phys221** | | **Introduction to atomic and radiation physics** | accelerators, atomic models, atoms, beam transport, electronic structure, electrons, fission, hydrogen, ions, nuclear physics, quantum mechanics, radiation detectors, radioactivity, relativity theory, thermonuclear reactions, x radiation, x-ray spectra-charged particles, electromagnetic radiation, elementary particles, elements, fermions, ionizing radiations, leptons, mathematical models, measuring instruments, mechanics, nonmetals, nuclear reactions, nucleosynthesis, radiations, spectra. |
| **Phys222** | | **Managing renewable energy** | Clean Renewable Energy- Growth Management- Solar Renewable Energy Growth Management- Wind Renewable Energy Growth Management- Hydro and Ocean Renewable Energy Growth Management-Geothermal Renewable Energy Growth Management<br>Biofuel and Biomass Renewable Growth Management- Renewable Policy Development Management- Smart City Renewable Development Management-Renewable Finance and Investment Management-. Renewable Digital Transformation and Cyber Security Management-. International Companies Renewable Strategy Management |
| **Phys223** | | **Introductory to Astrophysics (1)** | Topics include gravity and orbits, radiation laws and stellar spectra, physical characteristics of the Sun and other stars, star formation and evolution, black holes, galaxies, the expanding universe, and the Big Bang. |
| **Phys224** | | **Nanoscience and nanotechnology** | This interdisciplinary course introduces students to the science and technology of nanoparticles. It presents both theoretical concepts and practical applications in the field of Nanotechnology. A nanometer (nm) is one billionth of a meter. Nanostructures, that is objects on the length scale of 1 to 100 nm, often exhibit properties that are inconsistent with bulk properties. For example, bulk gold has a golden color, but gold nanoparticles with diameters ~15 nm are red and ~40nm gold nanoparticles are purple. The phenomenon of size effects is critical to nanoscience and nanotechnology, Physical properties of nanostructures, magnetic and optical, will be dicussed, Different synthesis methods of nanoparticles, Introduction to nanoscale characterization methods such as scanning probe microscopy, electron microscopy, X ray diffraction, Applications of nanoparticles for advanced electronic, magnetic, biomedical and other areas will be presented. |
| **Phys225** | | **Micro/Nano fabrication techniques** | Introduction to Nanocomposites, Composite material, Mechanical properties of Nano composite material: stress - strain relationship, toughness, strength, plasticity. ic-Metal Nanocomposites, Ceramic based nanoporous composite, Metal matrix nanocomposites, Polymer based nanocomposites -Micro fabrication Techniques: |

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| | | | Lithography, Thin Film Deposition and Doping, Etching and Substrate Removal, Substrate Bonding, MEMS Fabrication Techniques, Bulk Micromachining, Surface Micromachining, High- Aspect- Ratio Micromachining.Micro-Machining: Material removal at micro-scale: size effect, chip thickness, Micro-Structure and Grain Size Effects; Tool geometry, Tool wear, and Tool Deflections, Tool Stiffness and Deflections under Dynamic Loading, Micro Turing and Micro Carbon nano-tube production and applications: Basis of nanotechnology, structure and properties of carbon nano tubes- Carbon nanotube based nanocomposites and Natural nanobiocomposites, Biomimetic nanocomposites and Biologically inspired nanocomposites.Production of carbon nano tube: chemical vapor deposition, arc discharge, laser ablation, mechanisms of growth, purification of carbon nano tube, applications. |
| **Phys226** | | **Biomass and bioenergy** | Processing and properties of date palm fibers and its composite – Bamboo fiber processing properties and applications-processing and properties of bagasse fibers – Kapok fiber structure and properties – introduction of natural fiber obtained from the leaves of pineapple plants. Production of Algal biomass- Biomass steam Gasification– Bioethanol G2 production process and recent studies. |
| **Phys227** | | **Computational physics** | Need of Computational Tools -Example of problems in physics requiring computational approach; Basic computer architecture and latest advancements.Basics of Programming and Programming tools -Use of C or Python in physics and related problems, Data visualization and related.Error Analysis and Curve fitting -Error and Uncertainties. Error propagation. Curve fitting and introduction to data processing.Numerical Methods - Roots of algebraic and transcendental equations – iterative methods such as bisection method, inverse interpolation and Newton – Raphson method; Matrix algebra, solution of simultaneous linear equations by matrix inversion methods; Interpolation – linear interpolation, Lagrangian interpolation, Newton's interpolation; Numerical Integration and Differentiation ( Numerical Methods implemented using C or Python). Monte Carlo Methods. |
| **Phys228** | | **Efficient energy generation & conversion** | Energy power- and efficiency-the efficiency-power trade off-equilibrium statistical thermodynamics energy-entropy -maximization static quantum particles-examples of equilibrium state-reversible process-cycle processes and efficiencies – linear nonequilibrium thermodynamics- the entropy production rate-power and efficiency limit-solar power-solar thermal power-electrical power conversion devicies- DC-DC converter transformer-impedence matching electro-mechanical energy-conversion motors. |
| **Phys229** | | **Introduction to electric circuits** | Units and dimension-electric current elements-DC circuit analysis-single phase a.c circuits –Three phase a.c circuit- Resonance-Nodal and mesh analysis-Two port networks-Duals and analgues, |
| **Phys230** | | **Distribution power system** | Power distribution system reliability As power distribution systems age, the frequency and duration of consumer interruptions will increase significantly. Now more than ever, it is crucial for students and professionals in the electrical power industries to have a solid understanding of designing the reliable and cost-effective utility, industrial, and commercial power distribution systems needed to maintain life activities (e.g., computers, lighting, heating, cooling, etc.). industrial power system |

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| | | | design problems worked out with real examples, as well as additional problem sets and their solutions. Power Distribution |
| **Phys231** | | **Introduction to green energy** | Transport, electricity generation, bio-fuels, Homogenous Charge Combustion Ignition research, kinetics, thermodynamics, combustion, (photovoltaic) solar energy, biomass, hydrogen combustion, hydrogen stocking, wind power, wind energy, hydro-electric power plants and fuel cells. The interdisciplinary content combines energy source engineering, fuel technology and environmental chemistry. basic source of information on alternative energy for scientists, academics and industrials. Electricity Generation and Consumption Overview. |
| **Phys233** | | **Energy storage Materials and applications** | Generalities on Energy Storage- Energy Storage Systems- Comparative Ratings and Properties- Electrochemical Energy Storage-. Energy Storage by Means of Supercapacitors- Energy Storage Systems Based on Compressed Air- Hydropower and Pumped Storage Facilities- Flywheel Systems- Energy Storage Based on Hydrogen- System Arrangements and Applications- Power Electronics—Basic Circuits and Principles. |
| **Phys235** | | **Power plant technology** | A Thermodynamics Evaluation-The Rankine Cycle-Fossil Gasoline Steam Turbines-Fuels And Combustion-Generators-The Condensate-Feedwater System-The Circulating-Water System-Gasoline Turbine and Mixed Cycles-Rules of Nuclear Vitality-Thermal Fission Reactors and Powerplants-Quick Breeder Reactors and Powerplants-Geothermal Vitality-Photo voltaic Vitality-Wind Vitality-Vitality from the Oceans-Vitality Storage-Environmental Features of Power Era |
| **Phys237** | | **Environmental climatology** | The emergence of applied climatology and climate impact assessment. Part i: applied climatology: the 'tools' of research. Ground and remotely-sensed measurements. Statistical considerations- climate models. - Atmospheric resource management. Part ii: climate and the physical/biological environments. Hydrological processes and water resources. Glaciers. Geomorphic processes and landforms. Soils. Vegetation. 11: animal responses to climate. Part iii: climate and the cultural Environment. Comfort, clothing and health. Town planning, architecture and building. Industry and commerce. Transport systems. Agriculture and fisheries. Forestry. Recreation and tourism. Political, social and legal apsects of climate. The energy sector. Part iv the changing climatic environments. Urban climates and global environmental change. Air pollution. Climate extremes as a hazard to humans. Climate change. |
| **Phys239** | | **Advanced circuit design** | Linear and nonlinear circuitry controlled sources and impedance converters active filters. Broad band amplifier- power amplifier-Analog switches and compartors signal generators- combinatorial logic circuit – Digital filters-Measurement circuits-electronic controllers. |
| **BPhy201** | | **Modern Biophysics** | Introduction to modern biophysical methods. An array of new, faster and higher-power biophysical methods now enables scientists to examine the mysteries of life at a molecular level. This innovative text surveys and explains the ten key biophysical methods, including those related to biophysical nanotechnology, scanning probe microscopy, X-ray crystallography, ion mobility spectrometry, mass spectrometry, proteomics, and protein folding and structure. |

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| **BPhy202** | | **Physical optics and its biological application** | Introduces key developments in optical polarization methods for quantitative studies of tissues, while presenting the theory of polarization transfer in a random medium as a basis for the quantitative description of polarized light interaction with tissues. This theory uses the modified transfer equation for Stokes parameters and predicts the polarization structure of multiple scattered optical fields. The backscattering polarization matrices (Jones matrix and Mueller matrix) important for noninvasive medical diagnostic are introduced. Describes a number of diagnostic techniques such as CW polarization imaging and spectroscopy, polarization microscopy and cytometry. As a new tool for medical diagnosis, optical coherent polarization tomography is analyzed. The monograph also covers a range of biomedical applications, among them cataract and glaucoma diagnostics, glucose sensing, and the detection of bacteria. |
| **BPhy203** | | **Molecular biophysics and bio modeling** | Analysis of X-ray and Molecular Formation - X-ray diffraction - X-ray diffraction - Diffraction forms of some protein fibers - Protein form - External and internal molecular strength - Strong and weak force - Joint association - Ionic association - Resonance - Bipolar reaction - Ionizing ionizing effect on cellular components - : The effect of ionizing radiation — measurement of radiation - measurement of the dose - the results of the process of throwing large biomolecules. protein folding- Light-energy conversion- Muscle contraction- Infrared light detection of centrioles- Intracellular signaling via microtubules- Electronic and protonic conduction of biopolymers- Molecular level protein—protein interactions- -Supramolecular protein assemblies- Cell division- Flagellar motors- Motor protein motion (especially thei directionality)- Synaptic plasticity. |
| **BPhy204** | | **Thermodynamics for biological system** | Binding Reactions and Biological Thermodynamics- Thermodynamic models of binding- Thermodynamic 9models of transcription- The unreasonable effectiveness of MWC models- The Unreasonable Effectiveness of Random-Walk Models. |
| **BPhy205** | | **Electronics integrated circuits** | Atomic structure and theory of solids-semiconductor material and its band diagram-Transport phenomena in semiconductor- p-n junction-metal semiconductor contact-field effect transistor-metaloxide semiconductor field effect transistor-biopolarrr transistor-optoelectric devices and power devices. |
| **BPhy206** | | **General biophysics and waves** | Preparation and Physical Properties of Asymmetric Model-Membrane-Spontaneous Lipid Flip-Flop in Membranes-Membrane Lipid-Protein Interactions- Principles of Mechanosensing at the Membrane Interface- Lipid Domains and Membrane (Re)Shaping: From Biophysics to Biology- Minimal Cellular Models for Origins-of-Life Studies and Biotechnology. |
| **BPhy207** | | **Health biophysics** | Applications of physical ideas and concepts enshrined in mechanics, hydrostatics, hydrodynamics, optics, acoustics, electrodynamics and radiological physics to medical sciences. Some aspects of biophysics are indistinguishable from biochemistry, physiology, medical physics, nuclear medicine, biomedical engineering and biotechnology. Physical principles in understanding cardiovascular system. X-ray tube and machine - X-ray production and their properties. Radioisotopes production, use and handling of radioisotopes -The safe use of detectors for measuring different types of radiations. NMR imaging system -various types of microscopes, their optical principles and use in medical sciences. |

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| **BPhy208** | | **Membrane biophysics, control and communication** | Radiation effects of radiation: Direct response to radiation doses - Radiation effects: Acute effect - Blood changes - Blood system symptoms - Digestive system symptoms - Central nervous system symptoms - Late effects: Cancer - Leukemia ) – Bone cancer - Lung cancer - Biological effects: Risk and toxicity - Time period - Cataract - Risk assessment - Relative biological effects - QF Correlation coefficient - Equivalent dose - Radiation reagents - Particle counting devices - Gas filled counter - -Counter To fit the-counter Gejr- time measuring Chapter Alvsal- time-meter Fluorescence spectroscopy, Neuron spectroscopy, Cycloph detectors, Semiconductor detectors, Dosimeters, Pocket scale, Films, Thermodynamic thermometer, Ion flow chamber, Nitron measurement, Neuron interactions, Neutron counter with proportionometer, Long meter, For rapid neutron-meter-hars-thermometers for thermonetic and rapid neutron-shielding of external radiation exposure-general rule: methods of protection from external exposure to radiation. For electrical properties in tissues and cells, physical fundamentals of animal electrical efforts: electrophysiological jihad, responses to animal life, outcome Tissue stimulation, micro - electrodes: their applications and applications . |
| **BPhy209** | | **Enviromental biophysics and renewable energy** | Microenvironments- Energy Exchange- Mass and Momentum Transport- Conservation of Energy and Mass- Continuity in the Biosphere- Models,Heterogeneity, and Scale- Applications- Units. Water Vapor and Other Gases- Liquid Water in Organisms and their Environment- Wind- Heat and Mass Transport- Conductances for Heat and Mass Transfer- Heat Flow in the Soil- Water Flow in Soil- Radiation Basics- Radiation Fluxes in Natural Environments- Animals and their Environment- Humans and their Environment- Plants and Plant Communities- The Light Environment of Plant Canopies. |
| **BPhy210** | | **Quantum mechanics and its biological applications** | angular approach approximation assume atom basis becomes bond calculations classical coefficients compute condition Consequently consider constant contribution coordinates corresponding coupling define denotes density matrix depends derivative described determine dipole discussion distance distribution dynamics effect eigenstates electron energy equations of motion evaluate evolution example excited exciton expand expression fact field Figure final force frequency given gives ground Hamiltonian harmonic indicate initial integral interaction lattice length limit linear mass matrix elements molecular molecule momentum moving normal Note Notice obtain operator orbitals original oscillator particle path perturbation phase physical position potential probability Problem quantum mechanics relation representation represents resonance result rule scattering Schrödinger equation Show simple solution solve space structure term theory transfer transform transition unit values vector vibrational wave function. |
| **BPhy211** | | **General Biophysics (1)** | Experimental studies on the living cell, the flexibility of the living cell, the viscosity of the living substance of the cell, the energies of the cell surface, the biological effects of some fields, light: the energy of the unit of light, transmission and absorption, the physical bases of light processes, biological effects, laboratory therapeutic effects, electromagnetic waves (non-ionizing). Spectra and fields, measurement of biological resistors, effects of low frequencies, microwave radiation, laser radiation, ultraviolet radiation, acoustic phenomena with biophysical significance, units used in acoustic measurements, acoustic generators, physical considerations for absorbing sound rays. |

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| **BPhy212** | | **Bioenergetic** | Energy transfer in the biologist, free energy change for chemical reactions, non-ionic conditions, ATP and cell transfer, mitochondria, toliad Only ATP in cell, respiration and phosphorylation, oxidation pathways, plastids, photovoltaic construction and photovoltaic flow, non-linear structures, AT.Chemical and ionic circuits, bacteriophageal staphylococcus aureus, the chemical concern of the biological structures, the organic structures of adenic acid. |
| **BPhy213** | | **Biomathematices** | The Monte Carlo method of simulation - simulation of the results of a known model - simulation of the results of the evaluation of the decay constant and the linear coefficient of decay of a porous substance and its applications for the design of logic circuits - binomial distribution of Dobson and their applications in biology - models of biophysics - matching results of a linear model - Linear equations - matching the results of a nonlinear model - the Newton-Raafson method to match the practical results of a nonlinear model - regression method to match the practical results of a nonlinear model - a multi-head method to match the practical results of a nonlinear model Logic-logic method of genetic gene applications in small and large endings - ttabiqat logic gene in biological . |
| **BPhy214** | **Phys 112** | **General Biophysics (2)** | Electrophysiology during a live body, the nervous system and nerve cell, the electrical potential of the nerves, the electromyogram, the electrocardiogram, the electroencephalogram, the eye drawing, diagnostic X-ray physics, the generation and absorption of X-rays, X-ray imaging, the uses of radioactive nuclei in medicine. Radiation properties and units - Radioactive sources used in nuclear medicine - Statistical aspects in nuclear medicine - Basic radiometers and their medical applications - Geiger counter - Photomultipliers tube - Pulse height analyzer - Gamma ray camera - Radiation doses in nuclear medicine - Radiation protection in medicine - Natural and industrial sources of ionizing radiation Biological effects of ionizing radiation - radiation protection units and their limits in nuclear medicine - applications of heat and cold in medicine - heat treatment using both heat conduction method - infrared and radio waves - microwaves and ultrasound - the use of ultra-low temperatures in medicine - blood and tissue preservation Cryosurgery - the use of light in medicine General properties of light and measurement of light units - applications of visible light in medicine - flexible optical fiber endoscopes - applications of ultraviolet and infrared rays in medicine - infrared imaging - lasers and its medical applications-microscopes. |
| **BPhy215** | | **Electric current in biological system** | Electromagnetic Energy and Regulation of Life Processes - Bacterial Biomagnetism and Geomagnetic Field Detection by Organisms - The Earth's Magnetic Field as a Navigational Cue - NMR Conditions and Biological Systems - Apoplastic Electropotentials in Plants: Measurement and Use- Electrical Properties of Tissue - Biological Effects of Electromagnetic Energy - Therapeutic Applications of Electromagnetic - Health Hazards of Electromagnetic Energy - Evolution and Results of Biological Research with Low-Intensity Nonionizing Radiation - Electromagnetic Energy and Cataracts - Immunologic and Cancer-Related Aspects of Exposure to Low-Level Microwave and Radiofrequency Fields - The Biological Effects of Power-Frequency Electric Fields in the Environment - Environmental Electromagnetic Fields and Public Health. |

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| **BPhy216** | **Phys 112** | **Biophysics of ionizing radiation imaging** | Photographic receivers: Phosphorescence screen, fluoroscience - X-ray films - Digital radiography - Quality control for films and photo purification systems - Image rays: Image quality - Contrast - Diffraction of various energies - Filtration networks - Separation force and uncertainty - Engineering dimensions of film and patient and exporter Radiation therapy - High Radiation Imaging - Large-scale Radiation Imaging - Photographic Imaging Techniques - Diagnosis of Radiation Isotopes - Factors Affecting Image Quality of Radial Nuclei - Quality Control Standards Security - Diagrams: Diyographic imaging of the top - imaging Diahi axial force - Photonography of a single photon output of energy using a computer - Photographic imaging of positronate issued. |
| **BPhy218** | **BPhy207** | **Biophysics measurements** | Means of separation of biomolecules: chromatography (normal and high-performance vertical chromatography, absorption-dependent chromatography, ion exchange and permeability, gas-liquid chromatography and thin-layer chromatography). Electrophoresis (separation of proteins and DNA), separation by diffusion and sedimentation, basics of X-ray diffraction from biological samples, nuclear magnetic resonance, mass spectrometry and dipole electrometry (to measure the dielectric constant, relaxation time and dipole moment. Preparation and Physical Properties of Asymmetric Model-Membrane-Spontaneous Lipid Flip-Flop in Membranes-Membrane Lipid-Protein Interactions- Principles of Mechanosensing at the Membrane Interface- Lipid Domains and Membrane (Re)Shaping: From Biophysics to Biology- Minimal Cellular Models for Origins-of-Life Studies and Biotechnology. |
| **BPhy220** | | **Neurobiophysics** | Introduction, structure and function of the nervous system, biophysics of neurons, cellular membrane effort, chemical transmission, electrical, assembly of nerve signals, electrical, chemical transmission, biophysics of ion channels, types, methods of measuring their activity, nervous systems, comprehensive theory, sensory devices, Neural networks, learning and memory, devices used to measure the electrical activity of neurons. Extracellular recording, intracellular recording, tuning of signals, electrodes, noise in measurements, methods of analyzing results. |
| **Phys301** | **Phys203** | **Quantum physics 1** | Need for quantum description of nature: Failures of classical theories Stern-Gerlach experiment, Black body radiation, Photoelectric effect, Dependence of Cp, Cv on degrees of freedom, Interference patterns of double slit experiment, Debroglie hypothesis, dual nature of matter –Wavefunctions-Waves, superposition and phases, Basic postulates of quantum mechanics, Normalization and expectation values. Fourier transforms, delta functions, gaussians and their relevance in quantum mechanics.Momentum space wavefunction.The uncertainty principle, Commutation relationships, Dispersion of a gaussian. Schrodinger equation. 1-dimensional problems -Bound states and scattering states, Infinite and finite square wells, Potential barrier, Harmonic oscillator, Delta function potential and finite step. Reflection and transmission coefficients. S matrix and M matrix. Quantum mechanics in 3-dimensions -The commutation relationships in 3 dimension,. 3-D Schrodinger equation, Extension from 1-d to 3-d for free particle and harmonic oscillator. Degeneracy and rotational invariance, Central potentials, Hydrogen atom. |
| **Phys302** | **Phys203** | **Nuclear physics 1** | General Properties of the Nucleus. Theory of Radioactive Disintegration. Alpha Emission (spectra and decay). Beta Emission (Pauli hypothesis, Fermi theory of beta- |

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| | | | decay, detection of the neutrino. Gamma Rays (emission, selection rules, internal conversion, nuclear isomerism).Nuclear reactions. Nuclear Spin and Parity. Nuclear Models. Interaction of radiation with matter. |
| **Phys303** | **Phys203** | **Atomic and molecular physics** | - Atomic structure and the interaction between atoms and fields- electronic excitations- atomic spectra-excited states, hydrogenic and multi-electron atoms.<br>- Binding of atoms into molecules, molecular degrees of freedom (electronic, vibrational, and rotational), elementary group theory considrations and molecular spectroscopy. |
| **Phys304** | **Phys204** | **Material science (1)** | Classification of Materials -Advanced Materials -Atomic Structure and Interatomic Bonding -Atomic Bonding in Solids - Structures of Metals and Ceramics – Structure-Crystallographic Points, Directions, and Planes -Crystalline and Noncrystalline Materials -Polymer Structures - Imperfections in Solids -Point Defects -Miscellaneous Imperfections -Microscopic Examination-Diffusion -Mechanical Properties -Elastic deformation -Hardness and Other Mechanical -Property Considerations -Property Variability and Design/Safety Factors - Deformation and Strengthening Mechanisms -Deformation Mechanisms For Metals -Mechanisms of Strengthening in Metals Recovery, Recrystallization, and Grain Growth -Deformation Mechanisms For Ceramic Materials -Mechanisms of Deformation and For Strengthening of Polymers. |
| **Phys305** | | **practical physics (3)** | Resonance experiment, Solar cell experiment, Thermistor experiment, Triac experiment, Photoelectric effect experiment, Zener-Diode experiment, Rectifier experiment, Millikan experiment, Regulator 7805 experiment |
| **Phys306** | | **Practical physics (4)** | Lissajous figure experiment, Power of LED experiment, Microwave experiment, Thomson experiment, Geiger–Müller counter experiment, Thermocouple experiment, Hall effect experiment, valve experiment, Logic gates experiment. |
| **Phys307** | | **Radiation protection safty** | the weighted factor of the radiation - the equivalent dose - the acquired effective dose - the mass equivalent dose - the collective effective dose - the objectives of radiation protection - the international permissible limits for workers and the public - the risks of external radiation exposure - the effect of time (exposure period), distance and protective barriers to radiation sources Gamma and Neutron Sources-Primary and secondary protective barriers for x-ray devices - internal radiation exposure risks - pathways for entry of radioactive materials into the body - permissible limits for the strength of radioactive elements inside the body - control of the risks of radioactive contamination. Safety of radiation sources - security of radiation sources - verification of radiation protection and safety and security of sources - radiation protection in occupational exposure - radiological protection in medical exposure - radiation protection in public exposure - radiation protection in exposure to naturally occurring radioactive materials - rules for the safe disposal of radioactive waste - Radiation protection in exposure to naturally occurring radioactive materials. Rules for safe disposal of radioactive wastes. |
| **Phys308** | **Phys201** | **Electrodynamics** | Electrostatic fields, Electric polarization, Divergence, Calculation of electric fields, Laplace's equation, Magnetic field, Magnetization, Inductances, energy stored in a magnetic field,Magnetic induction and Divergence, Magnetic field intensity, Boundary conditions, Maxwell's equation, Conservation of electric charge, Lorentz condition, non-homogenous wave equations. |

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| **Phys309** | | **Nonrenewable & renewable energy resources** | **Non-renewable energy sources:** Fossil fuels-Petroleum-Hydrocarbon gas liquids-Natural gas-Coal- Nuclear energy.<br>**Renewable energy sources:** Solar energy benefits and limitations- Photovoltaic systems -Basics of solar cell; Intrinsic, extrinsic and compound semiconductor; pn junction: homo and hetro junctions, Metal semiconductor interface; Dark and illumination characteristics; Solar PV Cell and modules: Cell structure, Front and back surface, optical properties of solar cell, Different losses and mitigation- Geothermal energy from heat inside the earth -Wind energy- Hydrothermal-Tidal- Biomass from plants -Hydropower from flowing water -Energy storage devices-(Fuel cell, supercapacitors and batteries) |
| **Phys310** | **Phys303** | **Spectroscopy and lasers** | Semiclassical Principles of Atomic and Molecular Spectra - Lasers for Spectroscopy - Resonance Photoionization Spectroscopy - Applications of Laser Absorption Spectroscopy - Laser Plasmas for Chemical Analysis - Laser-Induced Molecular Dissociation Applications in Isotope Separation and Related Processes -Laser Raman Techniques - Laser Remote Sensing Techniques -Applications of Laser-Induced Fluorescence Spectroscopy for Combustion and Plasma Diagnostics. |
| **Phys311** | **Phys204** | **Solid state physics (1)** | Crystal Structure - Bravais lattices - Miller indices - X-ray Diffraction - Bragg's law - The reciprocal lattice - Lattice Vibrations - Elastic waves - Specific heat - Lattice waves - Thermal conductivity - The Free electron Model - Conduction electrons - Electrical conductivity - Failure of the free electron model |
| **Phys312** | | **Radiofrequency electronics** | Impedance matching-Linear power amplifiers-Basic filters-Frequency converters-Amplitude and frequency modulation<br>Radio receivers-Suppressed-carrier AM and quadrature AM (QAM)-Class-C, D, and E power RF amplifiers-Transmission lines-Oscillators-Phase lock loops and synthesizers Coupled-resonator bandpass filters-Transformers and baluns-Hybrid couplers-Waveguide circuits-Small-signal RF amplifiers<br>Demodulators and detectors-Television systems-Antennas and radio wave propagation-Radar-Digital modulation techniques-Modulation, noise, and information-Amplifier and oscillator noise analysis-The GPS navigation system-Radio and radar astronomy-Radio spectrometry-S-parameter circuit analysis-Power supplies-RF test equipment. |
| **Phys313** | | **Semiconductor technology** | Silicon Compound Semiconductor Processing Epitaxial Growth - Photolithography - Selective Doping-Etching Processes in Semiconductor Manufacturing -Silicon Device Structures-Compound Semiconductor Device Structures Silicon Device Processing-Compound Semiconductor Device Processing-Integrated Circuit Packaging - Interconnection Systems. |
| **Phys314** | **Phys204** | **Applied electronics** | Transistors Characteristics. Amplification of step voltage and pulses. Some important circuits. Feedback Amplifiers and Oscillators. Operational Amplifier. Delay lines. Some applications in nuclear electronics. Noise |
| **Phys315** | **Phys202** | **Low temperature physics vacuum technology** | **Low Temperature Physics:** Introduction - Joule Thomson effect - Regenerative cooling - Vacuum pumps - liquefaction of air - Hydrogen - Helium - Maintenance of low temperature -production of temperature below 1 K - Adiabatic demagnetization - Evaporative cooling of He-3 - Dilution refrigeration - Laser cooling - Nuclear demagnetization- The gas thermometer and it corrections - Specific heats - Rotational |

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| | | | specific heat of Hydrogen - Einstein"s and Debye"s theories -Schottky effect - Anomalies in specific heats at low temperature<br>**Vacuum Technology:** The nature of vacuum, history of vacuum. Pressure, temperature and general gas laws. Conductance, outgassing. Vacuum pumps, total pressure gauges, partial pressure gauges. Vacuum materials and components. Vacuum systems and selection criteria for system construction. Troubleshooting vacuum systems and leak detection. Cleaning methods and ecological aspects. Handling of clean equipment, clean benches, clean rooms etc. |
| **Phys316** | **Phys213** | **Principles of remote sensing** | Concept and foundations of remote sensing, Ideal remote sensing-System, Methodology, Resolutions-Spatial, Spectral, radiometric and temporal, Spectral signatures, Radiometric terms and definitions, Interactions of electromagnetic radiation with earth's surface and earth's atmosphere – application of remote sensing. |
| **Phys317** | | **Computational physics** | Example of problems in physics requiring computational approach; Basic computer architecture and latest advancements. Basics of Programming and Programming tools.Use of C or Python in physics and related problems, Data visualization and related. Error Analysis and Curve fitting .Error and Uncertainties. Error propagation. Curve fitting and introduction to data processing. Numerical Methods-Roots of algebraic and transcendental equations – iterative methods such as bisection method, inverse interpolation and Newton – Raphson method; Matrix algebra, solution of simultaneous linear equations by matrix inversion methods; Interpolation – linear interpolation, Lagrangian interpolation, Newton's interpolation; Numerical Integration and Differentiation ( Numerical Methods implemented using C or Python). Monte Carlo methods |
| **Phys318** | | **Semiconductor physics and devices** | The Crystal Structure of Solids -introduction to Quantum Mechanics-Introduction to the Quantum Theory of Solids - The Semiconductor in Equilibrium -Carrier Transport Phenomena -Nonequilibrium Excess Carriers in Semiconductors-The p-n Junction-The p-n Junction Diode-Metal-Semiconductor and Semiconductor-Heterojunctions-The Bipolar Transistor - Fundamentals of the Metal -Oxide-Semiconductor-Field-Effect Transistor -Metal-Oxide-SemiconductorField- Effect Transistor:Additional Concepts -The Junction Field -Effect Transistor-Optical Devices-Semiconductor Power Devices. |
| **Phys319** | | **Applied atomic spectroscopy** | Emission Spectroscopy-Analysis of Noble Metals Sample-Graphite Techniques - Metallic Samples- Comparison of Methods-Determination of Noble Metals in Other Metals and Materials .Graphite Electrode- Globule Arc- Determination of Noble Metals in Geologic Samples, Minerals,and Ores Normal Geochemical Analysis - Methods with Increased Sensitivity- Enrichment Techniques - New Developments in Spectral Analysis - Flame Techniques - FES, AAS, and AFS - Interferences- Single Elements in Solution-Analysis of Noble Metals- Determination of Noble Metals in Geologic Samples, Minerals, and Ores Flameless Techniques- Solid Fuel --Graphite Cuvette Graphite Rod. |
| **Phys320** | | **Crystallography and its applications** | Lattices-Two-Dimensional Lattices-Two-Dimensional Basis Vectors and Unit Cells-Two-Dimensional Transformations between Sets of Basis Vectors-Three-Dimensional Basis Vectors, Unit Cells, and Lattice Transformations-Conversion into Cartesian Coordinates- Crystallographic Directions -Crystallographic Planes and Miller Indices - Density -Revisiting Thermal Expansion and Isothermal Compressibility -Group Theory |

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| | | | -Symmetry Operations -The Reciprocal Lattice-Properties of X-Rays-Electron Density Maps. |
| **Phys321** | | **Nanomaterials and environmental applications** | Introduction to Nanomaterials: Properties and Applications.Carbon Nanotubes for Gas Sensing -Titanium Dioxide -Nanomaterials for Renewable Energy-Applications -Nanostructured Catalysts for Biomass Gasification Nanomaterials to Improve Bio-Oil from Biomass Pyrolysis-Iron-Based Nanomaterials for Fenton Reaction-Nanomaterials for Fuel Production -Photoelectrochemical Performance of Doped and Undoped $TiO_2$- Nanotubes for Light-Harvesting and Water Splitting Techniques. |
| **Phys322** | | **Nanomaterials and biodevices** | Nanomaterial types are covered, such as carbon nanotubes, nanobiomaterials, nano-magnetic materials, semiconductor materials and nanocomposites. Also, provides detailed coverage of key emerging technologies such as DNA nanotechnology and spintronics. |
| **Phys323** | | **Electric circuits** | Units and dimensions -Electric circuit elements - DC circuit analysis - Single phase AC circuits - Resonance - Nodal and mesh analysis - Transient analysis -Two-port networks -Duals and analogues -Thevenin/Norton equivalent circuits for both DC and AC cases in transient and steady states Capacitors and<br>Inductors- -Capacitors-Series and Parallel Capacitors- Inductors-Series and Parallel Inductors - Integrator Differentiator-Analog Computer- Comprehensive Problems - First-Order Circuits.<br>The Source-Free RC Circuit- The Source-Free RL Circuit- Singularity Functions Step Response of an RC Circuit<br>Step Response of an RL Circuit - First-Order Op Amp Circuits<br>Applications- Delay Circuits-Photoflash Unit-Relay Circuits. |
| **Phys324** | **Phys321** | **Ceramic materials** | Definition & scope of ceramics and ceramic materials, classification of ceramic materials – conventional and advanced ceramics, ceramics used in advanced applications, ceramics for medical and scientific products, ceramics for electrical and electronic, aerospace.Definition of glass, glass raw materials and their functions, elementary concept of glass manufacturing process specially for container glass, different types of glasses, application of glasses. |
| **Phys325** | | **Phase equilibria & diffusion of materials** | Thermodynamics of condensed systems and criteria for<br>equilibrium; phase rule; Gibbs free-energy diagrams and their relation to binary and ternary phase equilibrium diagrams; departures from equilibrium. Thermodynamics of interfaces; grain boundary and interphase-interfaces in solids; effects of interfacial energy on second-phase shape; effects of interfaces onphase stability; interface migration phenomena (e.g. recrystallization and graingrowth).Phenomenological and atomistic treatments; interstitial-and substitutional diffusion; Kirkendall effect; defects, defect reactions, and diffusion in ioniccompounds; activation energies for diffusion; diffusion couples; boundary conditions and appliedsolutions to the diffusion equation. |
| **Phys326** | **Phys321** | **Catalyts/sensors** | The basic principles of catalysis, including kinetics and mechanistic models. Heterogeneous and homogenous catalysis as weel as biocatalysis of relevance to renewable energy, e.g. artificial photosynthesis, and other relevant/representative |

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| | | | examples. The fundamentals of electrocatalysis and the effects of coupling proton and electron transfer for catalytic redox reactions.<br>Sensor Characteristics and Physical Effects: Active and Passive sensors - First and second order sensors – Physical effects involved in signal transduction- Photoelectric and Photo dielectric effect-Photoluminescence - Electroluminescence – chemiluminescence effect – Doppler effect – Barkhausen effect – Hal effect – Ettinshausen effect – Thermoelectric effect – Peizoresistive effect – Piezoelectric effect – Pyroelectric effect –Magneto-mechanical effect (magnetostriction) – Magneto resistive effect. Types of sensors (e.g. thermal sensors) |
| **Phys327** | | **Micro/nano electrochemical systems** | Development of microelectronics - Region of Nanostructures - methods and limits on microminiaturization in semiconductors- micro electro mechanical systems.Silicon micromachining- semiconductors and insulators- Microsystems fabrication techniques - Silicon MEMS fabrication technology - Single crystal reactive etching and metallization process.Non-silicon MEMS and fabrication techniques - SIC MEMS - Biomedical-MEMS techniques - Integration of microsystems with electronics – RF MEMS – Applications-Polymers in Microsystems - Packaging of MEMS devices by anodic/fusion bonding - Pressure sensors and packaging - MEMS performance and evaluation. Nano electro mechanical systems - fabrication and process techniques - Integration of nanosystems and devices - applications and future challenges. |
| **Phys328** | | **Electrochemical processing of materials** | Electrolytes-Structure and Bonding-Electrode Potentials- Ad-Atoms and Underpotential Deposition-Mass Transport-Charge Transfer-Nucleation and Growth of Metals-Deposition of Alloys-Oxides - Semiconductors-Corrosion - Corrosion Protection-Intrinsically Conducting Polymers. |
| **Phys329** | | **Solar Energy** | Solar Resources-Sun–Earth Geometric Relationship-Equation of Time-Structure of the Sun-Electromagnetic Radiation-Solar Spectral Distribution-Solar Constant-Extraterrestrial Solar Radiation-Terrestrial Solar Radiation-Measurement of Terrestrial Solar Radiation-Terrestrial Insolation on Tilted Collectors.<br>Fundamentals of Engineering: Thermodynamics and Heat Transfer-Conduction Heat Transfer-One-Dimensional Conduction Heat Transfer in a Rectangular Coordinate-Thermal Resistance Circuits-One-Dimensional Conduction Heat Transfer in a Cylindrical Coordinate-Convection Heat Transfer-Radiation Heat Transfer-Introduction to Thermodynamics-Solar Thermal Systems and Applications-Solar Collectors-Tracking Systems-Solar Thermal Systems-Photovoltaic Cells by Jeanette Moore-Crystal Structure-Cell Physics-Energy Bands-More about Electrons and Their Energy-Electrons and Holes-Direct and Indirect Band-Gap Materials-Doping-Transport-Generation and Recombination-The p–n Junction-Solar Cell Equations-Characterization-Efficiency. |
| **Phys330** | | **Laser optics** | Laser operaion and characteristic, Different types of lasers, Laser applications in science and technology, ABCD meterices, aberraions, Optical instrumentation, Interferometery, Holography, Polarizedlight, Feresnal diffraction, Multilayer films, Fiber optics, Nonlinear optics, Optical properties of materials, as awell as Fourier optics. |
| **Phys331** | | **Laser physics and technology** | Lasers: An Introduction-Basics of Nonlinear Optics-Gas Lasers -Diode-Pumped Solid-State Lasers and Intracavity-Frequency Conversion-Semiconductor Lasers: Basics and |

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| | | | Technology-Fiber Lasers -Free Electron Lasers -Lasing in Random Amplifying Media -Hema Ramachandran -Terahertz Transients: Generation and Applications-Phase-Shifting Laser Interferometry for Measurement-of Surface Form Error-Lasers in Materials-Processing -Biomedical Applications of Lasers. |
| **Phys332** | | **Nuclear energy** | Energy. Atoms and Nuclei. Radioactivity. Nuclear Processes. Radiation and Materials. Fission. Fusion. The History of Nuclear Energy. Particle Accelerators. Biological Effects of Radiation. Radiation Protection. Radiation Detectors. Information From Isotopes. Useful Radiation Effects. Isotope Separators. Neutron Chain Reactions. Nuclear Heat Energy. Nuclear Power Plants<br>Reactor Theory Introduction. Time Dependent Reactor Behavior. Reactor Safety and Security. Nuclear Propulsion and Remote Power. Radioactive Waste Disposal. Nuclear Energy Future- Breeder Reactors- Fusion Reactors- Nuclear Weapons. |
| **Phys333** | | **Biomass conversion technology** | Biomass types-Wood and agricultural products -Solid waste-Landfills-Biogas-Alcohal fuel-Biomass properties and haracterization- Biomass composition- Typical biomass composition- Biomass conversion process- Thermal conversion- Direct combustion-Co-firing-Pyrolysis- Torrefication- Gasification -Biochemical processing-Anaerobic digestion- Fermentation- Biofuels- Combined Biogas and Bioethanol Production-Advantages and disadvantages of biomass utilization- Biomass projects worldwide-Commercialization and technology risks- Energy related environmental issues. |
| **Phys334** | | **Biofuels and biomass** | Biofuels and Bioenergy- .Opportunities and challenges in industrial production of biofuels- Biomass into Biofuels and Bioenergy-Technology to convert biomass to biooil: Challenges and opportunity- .Nonwaste technology in the bioethanol and biodiesel industries .Importance of nanocatalyst and its role in biofuel production. |
| **Phys335** | | **Electric power generation** | Electric power generation: nonconventional methods-Electric power generation: conventional methods-Transmission system-Distribution systems-Electric power utilization-Power quality. |
| **Phys336** | | **Green technology** | Theory: Green engineering and environmentally conscious manufacturing; infrastructure; regulations and the waste stream; new theories for environmental regulation; design for the environment; recycling issues; plastics for environmentally conscious engineering. Part 2 Design examples: design for assembly and disassembly; design for environmentally friendly vehicles; design for manufacturing process improvement; design for quality application in machining; life cycle analysis and maintainability; multiattribute utility analysis of municipal recycling. |
| **Phys337** | | **Introduction to nanoscience** | Nanotools-Characterization- Methods-Characterization of Nanomaterials-Electron Probe Methods-Scanning Probe Microscopy Methods-Spectroscopic Methods-Nonradiative and Nonelectron Characterization Methods-Fabrication Methods-Fabrication of Nanomaterials-Top-Down Fabrication-Bottom-Up Fabrication-Computational Chemistry and Molecular Modeling- Materials, Structure, and the Nanosurface-Importance of the Surface-Engineering Materials-Particle Shape and the Surface-Surface and VolumeAtomic Structure-Particle Orientation- Energy at the Nanoscale-Surface Energy-Basic Thermodynamics-Liquid State-Surface Energy (and Stress) of Solids-Surface Energy Minimization Mechanisms- Nanothermodynamics-hermodynamics and Nanothermodynamics-Classical Equilibrium Thermodynamics- |

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| | | | Statistical Mechanics-Other Kinds of Thermodynamics-Nanothermodynamics-Modern Nanothermodynamics- Chemical Interactions at the Nanoscale-Bonding Considerations at the Nanoscale-Electrostatic Interactions-Hydrogen Bonding-Van der Waals Attractions-Hydrophobic Effect. |
| **Phys338** | | **hydroelectric Power** | Hydropower history and the design of a hydropower station. Dams, spillways and waterways. Meteorology and hydrology. Applied fluid dynamics. Hydraulic losses, torque on a runner blade. Turbine and draft tube. Electrical generators, the generator on the grid. Transmission of electrical power. Hydraulic transients; water hammer and surges. Regulation and dynamics. Environment and laws. Marine current power. Pumped storage hydropower. Production planning. A large scale project (eg newbuilding / renovation of a larger power station). |
| **Phys340** | | **Nanomaterials** | What is Nanotechnology?" Nanotechnology – An Introduction-Materials Synthesis, Fabrication and Surface Energy- Basic Metrology and Nanomaterials Characterization techniques- Nanomaterial Examples (0, 1, 2, etc. dimensional material classification) – Size-Dependent- Chemical & Physical Properties- Implications, Ethics, & Safety of Nanomaterials- Applications of Nanomaterials. |
| **Phys341** | | **Gas sensors** | Fundamentals of semiconductor gas sensors-Conduction mechanism in semiconducting metal oxide sensing films<br>The effect of electrode-oxide interfaces in gas sensor operation<br>Introduction to semiconductor gas sensors- One- and two-dimensional metal oxide nanostructures for chemical sensing<br>Chapter Six. Hybrid materials with carbon nanotubes for gas sensing Carbon nanomaterials functionalized with macrocyclic compounds for sensing vapors of aromatic VOCs-Luminescence probing of surface adsorption processes using InGaN/GaN nanowire heterostructure arrays- Rare earth–doped oxide materials for photoluminescence-based gas sensors-Part Three. Methods and integration-Recent progress in silicon carbide field effect gas sensors-Semiconducting direct thermoelectric gas sensors<br>Dynamic operation of semiconductor sensors Micromachined semiconductor gas sensors-Integrated CMOS-based sensors for gas and odor detection. |
| **Phys342** | | **Fluid Mechanics** | Fundamental Concepts-Fluid Statics-The Principles Governing<br>The Momentum Equation-Physical Similarity and Dimensional Analysis-Laminar Flow Between Solid Boundaries-Flow and Losses in Pipes and Fittings-Boundary Layers, Wakes and other Shear Layers-The Flow of an Inviscid Fluid-Flow with a Free Surface-Compressible Flow of Gases-Unsteady Flow-Fluid Machines-Fluid Mechanics in a Changing World |
| **Phys343** | | **Soft matter and biomaterials** | Self-assembly and Structure in Soft Matter. Liquid Crystals. Surfactants. Polymers. Colloidial Materials. Soft Biological Materials. |
| **Phys344** | | **Materials for energy applications** | Piezoelectricity of 2D materials and its applications toward mechanical energy harvesting-Two-dimensional metal oxide nanomaterials for sustainable energy applications- Graphene-based hybrid materials for advanced batteries-D materials as the basis of supercapacitor devices-Organometallic hybrid perovskites for humidity and gas sensing applications-Vacancy formation in 2D and 3D oxides-D materials for smart energochromic sunscreen devices-D thermoelectrics-Hydrogen storage in 2D |

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| | | | and 3D materials-D nanomaterials for electrokinetic power generation D materials for solar fuels production-Application of two-dimensional materials for electrochemical carbon dioxide reduction. |
| **Phys345** | **Phys217** | **Analytical mechanics** | Canonical formalism: Hamiltonian. Canonical equations. Phase portraits. Canonical transformations. Poisson brackets and conservation laws. Liouville's Theorem. Hamilton-Jacobi method: Hamilton-Jacobi equation. Separation of variables. Action-angle variables. Adiabatic invariants.Qualitative behaviour of Hamiltonian systems: Canonical perturbation theory. Chaotic and integrable systems. Kolmogorov-Arnold-Moser Theorem. Chaos in the Solar system. Example of integrability: Calodgero-Moser system. |
| **Phys346** | | **Solar,wind and marine energy** | Energy Review; Electric Power Basics- Distributed Generation-Wind Energy- Solar Energy, Solar Thermal Energy Systems-Photovoltaic System-Marine Energy I – Tidal, Wave, Marine Kinetic Energy Systems- Marine Energy II – Offshore Wind Energy, Ocean Thermal Energy- Energy Storage, Batteries and Fuel Cells. |
| **Phys348** | | **Nanomaterials & environmental applications** | Applications of Nanomaterials in Environmental Remediation - Multifunctional Nanomaterials for Environmental Remediation-Carbon Nanotubes in Wastewater Remediation- Magnetic Nanomaterials for Wastewater Remediation- Silica Nanomaterials for Water Remediation- Aluminosilicate-Based Adsorbents for Removal of Water Contaminants: Advanced Statistical Physics Models-Antimicrobial Nanomaterials for Water Disinfection. |
| **BPhy301** | | **Bio-statics** | Descriptive Methods for Categorical Data for Continuous Data Probability and Probability Models- Estimation of Parameters- Introduction to Statistical Tests of Significance- Comparison of Population Proportions- Comparison of Population Means- Analysis of Variance- Regression Analysis- Logistic Regression- Methods for Count Data- Methods for Repeatedly Measured Responses- Analysis of Survival Data and Data from Matched Studies. |
| **BPhy302** | | **Basic of nuclear physics and radiobiology** | Structure of Matter. Radioactive Decay-Kinetics of Radioactive Decay-Statistics of Radiation Counting-Production of Radionuclides-Interaction of Radiation with Matter-. Gas-Filled Detectors-. Scintillation and Semiconductor Detectors-Gamma Cameras-Performance Parameters of Gamma Cameras-Digital Computers in Nuclear Medicine-. Single Photon Emission Computed Tomography-Internal Radiation Dosimetry-Radiation Biology.-Radiation Regulations and Protection. |
| **BPhy303** | | **Principles of genetic engineering** | explains the biological and chemical principles of recombinant DNAtechnology ... emphasizes techniques used to isolate and clone specific genes frombacteria, plants, and animals, and methods of scaling-up the formation of the geneproduct for commercial applications - analyzes problems encountered in scaling-upthe microprocessing of biochemical procedures . includes an extensive glossary andnumerous illustrations identifies other resource materials in the field and more.Presenting the fundamentals of biochemistry and molecular biology to workers andstudents in other fields, this state-of-the-art reference/text is essentiai reading fortechnologists in chemistry and engineering; biomedical, chemical, electrical andelectronics, industrial, mechanical, manufacturing, design, plant, control, civil, genetic,and environmental engineers; chemists, botanists, and |

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| | | | zoologists; and advancedundergraduate and graduate courses in engineering, biotechnology, and industrialmicrobiology. |
| **BPhy304** | | **Biophysical techniques in diagnosis and physical therapy** | Suitability of Biodosimetry - Specific Requirements for BiD-Indicators of Radiation Exposure- BIOLOGICALINDICATORS<br>- Haematological Indicators - Bone marrow cells - Blood cells<br>Germ Cell Indicators - Immunological Indicators - Lymphocyte subpopulations - Immunoglobulin production by lymphocytes Lymphocyte stimulation - Mixed lymphocyte culture - Membrane Biomarker Indicators - Cytological Indicators - Chromosomal aberrations -Mieronuclei . Genomic Indicators - Fluorescence in situ hybridization (FISH) - Mutation expression - Glycophorin A locus -(ii) T-cell receptor genes - H P R T locus -Human leukocyte antigen - Body Fluid Indicators (a) Urine metabolites (b) Blood biochemicals -(c) Saliva Other Indicators (a) Hair (b) Skin 1. Electron Spin Resonance (ESR). Nuclear Magnetic Resonance (NMR)-. Optically Stimulated Luminescence (OSL ) -. Neutron Activation Analysis (NAA) - Lyoluminescence (LL )- Thermoluminescence (TL ) -IV. OTHER USEFUL-Molecular Techniques (a) DNA probes (b) Direct mutational spectra. Physical Techniques |
| **BPhy305** | | **Electrodynamics and its biological applications** | From simple morphologi cal concepts of cells as the essential units of living matter there has been an ever-sharper focus on functional organization of living systems, with emphasis on molecular dynamics. Thus, life forms have come to be defined increasingly in terms of metabolism, growth, reproduction and responses to environmental perturbations. Since these properties occur in varying degrees in systems below the level of cellular organization, there has been a blurring of older models that restricted the concepts of life to cellular systems. At the same time, a search has begun for elemental as pects of molecular and atomic behavior that might better define properties common to all life forms. This search has led to an examination of nonlinear behavior in biological macromolecules, whether in response to electrical or chemical stimulation, for example, or as a means of signaling along a molecular chain, or as a means of energy transfer. Experimental knowledge in this area has grown rapidly in the past decade, and in some respects has outstripped theoretical models adequate to ex plain these new observations. Nevertheless, it can be claimed that there is now an impressive body of experiments implicating non linear, nonequilibrium processes as fundamental steps in sequential operations of biological systems. |
| **BPhy306** | | **Bioelectronics** | Electron Transfer Through Proteins- Reconstituted Redox Enzymes on Electrodes: From Fundamental-Understanding of Electron Transfer at Functionalized Electrode-Interfaces to Biosensor and Biofuel Cell Applications- Application of Electrically Contacted Enzymes for Biosensors- Electrochemical DNA Sensors- Probing Biomaterials on Surfaces at the Single Molecule Levelfor Bioelectronics- Interfacing Biological Molecules with Group IV Semiconductorsfor Bioelectronic Sensing-Biomaterial-nanoparticle Hybrid Systems for Sensing<br>and Electronic Devices- DNA-templated Electronics- Single Biomolecule Manipulation for Bioelectronics. |
| **BPhy307** | | **Brachytherapy dosimetry** | Photon source characteristics -- Clinical use and dosimetry systems-Dose distribution around sources- Dose specification and reportingSource commissioning - Dose |

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| | | | calculation procedures -Commissioning of brachytherapy computer TPSs- Quality assurance - Brachytherapy versus external beam radiotherapy. |
| **BPhy308** | | **Human anatomy** | Bones-Sutures, joints and ligaments -Muscles--Muscles, synovial bursae and sheaths -Digestive system-Digestive and respiratory system -Urogenital system-Peritoneum -Endocrine glands-Heart –Arteries-Veins-Lymphatic system -Spleen, meninges-Meninges -Spinal cord-Brain-Cranial nerves -Spinal nerves -Autonomic nervous system -Sense organs-Skin and its appendages. |
| **BPhy309** | | **Neurophysiology** | Basic Neurophysiology And An Introduction To Analysis Of Electrophysiologic Waveforms- Electrophysiologic Assessment Of Neural Function- Brain Stem Auditory Evoked-Potentials in Central Disorders- Visual Evoked Potentials-Compound Muscle Action Potentials- Assessing The Neuromuscular Junction With Repetitive -Stimulation Studies- Motor Evoked Potentials- Autonomic Physiology. |
| **BPhy310** | | **Biophysics of hearing and vision** | Introduction to Waves: Vibrations, the Trigger Effect and Information<br>The Ear: Parts of the Ear, Other Ears, the Non-acoustic Labyrinth, and the Sound Spectrum The Eye: The Electromagnetic Spectrum<br>Wave Properties: Mirrors, Butterflies, Rainbows, and Diamonds<br>Hearing: Sound Intensity, Tones, and Musical Instruments<br>Vision and the Perception of Light and Color: Light Intensity, Blindness Prevention, Cataracts, Color, and Color Blindness. |
| **BPhy311** | | **Magnetic properties of biomolecules** | The effect of magnetic fields on living cells - detection of the magnetic field by animals - growth in magnetic fields - wrapping of large particles under the magnetic field - membranes and micelles under the magnetic field - arranged biological particles - outer pieces of retinal cylinders - systems containing chloroplasts - various biological particles. |
| **BPhy312** | | **Advanced Bio-optics** | Rayleigh Theory and Mie Theory for a Single Scatterer- Monte Carlo Modeling of Photon Transport in Biological Tissue- Convolution for Broadbeam Responses-Radiative Transfer Equation and Diffusion Theory- Hybrid Model of Monte Carlo Method and Diffusion Theory- Sensing of Optical Properties and Spectroscopy-Ballistic Imaging and Microscopy- Optical Coherence Tomography- Mueller Optical Coherence Tomography- Diffuse Optical Tomography- Photoacoustic Tomography-Ultrasound-Modulated Optical Tomography. |
| **BPhy313** | | **Cellular Biophysics** | Importance of biological membranes, cell protection, selective contact with the medium, storage of materials inside compartments inside the cell, electrochemical transmission system, biomembrane dating. Molecular composition of biological membranes: liquid model, mosaic dynamic model of biological membrane, laboratory manufactured models of biological membranes, mono-lipid membrane on the surface of water, air, liposomes, black lipid membrane. Transmembrane permeability and transmission: the effect of both temperature and the effect of kinetic stress on the permeability, permeability channels within the cell membrane. Liposomes as carriers of drugs and genes. |
| **BPhy314** | | **Technology of drug** | Biochemistry Research- Biosafety systems- DNA-- Diagnosis of genetic diseases- The technique of nanoparticles- Diagnosis and treatment of cancer by biotechnology-Manufacture of insulin by biotechnology- Bioethics and national experience- |

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| | | **&biomolecules carrier system** | Different methods of preparing liposomes - Characteristics of liposomes in terms of size distribution - Stability when storing and leakage of molecules from inside - Detailing the double membrane of liposomes and preparing phantom liposomes - Interaction of the lipid membrane with blood cells and protein - Targeting liposomes loaded with immune bodies - Targeting sensitive liposomes as carriers of medicinal drugs. |
| **BPhy315** | | **biophysical calculations** | Study of different models, one-chamber model, two-chamber model, models on differential equations, models based on differential equations, enzyme kinetic models, matching models with practical results, simulation by Monte Carlo method, Monte Carlo simulation applications in biophysics. |
| **BPhy316** | | **Bio modeling & Simulation** | Biological Modeling and Simulation is intended to fill that gap by teaching students how to reason about developing formal mathematical models of biological systems that are amenable to computational analysis. It collects in one place a selection of broadly useful models, algorithms, and theoretical analysis tools normally found scattered among many other disciplines. It thereby gives the aspiring student a bag of tricks that will serve him or her well in modeling problems drawn from numerous subfields of biology. These techniques are taught from the perspective of what the practitioner needs to know to use them effectively, supplemented with references for further reading on more advanced use of each method covered. |
| **BPhy317** | | **Alternative biophysics materials** | For metals used in Al-Badayl Al-Badailyat: Al-Ma'aden, Al-Sayramik, Albolymerat, and its chemical properties and their chemical composition: Electrical properties of animal materials-Alternatives: Study of Electrical Properties in the Asymmetrical Aspects (Electrostatics - Molecular - Atalaeal Relatives and Claasius and Mosai - Theory of Thabam Insulation and Molecular Weight.) General Theory of Relaxation. Tareq is different for the measurement of electrical properties (for example, the insulators, resistors, etc.) Alternative materials. Mechanical Properties of Alternative Biomaterials The basic properties of the materials used, hardness measurement, fracture, stress, talc with stress,General properties of materials used in alternative materials. Response of tissue and body after the process of replacement joints and organs, reaction of alternative material bone marrow,Study of how the surface of the separator is formed. Natural bone and alternative organ fixation cause the collapse of the papillae. Applications applied to metals as a powder,Alternative, body interactions with metals, polymers and ceramics. |
| **BPhy318** | | **Biotechnology** | Genomics: Prediction Expression Analysis and Target Validation of Bacterial Small RNAs- Genome Editing3 Silencing Human VCAM 1 Gene- In Silico Analysis of Human AGTR1 Geneand Precision Medicine Among Hypertensive Population - Bionanotechnology and Drug Designing-In-Silico Drug Designing: Transition to Modern-Day-Drug Discovery - Nanocarriers in Drug and Gene Delivery - Nano-based Delivery System for Nutraceuticals:The Potential - Chitosan Nanoparticles as Carrier for Anticancer Drugs: Metallic Nanoparticles: Potential Antimicrobial and Therapeutic - Application ofNanotechnology forCancer Treatment - Biotechnology in Diagnostics & Therapeutics- Food and environment nanotechnology- Biotechnological techniques. |
| **BPhy320** | | **Ionizing Radiation Sources** | Electrical properties through tissues and cells - physical basics of vital electrical potentials - stable electrical potentials - biological cell responses as a result of tissue |

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| | | | agitation - microelectrodes, their uses and applications. Radiation effects of radiation: Direct response to radiation doses - Radiation effects: Acute effect - Blood changes - Blood system symptoms - Digestive system symptoms - Central nervous system symptoms - Late effects: Cancer - Leukemia ) – Bone cancer - Lung cancer - Biological effects: Risk and toxicity - Time period - Cataract - Risk assessment - Relative biological effects - QF Correlation coefficient - Equivalent dose - Radiation reagents - Particle counting devices - Gas filled counter - -Counter To fit the-counter Gejr- time measuring Chapter Alvsal- time-meter Fluorescence spectroscopy, Neutron spectroscopy, Cycloph detectors, Semiconductor detectors, Dosimeters, Pocket scale, Films, Thermodynamic thermometer, Ion flow chamber, Nitron measurement, Neuron interactions, Neutron counter. |
| **BPhy322** | | **Medical Radiation Protection** | Units of measurement - the weighted factor of the radiation - the equivalent dose - the acquired effective dose - the mass equivalent dose - the collective effective dose - the objectives of radiation protection - the international permissible limits for workers and the public - the risks of external radiation exposure - the effect of time (exposure period), distance and protective barriers to radiation sources Gamma and Neutron Sources- Primary and secondary protective barriers for x-ray devices - internal radiation exposure risks - pathways for entry of radioactive materials into the body - permissible limits for the strength of radioactive elements inside the body - control of the risks of radioactive contamination. Safety of radiation sources - security of radiation sources - verification of radiation protection and safety and security of sources - radiation protection in occupational exposure - radiological protection in medical exposure - radiation protection in public exposure - radiation protection in exposure to naturally occurring radioactive materials - rules for the safe disposal of radioactive waste - Radiation protection in exposure to naturally occurring radioactive materials. Rules for safe disposal of radioactive wastes. |
| **Phys401** | **Phys302** | **Cosmic rays and elementary particles** | Historical Introduction to the Elementary Particle, The Classical ERA, The Photon, Mesons, Antiparticles, Neutrinos, Strange Particles, The Eightfold Way, The Quark Model, The November Revolution and Its Aftermath, Intermediate Vector Bosons, The Standard Model, The Four Force, Decays and Conservation Law, Symmetries, Feynman rules. |
| **Phys402** | **Phys311** | **Solid state physics (2)** | Fundamentals of band theory: Schrödinger equation for a solid. Hartree-Fock approximation. Bloch theorem. Kroing and Penney model. Electron in periodic field. Nearly free electron model. Tightly bound Electron approximation. Effective mass approximation.<br>Quantum theory of diamagnetism and paramagnetism. Ferromagnetic and anti-ferromagnetic order. Ferromagnetic domains and hysteresis. Magnetic Relaxation and Resonance phenomena.<br>Quantum theory of lattice vibrations and phonons. Anharmonic effects and thermal expansion of solids. Deformed energy bond in strong fields Galvano-Magnetic effect. |
| **Phys403** | **Phys301** | **Quantum physics (2)** | The Harmonic Oscillator in One Dimension 1.13 Delta Function Potentials in One Dimension - Harmonic Oscillator Solution with Operators -More Fun with Operators -Two Particles in 3 Dimensions -Identical Particles -Some 3D Problems Separable in Cartesian Coordinates - Angular Momentum - Solutions to the Radial Equation for Constant Potentials- Hydrogen -Solution of the 3D HO Problem in Spherical |

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| | | | Coordinates - Matrix Representation of Operators and States - A Study of $\ell = 1$ Operators and Eigenfunctions- Spin 1/2 and other 2 State Systems- Quantum Mechanics in an Electromagnetic Field - Local Phase Symmetry in Quantum Mechanics and the Gauge Symmetry - Addition of Angular Momentum - Time Independent Perturbation Theory - The Fine Structure of Hydrogen - Hyperfine Structure -The Helium Atom - Atomic Physics - Molecules - Time Dependent Perturbation Theory - Radiation in Atoms - Classical Field Theory The Classical Electromagnetic Field - Quantization of the EM Field |
| **Phys404** | **Phys304** | **Material science (2)** | Classification and Selection of Materials-Atomic Structure, and Electronic Configuration-Crystal Geometry, Structure and Defects Bonds in Solids-Electron Theory of Metals-Photoelectric Effect- Diffusion in Solids-Mechanical Properties of Materials and Mechanical Tests-Alloy Systems, Phase Diagrams and Phase Transformations-Heat Treatment-Deformation of Materials- Oxidation and Corrosion-Thermal and Optical Properties of Materials-Electrical and Magnetic Properties of Materials- Semiconductors-Superconductivity and Superconducting Materials-Organic Materials: Polymers and Elastomers- Composites-Nanostructured Materials. |
| **Phys405** | | **Practical physics (5)** | Op-Amp as non-inverting-Op-Amp as comparator<br>Op-Amp in oscillator circuit 555 IC-logic gates<br>Half adder circuit-D flip flop-Octal latch |
| **Phys406** | | **Practical physics (6)** | Hall effect -Hysteresis Loop -Energy gap- THE FRANCK-HERTZ EXPERIMENT- Fabry-Perot experiment- Geissler tubes- The Power of LED- Energy transformation. |
| **Phys407** | **Phys301** | **Nuclear physics (2)** | Leptons and the electromagnetic and weak interactions -The electromagnetic interaction - The weak interaction-Mean life and half life - Leptons - The instability of the heavy leptons: muon decay- Parity violation in muon decay-Problems Nucleons and the strong interaction - Properties of the proton and the neutron - The quark model of nucleons-The nucleon±nucleon interaction: the phenomenological - description - Mesons and the nucleon±nucleon interaction The weak interaction: - decay More quarks - The Standard Model of particle physics -Nuclear sizes and nuclear masses - Electron scattering by the nuclear charge distribution Muon interactions - The distribution of nuclear matter in nuclei -The masses and binding energies of nuclei in their ground states - The semi-empirical mass formula - The - stability valley -The masses of the -stable nuclei - The energetics of -decay and emission Nuclear binding and the nucleon±nucleon potential - Ground-state properties of nuclei: the shell model - Nuclear potential wells - Estimates of nucleon energies Energy shells and angular momentum - Magic numbers - The magnetic dipole moment of the nucleus - Calculation of the magnetic dipole moment - The electric quadrupole moment of the nucleus - Alpha decay and spontaneous emssion Energy release in -decay The theory of -decay Spontaneous emission -Excited states of nuclei . |
| **Phys408** | **Phys301** | **Dielectric and electrical properties in solids** | Review of basic formulas, the dielectric constant and polarization: the local field, sources of polarizability, dipolar polarizability, dipole dispersion, dipole polarization of solids, ionic polarizability, electronic polarizability, Ferroelectricity. |

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| **Phys409** | **Phys304** | **Nanoscience and applications** | What nanoscience is? The size and shape dependent properties at the nanometer scale Enhanced physical properties of nanomaterials What nano particles are and how it is used currently? Novel applications of nanotechnology in electronic, magnetic, biomedicine, energy, and environmental fields. |
| **Phys410** | | **Acoustic optics** | Bulk-Wave Acousto-Optic Bragg Diffraction- A Simple Experiment - Historical Perspective - Heuristic Picture - Parametric Excitation and Bragg Diffraction - A Quantum-Mechanical Point-of- View- Wave Theory- A Sample Calculation - The Reflection Case- Birefringent Bragg Diffraction. Acousto-Optic Materials - Optical Waveguides - Theory and Technology- Wave Equations and Wave Vectors .Zigzag-Wave Model -The Potential-Well Model-Mode Equations of a Slab Waveguide - Mode Equations of a Channel Waveguide - Effective-Index Method - Diffused Waveguides and the WKB Method - Waveguide Materials – Glass-Semiconductor -Lithium Niobate -Channel Waveguides - Ridge and Metal-Clad Channel Waveguides-Coupling to a Dielectric Waveguide -Fiber-Waveguide Coupling . |
| **Phys411** | **Phys212** | **Microwaves** | Microwave Frequency Bands-Advantages-Components of Microwave System-Applications-Health Hazards-Fundamentals of Wave Propagation-Basic Equations and Parameters-Nature of Media-Wave in Lossless Media-Wave in Lossy Media-Conductors and Dielectrics-Polarisation-Depth of Penetration-Surface- Impedance-Poynting Theorem-Reflection and Refraction-Direction Cosines, Wavelength and Phase Velocity-Classification of the Cases of Reflection-Normal Incidence Cases-Oblique Incidence-Parallel Plane Guide-Transverse Waves-Characteristics of TE and TM Waves-Transverse Electromagnetic Waves-Wave Impedances-Attenuation in the Walls of Parallel Plane Guide-Transmission Lines-Equations Governing Transmission Line -Applications of Transmission Lines-Types of Transmission Lines- The Smith Chart-Characteristic Parameters of a Uniform Transmission Line. |
| **Phys412** | **Phys304** | **superconductivity** | A Brief Overview About Superconductivity. Superconducting Material. Electrodynamics of Superconductivity. Thermodynamics of Superconductivity. Ginzburg-Landau Theory. BCS Theory. Weak Links and Josephson effect. Small- and Large-Scale Applications of Superconductivity. |
| **Phys413** | **Phys201** | **Nuclear & Mossbaur spectroscopy** | Nuclear Resonance- Synchrotron Radiation - Historical Development - Scientific Dreams - Technical - Political Facts - First Results—The Needle in the Haystack - Techniques in NRS Synchrotron Mössbauer Source - Synchrotron Radiation Based Mössbauer-Spectroscopy -Nuclear Forward Scattering -ynchrotron Radiation Based Perturbed Angular- Time Interferometry and Rayleigh Scattering - Inelastic Scattering - Other Techniques - Hyperfine Spectroscopy -absorption - Dynamical Beats - Quantum Beats - Structural Dynamics - Quasi-elastic Dynamics - Phonon Density of States - Experimental Details - X-Ray Optics<br>Detectors - Sample Environment . |
| | **Phys302** | **Neutron and reactor physics** | Nuclear Reactions- Nuclear Reaction Fundamentals- The Curve of Binding Energy-Fusion Reactions- Fission Reactions- Fissile and Fertile Materials- Radioactive Decay.Neutron Interactions- Neutron Cross Sections- Neutron Energy Range- Cross |

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| **Phys414** | | | Section Energy Dependence- Neutron Scattering- Neutron Distributions in Energy- Nuclear Fuel Properties- Neutron Moderators- Neutron Energy Spectra- Energy-Averaged Reaction Rates- Infinite Medium Multiplication: The Power Reactor Core- Core.Composition- Fast Reactor Lattices- Thermal Reactor Lattices- Reactor Kinetics- Neutron Balance Equations- Multiplying Systems Behavior- Delayed Neutron Kinetics- Step Reactivity Changes- Prolog to Reactor Dynamics- Spatial Diffusion of Neutrons- The Neutron Diffusion Equation- Non-multiplying Systems. |
| **Phys415** | **Phys201** | **Detectors and accelerators** | Detectors: General Properties of Radiation Detectors. Ionization Chambers. Proportional Counters. Giger–Muller Counters. Scintillation Detectors, Radiation Spectroscopy with Scintillators. Semiconductor Diode Detectors. Germanium Gamma Ray Detectors, Lithium-Drifted Silicon Detectors. Slow Neutron Detection Methods. Miscellaneous Detector Types.<br>Accelerators: Ion Source. Electrostatic Accelerators. Cockcroft-Walton Accelerator, Van de Graaff Accelerator, Tandem Van de Graaff Accelerator. Magnetic Resonance Accelerator, Cyclotron Accelerators, Synchrocyclotron Accelerators and Synchrotron Accelerators. Linear Accelerators. Colliding Beam Accelerators. |
| **Phys416** | **Phys401** | **Introductory to Astrophysics (2)** | The structure of our galaxy, the interstellar medium, star clusters, properties of external galaxies, clusters of galaxies, active galactic nuclei, and cosmology. |
| **Phys417** | | **String theory** | Mathematically inclined monographs about string theory<br>Mainstream physics monographs- More elementary- More advanced- Physics lecture notes- Popular level books and string propaganda- Big mathematically inclined surveys |
| **Phys418** | | **Physics of thin films** | Thermostatistics (review of thermodynamics of pure systems- partition functions - statistical mechanics of vapor systems- mean free path and vapor flux). Vacuum Technology (pumping and pumping systems- conductance- vacuum gauges). Methods of preparation of thin films (electrochemical- vacuum evaporation- sputtering- MBE- CVD- mashing and micro fabrication). Film formation (Nucleation- Capillary theory of nucleation- atomistic theory of nucleation- growth modes- 3 D nanostructures by shadowing growth). Film characterization (RHEED- LEED- XRD- STM- SEM- AES- FIM- AND RBS). |
| **Phys419** | | **Magnetic resonance** | Equations of Bloch. Radiation interaction with spin systems. Spin Lattice relaxation, spin-spin relaxation, strong electron dipole interaction, strong electron dipole interaction. Hamiltonian. Fine structure and Hyperfine structure, line shape and line width. Magnetic resonance spectrometers. Magnetic resonance in gasses and liquids. Magnetic resonance of free electrons in metals and semiconductors. Defect centers, and free radicals in solids. Magnetic resonance imaging techniques. Application of magnetic resonance to materials having special properties. |

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| **Phys420** | | **Advanced nuclear techniques** | Physical and chemical properties of actinides in nuclear fuel reprocessing- Physical and chemical properties of actinides in nuclear fuel reprocessing - Chemical engineering for advanced aqueous radioactive materials separations- Spectroscopic on-line monitoring for process control and safe guarding of radiochemical streams in nuclear fuel reprocessing facilities- Safe guards technology for radioactive materials processing and nuclear fuel reprocessing facilities- Safe guards technology for radioactive materials processing and nuclear fuel reprocessing facilities. |
| **Phys421** | | **Selected topics in physics** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| **Phys422** | | **Nanostructured materials and processing** | Introduction and Background-Phenomenology of Nanostructure Formation Chemical Synthesis of Nanostructured Particles and FilmsParticles- Films and Coatings- Synthesis of Nanostructured Materials by Inert-Gas Condensation Methods- Classification- Evaporation Techniques- Particle Transport- Particle Collection- Nucleation and Growth- Limitations of the Classical Nucleation Theory- Crystal Structure and Morphology- Influence of Process Variables on Particle Size- Advantages of IGC- Drawbacks of IGC- Recent Developments in IGC-Thermal Sprayed Nanostructured Coatings: Applications and Development- Thermal Spray Technology- Nanostructured Materials and Composites Prepared by Solid State Processing - High-Energy Ball Milling and Mechanical Attrition- Phase Stability at Elevated Temperatures- Diffusion in Nanocrystalline Materials. |
| **Phys423** | | **Material science microscopes** | Application of TEM in Materials Science- Dislocation Theory- Mechanical Properties- Point Defects and Dislocations: Quench-Hardening- Radiation Damage-Phase Transformations- Kinetic Studies-Surface Layer Studies- Magnetic Properties- Miscellaneous Applications-Electron Optics and Instrumentation-A. Septier: Geometrical Electron Optics-Electrostatic Lenses- Equation of Motion in an Electrostatic Lens-The Properties of Some Electrostatic Lenses-Aberrations of Electrostatic Lenses- Magnetic Lenses- The Motion of Particles in a Magnetic Lens- Optical Properties- Aberrations of Magnetic Lenses- Magnetic Lenses for High Voltage Microscopes- Quadrupole Lenses- Optical Properties of Quadrupole Lenses- Quadrupole Systems Suitable as Objectives- The Aperture Aberrations of Quadrupole Systems and their Correction- Correction of Chromatic Aberration-Prisms Optics- Simple Prisms- Magnetic Prisms- Electrostatic Prisms- Electrostatic Lenses. |
| **Phys424** | | **Materials characterization techniques** | This course covers a range of methods in the analysis of materials including spectroscopy, scattering, and microscopy methods. Emphasis is placed on the applicability of each technique to appropriate analysis and the limitations of each method. XRD, FTIR, RAMAN, $N_2$-Adsorption, XPS, SEM, TEM, EDX, TGA, DSC, AFM, etc. |
| **Phys425** | | **Fundamental of quantum optics** | Quantum Theory of Radiation, Maxwell's Equations and Field Quantization, Quantum States of the Field, Photon Detection and Correlation Functions, Representations of the Field-Atom in an External Radiation Field, One Electron Atom, Coupling of Radiation Field with Atomic Electron, Two-Level Atom Interacting with Monochromatic Fields, Two-Level Atom in a Harmonic Potential, Quantum System Coupled to a Reservoir, Three-Level Atom. |

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| **Phys426** | | **Laser physics and applications** | An introduction to laser and its characteristics. Energy and power in EM fields. Wave propagation in isotropic media and in crystals. Birefringence. Index ellipsoid. Spontaneous and stimulated emission. Homogeneous and inhomogeneous broadening. Gain coefficient. Electron oscillator mode of an atomic transition. Atomic susceptibility. Gain saturation. Propagation of rays through lenses, between mirrors and in lens like media. Propagation of optical beams in homogeneous and guiding media. High order Gaussian beam. Optical resonators and their characteristics. Two, three and four level lasers. Mode locking. (Q-Switched) laser. Hole burning and lamb dip in Application of laser. |
| **Phys427** | | **Selected topics in nanoscience** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| **Phys428** | | **Modeling and simulation of materials** | Introduction into modeling and simulation approaches, covering continuum methods (e.g. finite element analysis), atomistic simulation (e.g. molecular dynamics) as well as quantum mechanics.<br>Application of quantum mechanics to solar thermal fuels<br>More QM modeling for solar thermal fuels, plus alittle-Hstorage-From atoms to solids<br>-Quantum modeling of solids: Basic properties-Advanced properties of materials: Some review and introduction to solar photovoltaics (PV) - Solar photovoltaics-A bit more solar PV, some verification and validation and a few concluding thoughts. |
| **Phys429** | | **Nanomaterials applications in electronic devices** | Importance of Nanotechnology, Various Applications in Electronic Field - Nanotechnology for Batteries -Energy Storage Application -Nanotechnology and Nanomaterials for Medical Applications - Application of Nanotechnology in Enhanced Oil Recovery -Nanotechnology Application for Wireless Communication-System - Nanomaterials-Based Chemical Sensing -Application of Nanomaterials in Fuel Cell and Photovoltaic System - Nanocellulose for Gas Sensor Applications -Vipul V. Kusumkar, Eva Viglašová, Michal Galamboš-Nanotechnology for Defence Applications -Nanotechnology for Biomedical Devices: Cancer Treatment - Nanotechnology for Food and Packing Application . |
| **Phys430** | | **Nanomaterial and green energy** | Introduction to Advanced Nanomaterials- Synthesis of Multifunctional Inorganic Materials: From Micrometer to Nanometer Dimensions- Characterization Tools and Techniques for Nanomaterials- Energy Harvesting Using Droplet- Advanced Nanomaterials for Water Splitting and Hydrogen Generation- Novel Nanomaterials as Electrocatalysts for Fuel Cells- Synthesis of Nanomaterials for Fuel Cell Applications- Novel Nanomaterials for Solar Cell Devices- Recent Progress on Hole-Transporting Materials for Perovskite-Sensitized Solar Cells - Empowering the Future With Organic Solar Cell Devices- Graphene-Based Materials for Clean Energy Applications- Nanomaterials and Its Application for Clean Environment- White Light-Emitting Novel Nanophosphors for LED Applications- Scale-Up Technologies for Advanced Nanomaterials for Green Energy: Feasibilities and Challenges- Advanced Nanomaterials for Green Energy: Current Status and Future Perspectives |
| | | **Electronic materials** | Electronics materials in general physics- Comments on theoretical approaches- First example: extralarge parameters of material- Second example: giant effects- |

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| **Phys431** | | | Electronics materials structure- Atomic bonding in metals, semiconductors and dielectrics- Symmetry of crystals, textures and composites- Basic structures and defects in lattice- Quasicrystals and nanomaterials- Mechanical properties of solids- Mechanical stress and strain tensors- Elastic stiffness and compliance- Elastic waves in crystals and films- Thermal properties of solids- Basic thermodynamic relations- Thermal expansion of solids- Heat capacity in crystals- Thermal conductivity of solids. |
| **Phys432** | | **Semiconductors and its applications** | HgCdTe Growth and Detector Technology-Blue-Green Semiconductor Lasers-Molecular Beam Epitaxy of Widegap II-VI Compounds-Optical Properties and Electronic Structure of Wide-Gap II-VI Semiconductors-Nonlinear Optics and Propagation of Excitons-Beryllium Containing II-VI Compounds-II-VI Materials for Visible Light Emitters-Spin Engineering in II-Vi Magnetic Semiconductor Heterostructures-Self-Organized, Low-imensional II-VI Nanostructures |
| **Phys433** | | **Electrochemical processing of materials** | Fundamental electrochemical equilibria and kinetics, electro-synthesis and electrochemical processing of materials, corrosion and degradation in aqueous and non-aqueous systems, and concepts of electrochemical energy storage, including examples from batteries, fuel cells, supercapacitors, and photoelectrochemistry. |
| **Phys434** | | **Electrical,optical,and magnetic properties of materials** | Optical and magnetic properties of organic solid-state materials continues to grow both in scope and technological importance. Early studies of charge transport in conducting polymers have evolved from the elucidation of fundamental structure/function relationships to applications such as batteries, simple electrical devices such as diodes, chemical sensors, antistatic coatings, microwave and millimeter wave-absorbing materials, and photochromic devices. A particularly exciting evolution has been the discovery and development of organic light-emitting diodes (OLEDs) which appear to be nearing commercialization in an amazingly short period of time. This application is of particular interest because both electrical and optical properties must be considered.Topics include: organic light-emitting materials and devices; photonic materials and devices; conducting and electroactive polymers and materials; molecular and supramolecular engineering; organic metals and magnetic materials and poster presentations. |
| **Phys435** | | **Advanced optics** | Limit of resolution-The double slit-The Fresnel mirrors.--The Fresnel bi-prism-The Michelson interferometer-The visibility curves-The prism spectrometer-Total reflection-The diffraction grating-The concave grating-Polarized light-Rotation of the plane of polarization-Elliptically polarized light-The reflection of polarized light from homogeneous transparent substances-Metallic reflection-The spectrophotometer-The development of optical theory-The trend of modern optics |
| **Phys436** | | **Material characterization technique devices** | Mass Spectrometry- Matrix-Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry -Atomic Force Microscopy -Raman Spectroscopy - X-ray Photoelectron Spectroscopy (XPS)-Nanoindentation. |

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| **Phys437** | | **Industrial applications of nanotechnology** | Different types of semiconductor Nanostructures Devices - Semiconductor Quantum dots (QDs) – QD LASER- Quantum cascade LASER-QD. White LEDs - LEDs based on nanorods. Silicon horizontal and vertical core shell Nanowires. Electro optical devices - Optical memory - Present and future trends - Nanomaterials as Electrolytes - Nanoscale Electronic and Ionic Transport – Energy Conversion and Storage in Electrochemistry – Industrial applications of energy devices. Extension to the nanoscale Sensors Applications- Biomedical and Healthcare. |
| **Phys438** | **Phys221** | **Plasma physics** | Plasma concepts note on units. Properties of plasma. Debye radius plasma oscillations. Distribution of energy-dissociation equilibrium. Saha's equation for ionization. Temperature and equilibrium. Local thermodynamics equilibrium. Application of plasma spectroscopy. Spectroscopic measurement of temperature, gas kinetic temperature. Population and excitation temperature, ionization temperature. Spectroscopic measurement of electron density, line width, plasma frequency. |
| **Phys439** | | **Optical interferometry and technology** | Optical interferometry: its development- The wave theory of light- Michelson"s experiment- Measurement of the metre- Coherence- Interference filters- Interference spectroscopy- The development of the laser- Electronic techniques- Heterodyne techniques- Holographic interferometry- Speckle interferometry- Stellar interferometry- Relativity and gravitational waves-Fiber interferometers -Nonlinear interferometers- Quantum effects. |
| **Phys440** | | **Wastewater treatment** | Microbiology and ecology of wastewater reatment - Microorganisms present in water and wastewater - Biological cells - Energy and carbon sources for microbial cells - Metabolism of microorganisms - Energy generation in microbial cells - Ecology of biological wastewater treatment- Reaction kinetics and reactor hydraulics - Reaction kinetics Mass balance - Reactor hydraulics - Conversion processes of organic and inorganic matter - Characterisation of substrate and solids - Conversion processes of the carbonaceous-and nitrogenous matters - Time progress of the biochemical oxidation of the-carbonaceous matter - Principles of bacterial growth . |
| **Phys441** | | **Advanced microscopy and its applications** | Confocal Laser-scanning Microscopy in Filamentous Fungi<br>Fluorescence-Based Methods for the Study of Protein<br>Localization, Interaction, and Dynamics in Filamentous Fungi<br>Super-Resolution Microscopy: SIM, STED and Localization<br>Fourier Transform Infrared (FTIR) Microscopy and Imaging of FungiAnnette<br>Naumann-Whole Cells Imaged by Hard X-ray Transmission Microscopy- In Situ<br>Nanocharacterization of Yeast Cells Using ESEM and FIB -Imaging Living Yeast Cells and Quantifying Their Biophysical Properties by Atomic Force Microscopy. |
| **Phys442** | | **Physics of nanomaterials and their properties** | Mechanical Properties of Micro- and Nanostructures-. Electronic Properties at Nanoscale- Optical Properties of Nanostructures- Nanomagnetism- Spintronics and Device Applications- Spin Dynamics in Magnetic Nanostructures. |
| **Phys443** | | **Photonic and optoelectronic materials** | An introduction to optoelectronics- Introduction to optical materials- Incandescent, discharge, and arc lamp sources- Detection of optical radiation- Propagation along optical fibers and waveguides- Introduction to lasers and optical amplifiers- Advanced optics- Basic concepts in photometry, radiometry, and colorimetry- Nonlinear and short pulse effects- Light emitting diodes (LEDs)- Semiconductor |

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| | | | lasers- Optical detectors and receivers-Optical fiber devices-Optical modulators-Optical amplifiers-Ultrafast optoelectronics-Integrated optics-Infrared devices and techniques. |
| **Phys444** | | **Theoretical atomic physics** | Wave Functions and Equations of Motion - States and Wave Functions - Linear Operators and Observables -The Hamiltonian and Equations of Motion - Constants of Motion and Symmetries The Radial Schrödinger Equation - Example: The Radially Symmetric Harmonic Oscillator - Bound States and Unbound States - Bound States - Unbound States -Attractive Coulomb Potential - Normalization of Unbound States- Processes Involving Unbound States - Wave Packets- Transmission and Reflection - Time Delays and Space Shifts- Resonances and Channels — Channels- Feshbach Resonances- Potential Resonances -Methods of Approximation -Time-Independent Perturbation Theory - Ritz's Variational Method Semiclassical Approximation - Inverse Power-Law Potentials . |
| **Phys445** | **Phys304** | **Composite and functional materials** | Applications of composite materials- science of composite materials- Composite materials for electrical applications- Composite materials for electromagnetic applications- Composite materials for dielectric applications- Composite materials for optical applications- Composite materials for magnetic applications- Composite materials for electrochemical applications- Composite materials for biomedical applications- Composite materials for vibration damping- Intrinsically smart structural composites. |
| **Phys446** | | **Optics properties of materials** | Classical propagation-Interband absorption- Excitons-Luminescence- Quantum confinement-Free electrons-Molecular materials-Electromagnetism in dielectrics-Quantum theory of radiative absorption and emission-Angular momentum in atomic physics-Band theory-Semiconductor pin diodes- Nonlinear optics. |
| **Phys447** | | **Basic of material engineering** | Introduction, Properties and Their Measurement, Atomic Structure and Atomic Bonds, Structure of Crystalline Solids, Diffusion and Plastic Deformation, Property Management of Metallic Materials, Ceramics, Structure and Properties of Polymers, Composites, Electrical Properties of Materials, Magnetic Materials, Optical Materials, Semiconductor Processing, Environmental Degradation of Engineering Materials, Materials and Process Selection, Ferrous and Nonferrous Metals for Special Applications, Comparative Properties, |
| **Phys448** | | **Physics and energy of the earth** | Orogenic Fold-belts and a Hypothesis of Earth Evolution-Earthquake Energy and Magnitude-Meteoritic, Solar and Terrestrial Rare-Earth Distributions. |
| **Phys449** | | **Digital electronics** | Decimal numbers - Binary numbers -Octal numbers - Hexadecimal numeration - Representation in a radix - Binary-coded decimal numbers -Representations of signed integers - Sign-magnitude representation - Two's complement representation - Excess-E representation - Representation of the fractional part of a number - Arithmetic operations on binary numbers - Addition .- Subtraction - Multiplication - Division -Representation of real numbers - Fixed-point representation - Floating-point-representation - Data representation - Gray code - p-out-of-n Digital Electronics - Parity bit - Error correcting codes Logic Gates- Logic gates - NOT gate -AND - OR gate |

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| | | | - XOR gate -Complementary logic gates -Three-state buffer - Logic function - The correspondence between a truth table and a logic function - Boolean algebra - Boolean algebra theorems - Simplification of logic functions with multiple outputs -level logic circuit implementation -NAND gate logic circuit -NOR gate based logic circuit . |
| **Phys450** | | **Digital electronics (2)** | Function Blocks of Combinational Logic-Introduction –Multiplexer- Demultiplexer and decoder- Implementation of logic functions using multiplexers or decoders - Multiplexer Encoders -encoder -encoder - Priority encoder -Transcoders - Binary code and Gray code - BCD and excess-3 code - Parity check generator - Barrel shifter - Exercises - Systematic Methods for the Simplification of Logic Functions- Definitions and reminders-Minimization principle of a logic function - Karnaugh maps - Function of five variables - Function of six variables - Karnaugh map with entered variable - Representation based on the XOR and AND operators -Systematic methods for simplification - Determination of prime implicants - Finding the constitutive terms of a minimal expression -McCluskey technique: simplification of incompletelydefined functions - Simplification of functions with multiple outputs . |
| **Phys451** | | **Non linear optics** | The Nonlinear Optical Susceptibility- Introduction to Nonlinear Optics- Descriptions of Nonlinear Optical Processes- Formal Definition of the Nonlinear Susceptibility- Nonlinear -usceptibility of a Classical Anharmonic Oscillator- Properties of the Nonlinear Susceptibility- Time-Domain Description of Optical Nonlinearities- Kramers–Kronig Relations in Linear and Nonlinear Optics. |
| **Phys452** | | **Solid and hazardous waste management** | Some basics of radioactive waste characterization and handling are also provided.Solid Waste analysis and characterization, Hazardous waste Characterization Environmental legislation for solid and hazardous waste disposal and transport Risk Assessment, Waste minimization and resource recovery, Waste stabilization techniques, Chemical, physical and biological treatment Landfill design for Sanitary and Hazardous Wastes, Incineration. |
| **Phys453** | | **Group theory of physics** | Basic Group Theory- Group Representations- General Properties of Irreducible Vectors and Operators- Representations of the Symmetric Groups- One-Dimensional Continuous Groups<br>Rotations in Three-Dimensional Space — The Group SO(3)<br>The Group SU(2) and More About SO(3)- Euclidean Groups in Two- and Three-Dimensional Space- The Lorentz and Poincaré Groups, and Space-Time Symmetries- Space Inversion Invariance<br>Time Reversal Invariance- Finite-Dimensional Representations of the Classical Groups |
| **Phys454** | | **Energy Conservation and efficieency** | Defining Energy Efficiency- Impetus for Understanding and Employing Energy- Energy Sources and Energy Carriers- The Energy Supply/Demand Chain- Efficiency Calculation: Assessing Cumulative or Total System Efficiency- Sources of Energy Efficiency Information- Dealing with energy units, measures, and statistic- Systems of Measurement, Common Units, and Prefixes- Power and Its Equivalencies- Production and Consumption Definitions and Statistics- Definitions and Representations of Energy Efficiency- Primary energy trends- Conceptualizing Primary Energy Supply- Conceptualizing Primary Energy Flows to End Use- Oil and |

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| | | | Gas Supply and Production- Coal Supply and Production- Uranium Supply and Production- Hydropower Supply and Production- Wind Supply and Production- Solar Supply and Production- Biomass Supply and Production- Geothermal Supply and Production. |
| **Phys455** | | **Power and energy engineering** | Environmental Characteristics - Solar Energy Collectors - Performance of Solar Collectors - Solar Water-Heating Systems- Solar Space Heating And Cooling - Industrial Process Heat, Chemical Applications, and Solar Dryers - Solar Desalination Systems - Photovoltaic Systems - Solar Thermal Power Systems- Design and Modeling Of Solar Systems- Solar Energy Analysis - Wind Energy Systems. |
| **Phys456** | | **Water purification and distilation** | Impurities in water –Suspended solid particles . Colloids -Dissolved inorganic salts - Dissolved organic - Micro-organisms and Pyrogens -Dissolved gases -Pure water – How pure is it? Methods of Purifying water-Distillation –Deionisation-Reverse osmosis -Filtration -Photo-oxidation -Choosing a water purification-system-General purpose water Ultra-pure water (Type I) -Storage of purified water-Reasons for choosing distillation -Bibby Scientific water stills -Choosing a water -Installation of water stills-pH of distilled water. |
| **Phys457** | | **Photovoltaics** | Principles of Solar Cell Operation- Electrical Characteristics. Optical Properties. Typical Solar Cell Structures. Semiconductor Materials and Modelling. Semiconductor Band Structure. Carrier Statistics in Semiconductors. The Transport Equations. Carrier Mobility. Carrier Generation by Optical Absorption. Recombination. Radiation Damage. Heavy Doping Effects. Properties of Hydrogenated Amorphous Silicon. Ideal Efficiencies Thermodynamic Efficiencies. Efficiencies in Terms of Energies. Efficiencies Using the Shockley Solar Cell Equation. General Comments on Efficiencies. Crystalline Silicon-Characteristics of Silicon Wafers for Use in PV Manufacturing-. Feedstock Silicon. Crystal-Preparation Methods. Shaping and Wafering. High-Efficiency Silicon Solar Cell Concepts. High-Efficiency Laboratory Cells. |
| **Phys459** | | **Technology of electric power plant** | Introduction to Electricity- Introduction to Steam Power Plants- Steam Generators: Water-Steam Side- Steam Generators: Fire Side- Emission Reduction in Steam Generators- Steam Turbines- Condensate-Feedwater Systems- Cooling Systems (Circulating Water Systems)- Gas Turbines- Combined Cycle Power Plants and Cogeneration Plants- Solar Energy and Photovoltaic Solar Units- Solar Thermal Energy- Wind Energy- Ocean Renewable Energy- Geothermal Energy- Energy Storage Systems. |
| **Phys461** | | **Trends in renewable energy** | Carbon Neutral Strategies to Reduce CO2 Emissions and Mitigate Climate Change-Greenhouse Gases Solutions in Roads and Transportation-. Recent Clean Hydrogen Production Technologies- Eco-Friendly Sustainable Stabilization of Dredged Soft Clay Using Low-Carbone Recycled Additives-. Acceptable Zone for Green Construction of Compacted Tropical Laterite Soil- Green Economy and Sustainable Development Toward Sustainable Landfill Siting. Solution of Global Elevated Carbon |

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| | | | Dioxide Emission—A Comprehensive Technique and Methodology for Quantification. The Fourth-Generation Biofuel. |
| Phys463 | | **Selected topics in renewable and sustainable energy** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| **BPhy401** | | **Medical radioactive isotopes, radiation safety and protection** | Introduction to justification in the use of radiation in medicine -Strategies for improving justification -Developing and implementing appropriateness criteria and imaging referral guidelines: Where are we and where are we going. Bettmann Justification and the role of technology and algorithms - Radiation protection of patients in external beam radiotherapy:Introduction of the topic -Impact of new treatment technology on patient protection in -Tools needed and tools available for safety improvement-in radiation therapy-Medical issues associated with radiotherapy accidents:Some examples and lessons learned. |
| **BPhy402** | | **Cancer biology** | Overview of cancer assessment, diagnostics and therapeutics<br>Cell viability and apoptic assays to assess drug efficacy-Assays to assess the proliferative behavior of cancer cells-Assays to evaluate tumor angiogenesis-Assays and protocols for the detection of cancer metastasis-Isolation and characterization of cancer stem cells-Histopathology-based cancer detection methods-Molecular imaging in tumor diagnosis and treatment-High throughput cell-based screening methods for cancer drug discovery-Nanotechnology in cancer therapeutics: cerium oxide nanomaterials as cancer therapeutic agents. |
| **BPhy403** | | **Biomagnetism** | Relationship between the principles of impedance measurement and bioelectric signal measurement, Tissue impedance, Impedance Cardiography, Measurement of the impedance of the thorax, Simplified model of the impedance of the thorax, Determining changes in blood volume in the thorax, Determining the stroke volume, Discussion of the stroke volume calculation method, The Origin of Impedance Signal in Impedance Cardiography, Model studies, Animal and human studies, Determining the systolic time intervals from the impedance, The effect of the electrodes, Accuracy of the impedance cardiography, Other Applications of Impedance Plethysmography, Peripheral blood flow, Cerebral blood flow, Intrathoracic fluid volume, Determination of body composition |
| **BPhy404** | | **Biophysical techniques** | The motivation for biophysics-Orientation for the bio-curious-Introduction: the material stuff of life-Architecture of organisms, tissues and cells, and the bits in between.The chemicals that make cells work-Cell processes-Physical quantities in biology-Making light work in biology-Introduction-Basic UV-VIS-IR absorption, emission, and elastic light scattering methods-Light microscopy basics-Non-fluorescence microscopy-Fluorescence microscopy: the basics-Basic fluorescence microscopy illumination modes. Super-resolution microscopy-Förster resonance energy transfer (FRET)-Fluorescence correlation spectroscopy (FCS)-Light microscopy of deep samples-Advanced biophysical techniques using elastic light scattering-Tools using the inelastic scattering of light. |
| **BPhy405** | | **Nanotechnology** | Half Title -The nanoscale- Forces at the nanoscale<br>- The nano/bio interface-Nanometrology-Noncarbon nanomaterials and their production-Noncarbon nanomaterials and their production- Nanodevices- |

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| | | | Nanofacture of devices- Carbon-based nanomaterials and devices- Nanosystems and their design- Bionanotechnology- The impact of nanotechnology. |
| **BPhy406** | | **Basics of NMR and medical imaging** | Nuclear Magnetic Resonance Spectroscop- Structural Changes of Zn(II)bleomycin Complexes When Bound to DNA Hairpins Containing the 5′-GT-3′ and 5′-GC-3′ Binding Sites, Studied through NMR Spectroscopy- Application of NMR Screening Methods with 19 F Detection to Fluorinated Compounds Bound to Proteins- Accelerating NMR-Based Structural Studies of Proteins by Combining Amino Acid Selective-Unlabeling and Fast NMR Methods- Calcium-Dependent Interaction Occurs between Slow Skeletal Myosin Binding Protein C and Calmodulin- Short-Chain Alkanethiol Coating for Small-Size Gold Nanoparticles Supporting Protein Stability. |
| **BPhy407** | | **Planning radiotherapy** | Radiation dosimetry units, emitted and absorbed doses. Factors Affecting Equivalent Tissue Dose Distribution Curves, Equivalent Tissue Types, Equivalent Square and Circle Radiation Fields for Rectangular Fields, Relative Relative Dose and Backscattering, Dose Ratio (factor) in Tissues to Same in Air, Ratio of dose in Tissues to Same in Equivalent Tissue . The effect of the curves of the patient's body surface on the map of equal dose distribution and the method of practical treatment or calculation, the effect of the heterogeneity of the mean on the map of equal dose distribution. Screw filters for high energies, integrated dose. Map of the isosceles curves of several radiation fields (two and three). Manual collection of radioactive fields. Radiation field guidance devices, calculating the therapeutic dose when the distance of the source from the surface of the skin is proven using the percentage relative dose. A prescription for calculating therapeutic doses for the patient. Calculation of the therapeutic dose with the proven distance of the source from the axis of rotation using the ratio of dose in tissues to itself in the air. Correlation between the relative radiation dose percentage and the relative dose in tissues to air. |
| **BPhy408** | | **Structure of biological macromolecules by using x-rays** | Role of Structural (Molecular) Biology- A Short History of Structural (Molecular) Biology- The Nature of the Problem 'Imaging' Techniques- Nuclear Magnetic Resonance- Fundamental Limitations to Finding Macromolecule Structures- Fourier Transforms- Correlations and Convolutions- Introducing Correlations- Function Parity- Auto-Correlation Function- Fourier Fundamentals- Component Functions- Fourier Analysis of Periodic Even Functions- Sines and Phasors- Fourier Transforms- Digital Fourier Transforms- Data Preparation- Digital Fourier Transform Features- Digital Fourier Transform Calculations<br>- Filters- Blurring Filters- Digital-to-Analog Conversion- Correcting Blurring Filters- Gradients and Derivatives |
| **BPhy409** | | **Nuclear medicine** | Radiopharmaceuticals- Molecular Imaging. Physics in Nuclear Medicine. Radiation Detection and Instrumentation. Single-Photon Emission Computed Tomography, Positron Emission Tomography, and Hybrid Imaging. clinical nuclear medicine- Endocrine System. Skeletal Scintigraphy. Hepatobiliary System. Genitourinary System. Pulmonary System. Oncology: Positron Emission Tomography. Oncology: Non-Positron Emission Tomography. Gastrointestinal System-. Infection and Inflammation. Central Nervous System- Cardiac System Pearls, Pitfalls and Frequently Asked Questions |

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| **BPhy410** | | **Biomaterials and prothesis** | Biomaterials for Oral and Dental Tissue Engineering<br>Introduction to Oral and Dental Tissue Engineering<br>Bioactive Glasses and Calcium Phosphates<br>Polymers for Oral and Dental Tissue Engineering<br>Hydrogels in Craniofacial Tissue Engineering<br>Dental Biocomposites<br>Surface Modification of Dental Implants<br>Characterization of Biomaterials<br>Biocompatibility of Dental Biomaterials<br>Processing and Preservation of Biomaterials and Regulatory Issues- Tissue Engineering Strategies<br>10. Specific Considerations in Scaffold Design for Oral Tissue Engineering- Stem Cells from Oral and Maxillofacial Tissues-. Bioreactor Design for Oral and Dental Tissue Engineering- Growth Factors for Oral and Maxillofacial Regeneration Applications-: Oral and Dental Soft Tissue Engineering. Oral Mucosa Tissue Engineering. Tissue Engineered Models of Oral Soft Tissue Diseases. Periodontal Soft Tissue Reconstruction. Layered Scaffolds for Periodontal Regeneration. Dental Pulp Tissue engineering and Regenerative Endodontic Therapy<br>Oral Nerve Tissue Repair and Regeneration<br>Tissue Engineering of Salivary Glands-Facial Muscle Tissue Engineering - Vascularization Oral and Dental Hard Tissue Engineering. Bone Tissue Engineering in Maxillofacial Region. Periodontal and Peri-implant Hard Tissue Regeneration. |
| **BPhy411** | | **Selected Topics in biophysics** | Offered as needed to present material not normally available in regular departmental course offerings, or for offering new courses on a trial basis. |
| **BPhy412** | | **Techniques for thin biomembranes** | Importance of Biomembrane Transport- Biomembrane Composition, Structure, and Turnover-Book chapterAbstract only-Biomembrane Composition, Structure, and Turnover-<br>Thermodynamics and Transport-Book chapterAbstract only<br>Thermodynamics and Transport- Transport Kinetics<br>Book chapterAbstract only - Transport Kinetics - Structure and Function of Transport Proteins That Form Solute Gradients- - Structure and Function of Transport Proteins That Form Solute Gradients- Transport Proteins That Dissipate Solute Gradients- A Proposed System for the Classification of Transmembrane Transport Proteins in Living Organisms - A Proposed System for the Classification of Transmembrane Transport Proteins in |
| **BPhy413** | | **Biophysical techniques in cancer therapy** | Dose Radiation - destroy lethal cancer stem cells that survive conventional cancer therapies (leading to cancer metastases). Live Cell Tumor Profiling – assay live tumor cells to ascertain the most effective medicine for eliciting tumor death. Tumor-Targeted Immunotherapy - enhance autologous immune response via a small number of cytokines injected directly into the tumor mass.<br>Autologous Dendritic Cell Vaccine - prevent cancer cells from spreading to surrounding tissue or organs to strengthen and stimulate the immune system to recognize and fight invading cancer cells. Systemic Detoxification – to complement |

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| | | | natural healing by removing harmful metals and minerals that have built up from external pollutants.<br>Toxic-free Therapies – Target cancerous cancer cells while still keeping vital tissues and organs healthy. These treatments work to strengthen the body and complement other principles rather than compromise the immune system and create debilitating side effects. |
| **BPhy414** | | **Electronics of biological systems** | Electronic Components. Molecular components for electronics. Nano-gaps based devices. Organic thin-film transistors for biological applications. Protein-based transistors. Single molecule bioelectronics. Biomemory device composed of recombinant protein variants.Biosensors. CNT and proteins for biosensors in personalized therapy. CMOS nanowire biosensing systems. Cell-array biosensors . Pulse radar sensor for contactless respiratory rate monitoring. MagCMOS. Metamorphic neural interfaces with insects for remote controlled biobots-Fuel Cells. Biological fuel cells. Advances and applications of biofuel cells<br>Switchable electrodes and biofuel cells logically controlled by chemical and biochemical signals. Biomimetic Systems.<br>Biomimetic systems. Epidermial electronics: flexible electronics for biomedical applications. Bioelectronics brain using memristive polymer statistical systems. Electronic design of synthetic genetic networks. Bionics. Bionics- Bio-electronics interfaces for artificially driven human movements. The bionic eye: a review of multi-electrode arrays. CMOS technologies for retinal prosthesis. Restoration of sight with photovoltaic retinal prosthesis. Brain Interfaces. Brain-machine interfaces ECG technology for the brain-machine interface. Reducing the implant footprint: low-area neural recording. High dimensional brain machine interface. Miniaturized implantable UWB antennas optimized for wireless brain machine interfaces. Intracranial epilepsy monitoring using a wireless neural recording system. Low power building blocks for neural recording systems. CMOS circuits for intracells brain-machine interfaces. |
| **BPhy415** | | **Accelerator protection** | Particle Accelerators and Accelerator Facilities. Sources of Ionizing Radiation from Accelerators. Radiation Shielding at Accelerators. Techniques of Radiation Measurement at Particle Accelerators. Environmental Radiological Aspects of Particle Accelerators. Operational Radiation Safety Program for Accelerators |
| **BPhy416** | | **Technology of non-ionizing radiation dosimetery** | Radiation Detector ELF-EMFs-Types of field measuring devices-detector-magnetic field meter-international limits and doses-biological effects-low-frequency microwave measuring devices-protection and calibration instructions-safety limits-ultraviolet radiation-detectors-effects Biological on the skin and eyes- Safety limits and precautions - laser beams - reagents - units of measurement - biological effects - skin and eye damage - protection and calibration instructions - requirements regulating safe measurements - power and energy - protective radiation shields against magnetic fields - low frequency - ultraviolet and laser rays. |
| **BPhy417** | | **Radiobiology** | Introduction: The significance of radiobiology and radiotherapy for cancer treatment. Irradiation-induced damage and the DNA damage response. Cell death after irradiation: How, when and why cells die. Quantifying cell kill and cell survival. Radiation dose-response relationships. Linear energy transfer and relative biological effectiveness. Physics of radiation therapy for the radiobiologist. Tumour growth and |

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| | | | response to radiation. Fractionation: The linear-quadratic approach. The linear-quadratic approach in clinical practice. Modified fractionation. Time factors in normal tissue responses to irradiation. The dose-rate effect. Pathogenesis of normal tissue side effects. Stem cells in radiotherapy. Normal tissue tolerance and the effect of dose inhomogeneities. The oxygen effect and therapeutic approaches to tumour hypoxia. The tumour microenvironment and cellular hypoxia responses. Combined radiotherapy and chemotherapy. Molecular targeted agents for enhancing tumour response. Biological individualisation of radiotherapy. Molecular image guided radiotherapy. Retreatment tolerance of normal tissues. Biological response modification of normal tissue reactions: Basic principles and pitfalls. Hadron therapy: The clinical aspects. Tissue response models. Second cancers after radiotherapy. |
| **BPhy418** | | **Biophysics of nuclear medicine** | Radiation detection on humans: Measurement of the total radiation emitted by the organ as a whole - collection of penetrating rays - scattering and absorption of radiation - sensors for measuring total radiation from the organ - measuring devices for distributing the concentration of radioactive isotopes in the organ - gamma imaging camera - digital camera - multi-detector camera - performance specifications Gamma imaging camera - sensitivity - spatial separation - linear proportionality - homogeneity - quality control tests - tomography devices. |
| **BPhy419** | | **Measurements of doses** | Absorbed dose next to the separation between two different substances - The relationship between the energy of the effect and the exposure-saturation In ionic chambers - calculations of the efficiency of ionic assembling - ionic chambers - diuretic thermometer - chemical dosimetry - direct measurements of calorimeters - summary of standard.methods - sources of ionizing radiation - endpoints of exposure to non-radioactive radiation workers - Dose calculations due to exposure to sources of radiation outside and inside the body-Non-Ionizing Dosage Technology: ELE-EMFs Measuring Instruments- Magnetic Field - International Limits and Dosages- Biological Effects - Low Frequency Microwave Wave Measuring Instruments - Protection and Calibration Guidelines - Safety Limits - Ultraviolet Radiation- Reagents - Biological Effects on Skin and Eye - Limits of Safety and Precautions - Lasers, detectors, measuring units, supplies, organization, safety measurements, power and protective radiation cover, to meet ELF-EMF, magnetic fields, low-frequency (RF), ultraviolet. |

# Courses Contents

# Department of chemistry

| Code | Prereq. | Course Title | Contents |
|---|---|---|---|
| Chem101 | | General Chemistry(1)<br>كيمياء عامة<br>(1) | Radiant energy, Quantum theory, Bohr's model, Wave mechanics, Nature of the electron. Schrödinger wave equation, Orbital shapes, Shielding effect, Electronic configuration of the elements, Effective nuclear charge, Atomic radii, Ionization energies, Electron affinity, Electronegativity, Diagonal and inert pair effect, Ionic bond, Covalent bond, Lewis structures, Polarity of |

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| | | | molecules, Valance bond theory, Hybrid orbitals, Molecular orbital theory, VSEPR theory, Binding forces and metallic bonding. Structural, Bonding in organic molecules, Reactivity, Acids and bases, Polar and non-polar molecules, Functional groups, Qualitative and quantitative determination of organic compounds, Types of reagents and reactions,, Isomerism.<br>Practical: General inorganic experiments, Qualitative analysis, Identification of simple organic compounds. |
| **Chem102** | | **General Chemistry (2)**<br>**كيمياء عامة (2)** | States of matter(gases, liquids, solids), Physical properties of solutions and colloids, Chemical thermodynamics and thermochemistry, Chemical kinetics, Chemical equilibrium, Acid-base equilibria in aqueous solutions, Solubility, Electrochemistry.<br>Practical: PH-indicators (pH-meters), Hydrolysis and amphoterism, Molar volume of oxygen, Enthalpy of formation, Molecular weight from freezing point depressing, Chemical equilibrium using the spectrophotometer, Conductivity of electrolytes, Electrode potentials, Determination of the solubility products, Chemical kinetics-clock reaction |
| **Chem211** | | **Organic chemistry (1)**<br>**كيمياء عضوية (1)** | Chemistry of alkane, alkenes and alkynes. Isomerism, Preparation, Properties and reactions of alcohols, Ethers, aromaticity and aromatic compounds.<br>Practical: Identification of organic compounds. |
| **Chem221** | | **Fundamentals of Analytical Chemistry**<br>**اساسيات الكيمياء التحليلية** | Fundamentals of quantitative chemical analysis, Quantities and concentrations, Stoichiometric calculations, Errors and uncertainties in quantitative analysis, Acids and bases, Acid-base equilibria, Acid-base titration, Precipitation and solubility of precipitates in water and in the presence of a common ion or fixed acid concentration, Precipitation titrimetry involving argentometric titrations, Complexometric titration, Oxidation-reduction titration, Applications covering all four types of volumetric titrations<br>Practical: Selected volumetric analysis experiments: Acid-base, Precipitation, Complexometric, Oxidation-reduction titrations and Application covering standard titrimetric methods of water analysis. |
| **Chem231** | | **Thermodynamic Chemistry**<br>**الكيمياء الحرارية** | Thermodynamics: Heat, Energy and work, First law of thermodynamics, Heat capacities, Adiabatic processes, Joule-Thomson effect, Thermochemistry, Second and third law of thermodynamics, Carnot cycle, Entropy and free energy, Properties of solutions.<br>Phase rule: The phase rule equation, One-component systems, Two component systems consisting of solid and liquid phases, Compound formation, Solid solutions, Three component systems. |
| **Chem212** | | **Organic chemistry (2)**<br>**كيمياء عضوية (2)** | Chemistry of Aldehydes, Ketones, Carboxylic acids and their derivatives .Amines. |
| **Chem222** | | **Chemistry of Representative Elements**<br>**كيمياء العناصر الممثلة** | Chemistry of s- and p-block elements with special reference to their industrial applications and chemistry of the environment. |

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| Chem232 | | Kinetic Chemistry and catalysis<br>كيمياء حركية وحفز | An introduction to the principles of kinetics in the solution and at solid surfaces. Examples will be from biochemistry, organic and inorganic chemistry.<br>An introduction to the principles of chemical thermodynamics and their applications in thermochemistry, chemical equilibria and phase equilibria |
| Practical: Kinetic Chemistry | | | |
| Chem311 | | Stereo and physical organic Chemistry<br>كيمياء فراغية وعضوية فيزيائية | Shapes, Sizes, Strain in organic molecules, Isomerism, Molecules with one, two or more stereogenic or without stereogenic carbons, Racemates and resolution, Stereospecific and stereoselective reactions. Mechanism of nucleophilic and electrophilic reactions, Extended structure-reactivity relationships, Intramolecular rearrangements, Symmetry controlled reactions, Mechanisms of elimination and free radical reactions. |
| Chem321 | | Transition Elements Chemistry<br>كيمياء العناصر الانتقالية | Chemistry of transition metals: d-block elements and lanthanides.Coordination chemistry. |
| Chem331 | | Electro and surface chemistry كيمياء الاسطح والكهربية | Electrochemical galvanic and electrolytic cells, Electrode potential and standard cells, Nernst equation, Types of cells, Measurements of electrode potential and cell electromotive force, Primary and secondary batteries, Electroplating |
| Chem313 | | Petroleum and polymers chemistry<br>كيمياء البترول والبلمرات | Constituents and properties of natural gas and crude oil. Industrial petrochemical processes. Types, Structures, Properties, Synthesis, Characterization, Applications of polymers |
| Chem312 | | Chemistry of Heterocyclic Compounds and Carbohydrates<br>كيمياء المركبات الحلقية غير المتجانسة والكرهيدرات | Chemistry of heteromonocyclic compounds containing one or more hetero-atoms and fused heteropolycyclic Compounds. Chemistry of carbohydrates: mono-, oligo-, and polysaccharides.<br>Practical: Techniques used in organic preparations, Preparation of some heterocyclic compounds and sugar derivatives, Infrared spectroscopy. |
| Chem314 | | Spectroscopy and natural products Chemistry<br>كيمياء الاطياف والمنتجات الطبيعية | Theories of ultraviolet, Infrared, Nuclear magnetic resonance, and mass spectra, Structural determination of organic compounds by spectroscopic methods. Terpenoids, Alkaloid, Steroids. |
| Chem316 | | Polyaromatic Hydrocarbons and Alicyclic Compounds<br>المركبات الاروماتية الهيدروكربونية المتكاثفة والالفاتية الحلقية | Synthesis, reactions of poly nuclear aromatic hydrocarbons, synthesis, reactions and conformational analysis of alicyclic aliphatic compounds. |

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| Chem322 | | Analytical Chemistry 2)<br>الكيمياء التحليلية (2) | Electroanalytical methods: Potentiometry and conductometry. Spectral methods:Absorption ( Ultraviolet and visible),emission. Atomic absorption spectroscopy,Atomic fluorescence spectroscopy, Atomic emission spectroscopy with plasma and electrical discharge.<br>Practical: Experiments in gravimetric analysis, Application in water analysis, Solvent extraction, Chromatography, General sample analysis, Selected experiments of instrumental analysis. |
| Chem332 | | Physical Chemistry of Macro molecules<br>الكيمياء الفيزيائية للجزيئات الكبيرة | General information (polydispensity molecular weight and structure of macromolecules). Theories of solutions and properties of macromolecular substances. |
| Chem326 | | Result Treatments<br>معالجة نتائج | Introduction to data analysis, Descriptive statistics (normal distribution, mean, median, standard deviation, confidence levels) Comparative tests, The use of t-test, Non-parametric methods, Least-squares method, Evaluation of sources of variation in chemical data (Anova and regression analysis), Calibration of analytical instruments using linear least-squares, Analysis of residuals, Analysis of variance, Prediction and error estimation of unknowns from the calibration curve, Calibration by standard addition method, Introduction to weights and weighted linear least-squares calibration, Introduction to non-linear calibration, Calibration procedures and steps according to ISO standards, Sensitivity and limit of detection, Decision limits, Detection limits and the concept of three, six and ten sigma. |
| Chem310 | | Green Organic Chemistry<br>الكيمياء العضوية الخضراء | Introduction to Green Chemistry, The 12 Principles of Green Chemistry, oxicology and Green Chemistry, Environmental Issues, Climate and Green Chemistry, Plastics and Green Chemistry, Energy and Green Chemistry, Session at the Warner Babcock Institute for Green Chemistry, Chemicals Policy and Education in Green Chemistry. |
| Chem411 | | Chemistry of Dyes and amino acids<br>كيمياء الاصباغ والاحماض الامنية | Color and chemical structures, Synthesis and properties of different classes of dyes and pigments, Dyeing. Chemistry of Amino acids, Lipids, Peptides, Proteins, Nucleic acids |
| Chem413 | | Chemotherapy<br>الكيمياء العلاجية | Sulphanilamides, Arsenical drugs, various groups of antibiotics, Types of toxic compounds, Chemistry of some physiologically active compounds. |
| Chem431 | | Molecular, ionic Spectroscopy and photochemistry<br>كيمياء ضوئية واطياف جزيئية | Molecular spectroscopy: Rotational spectra of diatomic and polyatomic molecules, Vibriational spectra of diatomic and polyatomic molecules, Rotational-Vibriational spectra, Electronic spectra of diatomic and polyatomic molecules. |
| Chem415 | | Spectroscopy of Organic Compounds | Theoretical basis of IR, UV, $^{1}$H NMR, $^{13}$C NMR and mass spectra and their application in Identification of structural study of different organic compounds. |
| Chem417 | | Topics in Organic Chemistry | Selected topics of more recent advanced Organic Chemistry in different fields (Mechanism, Spectroscopy, Photochemistry, Catalysis, Nano-organic , |

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| | | | Organometallic, Theoretical and Computational, Physical Organic, Bio-organic, Phyto-organic, Medicinal, Polymer, Industrial, . .....). |
| **Chem490** | | **Research Project** | A minor research project to be conducted either in the department of chemistry or in an industrial factory in the vicinity of Alexandria. The results should be presented in the form a report comprising: (a) introduction (b) results, (c) discussion, and (d) references. Evaluation will be made through a seminar given by the student before a committee from the staff of the department |
| **Chem433** | | **Combustion and Air Pollution** | Diffusion and premixed flames, Laminar and turbulent flames, Flame stability, Low pressure flames, Spontaneous ignition and cool flames, Flammability limits, Factors affecting burning velocity, The structure of the reaction zone, Two stage combustion, Three-way catalytic converter, Formation of oxides of nitrogen and of sulfur, The carbon black process. |
| **Chem435** | | **Solution and colloidal chemistry** | Classification of colloids, Preparation and purification of sols, Physical, colligative, optical, electrical and kinetic properties of sols, Viscosity and surface tension of colloids, Structure of the solid-liquid interface. Colloid stability, Electrostatic stabilization (Derjarguin-Landau-Verwey-Overbeek theory), Steric stabilization and flocculation kinetics, Emulsion stability and experimental methods for study of emulsion, Surfactants. |

# Courses Contents

# Department of Botany and Microbiology

| Code | Prereq. | Course Title | Contents |
|---|---|---|---|
| **Bot101** | | **General Botany (1)** | Diversity of Plants and Related Organisms: Introduction to the biology and genetics of plant cells and prokaryotic cells. Biodiversity of plants and plant-related organisms with emphas is on morphology Nutrition and reproduction. |
| **Bot102** | | **General Botany (2)** | Structural and functional organization of Plants: Plant cell structure and contents, Meristematic cells and plant tissue differentiation, Types of mature plant cells and tissues, Anatomy of young plant organs (stems, roots and leaves), Absorption and plant transport systems, Enzymes and catalysis, Photosynthesis and respiration in plants. |
| **Bot111** | | **General Botany** | Diversity of Plants and Related Organisms; Structural and functional organization of Plants. An evolutionary survey of the principle groups of plants based on the fossil records, Modes of fossilization, Palaeobotanical. |
| **Bot211** | **Bot101** | **Cell and genetics (Cytogenetics)**<br>**الوراثة الخلوية** | Cell theory, Prokaryotic and eukaryotic cell with emphasis to genetic material occurrence, Organelles containing nucleic acids, Plant cell and animal cell, Chromosome banding types, Chromosome structure and packing, karyotyping, transposon elements, cell cycle and divisions, chromosomal abnormalities during divisions. The course provides knowledge about types of chromosomal sequences, role of the chromosome criteria in classification and molecular systematic.<br>**Practical:** This course will include laboratory sessions covering the inspection of the living cell components of both prokaryotes and eukaryotes with emphasis to the genetic structure. In addition, primary and secondary chromosome structure cell cycle, the different phases of mitotic and meiotic divisions will be inspected. The sessions provide the student to be familiar with creating karyotyping, Giemsa banding, reverse banding, constitutive heterochromatin banding, telomere banding, nucleolar organizer's banding, and Quinacrine stain banding. |
| **Bot212** | **Bot101** | **Principles of Genetics**<br>**أساسيات الوراثة** | - This module provides an introduction to Genetics Language, Mendelian genetics principles (Dominance law, Segregation law, and independent assortment law), Deviation from Mendel; Allelic interaction (Incomplete dominance, Sex-Limited, Linked, and Influenced traits, lethal allele, Multiple |

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| | | | alleles); non-allelic interaction (Epistasis), maternal genetics, Linkage and chromosome mapping, Population genetics, Mutation and its impact on hereditary, Gene expression and environment.<br>-**Practical:** This course will include laboratory sessions covering problems on Mandalian genetics, Genetic behavior of some autosomal traits in Drosiphella, Chi-square test use in genetics experiments, Genetic behavior of some maize traits, Cross- Test, Mandalian deviations including non-allelic Interaction (epistasis; aleuron trait in maize) and allelic Interaction (incomplete dominance, lethal allele, Sex-limited traits, Sex-influenced traits and Sex-linked traits). The sessions provide knowledge with reciprocal-test, linkage, crossing over and chromosomal maps. |
| **Bot213** | **Bot102** | **Plant Water Relation and Mineral Nutrition**<br>**علاقات مائيه وتغذية معدنيه للنبات** | This course will explore the mechanistic basis of water relations and membrane transport in plants as well as historical and modern perspectives on plant mineral nutrition. This will include water transport processes in plant cell, role of cell wall in water uptake, water potential, and water absorption by roots, water transport in the xylem, transpiration, stomatal control, plant macro- and micronutrients, mechanism of nutrient translocation. It also includes mechanisms of nutrient acquisition, rhizosphere interactions, and biochemical function of essential and beneficial elements.<br>-**Practical:** The practical part is concerned with studying how to extract elements from plants and the effect of deficiency of elements on plants, as well as their importance, and studying the measurement of the transpiration process, the factors affecting it, and how to measure the root pressure. |
| **Bot214** | **Bot101** | **Biology of Algae**<br>**بيولوجيا الطحالب** | The course provides the student with the basic information on explanation of the different systems applied in algal taxonomy, different algal groups, different types of life cycles and major economic applications that built on algae<br>-**Practical:** The graduate should be able to; examine different specimens under light microscope Improve the scientific drawing skills work as a team compare between different algal groups realize the hierarchy of systematic apply of laboratory investigation |
| **Bot215** | **Bot102** | **General Ecology and Advanced Anatomy**<br>**التشريح المتقدم والبيئة النباتية** | Anatomy: Study of the development and microscopic structure of the young and old plant structures of vascular plants with emphasis on the flowering plants; Ecology: Relationships among living organisms and their environments at the individual, population, community and biosphere levels. Environmental Problems, Their Causes, and Sustainability, Biodiversity, Species Interactions, and Population Control, Climate and Terrestrial Biodiversity, The Ecosystem Approach, Energy, and ecosystems, Environmental issues.<br>-**Practical:** This course will include laboratory sessions covering primary and secondary growth of (root, stem and leaves) both monocot and dicot plants. In addition, normal and abnormal secondary growth, ecological anatomy, Climate Measurement Instruments, Ecosystem services, soil waters, case study about environmental issues. |

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| **Bot216** | **Bot101** | **General Plant Taxonomy**<br>**تصنيف النبات العام** | This course is an introduction to the basic plant taxonomic concepts. Covering the history of herbalists, earlier botanists and plant collector contributions to plant taxonomy is a major goal. The course introduces understanding the historical context and investigative procedures of taxonomists in designing classification systems. History of herbarium and plant catalogues. Study the International code of plant nomenclature system .<br>**Practical:** Applications of the international code of botanical nomenclature. Principles, articles and recommendations |
| **Bot217** | **Bot101** | **Medicinal Plants**<br>**النباتات الطبية** | The Medicinal Plant course intends to enhance the pivotal role of plants in healthier foods since plant is a significant source for food and medicine, as well as how food can be used as medicine; classes will focus on plant nutritive value as well as phytochemical ingredients that give plants their clinical effects. The course begins with an introduction to the botanical back story of major plant groups, followed by a brief overview of plant phyto-chemistry, concepts in medicinal plants and nutritive benefits, and a description of nutritional phyto-therapy of traditional used species, which involves the botanical name, plant habit, phyto-chemistry, nutritive benefits, therapeutic properties, and clinical effects, as well as the proper citation of botanical vernacular names, plant habits, phyto-chemistry, and nutritional information. Vegetable supplement include brief concepts in phytotoxins and descriptions of several hazardous plants. The course consists of lectures and group discussions.<br>- **Practical:** Medicinal Plants applications and techniques. |
| **Bot218** | **Bot102** | **Plant Molecular Physiology and Photosynthesis**<br>**فسيولوجيا النبات الجزيئيه والبناء الضوئى** | This course will explore the plant cell in molecular biology. This will include cell wall structure and function, cell membrane function and fine structure, cell membrane proteins, the role of cytoplasm and studying the structure and function of different plant cell organelles, types of RNA, photosynthesis as light and dark reactions(carbon metabolism), assimilation of nitrate and assimilation of ammonia .<br>-**Practical:** The practical study includes measurements of some primary and secondary metabolites, as well as organic acids and vitamins, and the study of isozymes, as well as the estimation of plant pigments and their separation by different methods. Factors affecting on photosynthestic process include effect of CO2 concentration, light intensity and light color. Audus apparatus by measuring of O2 length. |
| **Bot219** | **Bot102** | **Economic Botany**<br>**النبات الأقتصادي** | The course devoted to the consideration of plants that are useful or harmful to humans, their origins and history, botanical relationships, chemical constituents that make them economically important, and their roles in prehistoric and modern cultures and civilizations. Study fibers and fiber plants, forfeit products: wood and cork, forest resources, tanning and dye materials, rubber and other latex product, gums and resins, essential oils, fatty oils and waxes, sugars, starches, and cellulose product, medicinal plants and food plants.<br>-**Practical:** This course will include laboratory sessions covering all plants categories that have economic importance. The course introduces categories |

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| | | | of economic plants includes fruit trees, medicinal plants, crop plants, drinking plants, ornamental plants and oil plants. |
| **Bot220** | **Bot102** | **Biotechnology of Plant Products التقنية الحيوية للمنتجات النباتية** | Plant Products Extracts, Production Of Anticancer Secondary Metabolites, Biotechnological Production Of Phytochemicals, Functions Of Plants Products, Plant Chemical Ecology, Biomacromolecules, Allelopathy, Cell Line, Plants Products And Human Being, Toxic Plant, Phytoalexins, Plants Products Strategies, Environment And Plant Constituents, Literature Survey, Phytochemicals And Chemotaxonomic Significance, Biotechnologies Of Plant Products Isolation, The Oldest Natural Products, Geraniol, Farnesol, Santonin, Sesterterpenoids, Biological Properties, Uses, And Applications Of Plant Products, Marmesin, Reserpine, Biotechnological Production And Conversion Of Plants Products.<br>**-Practical:** Biotechnology of plant products applications and techniques. |
| **Bot222** | ----- | **Scientific Writing and Presentations الكتابة والعروض العلمية** | This course gives knowledge with types of scientific writing with emphasizing to types of scientific papers including research paper, reports and review articles and designing the study. The course provides different divisions of the scientific writing including the title, abstract, introduction, aim, literatures, methodology, results, discussion, summary, conclusion and references documentation inside the text and the references list. The course gives the opportunity to designing presentations and posters.<br>**-Practical:** Case studies and students' practical trails and workshops for different types of scientific writing in order to give the experience for writing the graduation research as an application to the course. |
| **Bot224** | **Bot102** | **Algal metabolism ايض طحالب** | This course will introduce knowledge about main metabolic path ways of algal species, N2 fixation, food storing, stress tolerance, gamete formation, cell division, pigment formation and distribution.<br>**Practical:** Isolation of some algae strains plot the growth curve of some algal strains-calculate pigment, carbohydrates, and lipid contents measuring algal growth by different ways. |
| **Bot226** | **Bot101** | **Genotoxicity and biosafety السمية الوراثية والأمان الحيوى** | This course presents definitions of genotoxicity and bio-safety. Identify and characterize the chemicals causing genotoxicity responsible for various diseases through DNA damages. 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. |
| **Bot228** | **Bot101** | **Biology of Algae and biotechnology و الطحالب تقنية بيولوجيا** | The course provides the student with the basic information on explanation of the different systems applied in algal taxonomy, different algal groups, different types of life cycles and major economic applications that built on algae, the course extended to study algae and human affairs, uses and cultivation of algae, conventional and molecular techniques concerning the algal mass production for applications in nutrition, industry, medicine, agriculture as well as the.<br>**-Practical:** The graduate should be able to; examine different specimens under light microscope Improve the scientific drawing skills work as a team compare between different algal groups realize the hierarchy of systematic |

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| | | | apply of laboratory investigation, learning about different methods for isolation of different algal sample from different habitats, preparation of different media of algae,. General requirements for algal growth in large scale. Different techniques for algal biological components extraction and standardization. |
| **Bot230** | **Bot215** | **Soil Sciences**<br>**علوم التربة** | Composition, general characteristics, genesis and classification, of soils; soil properties for importance in the supply of nutrient elements, water oxygen and heat for plants; quality deterioration in soils; basic principles of conservation and management of soil and water resources.<br>-**Practical:** soil structure, Types of soil water and application about physical soil properties. |
| **Bot310** | **Bot218** | **Plant Biochemistry and Metabolism**<br>**كيمياء حيوية و أيض النبات** | This course will explore the relationship and connecting points of universal and special metabolism. Chemical properties of some primary metabolites of plant, classification of carbohydrates, basic concepts of metabolism, biological oxidation of carbohydrates, glycolysis, fermentation, formation of acetyl-CoA, citric acid cycle, electron transport chain. Gluconeogenesis and hexose monophosphate pathway. Lipid metabolism; classification of lipids and its structure and function. Metabolism of fats; fat anabolism and fat catabolism ($\beta$ and $\alpha$ oxidation). The glyoxylate cycle. |
| **Bot311** | **Bot101** | **Molecular Genetics**<br>**الوراثة الجزيئية** | The course will introduce the kinds of genetic materials with differences between prokaryotes and eukaryotes. The course involves nucleic acids structure and occurrence, molecular aspects of genetics particularly gene structure, transcription of different RNA kinds. The course provides knowledge of different RNA polymerases and RNA processing mechanisms in eukaryotes, including the alternative splicing. DNA replication details in cell cycle, DNA and RNA role. The course involves the protein synthesis and posttranslational modifications for functional proteins synthesis, protein domain and motives, Isoenzyme/alloenzymes polymorphism.<br>**-Practical:** This course will include laboratory sessions covering the study of various molecular biology methods, including laboratory sessions covering the study of DNA as a genetic material, Cell lysis for molecular biology protocols, Protein as a product, (Function, Occurrence, and Structure), Protein extraction, Enzymes extraction, Proteins and isoenzymes electrophoresis |
| **Bot312** | **Bot214** | **Algal Biotechnology**<br>**التقنيه الحيويه للطحالب** | Algae and human affairs, uses and cultivation of algae, conventional and molecular techniques concerning the algal mass production for applications in nutrition, industry, medicine, agriculture as well as the.<br>**-Practical:** learning about different methods for isolation of different algal sample from different habitats, preparation of different media of algae,. General requirements for algal growth in large scale. Different techniques for algal biological components extraction and standardization. |
| **Bot313** | **Bot101** | **Archegoniate**<br>**ارشيجونات** | -Learning the difference between algae and archegoniate. Investigate the morphological and anatomical features and life cycles of Bryophytes, pteridophytes and Gymnospermae. providing the student with different skills by the practical and assignments linked to the course. |

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| | | | **-Practical:** The students should be able to examine slides under light microscope, draw scientific drawing, improve discussion skills, learn communication skills and their ability to work in a team, improve the time utilization through the timely assignments. Improve the self- management and IT skills |
| **Bot314** | **Bot216** | **Advanced Plant Taxonomy**<br>**تصنيف النباتات الزهرية المتقدم** | Study and practice the principles of flowering plant taxonomy. Emphasis is placed on acquiring the facility to use appropriate terminology in order to identify plants through an accurate identification keys. Understanding the wide variations of the taxonomic attributes, morphological, flowering, fruiting and pollen characteristics. General characteristics of angiosperm groups, monocots and dicots emphasizing on the Asterids and Rosids groups<br>**-Practical:** handling the available plant samples and investigates vegetative and reproductive features. Using dichotomous keys for plant groups identification. Study the floral diagram and floral anatomical sections for a representative plant group. Learn to recognize some of the common families of flowering plants. |
| **Bot 315** | **Bot215** | **Ecosystem dynamics and function**<br>**حركية ووظائف النظام البيئي** | Ecosystem components, ecosystem factors, types of ecosystems, ecological factors, temporal changes at population levels, nutrient cycles, population Ecology, community ecology growth curves, functional processes in the ecosystem, productivity, succession and community formation. |
| **Bot316** | **Bot315** | **Soil Ecology**<br>**بيئة التربة** | Composition, general characteristics, genesis and classification, of soils; soil properties for importance in the supply of nutrient elements, water oxygen and heat for plants; quality deterioration in soils; basic principles of conservation and management of soil and water resources.<br>- **Practical:** soil structure, Types of soil water and application about physical soil properties. |
| **Bot 317** | **Bot218** | **Plant Enzymology**<br>**انزيمات نباتية** | This course will explore the protein structure and function, nature of enzyme, specificity of enzyme, mode of enzyme action, classification of enzymes, structure and composition of enzymes, factors affecting enzyme reaction, kinetics of enzyme-catalyzed reactions, regulatory enzymes, isozymes, multi-enzyme system, separation and purification of enzymes, prosthetic groups and distribution of enzymes in the plant.<br>**-Practical:** The process includes preparing and extracting many different enzymes, such as hydrolysis enzymes, redox enzymes, emulsion enzymes, and studying the various factors affecting the enzyme activity. Determine the value of saponification in the oil, as well as the iodine value, and measurement of the rate of imbibition of water by different imbibants at room temperature. |
| **Bot318** | **Bot315** | **Environmental Biotechnology**<br>**التقنية الحيوية البيئية** | Introduction To Biotechnology, Role Of Environmental Biotechnology, Environmental Biotechnology Market, The Immobilization, Degradation Or Monitoring Of Pollutants From A Biological Origin, Plants and Environmental Biotechnology, Basis of Environmental Phytotechnology, Mobility of DNA, Biological Pollution Control Strategies, Applications to Pollution Control, Bioremediation, Organic Phytoremediation, Phytodegradation, Rhizodegradation, Phytovolatilisation, Biological Waste Treatment, |

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| | | | Environmental Biotechnology And Genetic Manipulation, Transgenic Plants, Integrated Environmental Biotechnology, Integrated Agricultural Applications.<br>- **Practical:** Environmental biotechnology applications and techniques. |
| **Bot319** | **Bot314** | **Fundamentals of Bioinformatics**<br>**اساسيات المعلوماتية الحيوية** | Introduction to the biological databases and related computational analysis tools. Study different types and formats of biological data. Structure and function of genes and proteins using computational analysis, statistics, and pattern recognition. International and local biological databases, NCBI, DDBJ (Japan), GenBank (USA) and European Nucleotide Archive. Sequences analysis software.<br>**-Practical:** recognize the different types of data formats. Use the international databases for collecting and treating the biological data units. reconstruct a complete phylogenetic relationship for a selective groups. |
| **Bot320** | **Bot215** | **Natural resources**<br>**الموارد الطبيعية** | Study a brief history of resource use, Classification of natural resources, types of natural resources, Land Resources, Forest Resources, Forest Resources, Energy resourses, Renewable resources, Non-renewable resources, Recyclable resources, Non-recyclable resources, Use of Alternate Energy Sources, Hydel energy, Wind energy, Geothermal energy, Ocean thermal energy conversion, Biomass energy, Solar energy, Problems Relate To the Use of Energy Resources, Growing Energy Needs, Case Study, Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles, Biological resources: conservation and management, Habitat protection and sustainability. |
| **Bot321** | **Bot214 or 228** | **Physiology of Algae**<br>**فسيولوجيا الطحالب** | Learn about media of algae, components and types, general requirements for algal growth, culturing of algae and importance, establishing uni-algal culture. .producing axenic culture (purification), checking the sterility of cultures. Preservation of axenic strain, algal growth measurements, growth curve, Generation time, factors affecting on algal growth, physical factors (Salinity, Osmotic pressure, temperature, light, pH). Chemical factors (different carbon sources, different nitrogen sources.(<br>**-Practical:** Tools used in algal -collection of algal sample from different habitats. Collection of algal sample from different habitats, media of algae, (components and types). General requirements for algal growth. Culturing of algae and importance. Establishing Uni-algal culture. Producing axenic culture (purification) Checking the sterility of cultures. Preservation of axenic strain. Algal growth measurements. Growth curve, Generation time. Factors affecting on algal growth. Physical factors (Salinity, Osmotic pressure, temperature, light, pH). Chemical factors (different carbon sources, different nitrogen sources). |
| **Bot323** | **Bot101** | **Genome and Epigenetics**<br>**الجينوم والوراثة الفوقية** | This course provides knowledge and understanding of epigenetics definitions and subjects, involving DNA changes rather than mutations. Epigenetics impact on health and hereditary and related issues. |
| **Bot324** | **Bot311** | **Forensic Biotechnology**<br>**التكنولوجيا الحيوية الجنائية** | 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 |

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| | | | 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 course. The particular role of these markers in crime diagnosis is emphasized.<br>**-Practical:** Molecular biology and molecular markers techniques |
| **Bot325** | **Bot213** | **Plant Stress Physiology**<br>**فسيولوجيا الإجهاد النباتى** | This course will explore the plant adaptation and response to different environmental stresses (abiotic). This will include drought, salt, heat, chilling, heavy metals, photo-oxidative and nutrient stresses. The course explains synthesis and role of osmo-regulators and stress proteins.<br>**-Practical:** the factors that affect the plant environment and the plant's response to stress are studied, how to design an experiment in plant stress and plant seeds under stressful conditions, and the method for estimating hydrogen peroxide gas, as well as estimating the enzyme catalase as an antioxidant. |
| **Bot490** | | **Research Project** | |
| **Bot411** | **Bot311** | **Genetic Engineering and Genes Technology**<br>**الهندسة الوراثية وتكنولوجيا الجينات** | This course gives the knowledge with DNA synthesis, DNA manipulation, DNA polymerases kinds and activities, and recruitments in genetic engineering. The course involves gene regulation emphasizing transcriptional control and principles of gene expression on molecular basis. DNA cloning and recombination molecular mechanisms related to markers gene expression. The course provides knowledge with cloning vectors, genetic transmission methods, PCR theory and its industrial, medical and judicial applications. The course explains mutation and its impact on molecular gene expression.<br>**-Practical:** This course will include laboratory sessions covering the study of various molecular biology methods including DNA extraction, Plasmid extraction, DNA electrophoresis, Standard polymerase chain reaction (PCR), Real time polymerase chain reaction (q-PCR). Students will be trained on different experiments of gene cloning, as well. |
| **Bot412** | **Bot411, 413** | **Plant tissue culture**<br>**زراعة الانسجة النباتية** | This course provides graduate-level knowledge of and expertise in plant tissue culture theory and practice. The course includes an introduction to the history of plant tissue culture, definition of genetic engineering, biotechnology and plant tissue culture, totipotency, competency, dedifferentiation, infrastructure requirements for plant tissue culture, culture media components and sterilization This course has a vocational focus and introduces the student to the theory and practice of plant tissue culture and their role from modifying plants in plant biotechnology to the propagation of endangered plants. 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 |

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| | | | uses of tissue culture and compared with traditional techniques. Types of in vitro culture, application of plant tissue culture in horticulture and agriculture.<br>-**Practical:** This course will include laboratory sessions covering the study of the media, sterilization, explants, micro propagation, callus culture, organogenesis, somatic variation, protoplast fusion and environmental conditions required. Designing of perfect plant tissue culture laboratory; instruments, devices and their uses, safety precautions, preparation of media and importance of each element, selection of explant, methods of sterilization of each component of media and application. |
| **Bot413** | **Bot310** | **Hormonal Regulation of Plant Growth and Development**<br>**التنظيم الهرمونى للنمو النباتى وتطوره** | This course will explore basic concepts of plant growth and development. This will include the mechanism of plant differentiation. Concept of plant ontogenesis. Morphogenesis and photomorphogenesis, plant photoreceptors, the phytochrome system, and its physiological function. Mechanism of plant motions, the center of gravity and gravitropism, phototropism. Vernalization, seed dormancy and its regulation and physiology of senescence. Integration of responses to regulate plant growth and development: structure, biosynthesis, transport, and physiological function of plant hormones including Auxins, gibberellins, cytokinins, ethylene, and abscisic acid.<br>-**Practical:** The practical study includes the difference between plant growth and development, the different types of plant hormones, the mechanism of the transport of the hormone auxin, the method of measuring the plant growth rate, the study of the process of phototropism and the effect of light on the auxin hormone, the study of the process of gravitropism and chemotropism, the determination of the functions of the hormone auxin and its effect on cellular elongation of coleoptile, and the effect of different concentrations of indole acetic acid on the growth of corn or wheat coleoptiles and the study of apical dominance regulated by indole acetic acid |
| **Bot414** | **Bot215** | **Phytogeography and Flora**<br>**الجغر افيا النباتية والفلورا** | History of plant geography, vegetation of the world, methods of studying vegetation and ecosystem changes, nomenclature of plants, natural selection, biomes and life forms, domestication of plants, rare and endangered species, endemism, discontinuity and cosmopolitanism, idea of continental drift, phytogeography and flora of Egypt.<br>-**Practical:** How to prepare herbarium sheets, Identification of plants, Common weeds, Fruit trees, Street trees. |
| **Bot415** | **Bot314** | **Plant diversity and species conservation**<br>**التنوع النباتى وحفظ الأنواع** | Study the biological diversity, genetic diversity, species diversity, ecosystem diversity. Extinction concept, Threats to Plants Biodiversity. The major causes of loss of biodiversity. Applications of biotechnologies for Conservation of Plants Biodiversity. Insitu and exitu strategies, In vitro Technologies<br>-**Practical:** study representative successful rehabilitated models of plants. Create a small red data list for the most up to date endangered plant species. Field visits to protected areas or botanic gardens that have run conservation strategies. |

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| **Bot416** | **Bot314** | **Plant Systematics and Evolution**<br>**التقسيم التطورى للنبات** | Study the overall evolutionary status for plant kingdom. Patterns of plant speciation and evolution. Cladistics analysis in comparison to phenetic analysis system emphasizing on the monophyllectic groups. Angiosperm tree of life groups, Astrids and Rosids. Markers and DNA sequencing data in classification and resolving the problematic nodes.<br>**-Practical:** selecting the appropriate systematic data, choosing the target regions. Biological characteristics of out groups. Using suitable software for cladistics analysis. DNA markers, PCR role of systematic projects. Interpretation of different cladistics outcomes |
| **Bot417** | **Bot310** | **Plant Propagation الأكثار النباتى** | Plant Propagation and Nursery Management, Importance of plant propagation, Modes of plant propagation, Merits and demerits of different modes of propagation, Sexual Propagation, Asexual Propagation, Types Polyembryony, apomixis, chimeras and budsports of dormancy, Methods of breaking seed dormancy, Layering, budding, grafting, scion grafting, cutting, special propagation structures, propagation tools, propagation zones, micropropagation.<br>**- Practical:** Plant Propagation applications and techniques. |
| **Bot418** | **Bot315 or 431** | **Vegetation and Plant Communities**<br>**الكساء الخضرى والمجتمعات النباتية** | Physiographic factors play roles in vegetation zones, sociability and dispersion, pattern, allelopathy and chemical defense, quantitative analysis of vegetation, man influence upon environment, role of NOG's, response of individuals, population and community.<br>**-Practical:** Minimal area, density, frequency, and cover vegetation maps. |
| **Bot419** | **Bot101** | **Diversity of Gymnosperms**<br>**التنوع فى النباتات معراة البذور** | Study the general characteristics of Gymnosperms living and extinct groups. Evolution of Gymnosperm subgroups, Cycads, Ginkgo, Conifers, and Gnetophytes. Classification of Gymnosperms including traditional taxonomy and phylogenetic reconstruction trends<br>**-Practical:** Handling the available plant samples and color catalogues for representative gymnosperm taxa. Collect and analyze data available online through international plant databases of gymnosperm groups. |
| **Bot420** | **Bot311** | **Applications of Molecular Genetics**<br>**تطبيقات الوراثة الجزيئية** | This course gives an opportunity to provide the students with comprehensive principles and concepts underlying the different molecular biology methods, including gel electrophoresis, molecular markers of based- and non-based polymerase chain reaction (PCR) protocols, 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.<br>**-Practical:** This course will include laboratory sessions covering the study of various molecular biology methods, including gel electrophoresis and molecular |

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| | | | markers of based- and non-based polymerase chain reaction (PCR). Students will be trained on different experiments of gene cloning, as well. |
| **Bot421** | **Bot311** | **Genome Analysis and Applications**<br>**تطبيقات وتحليل الجينوم** | This module explains the importance of using genomic approaches in modern research. The course provides the knowledge to primer designing, an introduction to the modern methods in sequencing of amino acids, DNA and RNA. The course enables the student to be familiar with gene banks' data base, extracting information from genomic data base and perform DNA sequence analyses using online bioinformatics tools, constructing phylogenetic trees. The course explains application of genomic and bioinformatics techniques that enabling student to create their own research programs.<br>**-Practical:** This course will include laboratory sessions covering Interpret case studies involving genome-wide association approaches, utilize bioinformatics-based approaches with greater facility and confidence, through practice exercises aimed at reinforcing concepts presented during the lectures. Identify potential areas where trans-disciplinary approaches involving relevant aspects of genomics and bioinformatics can synergistically promote translational research. |
| **Bot422** | **Bot310** | **Secondary plant metabolites**<br>**نو اتج الإيض الثانويه** | Study the most important secondary metabolites which produced during basic metabolic processes such as the nutrient metabolism of carbohydrates, proteins and lipids like phenolic compounds, pigments, flavonoids, and anthocyanins, |
| **Bot423** | **Bot313** | **Green Nanotechnology**<br>**تقنية النانو الخضراء** | This course will illustrate green manufacturing technology for different method, metal oxide, metaloid and non-metal nanoparticles, Physico-chemical methods for characterization of nanoparticles. Application of nanoparticles in agriculture. Nanotechnology in health care. Toxicological effects of nanoparticles.<br>**-Practical:** The practical part is concerned with learning how to make different biological extracts, metal solution and how to extract and purify nanoparticals. |
| **Bot424** | **Bot216** | **Systematic anatomy**<br>**تشريح تقسيمى** | Plant systematic anatomy is focusing on anatomical attributes, tracheal, vessels, wood, cambium, nodal, and trachoma's development structure and the role of the evolution of these aspects in taxonomic point of view at the levels of angiosperm and gymnosperms groups. The course is covering the sectional techniques and viewing the anatomical aspects from comprehensive investigations different concepts and theories.<br>**-Practical:** investigation and examination of sectioning representative, nodes, vessels, cambium, parenchymal tissues and leaf fiber structure that reflect a sequencing evolution aspects |
| **Bot425** | **Bot314** | **The origin and diversification of Angiosperms**<br>**نشأت كاسيات البذوروتنوعها** | Resolution of the higher clades and the backbone of the Angiosperms are clearly united by several synapomorphies. This course is covering the origin and the development of the basal and intermediate clades through the eudicot angiosperm groups. Focusing on consistent identification of Amborella, Nymphaeaceae, and Austrobaileyales as the basal most branches of the |

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| | | | angiosperm tree. Other basal lineages include Chloranthaceae, magnoliids, and monocots are the main course work investigation groups.<br>**-Practical:** Reconstruct and build new yaxonomic relationship based on the origin concluded data from the history of the angiosperms including, Amborella |
| **Bot426** | **Bot218** | **Plant nitrogen metabolism and protein**<br>**إيض النيتروجين فى النبات والبروتين** | This course will explore the nitrogen cycle in nature, nitrification, how to losses and gain of combined nitrogen from or to nitrogen cycle. The processing of inorganic nitrogen by the plant. The assimilation of nitrate. The assimilation of ammonia. Structure and properties of amino acids. Properties, structure, separation and classification of proteins. Nitrogen metabolism in the seed.<br>**-Practical:** How to determine the total nitrogen in plant organs. Determination of amino acids in plants. Extraction of protein in plant dry organs Estimation of soluble protein and total protein in plant organs. Detection of protein patterns in plants. |
| **Bot427** | **Bot215** | **Ecological engineering**<br>**الهندسة البيئية** | The course aim to study Relationship to Ecology, Relationship to Engineering, Design of New Ecosystems, Principles of Ecological Engineering, Sanitary Engineering, Ecological engineering and Treatment Wetlands, Soil Bioengineering, Microcosms in Ecotoxicology, Restoration Ecology, Restoration and Environmentalism, Bioremediation, Ecological Engineering for Solid Waste Management, Composting Ecosystems for Organic Solid Wastes, Industrial Ecology, Exotic Species and Their Control, Exotics as a Form of Biodiversity, Concepts of Control in Ecology and Engineering, Economics and Ecological Engineering, Ecological Nanotechnology, Techno ecosystems, Ecology and Aquacultural Design and Ecological Engineering Education. |
| **Bot428** | **Bot310** | **Plant Propagation**<br>**مقدمة فى الأكثار النباتى** | Patterns of plant genetic variation, ecotypes and ecolines, plant reproductive systems, self and cross-fertilization, vegetative reproduction.<br>**-Practical:** Plant Propagation applications and techniques. |
| **Bot429** | **Bot310** | **Primary plant metabolites**<br>**نو اتج الإيض الأوليه فى النبات** | Study the primary metabolites such as carbohydrates, protein, lipids, nucleic acids organic and amino acids, vitamins, hormones, and glucosinolates are essential for plant growth, development, stress adaptation, and defense. |
| **Bot431** | **Bot215** | **Ecosystem Dynamics and Environmental Biotechnology**<br>**حركية النظام البيئي و التقنية الحيوية البيئية** | Ecosystem Structure And Functions, Abiotic And Biotic Component, Energy Flow, Food Chain, Food Web, Ecological Pyramids, Biogeochemical Cycles, Ecological Succession, Ecads And Ecotypes. Population Ecology, Population Interactions. Introduction To Biotechnology, Role Of Environmental Biotechnology, Plants and Environmental Biotechnology, Basis Of Environmental Phytotechnology, Applications To Pollution Control, Bioremediation, Organic Phytoremediation, Phytodegradation, Phytovolatilisation, Environmental Biotechnology And Genetic Manipulation, Transgenic Plants, Integrated Environmental Biotechnology, Integrated Agricultural Applications.<br>**-Practical:** Environmental biotechnology applications and techniques. |

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| **Bot433** | **Bot101** | **Diversity of Archegoniate**<br>**التنوع فى الأرشجونات** | Explanation of the current diversity of lower land plants. Allowed to point out the inter-relationship between lower and higher plants, to understand the evolution among different plant groups and evidence on which evolutionary relationship is postulated. The principles of classification of plants with attention to the phylogeny and evolutionary development. To illustrate the comparative morphology, structure and reproduction of various members within different groups.<br>-**Practical**: Students should be able to Compare between liver worts and mosses Compare between pteridophytes Describe the development of plants in anatomy and morphology The students should be able to Examine slides under light microscope Draw Scientific drawing Improve discussion skills |

| Code | Prereq. | Course Title | Contents |
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| **Mic211** | | **Fundamental Microbiology**<br>**أساسيات الميكروبيولوجي** | This course will explore the history of Microbiology; Scientist of great concentration in microbiology , Diversity of the microbial world; Cell Structure and Organization, Why study Microbiology, Principles of Microscope, Preparing Specimens for Optical Microscopes; stains and staining reactions, Control of Microbial Growth; Physical control methods, Chemical control agents, Microbial nutrition and cultivation; Macronutrients and micronutrients, Laboratory Cultivation of Microorganisms, Estimation of microbial growth.<br>Practical: The practical part is concerned with studying orientation to the microbiology laboratory, Microbiology laboratory skills, Safety procedures and Precautions, Tools and glass wares for the microbiology laboratory, Cultivation of microorganisms, Preparing and dispensing media, Sterilization of media and equipment, Culturing microorganisms from the environment, Handling and Aseptic transfer of microbes, Microscopic morphology of microorganisms, Unicellular fungi (Yeast), Filamentous fungi(Molds) |
| **Mic212** | **Bot101** | **Microbial Diversity**<br>**التنوع الميكروبي** | This course will introduce Diversity of the microbial world, including Bacteria, Archaea, and Eukaryotes, Microbial diversity in aquatic and terrestrial systems, and in different types of extreme environments and other model systems, Interactions within microbial communities and between microorganisms and plants and animals.<br>Practical: Techniques for the study of environmental microbes : sample collection, sample processing, Culturing simple microflora from different sources (Soil , Water and Air). determination of microbial numbers. Determination of microbial biomass |
| **Mic213** | | **Microbial Cell Structure and Function**<br>**تركيب الخلية الميكروبية ووظائفه** | -Introduction to cells- Different types of cells (Prokaryotic cells and Eukaryotic cells) - General structure of viruses - Bacterial cell structure and function (Capsule-Flagella-Pili-Sheath-Cell wall-Cytoplasmic Membrane-Genetic material - Mesosome -Ribosome-Cytoplasm-Spore)- Fungi cell structure and function.<br>Practical: The lab introduces the students to the methods used for safely handling of microorganisms, the difference between prokaryotic and eukaryotic cell, virus structure, Different arrangement of bacterial cells, differentiation between Gram- |

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| | | | positive and Gram-negative cell using Gram stain, Classification, and examination of Fungi. |
| Mic214 | Mic211 | **Microbiological Techniques**<br>**تقنيات ميكروبيولوجية** | Laboratory sessions covering the following topics. Laboratory safety and understanding warning signs, enrichment, Isolation purification, quantification of microbial different products and methods used for characterization, Different types of polymerase chain reactions. Different types of gel electrophoresis, Different types of sequencing, Molecular cloning, Different types of microscopes, Instruments used in Different microbiology, Preparation of permanent slides. Field visit, planning a field project, field equipment and tools, safety, field observations, techniques for sampling collection and preservation, field notebook, preparation and writing report, presentation of data. visits to different central laboratories. |
| Mic215 | Bot101 | **Biological control**<br>**المقاومة الحيوية** | This course introduces the concept of the biological control of plant pathogens, including the history, scope, strengths and weaknesses, scientific basis of biological control and the biology of different microbes like fungi, bacteria, viruses, insects. Also, this course will deal with the development of method and approaches of microbial control, biological control methods, population ecology as it relates to biological control, biological control in integrated pest management, techniques, and protocols in implementation of control programs and related topics.<br>-Practical: This course focuses on developing the practical understanding of the biological control methods. First part including the isolation of the pathogens, microscopic examination of infected plant parts and identifying the pathogens. The second part is studying the lethal effect of many antagonistic fungi, bacteria, insects and nematodes against the pathogens in vitro and subsequently in green house. Finally, studying the interactions of these biological control agents with their target, host plant, and environment |
| Mic216 | Bot101 | **Biology of Algae**<br>**بيولوجيا الطحالب** | Basic characteristics of algae, Cellular and subcellular organization, Range of structure of algae, Reproduction and life histories, Classification of algae, Diagnostic features of the different classes with representative examples, Algae and human affairs and the environment. |
| Mic217 | | | |
| Mic218 | Mic211 | **Microbial toxins**<br>**سموم ميكروبية** | This course provides the concept of toxicity of microorganisms, microbial toxins and intoxication, division of microbial toxins by origin, chemical structure, and mechanism of action. The basic types of microbial product toxicity mechanisms - the effect on the components and processes in the cell and Functioning of microbial toxins on target organs (human, animal, and plant). Detection of toxicity of microorganisms in different in vitro (cell lines, microphysiological systems, enzymes) and in vivo assays. Studying certain mycotoxins that are secondary metabolites produced by microfungi. they are capable of causing food spoilage, disease and death in humans and other animals.<br>-Practical: Detection of bacterial endotoxin and exotoxin using many techniques; Determination of the toxicity of microorganisms in the enzyme assay PP1 (inhibition of enzyme protein phosphatase 1); Determination of neurotoxicity in the enzyme assay AChE (detection of inhibition of acetylcholine esterase enzyme); Determination of the cytotoxic effect of microorganisms using in vitro assays with |

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| | | | selected cell lines; Detection of aflatoxin and other food toxins using immunochromatographic and spectrophotometric methods. Finally, offer many methods for controlling the harmful effect of the toxins in their environment. |
| Mic219 | - | **Biostatistics and Experimental Designs**<br>**الإحصاء الحيوي وتصميم التجارب** | Topics include analysis of observational studies and randomized clinical trials for testing hypotheses (Analysis of variance, T-tests, Regression and nonparametric methods) and issues in sampling and design of experiments, Techniques in the analysis of survival and longitudinal data, Approaches to handling missing data and meta-analysis |
| Mic311 | Mic211 | **Bacteriology** علم<br>**البكتريا** | Bacterial cell shapes, sizes and arrangement, structure and function of bacterial cell, Endospore characteristics, Structure of archaea, Study of the nutrition of bacteria and relation to growth, preservation of bacterial cultures. Environmental factors affecting bacterial growth, Growth of bacterial population and methods of growth measurement, bacterial growth curve, synchronous and continuous culture.<br>Practical: This course will include Microbiology laboratory skills, Microbiology laboratory thinking skills, laboratory safety, pure culture techniques, negative staining, a preparation of a bacterial smear, simple stain, Gram stain, acid fast stain, bacterial endospore, capsule stain, isolation and cultivation of anaerobic bacteria. Quantitative determination of bacterial populations. Quantitative determination of bacterial |
| Mic313 | Mic211 | **Virology**<br>**علم الفيروسات** | This course will explore Some Viruses of historical importance, Nature of viruses, Architecture and assembly, Proteins and Nucleic acids of Virions, Genome organization and gene expression, Replication, Plant viruses nomenclature and classification, Modes of transmission, diagnosis and assay, Disease symptoms and control, Animal viruses nomenclature and classification, Initiation of infection and synthesis of macromolecules, Methods of transmission, diagnosis, and assay, Representative viruses, their pathogenesis, epidemiology and control, Bacterial viruses habitat, replication and classification, Viruses as vectors in genetic engineering, Determination of chemical characteristics of viruses particles, Seminars will be used to analyze current research papers and modern viral analysis techniques.<br>-Practical: The practical part is concerned with studying external Symptoms of virus diseases ( general appearance , color deviation maleformation, masking of symptoms, tolerance, mixed symptoms), studying internal Symptoms of virus diseases (inclusion bodies and their types), Virus transmission, Vector transmission, Aerial transmission, Soil transmission, Sap transmission (mechanical inoculation), Determination of physical properties of the virus(TIP,LIV,DEP), Determination of virus by serological methods (ELISA), Determination of virus by molecular methods (PCR), Real time polymerase chain reaction (q-PCR). Gel Electrophoresis (Agarose Gel Electrophoresis, Protein polyacrylamide gel ), Students will be trained on different experiments of gene cloning, studying various molecular biology methods including DNA extraction, Plasmid extraction |
| Mic315 | Mic213 | **Physiology and metabolism of Microbial cell** | What is metabolism, Generation of ATP, 1.Enzymes and their role in metabolism, 2. Energy producing reactions (EMP, -HMP, TCA), 3. Mixed acid fermentation (Butanol and butyric acid fermentation, Lactic acid fermentation), 4.-Anapleurotic |

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| | | فسيولوجيا و ايض الكائنات الدقيقة | reactions( Transport of nutrients), 5. Protein biosynthesis and regulation of enzyme activity, 6. Lipid metabolism, 7-Role of microbes in nature, 8-Microbial growth, 9-Measurement of Microbial growth, 10-Media: natural, synthetic and semi-synthetic media, 11-Physical factors affecting growth, 12-Nutritional factors affecting growth, 13-Vitamins and growth factors.<br>-Practical: Sterilization methods, Culture media, Isolation of soil fungi, Purification, Inoculum preparation, Spore suspension preparation, Methods of inoculation, Microbial growth determination Linear method of determination of fungal growth, Dry weight method, turbidimetry, growth curve of fungi, Effect of different carbon sources on microbial growth, Effect of different levels best carbon source on microbial growth, Effect of different nitrogen sources on microbial growth, Effect of different levels best nitrogen source on microbial growth, Effect of different temperature, pH, and Light on microbial growth, Antagonism and effect of antimicrobial chemicals, Transcriptomic analysis as a tool in analysis of microbial metabolism, Proteome and proteomic analysis as physiological response analysis, افكار وتجارب ابدعها الطلاب فى التخصص, General Revision |
| Mic312 | Mic211 | Mycology<br>علم الفطريات | -Morphology, Taxonomy, structures, Growth of fungi, Methods of determination of growth, Myxomycotina, Eumycotina, Zygomycetes, Oomycetes, Basidiomycetes, Ascomycetes, deuteromycetes, Plant pathology, Factors affecting fungi.<br>Practical: Sterilization methods , Culture media , Isolation of fungi from ( soil , air , seed , food and water ) .<br>-Plasmodiophora brassica , Synchytrium endobioticum , Allomyces, Saprolegnia , Achlya , Aphanomyces , Isolation of aquatic fungi . Pythium , Albugo , Plasmopara , Phytophthora , Peronospora , Bremia , Rhizopus , Mucor , Circinella , Absidia , Cunninghamella , Syncephalastrum, Saccharomyces cerevisiae , Taphrina deformans ,Aspergillus , Penicillium ,Erysiphe , Uncinula , Spaerotheca , Podosphaera , Microsphaera , Leveillula , Phyllactinia ,Claviceps purpurea , Peziza ,Venturia , Puccinia graminis , Ustilago , Trichoderma ,Stachybotrys , Cladosporium , Curvularia , Drechslera , Stemphylium ,Alternaria , Fusarium , Botrytis. General Revision. |
| Mic314 | Mic211 | Yeast and Yeast Biotechnology<br>خمائروتقنية خمائر | History and definition of yeasts, Ecology of yeasts, Classification of yeasts, Growth and reproduction of yeasts, Structure of yeasts cell, Yeasts morphology, Identification and preservation of yeasts, Fermentation and respiration, Yeast transformation, Economic importance of yeasts.<br>-Practical: This course will include laboratory sessions covering the above topics |
| Mic317 | Mic211 | Molecular Microbiology<br>ميكروبيولوجيا جزيئية | This course focuses on prokaryotic DNA replication, DNA repair mechanisms, mutagenesis, gene expression and gene regulation. In addition, it gives a special concern to the restriction-modification system. Some important molecular applications are also included in addition to DNA recombination, and Agrobacterium genetics.<br>-Practical: This course includes many laboratory skills including: genotyping and phenotyping, DNA isolation from different sources, mutagenesis, transformation, isolation of plasmid DNA, DNA band excision, gene expression, RNA extraction, and Southern blot technique. |

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| Mic316 | Mic213 | **Microbial Enzymes**<br><br>**انزيمات الكائنات الدقيقة** | Brief introduction to enzymology (Classes of enzymes ; active and binding sites; co-enzymes, co-factors, holo and apoenzymes, enzyme activity, units; enzyme inhibitors and activators, enzyme kinetics – Michaelis –Menten derivation, km values, association and dissociation constant, inhibition and its kinetics, effect of pH and temperatures on enzymes action, enzyme regulation, allosteric, covalent modification, isoenzyme, abzymes, ribozymes<br>Advantage of microorganisms as an enzyme producer<br>Fermentation for enzyme production (biology and technology)<br>Control of microbial enzyme production<br>Thermostable enzymes<br>Proteomic and transcriptomic in microbial enzymes<br>Application of microbial enzymes in industry, agriculture, and medicine<br>-Practical: Screening for extra cellular enzyme producing microorganisms<br>Assay of different enzymes (ex., cellulases, amylases, lipases, chitinases and etc.<br>Determination of enzyme kinetics – Michaelis –Menten derivation and km values<br>study the effect of cultivation conditions in microbial enzyme production.<br>liquid state and solid-state fermentation<br>OVAT and Response surface methodology in optimization of enzyme production<br>Immobilization of microbial enzymes<br>Some molecular techniques in increase enzyme productivity<br>Effect of substrate concentration, pH, heat treatment and salt concentration on the enzyme activity |
| Mic317 | Mic211 | **Molecular Microbiology**<br>**ميكروبيولوجيا جزيئية** | This course focuses on prokaryotic DNA replication, DNA repair mechanisms, mutagenesis, gene expression and gene regulation. In addition, it gives a special concern to the restriction-modification system. Some important molecular applications are also included in addition to DNA recombination, and Agrobacterium genetics.<br>-Practical: This course includes many laboratory skills including: genotyping and phenotyping, DNA isolation from different sources, mutagenesis, transformation, isolation of plasmid DNA, DNA band excision, gene expression, RNA extraction, and Southern blot technique. |
| Mic318 | Mic317 | **Microbial genetics**<br><br>**وراثة ميكروبية** | This course provides in-depth studies in many microbial genetic branches including, identifying the genetic material, structure and replication of genomes, gene function, gene mutation, DNA repair, genetic recombination, DNA recombination, microbial cloning and biotechnology.<br>-Practical: This course includes many laboratory experiments including, CFU-counting technique, isolation of different bacterial cultures from the agar surfaces, DNA extraction from bacterial strains, amplification of the 16S rRNA with PCR and purification of PCR product, amplification of the ITS region for fungi identification, isolation of phage from the mouth and sewage, mutant isolation by Gradient Plate Method, gel electrophoresis and southern blot technique |
| Mic319 | Mic211 | **Microbial secondary metabolites**<br>**النو اتج الثانوية الميكروبية** | Definition and impact of microbial SM.<br>Terpenoids: synthesis of IPP (isopentenyl pyrophosphate) in the cytosol and the plastid, role of terpenoids in the plant defense. |

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| | | | Alkaloids: biosynthesis, functional groups and biological activity, definition of the main metabolic pathways. Biotechnological applications.<br>Phenylpropanoids: biosynthesis and ecological functions. Phenols, polyphenols and tannins: classification and biosynthesis. Biotechnological applications. Biosynthesis of lignins.<br>Flavonoids: biosynthesis, localization, ecological significance. Synthesis and modification of the color of flowers for commercial purposes. Biotechnological applications.<br>Sulfur-containing SM<br>Polyketides, secondary metabolites produced by bacteria. Mode of biosynthesis, possibilities for biotechnology intervention.<br>Metabolic engineering in the expression of SM.<br>New trends in microbial secondary metabolities<br>-Practical: Microbial isolation, collection and preservation<br>Cultivation of microorganisms for SM production<br>Preparation of Extracts:<br>Ethanoic Extracts:<br>Methanolic Extract:<br>Aqueous extract:<br>Thin layer chromatography analysis<br>GC mass and HPLC<br>Storage of extracts:<br>Biochemical Assays:<br>Tests for alkaloids:<br>Test for steroidal compounds:<br>Test for phenolic compounds:<br>Test for Flavonoids:<br>Tests for Tannins<br>Tests for Cardiac Glycoside: 2<br>Antibacterial activity test: |
| **Mic320** | **Mic315** | **Fermentation Technology**<br>**تقنية تخمر** | Introduction, history and goals of fermentation technology, Fundamental types of fermentation biotechnology, Microorganisms used in industrial fermentation, Fermenters and equipments of fermentation, Chemical and physical factors affecting fermentation processes, Process control of fermentation processes, Basics quality control procedures of fermentation processes, Separation, purification and quantification of fermentation products, Industrial production of acids, alcohols, lipids, protein, vitamins, steroids, antibiotics, growth hormones and etc.<br>-Practical: This course will include laboratory sessions covering the above topics |
| **Mic410** | **Mic317** | **Bioinformatics معلوماتية حيوية** | Introduction, history and goals of bioinformatics, Nucleic acids sequence analysis, Protein sequence analysis, Predicting functional structures (DNA - RNA - proteins - lipids - carbohydrates), Sequence alignment, Databases, Software and tools, Applications.<br>-Practical: This course will include laboratory sessions covering the above topics |

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| Mic411 | Mic311 | **Systematic bacteriology**<br>**تقسيم بكتريا** | Diversity and relationships between organisms, Classification, characterization and relationships of a particular group of bacteria, numerical methods, chemotaxonomy in living organisms, and the use of these chemical characters for classification and identification. The evolutionary chemical variations distance (relatedness) between two species (Phylogenetics). The identification/diagnostic processes as the end result of taxonomy, Study of many traits of different members of phyla (morphological and physiological characters, diseases and life cycles) such as: Deinococcus-Thermus, Chlorobi, Proteobacteria including different classes as: (betaproteobacteria, Gammaproteobacteria, Deltaproteobacteria, Epsilonproteobacteria, Firmicutes (Class Clostridia, Mollicutes,, Bacilli), Actionbacteria, (Chlamydiae, Spirochaetes).<br>-Practical: This course covering the identification of unknown bacteria, cultural and morphological characteristics of bacteria. Study of Physiological characterisites (Biochemical tests) as Biooxidation reactions (Redox reaction), Sugar fermentation, Butanediol fermentation (Voges-Proskauer test), Mixed acid fermentation (methyl red test), production of Catalase, Oxidase, and nitrate reduction. Hydrolysis reaction such as hydrolysis of starch, casein, fat, tryptophane , urea and gelatin. Miscellaneous reactions Hydrogen sulphide production and Citrate utilization. IMVIC tests Analytical Profile Index (API),Automated machines, VITEK 2 system, BIOLOG system. |
| Mic412 | Mic413 | **Food and Water Microbiology**<br>**ميكروبيولوجيا المياة والغذاء** | This course focuses on fundamentals of food microbiology, characteristics of predominant microorganisms in food, sources of microorganisms in foods and food quality. It is also presenting beneficial uses of microorganisms in food industry, and how to control microorganisms in foods. Besides, it provides a firm background in drinking water microbiology, and the role of microbes in wastewater treatment.<br>-Practical: This course will include many important experiments such as: Aerobic mesophilic plate count of bacteria from different food sources, detection and determination of E. coli in food and beverages, and detection and determination of Salmonella, Shigella, yeast and molds in different food samples. It also provides a method of how to detect and confirm aciduric flat soure spore-formers in foods. Besides, some important biochemical tests procedures are provided to characterize food pathogens. Finally, some water quality tests are also included such as gene probing, Membrane filter technique, and Biological Oxygen Demand |
| Mic413 | Mic211 | **Medical Microbiology and Immunology**<br>**ميكروبيولوجيا طبية ومناعة** | Micro-organisms in the biological system. Micro-organisms and disease, Pathogenicity of bacteria, Pathogenicity of virus, Pathogenicity of fungi as well as the related laboratory methodology. Bacterial physiology. factors. Bacterial genetics. Antibiotics and chemotherapeutics. Current research within medical microbiology. Immune system, Immunity against pathogenicity and virulence of microorganisms. New trends in medical microbiology and immunity<br>Practical: Introduction, General Microbiology laboratory & Safety Microscopy Examination of Stained cellsHandouts3Bacterial Staining, Direct & Indirect Simple Staining Techniques (Capsule Staining) Gram Staining Acid Fast & Spore Staining Nutritional Requirements, Media Types &Techniques for The Cultivation of Microorganisms |

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| | | | Ubiquity of Microorganisms<br>Physical & Chemical agents for the control of Microbial Growth.<br>The Kirby-Bauer Antibiotic Sensitivity Test.<br>Biochemical activities of Microorganism<br>Ochtarlony double diffusion agar cup assay<br>Latex agglutination assay<br>Immunofluorescence<br>Immuno electrophoresis.<br>Serological test-Tuberculin Test<br>ELISA |
| **Mic414** | **Mic211** | **Industrial Microbiology and Biotechnology**<br>**ميكروبيولوجيا صناعية وبيوتكنولوجيا** | This course focuses on the diversity of industrially relevant microbes, microbial and and fermentation technology. Besides, it is presenting different applications of microbes in Agriculture, Environment, Food and Chemical industries. It also emphasises the role of microbes in enzymes and vaccine production. Finally, a comprehensive knowledge is also provided for genetic strain improvement for higher production.<br>-Practical: This course will include many laboratory experiments including: Microbial enzyme production such as caseinase, urease, and reductase. Testing microbial spoilage of meat, and role of microbes in food fermentation and beverage production, with especial concern to yoghurt and bioplastic production. Besides, minimal inhibitory concentration and protein analysis will also be exercised. |
| **Mic415** | **Mic211** | **Microbial Remediation**<br>**معالجة حيوية ميكروبية** | Introduction to microbial remediation, advantage and disadvantage of Bioremediation, Sources and hazards of toxic pollutants, Microbial remediation potential, types of bioremediation (Biostimulation, Bioattenuation, Bioaugmentation), venting and piles. Factors affecting microbial bioremediation, Wastewater and industrial effluent treatment, Soil and land treatment, remediation of heavy metals, Petroleum hydrocarbon, pesticides as for examples. Mechanism of biosorption, bioleaching, Plant–Microbial Remediation.<br>-Practical: The practical part is concerned with studying the isolation of hydrocarbon -degrading bacteria/fungi, isolation of bacteria/fungi from different contaminated sites (waste water, soil), Laboratory study on the bioremediation of diesel oil contaminated soil from a petrol station, Isolation of chromate-reducing bacteria/fungi, Isolation of pesticides-degrading bacteria, effect of different factors improve microbial remediation (optimization), Studying how to calculate biodegradation efficiency. Cultural and morphological Characterization of different active isolates |
| **Mic416** | **Mic211** | **Microorganisms of Extreme Environments**<br>**ميكروبيولوجيا البيئات القاسية** | Types of extremophiles, distribution, characteristic features, structures to adapt growth in extrem conditions. Importance of extremophiles, their applications in industrial, agricultural, environmental, and medical fields.<br>-Practical: Preparation the specific media for isolation of Extremophiles from different habitats, morphological characterization. Biotechnological applications of actinomycetes (antimicrobial agents, enzyme, pigment) production, metal nanoparticles synthesis, biodegradation of some hazards polluted substance. |

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| Mic417 | Mic317 | **Molecular systematic**<br>**تقسيم جزيئي** | -Introduction, history and goals of molecular systematic, Phylogenetics and classification, Species concepts, Molecular taxonomic techniques, Genes used for molecular systematics, Methods for inferring phylogenetic trees, Databases, Applications.<br>-Practical: This course will include laboratory sessions covering the above topics |
| Mic418 | Mic312 | **Plant pathology أمراض النبات** | This course provides a broad-based integrated study of different diseases affect cultivated and wild plants. It interested in identifying both biotic and abiotic pathogens, understanding of mechanism of infection and monitoring all the symptoms associated the disease. The course delves into the study of how the pathogens attacks the hosts, and how they defend. The course provides a wide knowledge' study of disease cycle involved the hosts and the pathogens. Finally, it offers different ways to eradicate or reduce the amount of pathogen present in an area, a plant, or plant parts.<br>-Practical: This course will include laboratory sessions covering the study of various plant diseases, including isolation of the pathogens, microscopic examination of infected plant parts, identifying the pathogens and suggesting specific methods for controlling the disease |
| Mic420 | --- | **Environmental Management and Impact Assessment**<br>**ادارة البيئة ودراسة الجدوى البيئية** | Concepts Of Environment, Environmental Degradation, Definition Of Environmental Impact Assessment (EIA), Principles Of (EIA), Aims And Benefits Of (EIA), (EIA) Process And Procedures, Applications Of (EIA), (EIA) And Sustainable Development, (EIA) And Its Implementation, Project Impacts And Effects, (EIA) And Project Cycle, Management Of (EIA) Study, Project Screening, Policies, Law, And Regulations And International Obligations Related To Environmental Impact Assessment (EIA), Identification Of (EIA) Concepts And Methods, (EIA) Prediction, Environmental Monitoring And Auditing, Introduction To Strategic Environmental Assessment, Methodology Of (EIA), Cases Studies Related To (EIA |
| Mic419 | Mic313 | **Viral Biotechnology**<br>**التقنية الحيوية للفيروسات** | This course will explore basic and advanced features of viruses and the virus-like particles (VLPs ) and their major applications are discussed. Viruses as vectors in genetic engineering; Uses of recombinant viruses in gene therapy ,vaccinology and immunotherapy. (VLPs) in prophylactic , therapeutic vaccines , also as vehicles in drug and gene delivery and more recently as tools in nanobiotechnology. The implications of large-scale production of viruses and VLPs are discussed.<br>- Practical: The practical part is concerned with techniques of viruses' purification, Techniques of Chemical analysis to show the type of nucleic acid present, the nature of the protein component, and the presence, if any, of other chemical substances. Selecting the appropriate techniques for application of viruses to biotechnology. |
| Mic422 | Mic211 | **Actinomycetes**<br>**أكتينومايستيات** | Biology of actinomycetes (distribution - characteristic features, structure- growth behavior), importance of actinomycetes in human's life, their applications in industrial, agricultural, environmental, and medical fields.<br>-Practical: Preparation the specific media for isolation of actinomycetes from different habitats, morphological characterization, cultivation on solid and liquid media. Biotechnological applications of actinomycetes (antimicrobial agents, enzyme, pigment) production, metal nanoparticles synthesis, biodegradation of some hazards polluted substance. |

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| Mic421 | -------- | Laboratory Safety, management &Infection Control احتياطات الامان في المعمل والأدارة ومكافحة العدوي | General laboratory safety standards. Control the instrument in standard. The design and operation of a quality control program in a clinical laboratory. Standard Precautions (Hand hygiene, personal protective equipment, Safe injection practices, Sterile instruments and devices, Cleaning, and disinfection of environmental surfaces), Transmission-Based Precautions (contact precautions, Droplet Precautions, Airborne Precautions). analytical goals and laboratory management, and control the hazardous compounds. |
| Mic426 | Mic413 | Food Microbiology ميكروبيولوجيا الغذاء | This course focuses on fundamentals of food microbiology, characteristics of predominant microorganisms in food, sources of microorganisms in foods and food quality. It is also presenting beneficial uses of microorganisms in food industry, and how to control microorganisms in foods.<br>-Practical: This course will include many important experiments such as: Aerobic mesophilic plate count of bacteria from different food sources, detection and determination of E. coli in food and beverages, and detection and determination of Salmonella, Shigella, yeast and molds in different food samples. It also provides a method of how to detect and confirm aciduric flat soure spore-formers in foods. Besides, some important biochemical tests procedures are provided to characterize food pathogens. |
| Mic490 | - | Research Project مشروع بحثي | Independent research related to a student's approved essay proposal with written and oral presentation of research results |

# Courses Contents

# Department of Zoology

| Code | Prereq. | Course Title | Contents |
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| Zoo101 | | General Zoology (1) | This course is an introduction to the biology of animals including anatomy and physiology, behavior and ecology. This course provides an introduction to the cellular and sub-cellular characteristics of cells with emphasis on structure and function of organelles common to eukaryotic cells, different tissue types and body systems, the mechanism of some biological process covering the animal activity, the mechanism of the animal development, as well as the interaction between animals and their environments.<br>The course includes practical experience in the dissection of various systems of the toad as a representative model of vertebrate animals and study of the histological sections of toad. |
| Zoo102 | | General Zoology (2) | This course provides an introduction to animal diversity and the phylogenetic relationships between the animal phyla in the kingdoms protista and animalia from primitive to advanced groups. This course covers the concept of biodiversity, the taxonomic characters and classification of various invertebrate phyla like Sarcomastigophora, Apicomlexa, Ciliophora, Porifera, Cnidaria, Platyhelminthes, Nematoda and Annelida with an emphasis on Egyptian examples.<br>The course includes practical experience in the identification of the representative invertebrate organisms with systematic position and morphological features of different species using slides and specimens. |
| Zoo111 | | General Zoology | This course is an introduction to various invertebrates and vertebrate animals with emphasis on their evolutionary relationships, and biology including anatomy, histology and physiology, embryology, behavior, and ecology.<br>This course includes practical experience in the identification of the invertebrate organisms with systematic position and morphological features of different species using slides and specimens. Also, it includes the dissection of various systems of the toad as a representative model of vertebrate animals and study of the histological sections of toad. |
| Zoo201 | | Invertebrates Biology (1) | This course provides a review of invertebrates design, classification, taxonomic characters, and detailed investigation of selected invertebrate groups, such as Annelida, Arthropoda, Mollusca, and Echinodermata. This course covers the diversity, form, function, and adaptation of the major invertebrate phyla.<br>Practical classes illustrate the systematic position and morphological features of different species of the major invertebrate phyla using slides and specimens in addition to dissection. |

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| **Zoo202** | | **Invertebrates Biology (2)** | This course covers the diagnostic features, the basis of classification, evolution, and distribution of major and minor invertebrate phyla, such as Porifera, Cnidaria, Ctenophora, Nemertea, Rotifera, Annelida, Arthropoda (Class: Crustacea), and Bryozoa (Ectoprocta), with special reference to their affinity and inter-relationships.<br>The practical course illustrates the affinities and differences between different invertebrate species using slides and specimens. Also, it illustrates the identification method of invertebrate species using systematic key. |
| **Zoo203** | | **Histology and zoo-techniques** | The course enables the student to understand the general tissues characteristics, microscopic structure, and function of major tissues and will explore the different tissue types in the body including epithelial, connective, skeletal, blood/vascular, muscular, and neurological tissues with studying principles of tissue processing, fixation, and common stains.<br>The practical course will include:<br>• Examining cells, tissues and organs using light microscopy.<br>• Practicing tissue processing and H&E staining method.<br>• Learning trouble shooting techniques and their applications relative to maintaining quality control in the histology lab.<br>• Using optical and computational methods of image processing (digital imaging). |
| **Zoo204** | | **Fundamentals of Chordates** | Classification of chordates. Origin of aquatic and terrestrial life of vertebrates. Study of life and morphology of representatives of the different classes of vertebrates, with special emphasis on their phylogenetic relationships.<br>The practical aspects include studying of morphological and anatomical aspects from protochordates till amniotes. |
| **Zoo205** | | **Physiology 1** | This course focuses on basic physiological principles and the functional organization of living systems and mechanisms for maintaining homeostasis within the human body. Also, this course provides a comprehensive overview of the physiology of the human body systems as muscular and skeletal system, nervous system sensory organs, digestive system, and urinary system.<br>The practical course provides bioanalysis of some biological molecules as carbohydrates, lipids, proteins in animal cell. Bioanalysis of diabetic profiletests. Urine analysis and electrolytes. |
| **Zoo206** | | **Ecology and animal behavior** | This course illustrates ecosystem; structure and function, the interaction of animals with their physical, chemical, and biological environments, principles of population ecology. Also, it presents introduction to quantitative methods in ecology, environmental pollution and its causes, nature of behavior and its relation to the nervous system, reflexes, orientation, learning, social, sexual behaviors and parental care.<br>The practical course includes:<br>• Study of organisms in relation to their surroundings. |

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| | | | • Observe and record the organisms in its natural environment (simplest method) observation.<br>• Carry out experiment in field to find out how organisms reacts to certain changes in its surroundings (field work).<br>• Bringing organisms into controlled environment in laboratory cage or green house (experimental work). |
| **Zoo207** | | **Fauna of Egypt** | This course presents the category and the kinds of animals live in Egypt and the most prevalent animals to be found in Egypt as for desert wildlife of some animals live in the desert as camels, foxes, and desert lynx. Also, it illustrates the majority of Egypt's landscape is in the desert, geographic and the diversity of plants and animals each adapted to its particular habitat and types of Egyptian animals.<br>The practical course presents the study of the types of Fauna as Cryptofauna, Epifauna, Infauna, and Limnofauna and illustrates the statistics method to estimate the population density. |
| **Zoo208** | | **Desert Ecology** | This course presents general description of desert classification and distribution of the world's major deserts. Also, it illustrates weather and climate of the desert environment, morphological, behavioral, and physiological adaptation of animals to the desert environment.<br>The practical course includes the study of a large number of animals inhabit in the desert and their adaptations to desert life to overcome these problems and maintain their reproductive abilities. |
| **Zoo209** | **Zoo101** | **Animal Biotechnology** | This course deals with the details on animal biotechnology i.e. the applications of tools of molecular biology for the improved production and protection of animals, animal products.Principles and applications of recombinant DNA technology, Gene cloning, vectors and expression vectors, transformation, transfection, PCR, construction of the genomic library and cDNA library, DNA sequencing, biotechnological techniques, transgenic animal, animal cloning, and biopharming have been explained. |
| **Zoo210** | | **Cellular Immunology** | Topics covered include Mechanisms of antigen recognition in innate and adaptive immunity, antigen processing and presentation, the MHC, generation of diversity in immune receptors, B and T cell development, activation, differentiation, death and effector functions; mechanisms of homeostasis and immunosuppression; NK cells and other innate immune cell types, immunological tolerance and its breakdown. |
| **Zoo211** | | **Basic Immunology** | Cellular and molecular interactions in the inductions, expression, and regulation of the cellular and humoral immune responses; recent knowledge and applications concerning immunity to various microbial infections as well as antigen-antibody interactions; serodiagnosis and detection of celthe l-mediated immune response. |
| **Zoo212** | | **Enzymology** | The course will cover a wide range of subjects such as classification of enzymes, mechanism, and kinetics of the enzyme-catalyzed reaction. Their assay methods, and clinical applications in the diagnosis of diseases related |

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| | | | to disorders of liver, kidneys, intestines, pancreas, bones, or muscles including heart-muscles.<br>Practical course provides study of basic principles of enzymes, classification, structure, and estimation of different enzymes that secreted in human blood as liver, and kidney function tests, cardiac enzymes, pancreatic profile tests. |
| **Zoo213** | **Zoo101** | **Genetics and Cell Biology** | Understanding of the key concepts of the biology of the cell, integrating principles of cell structure and function with the underlying genetic mechanism(s). Aspects of gene regulation, genomics, cell cycle control, protein synthesis, intracellular protein trafficking and protein degradation in eukaryotic cells. cellular regulation of cell cycle progression and cell death as well as the consequences of deregulated signal transduction in terms of disease, primarily cancer.<br><br>The practical course will include:<br>• Distinguishing between different cellular membranes and organelles in TEM micrographs.<br>• Comparing between mitosis and meiosis and their relation to cell cycle.<br>• Appling Mendel's Laws of inheritance on some heredity conditions.<br>• Estimating risk factors of some genetic traits or disorders. |
| **Zoo214** | | **Soil Ecotoxicology** | This course presents the soil composition as a living community, methods of extraction of soil organisms, the impact of soil and on soil fertility, soil pollution; source and effect, and methods of control.<br>The practical course includes the study of types of soil, techniques of laboratory extraction of animals other than micro-organism, observational techniques to show changes taking place over a period of time in soil which indicate the spatial distribution of micro-organisms. Also, it illustrates the contact slide technique and the dilution plate method. |
| **Zoo215** | **Zoo102** | **Human Biology** | Emphasizes basic human physiology and provides students with an understanding of the human body in health and disease. Environmental problems as the relationship between sunlight and skin cancer and the ecological effects of biotechnology. Aspects of biology which are most relevant to our own species; genetics, physiology, cell biology, evolution and development.<br>The practical course will include:<br>• An introduction to environmental factors and their association with human disease.<br>• Studying of the structure and function of the human cells organelles.<br>• Learning the relationships between genetic makeup and development of human diseases. |
| **Zoo216** | | **Basic Genetics** | The course enables the student to understand principles of genetics including patterns of inheritance, structure, and function of genetic material, the flow of genetic information, control of gene expression, |

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| | | | genetic mutation, introduces students to the basic methods used in genetics such as gene mapping, gene expression techniques, introductory genomics, and gene manipulation. |
| **Zoo217** | | **Immunohistochemistry** | Anatomical, immunological and biochemical techniques to image discrete components in tissues by using appropriately-labeled antibodies to bind specifically to their target antigens in situ. The various applications of IHC in diagnosis of diseases.<br><br>The practical course will include:<br>• Practicing tissue processing, embedding, and section preparation.<br>• Studying immunohistochemistry staining techniques.<br>• Learning strategies for trouble shooting problems associated with IHC slide preparation.<br>• Identifying various applications of IHC in diagnosis of diseases.<br>• Analyzing of IHC slides and their diagnostic significant using scoring programs. |
| **Zoo218** | **Zoo102** | **Medicinal and Economic invertebrates** | Overview of the use of invertebrates in traditional medicine. Information on sponges, jellyfish, sea anemones, corals, crabs, crayfish, lobsters, shrimp, hermit crabs, spiders, scorpions, molluscs, starfish, sea urchins, and many more.<br>The practical course presents different species of invertebrates that can be used as antioxidant, anti-inflammatory, anticancer, antimicrobial and antiviral using plates and specimens, and illustrates the bioactive components in these invertebrate animals. |
| **Zoo219** | | **Molecular and Cellular Basis of Hematology** | The biological properties of the hematopoietic stem cells and relevant biotechnological applications. The phenotype and genotype of hematological malignancies. The principles of targeted therapy and cell therapy with particular reference to the transplantation of stem cells and regenerative medicine.The molecular targets and cellular structures suitable for the development of new forms of targeted therapy. |
| **Zoo220** | | **Cellular Differentiation** | The generalized cells of a developing embryo or the stem cells of an adult organism become differentiated into specialized cells Distinguish between the categories of stem cells Cell signaling and intercellular communication. |
| **Zoo222** | | **Control of Gene Expression** | The transcription of a gene into mRNA and its subsequent translation into protein. The structural genes contain the code for the proteins products that are to be produced. The RNA Interference system (RNAi).<br>The practical course will include:<br>• Summarization of heredity principles and gene structure.<br>• Studying information flow and decoding by the cells in response to changes in environment or developmental stage.<br>• Practice karyotyping analysis.<br>• Determining macromolecule structure related to gene expression.<br>• Studying of gene therapy techniques and their applications. |

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| | | | • Analyzing experimental data related to gene structure and/or expression.<br>• Learn to write genetic reports. |
| **Zoo301** | | **Cell Biology and genetics** | The course enables the student to understand the Ultrastructure and organization of cell organelles, structure, e, and function of the cell. In this course, we will focus on Eukaryotic cell biology and will cover topics such as biosynthesis of cellular membranes, subcellular organelles, cytoskeleton; cell cycle, intercellular and intracellular signaling, and biology of cancer cells. |
| **Zoo302** | | **Comparative anatomy of vertebrates** | Introduction to the structural evolution of the different organs and organ systems of the vertebrate body. The functional significance and evolutionary importance of the various changes are emphasized. Comparative studies on anatomical and structural aspects of different vertebrates.<br>The practical includes the studying of comparative anatomical aspects for the different body systems and organs among vertebrates. |
| **Zoo303** | | **Physiology 2** | This course provides a comprehensive overview of the physiology of the human body systems as circulatory system and blood physiology, respiratory system, male and female reproductive system, lymphatic system, and endocrine system.<br>The practical course focuses on physiological analysis of blood as types of blood cell, erythrocyte sedimentation rate, complete blood Count, determination of hemoglobin concentration, blood groups and Rh factor. |
| **Zoo304** | | **Vertebrates Embryology** | Development from fertilization to adulthood in different model systems. Evolutionary patterns of development. Morphogenes, gene regulation during development, cellular differentiation. Positional information and body axis formation. Development of sex and the nervous system as microcosms. The cellular and molecular events which underlie animal development, drawing on examples of a range of model organisms.<br>The practical included the studying of different embryonic developmental stages of vertebrates. |
| **Zoo305** | | **Invertebrates embryology** | This course will study the reproduction types (Asexual and sexual), the morphology of gametes, mechanism of development in invertebrate animals such as sponges, coelenterates, platyhelminthes, nematodes, and Echinodermata.<br>The practical course presents invertebrate examples for each type of reproduction with notes on fertilization, cleavage, blastulation and gastrulation of each invertebrate species using plates and slides. |
| **Zoo306** | **Zoo102** | **Basics of Medical Parasitology** | An introduction to; parasitism, selected specimen of some medically important parasites with emphasis on morphology, life cycle, pathogenicity, and diagnosis. Fundamental and important aspects of the morphology and life cycles of protozoa and helminths causing human disease, pathological processes caused by these parasites. Special attention |

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| | | | is given to life cycle and methods used in collection and examination of specimens used for the diagnosis of parasitic diseases.<br>The labs associated with this course are designed to identify the different types of parasites and hosts and learn how to distinguish between different parasites. |
| **Zoo307** | | **Soil Ecology** | This course presents the geological guides, characteristics for mineral resource, application to water resources evaluation and soil moisture determination: water shed parameters, physiographic measurements, surface water, soil as a living community, soil composition, methods of extraction of soil microorganisms, impact of soil on fertility, soil pollution sources and methods of control.<br>The practical course includes:<br>• The methods of estimating populations of soil organisms.<br>• The overlap of species inhabiting the above –ground vegetation "the soil".<br>• A qualitative of soil organisms involves their extraction and identification.<br>• We need to make estimate their numbers then the methods adopted to extract them from a soil sample.<br>• We will ensure that the techniques selected will give the best possible results in terms of numbers obtained.<br>Successful for making a total extraction or with every type of soil. |
| **Zoo308** | | **Neurophysiology and Endocrinology** | This course focuses on the neuroanatomy, neurophysiology, and neurochemistry of the central and peripheral nervous system include neuronal function, synaptic transmission, the basic units responsible for fast communication within the nervous system. principles of electric current flow exploited by the nervous system; the basis of the resting potential of neurons; the structure and function of voltage-gated and neurotransmitter-gated ion channels; generation and propagation of action potentials; the physiology of fast synaptic communication. This course focuses on sensory processing, movement, sleep and wakefulness, hunger, thirst, caloric and body fluid homeostasis, recovery of function after brain damage, and various neurological and psychiatric disorders. learning and memory, emotions, and neurological and neuropsychiatric disorders. It also provides discuss about relationship of the nervous system to the endocrine system. The course is designed to provide an understanding to the anatomy, physiology, and biochemistry, of the human endocrine system which include the various classes of hormones, production and synthesis of hormones, receptors and target tissues, mechanisms of action and metabolic regulation. The primary organs of the endocrine system will be covered in detail these include, pituitary gland, pancreas, adrenal, thyroid, parathyroid, gonads and pineal gland. The common endocrine disorders, regulations, and metabolic abnormalities, and their management. |

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| | | | The practical course provides the mechanisms by which neurotransmitters are synthesized and released and the biochemistry of synaptic responses. Illustrated some neural diseases which affected.study cases of pathological conditions and diagnostic procedures associated with endocrine imbalance, and bioanalysis and estimation of some hormones in blood. |
| **Zoo309** | | **Chordates biodiversity** | An introduction on the classification of protochordate till advanced vertebrates. Ecological distribution of aquatic and land-living vertebrates. Structural and functional adaptation of chordate to their life. |
| **Zoo310** | | **Protozoology** | Protozoan phyla, position in the animal kingdom, classification, representative types of Protozoa, Phytoflagellates, Zooflagellates, Intestinal flagellates, Haemoflagellates, Sarcodina, Apicomplexa, and Ciliophora.<br>The labs associated with this course are designed for identification of morphology of protozoan animals and how to identify underlight microscopy. |
| **Zoo311** | | **Stem Cells Programing** | This course will provide students with the building blocks necessary for understanding, examining, and dissecting the dynamic field of stem cell research. This course will delve into the basic research that uncovers the molecular mechanisms and cell biology of stem cell properties and functions as well as translational research and applications of stem cell science to human health. |
| **Zoo312** | | **Bioethics** | This course provides study of moral issues about life and death, typically arising from new technologies and advancements in biology. Human cloning, moral and legal obligations when dealing with excremental animals, basic logic and moral theory. Euthanasia of excremental animals. This course is an introduction to contemporary issues in bioethics. Topics include the ethics of DNA analysis controls, identification, gene selection, human cloning, adult stem cell research as an alternative to cloning, abortion, euthanasia, as well as animal experimentation. |
| **Zoo313** | | **Viral Pathogens and Immunology** | The immune responses to pathogens, as well as on immune evasion of microbes. The organisms studied include bacteria, parasites, and viruses. Host-pathogen interaction and include innate immunity, modulation of antigen processing and presentation Pathogenicstrategies for subversion of immune responses, effector functions of immune cells, and immunopathology. |
| **Zoo314** | | **Molecular biotechnology** | The purpose of this course is to provide students with the scientific principles and molecular biotechnology techniques, and how these techniques are applied. Topics include manipulating DNA, cloning DNA into animals, expressing recombinant proteins, and modifying genomes. The ethics of molecular biotechnology are also covered. |
| **Zoo315** | | **Immunotoxicology** | Describe major laboratory methods in immunotoxicology, - classify toxicants (drugs, pollutants, etc.), and describe ecological immunotoxicology Basic toxicology and the adverse effects of toxic substances on living systems including how toxic substances are taken up |

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| | | | in the organisms, distributed, bio-transformed, and excreted, How toxic substances react with biomolecules, as well as knowledge about toxic substances, e.g. metals, organic contaminants, and pesticides. |
| **Zoo316** | **Zoo205** | **Cancer Immunology** | Role of the immune system in oncogenesis. the domain of cellular transformation, carcinogenesis, and immune surveillance. Innovative cancer immunotherapies to treat and retard progression of the disease. Currently adopted immune-based therapies and new possible approaches in cancer treatment. |
| **Zoo317** | | **Diagnostic Histopathology** | Study of the appearance of normal cells and tissues, selected abnormal/diseased tissues will be examined. Understand pathological changes in the organs, tissues, and cells using a light microscope, diagnostic features of tissue injury, infection, degeneration, malignancy with applying histopathological techniques for the diagnosis of tissue abnormalities.<br>The practical course will include:<br>• Examining different types of tissue using light microscope.<br>• Practicing slide preparation steps.<br>• Comparing between different histological stains.<br>• Differentiating between tissues abnormalities using light microscope.<br>• Identifying and grading malignant tissues.<br>• Preparing of histopathological report. |
| **Zoo318** | | **Invertebrates pathology** | This course will study the diseases that affect invertebrate animals, such as parasitic, bacterial, fungal, and viral diseases. It also illustrates the mode of transmission, diagnostic methods and control measures of these diseases. The practical course includes the study of different agents of invertebrates diseases including bacteria, fungi and parasites by using different methods to differentiate between each disease by macroscopic and microscopic examination. These can be illustrated by different invertebrate's specimens and plates. |
| **Zoo319** | | **Biosafety and Bioethics** | Introduction to contemporary issues in bioethics. The ethics of DNA analysis controls, identification, gene selection, human cloning, adult stem cell research as an alternative to cloning, abortion, euthanasia, as well as animal experimentation.<br>The practical course will include:<br>Description of ethical laws associated with genetic manipulation andcloning eligibilities. |
| **Zoo320** | | **Diagnostic parasitology** | Study of soil-transmitted helminths and intestinal protozoal infection. Description of how to prepare and interpret specimens to diagnose medically relevant parasites of human.<br>The labs associated with this course are designed to learn different types of techniques for diagnosis of parasites. |
| **Zoo321** | | **Genetic engineering and Biotechnology** | This course presents the applications of tools of molecular biology for the improved production and protection of animals, animal products. |

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| | | | Principles and applications of recombinant DNA technology, Gene cloning, vectors and expression vectors, transformation, transfection, PCR, construction of the genomic library and cDNA library, DNA sequencing, biotechnological techniques, transgenic animal, animal cloning, and biopharming.<br>This practical course will include:<br>• Studying genes and the heredity.<br>• Understanding of basic genetic engineering techniques. |
| **Zoo322** | | **Comparative anatomy of vertebrates and Embryology** | Introduction to the structural evolution of the different organs and organ systems of the vertebrate body. The functional significance and evolutionary importance of the various changes are emphasized. Development from fertilization to adulthood in different model systems. Evolutionary patterns of development.<br>The practical course linked with studying of different embryological and comparative aspects among vertebrates. |
| **Zoo324** | | **Cellular and Molecular Diagnosis** | This course includes the measurement of different cell phenotypes, tissue derivatives and other source of cells, DNA, RNA, proteins or metabolites Overview of specialized fields such as biomarker, genetic marker, screening, DNA profiling, next-generation, sequencing, cytogenetics, transcriptome, cancer biomarkers, prostate-specific antigen, andbiomarker toxicology.<br>The practical course will include:<br>• Identification of cellular diagnostic methods.<br>• Detecting pathological conditions using light microscope.<br>• Practicing cellular diagnosis using TEM and SEM micrographs and images. |
| **Zoo326** | | **Nano-Biotechnology** | The principles, limitations, challenges, improvements and applications of nanotechnology in medical science Novel nanoparticles and nanodevices The design, development and application of materials & devices whose least functional make up is on a nanometer scale. |
| **Zoo401** | | **Fundamentals of Molecular Biology** | This course provides students with the knowledge of the fundamentals of molecular biology through a deep understanding of the structure and function of living organisms at a molecular level; Function and properties of Nucleic acids; DNA structure, DNA replication, DNA transcription, RNA and protein, genetic code, Translation, Regulation of mRNA transcription, post-transitional modifications, gene mutations, DNA repair mechanism, techniques in molecular biology will be included as necessary to understand experiments and concepts.<br>This course provides students with in-depth experience in experimental molecular genetics, using modern methods of molecular biology and genetics to conduct original research. Enzymes used in DNA technology; Cloning vectors. Epigenetic effects refer to reversible alterations in chromatin structure that can stably and heritably influence gene expression; covalent modifications to DNA itself or proteins bound to DNA |

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| | | | as well as non-covalent remodeling of chromatin, patterns of inheritance, allelic variation, gene interaction, linkage, gene mapping and changes in chromosome structure and number. |
| **Zoo402** | | **Molecular biology of cancer** | Gene structure, gene mutations, DNA repair and predispositions to cancer, regulation of gene expression, epigenetic regulations, telomere and telomerase, Oncogenes, growth inhibition, and tumor suppressor genes, Apoptosis and cancer, The process of metastasis, Angiogenesis, Metalloproteinase inhibitors. |
| **Zoo403** | **Zoo101** | **Diagnostic immunology** | Fundamental aspects of the various immunological and serological methods used in laboratory diagnosis of disease as well as the basic mechanisms and reactions involved in such methods. |
| **Zoo404** | **Zoo401** | **Advanced Molecular Biology** | Modern and advanced methods and strategies of nucleic acid manipulation, and characterization of genes in cells and whole organisms.Delivery of genes into cells and animals, generation of transgenic and gene knockout animals, genome editing, DNA forensics, and aspects of systems biology. |
| **Zoo405** | | **Histochemistry** | Histochemistry combines the techniques of biochemistry and histology in the study of the chemical constitution of cells and tissues. The course enables the student to understand the theory and practical principles, techniques in histochemistry, Types of biomolecules, and their roles and features in cells and tissues in normal and pathological conditions, with studying the histochemical methods for their detection.<br>The practical course will include:<br>• Applying basic biology and chemistry principles to the study of fixation, processing, and staining of tissue specimens.<br>• Studying the principles and protocols of histochemical techniques.<br>• Analyzing and evaluating of histochemical stained slides using different analysis methods and programs.<br>• Writing histochemical report. |
| **Zoo406** | | **Immunology and parasitology** | The evolution of the immune system. Innate immunity. Phagocytosis and complements. Antigens and immungens. Structure and function of immunoglobulin. Ontogeny of cells of the immune system. Acquired immunity. The immune response with special reference to the parasites. The practical course illustrates the immunology of parasitic infections. |
| **Zoo407** | | **Epidemiology & Medical Parasitology** | An introduction to; Epidemiology with special reference to transmission, prevention, and control of parasitic infection of human.<br>The practical course includes the epidemiology of parasites, sources of infection and protection from different parasites. |
| **Zoo408** | | **Advanced in vitro fertilization (Advanced IVF)** | Full experimental studies focused on the aspiration of sperms and oocytes, injection of oocytes with sperm in vitro and subsequent processing for embryogenesis and implantation.<br>The practical is linked with the studying of infertility causes for male and female individuals. |

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| **Zoo409** | | **Basics of In-vitro fertilization (Basics of IVF)** | Overview of experimental studies focused on the aspiration of sperms and oocytes, injection of Oocytes with sperm in vitro, and subsequent processing for embryogenesis and implantation. |
| **Zoo410** | | **Hematology** | This course provides the basic concepts of hematology with principles of blood testing; both manual and currently available fully automated diagnostic tools. The course includes definition of the science of hematology, hematopoiesis, blood components and function etc. In Addition, the manual automations in hematology and the common pathological blood disorders will also be covered.<br>Practical course focuses on blood sampling, complete blood count, Estimation of hemoglobin concentration, Anemia and red blood cells indices, Reticulocyte count, preparation of blood and platelet smear, Clotting and bleeding time, and Coombs test. |
| **Zoo411** | | **Histopathology** | The course's emphasis will be a study of the appearance of normal cells and tissues, selected abnormal/diseased tissues will be examined. Also, the course enables the student to understand pathological changes in the organs, tissues, and cells using a light microscope, diagnostic features of tissue injury, infection, degeneration, malignancy with applying histopathological techniques for the diagnosis of tissue abnormalities.<br>The practical course will include:<br>• Practicing slides preparation techniques.<br>• Identifying the common pathological conditions using light microscope.<br>• Scoring of histopathological abnormalities using light microscope.<br>• Learning to write a pathology report. |
| **Zoo412** | | **Toxicology** | This course aims to provide students with basic toxicology and the adverse effects of toxic substances on living systems including how toxic substances are taken up in the organisms, distributed, biotransformed, and excreted, how toxic substances react with biomolecules, as well as knowledge about toxic substances, e.g. metals, organic contaminants, and pesticides. |
| **Zoo413** | | **Techniques of Electron Microscope** | The course enables the student to understand electron microscopy principles and theory, as well as different fields of application, operation modes, and image interpretation with understanding principles of specimen preparation, with the main focus being on microscope operation and the production of excellent micrographs plates from both the Transmission Electron Microscope (TEM) and the Scanning Electron Microscope (SEM). |
| **Zoo414** | **Zoo403** | **Molecular Immunology** | Properties of Immune System Antibodies and Antigens. Major histocompatibility complex. Antigen processing and presentation to T lymphocyte. Antigen receptors and accessory molecules of T lymphocytes. Development of Lymphocytes. Activation of Lymphocytes. B cell activation and antibody production. |

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| Zoo415 | | Ecological Pollution | This course presents types of environmental pollution causes, effects, and remedies. Exploring and potential current tools for removal and hazardous materials from the environment. The sustainability and ecosystem services. Air pollution, water, soil, and land. Concerned about the problems that affect biodiversity and ecosystems and human health worldwide by contaminating soil and water. Diffusion and premixed flames, Laminar and turbulent flames, Flame stability, Low-pressure flames, Spontaneous ignition and cool flames, Flammability limits, Factors affecting burning velocity, The structure of the reaction zone, Two-stage combustion, Three-way catalytic converter, Formation of oxides of nitrogen and sulfur, The carbon black process.<br>The practical course includes:<br>• The study of the interrelationship between an organism's physical functioning and its environment.<br>• The study of the physiology of organisms with respect to their adaptation to the environment.<br>Study the types of pollution and the relationship between the population of the animal and the density of it and the pollution. |
| Zoo416 | Zoo303 | Reproductive physiology | This course focuses on anatomy, Physiology, and development of the male and female reproductive organs; the role of endocrine, and neuroendocrine in regulating reproduction in mammals and environmental control of reproduction, fertilization, pregnancy, parturition and lactation in humans. This course, discuss an emphasis in humans. sexual differentiation of the brain, Spermatogenesis and oogenesis. Sexually transmitted diseases. assisted reproductive technologies; and reproduction in a community and global perspective.<br>Practical course provides analysis of sexual male and female hormones and study case of some sexual diseases. |
| Zoo417 | | Bioinformatics | This course provides students with both a theoretical background and a working knowledge of the techniques employed in bioinformatics. biological sequence (DNA, RNA, protein) analysis and its applications; bioinformatics databases, sequence and structure alignment, protein structure prediction, protein folding, protein-protein interaction. |
| Zoo419 | Zoo101 | Physiology of cardiovascular | This course focuses on Anatomy, physiology and pathophysiology of the cardiovascular system. Deal with cardiac and vascular anatomy, and structure aspects of cardiovascular tissues; the vascular endothelium, cardiac and smooth muscle and cell communication. Systemic cardiovascular physiology, from capillary exchange, the microcirculation, the ECG, control of regional blood flow and hemodynamics, up to regulation of cardiac output and blood pressure and the function of the cardiovascular system in exercise. Relationships of hemodynamics of the heart and vascular system. Includes pathophysiology, etiology, pathology, signs, causes and symptoms, of cardiovascular diseases. |

## rses Contents

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| | | | Practical course focuses on lipid profile tests as plasma lipoprotein and cholesterol I and II as Discuss Cholesterol metabolism and its regulation, triacyl glycerol metabolism, lipoprotein structural features and types. |
| **Zoo490** | | **Research Project** | In this course students are required to write an essay on a recent research topics to develop (representation, poster, and model) skills of several types. |
| **Zoo418** | | **Autoimmune Diseases** | Biomarkers in autoimmune or inflammatory disease and in healthy people. Screening and Laboratory Diagnosis of Autoimmune Diseases. |
| **Zoo420** | | **Functional Genomics** | Fundamental principles within functional genomics, emphasizing the transcriptome and proteome. Contribution of functional genomics to systems biology and systems medicine. Hypothesis generation/experimental design. Experimental model systems. Next generation HTP sequencing technology. Microarray-technology. Protein separation. |
| **Zoo421** | **Zoo201** | **Immunotherapy** | Comprehensive overview of the principles and the technology upon which immune-biotherapeutics are based. The overall aims of using small molecules, antibodies, genes and cells as immunotherapeutic agents. The use of viral and non-viral agents as gene delivery vehicles, cells as therapeutic agents and small molecules as delivery and therapeutic vehicles. |
| **Zoo422** | | **Introduction to Genomics and Proteomics** | Definition of genomics and proteomics. Human Progress in the Manipulation of Genomes at the Molecular Level. Definition of whole genome sequencing. Different applications of genomics and proteomics. |
| **Zoo424** | | **Tumor Biology** | Tumor Immunology focuses on the mechanisms by which tumors can escape from and subvert the immune system and conversely on the ability of innate and adaptive arms of the immune system to . Tumorantigens, tumor immunosurveillance and immunoediting, tumor microenvironment, tumor induced immunosuppression, tumor immunotherapy (including cancer vaccines, CARs, TILs, checkpoint antibodies, monoclonal antibodies and bispecific antibodies, as well as bone marrow transplantation and radiation therapy). Tracks the historical development of our understanding of modulating tumor immune response and discusses their relative significance in the light of current research findings. Prerequisite: for undergraduates, human biology or biology core. |
| **Ent201** | | **Introduction to Entomology** | An introductory course covering the basics of insect morphology, biology, and taxonomy. Subsequently, it will examine the importance of insects and the most important characteristic features of pests, beneficial species, and vector of diseases. In addition to the relation of insects to different pathogenic conditions<br>The labs associated with this course are designed to provide practical experience working with insects and how to use some basic laboratory equipment to dissect insects and studying their external and internal morphology and structure. |

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| **Ent202** | | **Insect Ecology and behavior** | This course is organized to understand the ecology of insects including individual, population, and community levels of insects and the ecosystems they represent. The course summarizes all processes and mechanisms of insect behavior in different ecosystems illustrating different types of insect behaviours (reflex, orientation, and learning). It also describes the behaviour of some social insects like bees and ants. Students will be able to carry out field experiments to explore how insects react with different environmental changes. |
| **Ent204** | | **Insect Taxonomy** | The major taxonomic categories of insects and use a key to put any insect at its right taxonomic position up to the order level. Also, studying the relation between the different types of metamorphoses and the main taxonomic divisions, Apterygota, Exopterygota and Endopterygota will be applied.<br>Practical topics include the study the structure of the main taxonomic characters such as: wings, antennae, legs and larvae and how they can be used to differentiate between insect orders and families via using taxonomic laboratory keys. |
| **Ent206** | | **Chemical Ecology of insects** | This course aims to give an introduction to this field of role of chemistry chemical ecology and emphasizes on the in the biological context by application on insects. The course differentiates between the main concepts of Chemistry, Ecology and Entomology in order to understand the originfunction, significance and human uses natural product of insect's.<br>To achieve this aim, examples of chemical communication in some social insects as bees ants, and termites are studied experimentally. |
| **Ent301** | | **Insect structure and function** | This course provides a comprehensive study to insect morphology, as well as the basic physiology, of insects. Subsequently, it will examine how adaptations in these different traits have allowed this group of organisms to exploit such a wide range of habitats on a global scale. Often the best approach to understanding internal morphology is by way of a dissection, therefore students will be able to dissect different insects' species. |
| **Ent303** | | **Applied Entomology** | This course will address aspects of entomology from an economic and applied perspective. The course will cover topics including survey methods, insect pest management, Integrated Pest Management (IPM), beneficial insects, pollination biology, insect-derived products, and insect vectors of plant disease.<br>The labs associated with this course are designed for collection, identification, and mode of damage of insects' pests of crops, fruits, vegetables, stored grains, and household; Collection; Insecticide, formulations and their computations. |
| **Ent305** | | **Apiculture and Honeybee biology** | This course is designed to acquaint the student with the broad field of beekeeping. It will include honeybee biology and behavior, management for honey production, products of the hive, pests and enemies and the value of bees as pollinators of agricultural crops. |

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| | | | Use of application equipment; Practical instructions in Apiculture, Sericulture and Lac-culture. |
| **Ent302** | | **Integrated pest management** | The identification of the pest, the different types of control which are: mechanical control, chemical control and biological control. Special emphasis will be applied to the biological control applications that depends on using the natural enemies of the pest (Predators, Parasitoids and Pathogens). Also, special chemicals such as insect growth and pheromones role in the pest control will be regulators discussed.<br>Lab experience includes field trips to private industry labs, collecting samples and analyzing problems. |
| **Ent304** | | **Insect Toxicology** | This course will provide an overview on insecticide classification, formulation, mode of action, resistance, metabolism, environmental fate, and regulatory legislation. |
| **Ent306** | | **Insect technique** | The course aims to study different methods of collecting insects then preserving and preparing them for examining, studying and displaying. Also, study the techniques of whole mount and histological preparations of insects. This course is designed primarily for museum specimens care and management.<br>Labs associated with this course are designed to introduce students to the basics of fixation, dehydration, clearing and staining of whole mount specimens. |
| **Ent308** | | **Economic Entomology** | This course covers where the destructive and beneficial insects live, what they eat, how reproduce and are distributed in the different habitats.<br>The students should be able to practically recognize the different life cycle stages with their economic value. |
| **Ent401** | | **Insect Physiology** | Insect Physiology is the study of the properties, processes, and functions of insect systems. A student in this course should be able to: Become familiar with the physiological systems in insects as outlined in the syllabus. Identify the influence that neural and hormonal controls have within each system.<br>Practical classes illustrate the physiological systems of different species of insects using slides and specimens in addition to dissection. |
| **Ent405** | | **Insect Immunology** | The study of the immune system of insects that rely mainly on innate defenses to survive infection has proven valuable to decipher these mechanisms. In this course, students will study the broad concepts of host microbe interactions, from their genetic and molecular basis to the physiological impact of microbes on their host. focusing on the innate immune mechanisms, as well as on new emerging concepts in immunity such as tolerance to microbes, or the role of stem cells and repair mechanisms during infection.<br>Practical classes illustrate the immune system of insects using different laboratory techniques. |

## Department of Earth Science

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| **Ent402** | | **Medical Entomology** | An introduction to the roles of insects and other arthropods in the direct causation of disease in humans and animals ,and as vectors in the transmission of disease organism. The epidemiology and replication cycles of vector-borne pathogens with major medical and veterinary importance will be examined. Information will be provided on the biology and behavior of disease vectors and external parasites, and the annoying and venomous pests of humans and animals.<br>Students will learn how to identify practically by using microscopic slides different mosquitoes, ticks, mites, lice, fleas, and other disease vectors. |
| **Ent403** | | **Forensic entomology** | This is an introductory course designed to provide students with a basic understanding of the interaction between the discipline of entomology and the legal system. Students will be taught the basic entomology concepts necessary to understand forensic entomology. They will also gain an understanding of how knowledge of insects and other arthropods is important to criminal and civil litigation surrounding death investigations, stored products, and urban environments. |
| **Ent490** | | **Research Project** | In this course students are required to write an essay on a recent research topic in the field of entomology to develop (representation, poster, and model) skills of several types. |
| **Ent406** | | **Insect Genetics** | The course will initially describe the variety of genetic systems found in insects. Laboratory and statistical techniques will be discussed for studying genetic variation in insect populations. The final part of the course will focus on means for genetic manipulation of populations. The laboratory session will be used to discuss and/or demonstrate techniques for studying insect genetics. |
| **Ent407** | | **Insect Endocrinology** | The student should study the nervous system of insects as a master piece which control the way of any biological functions done by an insect. The study of the insect controller of insect behaviour in endocrine system as a response to stimuli concerning sexual mating, reproduction, oviposition, social behaviour, self defense, etc... will be discussed.<br>The laboratory session will be used to discuss and/or demonstrate experimental techniques for studying role of endocrine system In controlling insect behavior. |
| **Ent408** | | **Molecular Entomology** | This course will introduce students to concepts of molecular entomology and novel techniques routinely used in research to investigate the molecular mechanisms of insect systems.<br>Practical sessions are targeted to familiarize students and practice of Molecular Entomology techniques. |
| **Ent410** | | **Aquatic Entomology** | This course is aimed to explain how insects can be used to monitor or assess the quality of an aquatic habitat and describe an example of a biomonitoring technique from the six hierarchical levels of biomonitoring each of programs including insect science, natural resource ,environmental studies, biological studies, environmental quality assessment and improvement. |

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| | | | Each laboratory will focus on one or more orders and will emphasize the structural and ecological diversity of each group. Particular emphasis will be on common Egyptian aquatic insects. |
| **Ent412** | | **Insect biotechnology** | This course will introduce students to concepts of molecular entomology and novel techniques routinely used in research to investigate the molecular mechanisms of insect systems. The course will focus on the advancements these applications have made in studies focused on insect pest control strategies, forensic entomology, plant-insect interactions, and genetic manipulation techniques particularly gene editing techniques and their broader applications such as gene drives. The course will also introduce students to the fundamental concepts of insect molecular biology, computational biology and how it pertains to arthropod genetics.<br>The course will experimentally cover whole insect genome projects, next generation sequencing applications, transcriptomics, and proteomics. |

| Code | Prereq. | Course Title | Contents |
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| **Geo101** | | **General Geology (1)** | Origin of the earth and its relation to the solar system, structure and internal processes inside the earth, elements of plate tectonics, earthquakes, volcanos, earth's magnetic field, endogenic and exogenic earth processes and their relevance to the formationof the different rock types, constituents of the earth's crustgeologic structures and their importance, crystallograph and mineralogy (crystal description with respect to the different classes and mineral structures) |

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| Geo102 | | General Geology (2) | Historical geosciences which emphasizes the geological evolution of the earth, study of the macro- and microfossils, palaeoecology and evolution and extinction of life, the record of global climatic changes, geological time scale. Study of the different processes in relation to the formation of different rock type, classification of rocks, natural resources , ores and minerals, hydrocarbons, groundwater, application of geology in environmental studies |
| Geo103 | | Historical Geology | The study of changes in Earth and its life forms over time. It includes sub-disciplinessuch as paleontology, paleoclimatology and paleoseismology |
| Geo201 | | Crystallography | The stereographic projection, the inversion axes of symmetry, systematic study of the 32 classes of symmetry, cubic system, tetragonal system, orthorhombic system, monoclinic system, triclinicsystem, trigonal system and hexagonal system. study of crystal models of the 32 classes ofsymmetry combinations |
| Geo202 | | Rock-forming Minerals | General Principals: crystalline state, formation of crystals, space lattice and types of unit cells, pointgroup and space group, internal symmetry elements, chemistry of minerals: atomic structure, atomic bonding, ionic size, coordination, isomorphism, solid solution and exsolution, defect lattice structure, pseudomorphism, polymorphism, systematic mineralogy: structural classification of silicates |
| Geo203 | | Geomophology | Geomorphology is the study of landforms, their processes, form, and sediments at the surface of the Earth (and sometimes on other planets). Study includes looking at landscapes to work out how the earth surface processes, such as air, water and ice, can mould the landscape. |
| Geo205 | | . Optical Mineralogy | Elementary concept of light, polarizing microscope, properties of minerals in ordinary light in plane polarized light, and between crossed nicols, conoscopic examination. Adjustment of the polarizingmicroscope, examples of selected miner |
| Geo207 | | Sedimentary Petrology (1) | Basic concepts, classifications and methodology, clastic and nonclastic sediment, identification ofhand-specimen and systematic petrographic study of various sedimentary rocks, textural andmineralogical evolution of the sedimentary rocks reflecting depositional and burial processes. |
| Geo208 | | . Lithostratigraphy | Introduction, stratigraphic units, code of stratigraphy, geologic time scale, principles of lithostratigraphy and cyclo-stratigraphy, sequence-stratigraphy, facies analysis, correlations |
| Geo209 | | Macropaleontology (1) | Fossils and fossilization names and classification, phylum Porifera (sponges), phylum cnidaria) Coelenterate), phylum bryozoa (moss animals), phylum brachiopoda (Lampshells), phylummollusca, class bivalvia (Pelecypoda), class gastropda, class cephalopda, class echinoidea, classcrinoidea, phylum arthropda, phylum hemicordata |
| Geo210 | | Micropaleontology (2) | Ostracoda (general characteristics and taxonomy), nannofossils (general characteristics and taxonomy), principles of paynology: a) Pollen and spores. b) Dinoflagellates. Morphology of theostracod carapase, morphology of the calcareous nannoplanktons, morphology of the pollen andspores, morphology of the dinoflagellates. |

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| Geo211 | | Gemstones | The prime requirements, for gems, the geological formation and occurrence of gemstones, the chemical composition of gemstones, physical and optical properties of gemstones, gemstone types, the fashioning of gemstones, cutting styles, grading of gemstones, important gem minerals |
| Geo212 | | Micropaleontology (1) | Collecting and processing microfossils, classification of microfossils, application of microfossils, thegeneral characters of the foraminifera, variation in the structures of the foraminiferal test, classification of order foraminifera, foraminifera through time |
| Geo213. | | Vertebrate Paleontology | Introduction to the history of vertebrates as revealed in the fossil record. Vertebrate fossils, evolution, taxonomy and classification of pisces, amphibian, reptilian, aves and mammalian, withspecial emphasis to the Egyptian vertebrate fossil. Taxonomy of pisces amphibian, reptilia, aves andmammilia |
| Geo214 | | Applied Mineralogy | Introduction, mineral resources and industry, modern technology, standard specifications, mineralsin metallurgy, alloys, drilling, cement, ceramics, glass, electronics, semi -conductors, supermagnets, fertilizers, energy supply, precious stones, ornamental stones, building stones |
| Geo215 | | Field Geology | Relationship to other geological disciplines equipments and tools planning for field project, mapping projection methods, compass uses, methods and errors clinometer strik and dip measurements, Plane tabling description and theory advantages, disadvantages theodolites equipment and theoryadvantages and disadvantages GPS description and Uses resolution, controls, exercises on fieldand surveying tools, and application on geological maps |
| Geo216 | | Advanced Stratigraphy | Biostratigraphic units: The Biozones, The species as a unit, Stratigraphical record and global rhythm, Trace fossils. Chrono-stratigraphy, seismic stratigraphy, magmeto-stratigraphy, interpreting the stratigraphical records. Interpreting biostratigraphic records and correlations |
| Geo217 | | Characterization and property of natural gas | Classification and main characters, origin of natural gas, composition, geochemical properties, Physical properties, Chemical properties, Melting temperature, importance |
| Geo218 | | Paleoecology | Geologic environments and ecosystems sediments and environments, organism and environments, geochemical evidences, environmental analyses, ancient environmental reconstruction and remodeling, advances and applications. Exercises for facies modeling and environmentalconstruction |
| Geo220 | | Field Training (2) | Relationship to other geological disciplines, equipments and tools, mapping and projection methods, compass, clinometer, strike measurements, presentation of data, plane table description and theory, theodolites description and theory, advantages and disadvantages, GPS description, uses, resolution and controls. Writing a geological report |
| Geo222 | | igneous and metamorphic Petrology | Magma, chemical composition of igneous rocks, classification, igneous rock forming minerals, orthomagmatic crystallization, late stage crystallization, origin and nature of magma, magmaticdifferentiation. Microscopic study of |

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| | | | the different igneous rock families. Types of metamorphism, metamorphic rocks forming minerals, classification, textures, thermal metamorphism, burial metamorphism, dynamic metamorphism, assemblages. Microscopic study of the characteristic mineral textures, metamorphic rock types.<br>Igneous activities in oceanic crusts, igneous activities in continental crusts, igneous activities above SBZ zones, Rock associations. Petrogenesis of the different rock families, modal analysis. Accurate measurements of mineral components. Exsolution phenomena, nomenclature |
| **Geo223** | | **Geological Survey** | Planning a field project, field equipments, safety field notebook, field observations, sedimentary rocks field relations, igneous rocks field relations, metamorphic rocks field relations, preparation of field reports, training on mapping, compass survey. |
| **Geo224** | | **Natural gas in the world** | Reserves estimation, reserves distribution in the world, the most of the world's natural gas reserves are in the Middle East, Europe, and the former U.S.S.R., with these reserves making up nearly 75 percent of total worldwide reserves, |
| **Geo225** | | **Crystal Chemistry** | Coordination numbers, chemical compounds and crystal structure of the elements. Crystal modelsof the 32 classes |
| **Geo226** | | **Natural gas uses and application** | Study different uses and application of natural gas as Power generation, Domestic use, Transportation, Fertilizers,producing hydrogen, Protein rich animal and fish feed is produced by feeding natural gas and Natural gas is also used in the manufacture of fabrics, glass, steel, plastics, paint, synthetic oil, and other products. |
| **Geo227** | | **Field Training (1)** | Planning a field project, field equipments, safety, field notebook, field observations, sedimentary rocks, field relations, Igneous rocks field relations, metamorphic rocks field relations, preparation offield reports, training on mapping, compass survey. |
| **Geo228** | | **Natural gas in Egypt and middle east** | origin of natural gas, Important production wellsin Egypt and middle east, types and maturity of natural gas in Egypt and middle east,Egypt's reserves of natural gas are estimated at 66 trillion cubic feet ($1.9\times10^{12}$ $m^3$), which are the third largest in Africa. |
| **Geo230** | | **Principles of Stratigraphy** | Principles of stratigraphy, including biostratigraphy, magnetostratigraphy, seismic stratigraphy, isotope stratigraphy, subsurface analysis, evolution of sedimentary basins and continental margins. Characterizing and predicting the vertical and lateral distribution of sedimentary rocks. Correlation methods, use of facies models, facies delineation, impact of tectonics and changes in relative sea level on sedimentary record, transgressions and regressions, concept and construction of stratigraphic framework and sequence stratigraphy |
| **Geo301** | | **Structural Geology (1)** | Primary structures of sedimentary and volcanic rocks, bedding planes, joints, folds and faults, reading of structural maps, stereographic projection of structural elements. Types of scales, construction of geologic maps and cross-sections |

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| **Geo302** | | **Tectonic Geology** | Early ideas on orogenic movements and emmergence of plate tectonics, plate boundaries, hot potsand triple junctions, types of mountain belts, ophiolites and melanges, recognition of ancient plateboundaries |
| **Geo304** | | **Subsurface Geology** | Subsurface structural maps, wireline log cross sections, preparation and uses of thickness maps, qualitative interpretation of logging diagrams, radioactivity well logging, geologic application ofdrilling time parameter, geologic application of drill-stem test data, criteria for subsurface faulting, analysis of sedimentary basins |
| **Geo306** | | **Biostratigraphy** | Geologic time scale, the evolving earth, selected minerals and rocks, paleontology (Key fossils),paleocology, mode of preservation, Ichon fossils, biostratigraphy. Practical: identification of key fossils, carbonate minerals, phosphates, silicates, mode ofpreservation, map reading |
| **Geo308** | | **Sedimentary Petrology (2)** | Textural and mineralogical evolution of the sedimentary rocks reflecting depositional and burialprocesses. Laboratory work emphasizes thin sections study of rocks |
| **Geo309** | | **Macropaleontology (2)** | Evolutionary theory, taxonomy: analyzing pattern, fossil and phylogeny, speciation gradual, punctuated or what ?. Adaptation and functional morphology, biogeography, mass extinctions, ruleand laws of taxonomic turnover, taxonomy of macrofossils, functional morphology macrofossils |
| **Geo310** | | **Engineering Geology** | Introduction, engineering properties of soil and rocks, soil mechanics, site investigation and civilengineering, rock masses, engineering problems related to dams and land-sliding |
| **Geo311** | | **Field Geology and Field Studies** | An introduction to field techniques; geological mapping on small and large scales; stratigraphic and structural interpretations, topographic and geophysical maps will be used where appropriate. This course involves elementary surveying techniques, systematic of hand specimen, rock and mineral identification.. Study of land forms, structure, lithology, surface processes using satellite data |
| **Geo312** | | **Geology of Ores** | Preparation of polished samples, mineral identification, ore mineral textures, paragenesis and paragenetic sequences, ore mineral assemblages, application of ore microscopy in mineral technology. preparation of polished samples, mineral identification, ore mineral textures, paragenesis and paragenetic sequences, ore mineral assemblages, application of ore microscopy inmineral technology |
| **Geo313** | | **Marine Geology** | Marine environment, physical chemistry of sea water, intertidal environment, estuaries, the seabottom productivity, plant-growth and the pelagic habitates. study of the biota and lithofaciescharacters of the different rocks in different environments. study of different biota events undermicroscope |
| **Geo314** | | **Structural Geology (2)** | Extensional tectonics and applications, compressional tectonics and applications, wrench tectonics and applications, inversion tectonics and applications, tectonites. Map reading, stereographic projection, orthographic projection. |

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| **Geo315** | | **Ore Deposits** | Introduction, classifications, ore deposits, industrial materials, ornamental stones, nonmetallic deposits in Egypt: phosphorites, coal, black shales, limestones, glass sand, basement rocks, among others, economic prospects |
| **Geo316** | | **Quaternary Geology** | Introduction, the quaternary system, historical development of definition and subdivision, terminology and nomenclature today, sedimentological and petrological characteristics, importance forarchaeological sciences, worldwide quaternary (climatic) events, the quaternary of Egypt and casestudies |
| **Geo317** | | **Rock Mechanics** | Scope of rock mechanics, stress and strain, physical properties and classification of rock materials. Rock mass discontinuities nature and significance, in situ stresses, stability of rock slopes. Physicaland mechanical properties of rock materials, instrumentation |
| **Geo318** | | **Geology of Africa** | Foliated boundaries, geologic map of Africa, volcanoes, lakes, rivers, structures, cratons, and resources. Applications on regional geological maps and satellite images |
| **Geo319** | | **Photogeology** | types of aerial photographs errors in flying reference information, geometrical parameters, geomorphological interpretation, structural interpretation, +lithological interpretation application of photogeology introduction to remote sensing. Applications on the geological and photogeological maps |
| **Geo320** | | **Volcanology** | Introduction, the facies description, properties of magma. General characteristics, lava flows, typesof pyroclastic deposits and their eruptions, transport and deposition of subaerial pyroclastic flows, subaquous pyroclastic flows, crystal rich volcanoclastic, modern and ancient volcanoes, volcanism and tectonic setting. Study of rock samples, microscopic examination, data processing |
| **Geo321** | | **Trace Fossils** | Ichnofossils of plant and animal traces. Implicit to this definition is that the traces mad by plants and animals reflect some sort of behavior. Ichnology can be divided into two major subdivisions: pleoichnology and neoichnology. Most icgnologists are involved in paleoichnology but a considerable number also study neoichnology for the comparison of modern equivalents to ancient traces. Biogenic structures, advantages of trace fossils, taphouomy paleontology and ichnology: differences |
| **Geo322** | | **Geoarcheology** | The application of geological principles and techniques to the solution of archaeological problems. Geological processes and deposits pertinent to archaeological sites, geologic framework of archaeology in Egypt, and techniques of archaeological geology and site analysis are studied |
| **Geo323** | | **Instrumental Techniques** | Safety in laboratories, preparation of samples for chemical and mineral analyses, mineralseparation, X-Ray diffraction analysis, scanning electron microscope, electron microprobe, chemicalanalysis techniques, data treatments and presentation |
| **Geo324** | | **. Environmental Geology** | Environmental science- introduction, basic concepts and definitions, environmental impacts due to mineral resources, water resources assessment of the rapid environmental changes usinggeoindicators. data processing, |

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| | | | environmental geochemical maps, techniques of analysis of theenvironment sensitive elements |
| **Geo326** | | **Petroleum traps and Maturation** | Petroleum trap definition, components, trap types, traps mechanism, diagenesis, catagenesis metagenesis, maturation definition, kerogen types and produce, maturation stages |
| **Geo328** | | **Manufacturing and Refining of Natural Gas** | Description of manufacturing and refining process of natural gas to produce, Types of raw-natural-gas wells. Applications of natural gas |
| **Geo330** | | **Prospect evaluation and appraisal** | Prospect Appraisal in oil and gas exploration assigns a qualitative or quantitative value to objectives that range from an entire basin, via concession, group of prospects, individual prospects to a faultblock. This process is multidisciplinary because it involves many branches of geology, geophysics, etc. making a team effort essential. Exploration and development plan. |
| **Geo333** | | **Reservoir Properties** | Fundamentals of reservoir rock properties, the reservoir rock properties that are of most interests to development geologists and reservoir engineers (amongst others) are Porosity, Compressibility, and Permeability. Reservoir Rock - Fluid Interaction Properties, types, potentality |
| **Geo337** | | **Natural gas formation** | Natural gas (fossil fuel) definition, how is natural gas extracted, types of natural gas, advantages of natural gas, natural gas uses |
| **Geo401** | | **Geology of Egypt** | Tectonic framework of Egypt, basement complex in Egypt, geology of selected areas in Egypt(Western Desert- Delta- Red Sea- Gulf of Suez- and Sinai), geological eras (Distribution of Egypt) |
| **Geo402** | | **Industrial Minerals** | Introduction, Mineral industry classification, Metallic and non-metallic minerals, Ceramic and glass industry, rare metal mineral industry, Construction industry, Gem minerals, Abrasive industry |
| **Geo403** | | **Remote Sensing** | Radiometric and geometric corrections, digital image analyses, image classifications, earth science applications, environmental applications, survey applications, hydrological applications |
| **Geo404** | | **Palynology** | Introduction, palynological techniques, pollen grains and spores, dino flagellates, acritarchs, chitinogoa, corodonts, microscopic identification of the different palynological texa for age dating and paleoenvironments |
| **Geo405** | | **Geochemistry** | Environmental geochemistry, geochemical exploration, geochemistry of selected groups of elements such as ree, pge, hfse or heavy metals, geochemistry of ore deposits (metallic or non-metallic, (other modern approaches. Data processing and geochemical mapping, treatments and presentation |
| **Geo406** | | **Precambrian Geology** | Arabian Nubian Shield, Egyptian basement rocks, lithologies, classification, evolution, economicresources. Geologic maps, studying rock sample and thin-sections of different rock units |
| **Geo407** | | **Geology of Ores in Egypt** | Mineral identification, ore mineral textures, paragenesis and paragenetic sequences, ore mineralassemblages, preparation of polished samples, mineral identification, ore mineral textures, paragenesis and paragenetic sequences, ore mineral assemblages |

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| **Geo408** | | **Mining Geology** | Combines the principles of economic geology and mining engineering to the development of a definite mineral resource. Studying quarries and different types of mines. |
| **Geo409** | | **Petroleum Geology** | Introduction, commercial accumulations and critical risk, evolution of petroleum, explorationtechniques, properties and composition of hydrocarbon, origin, digenesis of or ganic matter, maturation, migration, reservoirs, sedimentary basins and their hydrocarbon potentialities, hydrocarbons exploration in Egypt, main hydrocarbon provinces. risk analyses and economics, reserve calculation and development plans, giant oil and gas occurrences exploration in Egypt |
| **Geo410** | | **Basin Analysis** | Description of modes of origin of sedimentary basins, their thermal and subsidence history, and their patterns of sediment infill. Broad examination of modern concepts of thermal modelling, stratigraphy, sedimentology, and hydrocarbon generation. Architecture and evolution of sedimentary basins in relation to plate-tectonic setting and crustal properties. Sequence stratigraphy: sequence models and sequence forcing mechanisms tectonism, eustasy, climate change. The global-cycle-chart controversy. World-wide review of basins in the context of plate tectonics. Explores the aspects of sedimentary rocks and sequences that control their potential as sources or reservoirs of hydrocarbons, coal or other resources |
| **Geo411** | | **Hydrogeology** | Water cycle, evapotranspiration infiltration and runoff, aquifer properties, aquifer parameters,equilibrium and nonequilibrium methods, leaky aquifer, sea water intrusion, safe yield, underground water movement effect on quality, relationship of water quality to geologic conditions, water quality. composition of ground water, underground water exploration using seismic and electric methods, hydrogeochemistry of contaminants, applications of lsotopes in hydrogeology |
| **Geo412** | | **Groundwater modeling** | General introduction, aquifer properties, aquifer parameters, underground water movement, relationship of water quality to geologic conditions, water quality, underground water exploration using seismic and electrical methods, reservoirs, well investigations, reservoir parameters, equilibrium and disequilibrium |
| **Geo413.** | | **Clay Mineralogy** | Origin of clay minerals, chemical weathering, soil formation and secondary transported soils, structure of clay minerals and classification, diagenesis of clay mineral, clay as ore deposit, organicmatter and clay mineral relationship, laboratory methods for clay minerals identification : (SEM, XRD, DTA, GTA, EMPA |
| **Geo415** | | **Facies Analysis and Depositional Environments** | Analysis of sedimentary facies and environments of deposition. The processes, characteristics, and relationships among depositional systems; depositional basin analysis. Principles of sedimentation and modeling. Mechanical, chemogenic and biogenic sedimentation, and diagenetic processes discussed in detail. Emphasis on the study of the recent environments of sediment deposition. The products of sedimentary processes will be related to their analogs in the stratigraphic record |

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| **Geo416** | | **Application of Remote Sensing in natural hazards** | Radiometric and geometric corrections, digital image analyses, image classifications, earth scienceapplications, environmental applications, survey applications, hydrological applications |
| **Geo417** | | **Ore Dressing** | Introduction, ore deposit characteristics, mechanical separation, floatation, magnetic separation, using ore microscopy in mineral beneficiation of different ore deposits |
| **Geo418** | | **Reservoir modeling and simulation** | Sedimentary basins and their hydrocarbon potentialities, basin modeling and geohistory, evolving play concepts and analogues, develop is prospects for exploration, risk analyses and economics, reserve calculation and development plans, giant oil and gas occurrences exploration in Egypt |
| **Geo419** | | **Volcanoclastics** | Facies description, nomenclatures, properties of magma volcaniclastic deposits: fragmentation and general characteristics, lava flows, types of pyroclastic deposits and their eruptions, modernpyroclasic, transport and deposition of subaerial pyroclastic flows, ignimbrites, subaqueouspyroclastic. classification of modern and ancient volcaniclastic rocks, case studies from Egypt |
| **Geo420** | | **Hydrogeochemistry** | A study of natural water cycle. processes controlling soil water, stream flow, lake circulation, groundwater flow and the exchange of water between these natural reservoirs and the atmosphere. Theoretical aspects of aquatic chemistry with applications to natural water systems. Chemical processes affecting the distribution and circulation of chemical compounds in natural waters. |
| **Geo421** | | **Isotope Geology** | Introduction, age of the earth, decay of radioactives atoms, age dating methods (K-Ar, Ar-Ar, Rb-Sr, Sm-Nd, and U-, Th-Pb), oxygen, hydrogen, carbon and sulfur. Dating calculation, exercises andproblems |
| **Geo422** | | **Advanced Geochemistry** | Environmental geochemistry, geochemical exploration, geochemistry of selected groups of elements such as ree, pge, hfse or heavy metals, geochemistry of ore deposits (metallic or non-metallic), other modern approaches. Data processing and geochemical mapping, treatments and presentation |
| **Geo423** | | **Geochemical Exploration And Prospecting** | Sampling techniques, Application in ore mineral exploration, Applications in hydrocarbon exploration, data interpretation and modelling |
| **Geo424** | | **Organic Geochemistry** | Introduction, application of hydrocarbon exploration, organic richness, source rock developments, kerogen formation and maturation, bitumen compounds, composition of bitumen and petroleum, maturation and biomarkers, source rock evaluation |
| **Geo426** | | **Ore Mineralogy** | Preparation of polished samples, mineral identification, ore mineral textures, paragenesis andparagenetic sequences, ore mineral assemblages, application of ore microscopy in mineraltechnology. preparation of polished samples, mineral identification, ore mineral textures, paragenesis and paragenetic sequences, ore mineral assemblages, application of ore microscopy inmineral technology |

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| **Geo427** | | **Reservoir dynamics and mechanics** | The Dynamics of Fluids In Reservoirs, reservoir simulation, Measurement of reservoir fluid gradients, hydraulic fracturing, Thermodynamic Modelling, connectivity, gas charge into oil reservoirs |
| **Geo428** | | **Geographic Information Systems** | Computer system for capturing, storing, checking and displaying data related to positions on Earth's surface. |
| **Geo429** | | **Environmental Impact of The Energy Industry** | The environmental problems directly related to energy production and consumption includes air pollution, climate change, water pollution, thermal pollution, and solid waste disposal. How can the energy industry reduce the environment? Environmental Impacts of Renewable Energy, importance of energy in the environment |
| **Geo430** | | **Selected Topics in Geology** | A special topic course intended for non-geology majors. Subjects will include many issues of interest to non-geologists and non-scientists, such as earthquakes, evolution, and gems. Repeatable when topics vary. Repeatable. On demand. Course proceeds by arrangement with instructor. |
| **Geo432** | | **Natural Gas and Petroleum Processing** | Natural Gas and Petroleum facilities and processes, generation, maturation, explortion, production, Refining. |
| **Geo434** | | **Statistical Geology** | Elements of statistical theory, statistical types, statistical mechanics and uses and application of statistics in geology |
| **Geo490** | | **Research Project** | Original investigation under the supervision of a faculty member. A thesis describing the research is written, presented and defended. * Note: The first half of Geo490 is Taken in Semester 1, and the second half of Geo490 in semester 2. |
| **Gph104** | | **Introduction to Geophysics** | Physical properties of rocks and minerals, importance of geophysics and its relation to other subjects, principles of seismic, gravity, magnetic, electrical and electromagnetic, methods |
| **Gph20** | | **Basic Geophysics** | Geophysical techniques used for shallow exploration, such as gravity and magnetics, seismic refraction, shallow seismic reflection. Theoretical background; data collection and processing; and interpretation using analytical solutions, computer modeling, and other techniques will be discussed. The methods considered have particular application to hydrogeology, civil engineering, and mineral exploration |
| **Gph202** | | **Gravity and Magnetic Methods** | Gravitational force - acceleration and potential - the earth's gravity field - global variations in gravity - earth's tides Gravimeters - warden and laCoste / Romberg - land gravity survey - corrections of gravity data - typical gravity anomalies over subsurface bodies of discrete shapes -best density determination - determination of subsurface structures from gravity profiles - relation between gravity and magnetic anomalies - application and field examples - Magnetic force and potential of the earth - magnetic anomaly - magnetometers - vertical force, flux - gate and nuclear - magnetic survey on land - reduction of magnetic anomaly - theory of magnetic interpretation - magnetic anomaly over subsurface bodies of discrete shapes - qualitative interpretation of magnetic data - determination of subsurface structure from a magnetic anomaly profiles - field examples |

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| Gph203 | | Computer Application in Geophysics | Introduction to programming and scientific computing and review of numerical methods: elements of mathematical programming and optimization - appliactions to geological problems. Elements of geostatistics - normal, lognormal and Poisson distribution, ANOVA, Hypothesis testing, Regression analysis - bivariate and multivariate linear and nonlinear, stepwise and ridge regression techniques, trend surface and map analysis; Analysis of spatial data - semivariograms and kriging, Factor analysis, principal component analysis and cluster analysis; Time series analysis and Fast Fourier Transforms |
| Gph204 | | Seismic Methods | This course is designed to give geophysics students a practical introduction to seismic data processing. All conventional aspects of the processing of seismic reflection data are covered, beginning with 2- and 3- dimensional field geometries, digital tape formats, demultiplexing and editing, to the final display of the processed sections. The sequence of procedures and critical processing parameters are emphasized. Topics include the convolutional model, seismic resolution, types and characteristics of seismic events, well to seismic ties, interpretation objectives and procedure, map production, velocity anomalies and depth conversion. Particular emphasis is placed on well ties, fault interpretation, and the requirement for an interpretation and the resulting maps to be internally consistent and geologically sensible |
| Gph205 | | Principals of Earthquake Seismology | Seismicity and its causes in the context of plate tectonics, determination of earthquake location, size and focal parameters, seismogram interpretation, seismometry, hazard potential, use of earthquakes in determining earth structure |
| Gph207 | | Remote Sensing (1) | Radiometric and geometric corrections, digital image analyses, image classifications, earth science applications, environmental applications, survey applications, hydrological applications. |
| Gph301 | | Geoelectrical and Electromagnetic Methods | Equation of electric current flow through the ground and apparent resistivity Electrodes arrays - survey methods - instruments - interpretation of electrical resistivity data – applications and field examples - Electromagnetic wave propagation theory - interaction between transmitter & receiver - and conducting ores - response equation and response of a solid conductors - instruments - field survey -horizontal loop in phase and quadrature methods - vertical loop and dip angle methods - applications and field examples |
| Gph302 | | nterpretation of potential field methods | Development of equations of electromagnetic fields in conducting media. Solution of forward and inverse problems with natural and controlled sources: magnetotelloric and related methods. Includes the special case of static fields: DC resistivity, gravity, and magnetic interpretation. |
| Gph303 | | Well Logging and Formation Evaluation | What are the lower limits for porosity, permeability and water saturation that permit profitable production from a particular formation or pay zone; in a particular geographic area; in a particular economic climate. Do any of the formations in the well under consideration exceed these lower limits. |

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| | | | Formation evaluation tools- Coring - Mud logging - Wireline logging - Electric Logs- Porosity Logs -Lithology Logs - SP and Gamma Ray- Interpreting the Tools. |
| **Gph304** | | **Geophysical Exploration** | An introduction to refraction seismic, reflection seismic, gravity and magnetic methods applied to exploration for hydrocarbons, and their use in engineering studies |
| **Gph306** | | **Marine Seismic** | Introduction, Basic seismic Theory of wave propagation in fluid medium, Marine seismic sources andreceivers, Positioning of seismic sources and receivers, Noise types affecting seismic data, Designof seismic survey, Survey types in marine recording and application, Multi-component seismic : Acquisition and applications, New technologies in marine seismic, Other Geophysical methodsapplied in marine Geophysics |
| **Gph307** | | **Seismic data processing** | This course is designed to give geophysics students a practical introduction to seismic data processing. All conventional aspects of the processing of seismic reflection data are covered, beginning with 2- and 3- dimensional field geometries, digital tape formats, demultiplexing and editing, to the final display of the processed sections. The sequence of procedures and critical processing parameters are emphasized. Topics include the convolutional model, seismic resolution, types and characteristics of seismic events, well to seismic ties, interpretation objectives and procedure, map production, velocity anomalies and depth conversion. Particular emphasis is placed on well ties, fault interpretation, and the requirement for an interpretation and the resulting maps to be internally consistent and geologically sensible. |
| **Gph308** | | **Marine Gravity and Magnetic Geophysics** | Acquisition of marine geophysical data: gravity, and magnetic – different interpretation techniques - Field examples |
| **Gph310** | | **Engineering and Environmental Geophysics** | Geophysical methods in environmental site assessment, emphasis on sites relevant to toxic waste disposals, contamination, detection and mapping of cavities, near-surface pipes, and hidden harmful objects, geophysical precursors for monitoring earthquakes and volcanic eruptions, case histories |
| **Gph311** | | **Paleomagnetism** | Rock magnetism – Methods and Techniques – Reversals of Earth's magnetic field – Sea Floor spreading and plate tectonics – Apparent polar wandering. |
| **Gph312** | | **Advanced Earthquake Seismology** | An advanced treatment of seismic sources and wave propagation in the Earth. Topics include a detailed analysis of stress and strain, the elastic wave equation, vector solutions of the wave equation, P, SV, and SH waves, reflection and refraction of plane waves at a plane interface, surface waves in simple media, elastodynamic theorems, Green's function for unbounded media, the earthquake source, moment tensor sources, ray theory, effects of inelastic attenuation |
| **Gph314** | | **Advanced Electromagnetic Methods** | Discussions on the most recent land, marine and airborne survey and interpretation techniques – Correlation between gravity, magnetic and electric maps. |

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| **Gph325.** | | **Geophysics (1)** | Physics of the earth's crust, mantle and core. Laplace's equation and spherical harmonic expression of gravity and magnetic fields. Elastic wave equation in geologic media. Body and surface seismicwaves, equations of state, thermal structure of the earth |
| **Gph326** | | **Geophysics (2)** | Introduction, magnetic, gravity and seismic methods, applied geophysics, case study on Egypt. Application on petroleum exploration, environmental problems |
| **Gph401** | | **Seismic data interpretation** | seismic waves types - seismic wave recording and instruments - refraction shooting for horizontal layers - dipping bed and across fault - delay time - refraction record and reflection shooting - seismic noises -energy sources - geophone arrays and common depth point - land survey - reflection record - correction used in refraction -detailing salt dome - correction used in reflection analysis - seismic velocity determination - applications and field examples |
| **Gph403** | | **Remote Sensing (2)** | Radiometric and geometric corrections, digital image analyses, image classifications, earth scienceapplications, environmental applications, survey applications, hydrological applications |
| **Gph405** | | **Integration of Geophysical Data** | Integrated geophysical exploration programs, identifying the sub-surface evidences of mineralization or associated structures/alteration zones |
| **Gph407** | | **Seismic Stratigraphy** | Modeling - factor analysis –geologic interpretation – completion of Stratigraphic cross section - construction of chronostratigraphyic correlation chart – examples |
| **Gph408** | | **Reservoir geophysics** | Reservoir management - petrophysical & geophysical basis – geophysical technology – reservoir delineation (characterizing the trap - segmentation & distribution of a problem reservoir – reservoir development – vertical seismic profile techniques) |
| **Gph410** | | **Reservoir Correlation and Production** | Reservoir Correlation is the key process while creating geological model of oil reservoirs for the fields having dense wells network and hence the process determines effectively all following steps of oil production. Automatic well correlation software ( loading initial data, detailed well correlation, loading geophysical interpretation results, fluids and gas contacts level determination , construction of geophysical profiles, maps, reserves evaluation and transition to three-dimensional geological modeling). |
| **Gph412** | | **Ground Penetrating Radar (GPR)** | Geophysical method used to image the subsurface. It is a non-intrusive method of surveying the sub-surface to investigate underground utilities. It uses electromagnetic radiation in the microwave band of the radio spectrum and detects the reflected signals from subsurface structures. GPR can have applications in a variety of media, including rock, soil, ice, fresh water and structures |
| **Gph414** | | **Radioactive and Geothermal Methods** | Principles of radioactivity (nuclear disintegration-decay processes – radioactivity of rocks & minerals)-Instruments – (Ionization chamber – Geiger – Muller counter – Gamma ray spectrometer – Calibration of instruments) Field operations and Interpretation – Geothermal methods – Terrestrial heat flow – Examples and exercise |

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| Gph490 | | Research Project | |
| GA201 | | Principals of geoarchaeology | the direct use of geologic concepts, methods, and knowledge to solve archaeological problems and interpret archaeological records |
| GA203 | | Historical archaeology | describe the archaeology of the period, presentation of historical facts developed by documentary research based upon the archaeological record, the nature of archaeology, writing the history of archaeology, archaeological dating |
| GA202 | | Egyptian Geoarchaeology | archaeomineralogy, hieroglyphs, language, and pharaonic chronology, the environmental background to pharaonic civilization and egyptian prehistory, |
| GA204 | | Geoarchaeology field techniques | GPR: theory and practice in archaeological prospection, identification of shapes and uses of past landscapes through emi survey, magnetic prospection in archaeology and artifact analysis in sourcing geologic deposits |
| GA301 | | Advanced geoarchaeology | ses the techniques, methods, and concepts of the earth sciences to address archaeological problems, potential investigations include: (a) site survey techniques that use geochemical, electromagnetic and other remote sensing procedures to locate sites or features within a known site; (b) documentation of site-formation processes and the regional context of a site; (c) using a wide array of approaches to differentiate cultural from natural (nonhuman) sediments and features, including disturbance processes by biological, pedological, and geological processes; (d) the development and correlation of intra- and extrasite temporal contexts by relative and/or absolute dating; (e) integration of ancient landforms and biological information for the reconstruction of palaeolandscapes; (f) reconstructing palaeoenvironments by the identification and analysis of plant and animal remains; and (g) the geochemical analysis of artifacts to document interaction between social groups |
| GA303 | | Geoarchaeology; Restoration, saving and marketing | conserving the archaeological resource, archaeological site management, the cultural values of archaeological sites: conflict and resolution |
| GA401 | | Prospect Evaluation of monuments | discovering archaeological sites and documenting their internal structure; surveying site formation and disturbance processes; the analysis of soils and sediments; paleoenvironmental reconstruction and the impact of humans on the landscape; the physical analysis of archaeological materials; and the integration of geoarchaeology with social archaeology. |
| GA490 | | Research Project | |

# Courses Contents

# Department of Biochemistry

| Code | Prereq. | Course Title | Contents |
|---|---|---|---|
| BCh102 | | **Biochemistry of amino acids & Proteins**<br>**كمح 102 الكيمياء الحيوية للأحماض الأمينية والبروتينات** | Amino acids function, structure, and classifications. Peptide bond formation, Noncovalent bonds. Different structures of proteins. Globular and fibrous proteins. Examples of Proteins as hemoglobin, collagen, and elastin.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh104 | | **Biochemistry of Carbohydrates & Lipids**<br>**كمح 104 الكيمياء الحيوية للكربوهيدرات والدهون** | Definition, function, classification of carbohydrates. Structures of monosaccharides, disaccharides, and polysaccharides. Formation of glycosidic bonds and its types. Definition, function, classification of lipids. Formation of ester bond. Different examples of simple, complex fats inside body.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh201 | | **Biomolecules 1**<br>**كمح201**<br>**جزيئات حيوية 1** | Structure, properties, reactions and function of amino acids and peptides. Amino acid composition and proteins. Charge and chemical properties of amino acids and proteins. Primary, secondary, tertiary and quaternary structure of proteins. Dynamic aspects of protein structure. Structure – function relationship of protein family. DNA binding proteins. Hemoglobin and myoglobin. Nucleic acid and nucleotide and the biological role of nucleic acids.<br>*Practical periods: direct application on the theoretical course.* |
| BCh203 | | **Biomolecules 2**<br>**كمح203**<br>**جزيئات حيوية 2** | Carbohydrate: Classification, structure, properties, function, identification (monosaccharide, oligosaccharides and polysaccharides). Carbohydrates of biochemical importance (simple sugar, macromolecules as glycosaminoglycans, |

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| | | | Lipids: Classification (simple and complex). macromolecules of sugar acids). Fatty acids: type, properties, essential fatty acids separation by GLC. Neutral fats: types, properties, extraction from tissues, separation by TLC. Types of phospholipids, enzymatic and alkaline hydrolysis of phospholipids, phospholipids in cell membrane. Types of cerebrosides, structure and function. Types of gangliosides, structure and function. Derived lipids including steroids with different subclasses as cholesterol, bile acids, corticosteroids, male and female sex hormones respecting to their structure function.<br>*Practical periods: direct application on the theoretical course* |
| **BCh205** | | **Biochemistry of Cells**<br>**كمح 205 الكيمياء الحيوية للخلايا** | History of cytology and introduction to cell organelles. Historical account of cell biology; cell theory and protoplasm theory. Prokaryotic and Eukaryotic cell. Structure and functions of cell wall: bacterial cell wall; plant cell wall and fungal cell wall, plasma membrane , exocytosis, endocytosis, phagocytosis, vesicles and their importance in transport. Cytoskeleton structure, microtubules, microfilaments, intermediate filament.<br>*Practical periods: direct application on the theoretical course.* |
| **BCh202** | | **Principles of genetics**<br>**كمح 202**<br>**مبادئ علم الوراثة** | Chemical, physical and biological properties of nucleic acids and their role in replication, transcription, translation and regulation of gene expression and genetic materials. Molecular mechanisms of inheritance, and how both genetic and environmental factors influence traits in. |
| **BCh204** | **BCh201/ BCh203** | **Nutrition**<br>**كمح 204**<br>**تغذية** | Macronutrients: overview, energy metabolism, protein metabolism, energy balances, carbohydrates, lipids composition of macronutrients in the diet. Micronutrients: assessment, malnutrition, recommended dietary allowances, fat-soluble vitamins, water soluble vitamins, macrominerals, trace minerals and assessment of nutritional status in clinical practice. |
| **BCh206** | | **Biological Membranes & Transport**<br>**كمح 206**<br>**أغشية حيوية و انتقال** | Chemical composition of membranes, micelles and liposomes. Structure of biological membranes and movement of molecules through membranes (diffusion, passive and active). Mediated transport systems, ionphores, vesicles mediated transport. |
| **BCh208** | | **Biological Oxidation**<br>**كمح 208 أكسدة بيولوجية** | Oxidation process definition. Oxidative stress inside different tissues & oxidative stress biomarkers. Prooxoidants & antioxidants: definition, classification, mechanism of action and different types. |
| **BCh210** | | **Bioethics**<br>**كمح 210 أخلاقيات بيولوجية** | The historical development of clinical and research ethic. The guidelines, codes and regulations governing biomedical research. Overview on collecting different human biological samples ethics protocol. Introduction to ethics protocol of several experimental animal treatments. |
| **BCh231** | | **Principles of Nutrition**<br>**كمح 231 أساسيات علم التغذية** | Understand how key nutrients (carbohydrates, lipids, proteins, vitamins, minerals, and water) affect health, disease, energy balance, and weight control.<br>*Practical periods: Direct application on the theoretical course.* |

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| BCh233 | | Food Fermentation<br>كمح 233<br>تخمر الغذاء | Food fermentation principles. Functional foods and nutraceuticals, functional fermented foods, bioactive proteins and bioactive peptides, genetically modified foods. D and z-value calculation of common food pathogens.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh235 | BCh102 / BCh104 | Food additives & analysis<br>كمح 235 المكملات الغذائية وتحليل الغذاء | Introduction to the theory and practice of the analysis of food composition and characteristics. Techniques and instrumentation used for the analysis of foods including spectroscopy, chromatography, and titration. Diverse types of food additives, their functions and the properties of these additives, both in terms of chemical as well as physical properties. Additives integration into the food processing technology.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh237 | | Meal planning<br>كمح 237 تصميم وجبة غذائية | Perfect meal Components. Variety in meals, Basic meal preparation, how to replace different components in a recipe for suitable meal preparation. Preparation of a standard meal with a balance between cost and efficiency. |
| BCh239 | | Food Quality Control<br>كمح 239 مر اقبة جودة الغذاء | Food quality, food safety, food adulteration, food hazards. Natural toxins. Food contaminants and pesticide residues. heat treatments and related processing techniques. |
| BCh241 | | Flavor Biochemistry<br>كمح 241 الكيمياء الحيوية للنكهات | Categories of flavoring substances, Explain Physical Form, Method Of Production And Solubility of Absolutes, Concentrates (Ex. Fruit Juices), Concretes, Distillates: Fruit, Cocoa, Coffee, Enzymatic Modified Cheese, Essential Oils (Expressed And Distilled), Extracts (Tinctures And Vanilla, Oleoresins (Resinoids), Citrus Products. Identify major chemical component which characterizes aroma/flavor of natural flavoring items. Flavor labeling as FDA Flavor Declaration and allergens. |
| BCh232 | | Probiotics<br>كمح 232 البروبيوتك | Gut bacterial flora and how bacteria, associated to man, interact with the host, Types of probiotics and its classification, administration of specific probiotic bacteria could prevent and counteract disease and how probiotic food could be designed.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh234 | | Weight management & Sport nutrition<br>كمح 234 إدارة الوزن والتغذية الرياضية | Role of Nutrition in Sports, introduction and Definition to Sports Nutrition, Factors to Consider for Developing Nutrition Plan, Definition, Meaning, and Types of Obesity, Health Risks Associated with obesity. Daily calories intake. Steps of planning of weight management |
| BCh236 | BCh233 | Advanced Food Microbiology<br>كمح 236 علم الأحياء الدقيقة الغذائية المتقدم | Principles of food virology and immunology; biology, pathogenesis, immunity, and prevention of foodborne viruses; food as immuno-regulator in cancer immunology and immunodeficiency diseases; food allergy; and vaccines against foodborne pathogens.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh301 | | Physical biochemistryكمح 301<br>كيمياء حيوية فيزيائية | Thermodynamics and biochemistry. Physical properties of water. Physiochemical properties of proteins and amino acids. Blood buffering action. Methods of determining molecular weight, structure and shape of molecules |

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| | | | (proteins) in solution. Diffusion and transport phenomenon, movement of molecules through biological membrane. |
| **BCh303** | **BCh203** | **Metabolism of Carbohydrates & Lipids**<br>**كمح 303 أيض كربوهيدرات& دهون** | Special pathways, glycolysis, citric acid cycle, pentose phosphate pathway, gluconeogenesis, glycogen metabolism with special reference to energy production and clinical correlations. Catabolism of free fatty acids (β-oxidation of saturated and unsaturated fatty acids, triglycerides, phospholipids, glycolipids. Biosynthesis of phospholipids and fatty acids with special reference to energy production and clinical correlations.<br>*Practical periods: direct application on the theoretical course.* |
| **BCh305** | **BCh201** | **Metabolism of amino acids & Proteins**<br>**كمح 305 أيض أحماض أمينية& بروتينات** | Overview of metabolism, metabolic pathways, energy production, enzymatic degradation of proteins and their monomers, absorption of amino acids, Metabolic fate of amino groups in muscles and other tissues, transport of ammonium ions to the liver, urea cycle, Krebs bicycle, catabolism of carbon skeleton of amino acids through five families, biosynthesis of non-essential amino acids, the molecules derived from amino acids, glutathione, porphrins, carnitine, creatine, GABA, acetylcholine, pigments, polyamins. Biosynthesis of proteins. Protein degradation. Chemistry of nucleotides, nomenclature, biosynthesis and degradation of purines and pyrimidines, their regulation and formation of deoxysugars, functions of nucleotids, biosynthesis and degradation of RNA and DNA.<br>*Practical periods: direct application on the theoretical course.* |
| **BCh307** | | **Analytical Biochemistry كمح 307**<br>**كيمياء حيوية تحليلية** | General principles of chromatography, Exclusion chromatography, affinity chromatography. Electrophoretic techniques: general principles, low voltage electrophoresis, high voltage gel electrophoresis, isoelectric focusing techniques. General principles of spectrophotometric techniques. Molecular biology techniques: isolation of DNA, analysis of DNA, cloning vectors, applications of molecular biology.<br>*Practical periods: direct application on the theoretical course.* |
| **BCh309** | | **Enzymology 1**<br>**كمح309**<br>**إنزيمات 1** | Enzyme classification and nomenclature. Enzyme properties. Mechanism of enzyme action. Kinetics of enzyme (catalyzed reactions and the self-regulation of biological processes. Mechanism of inhibition and allosterism and their theories. Reversible and irreversible covalent modification of enzymes. Mechanism of certain enzymes. Ribozymes and Abzymes. Vitamins as coenzymes): structure, occurance, defeciemcy and mechanism of interaction with enzymes |
| **BCh311** | | **Metabolism of Inorganic compounds**<br>**كمح 311 أيض مواد غير عضوية** | Water (biochemical properties, physiological effect, transport, hormonal mechanisms of control of water inside body). Metabolism, function and deficiency of (iron, sulfur, calcium, phosphorous and iodine). |
| **BCh313** | | **Drug & Xenobiotics Metabolism**<br>**كمح 313 أيض عقاقير & مواد غريبة** | Methods of separation and identifications of drugs. Biosynthesis of alkalids, phenolics and terpenes. The commercial and medical importance of natural products. Pharmacokinetics of drugs (absorption, distribution, metabolism, |

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| | | | storage and excretion. Phase I and phase II reactions. The role of mixed functions of cytochrome P450 in drug metabolism. Other factors effect to the drug. |
| **BCh315** | | **General Metabolism**<br>**كمح 315 أيض عام** | Metabolism of carbohydrates, lipids, amino acids and proteins. Principles of enzymatic reactions in biochemistry with special reference to fermentation. Interaction of foreign substances within cellular enzymatic reactions.<br>*Practical periods: direct application on the theoretical course.* |
| **BCh302** | | **Enzymology 2**<br>**كمح 302 إنزيمات 2** | Mechanism of enzyme catalysis, covalent regulation of enzymes, examples of enzymatic reactions (evidence of enzyme-transition state complementarity and reaction mechanisms illustrate principles).<br>*Practical periods: direct application on the theoretical course.* |
| **BCh304** | **BCh303/ BCh305 Or BCh315** | **Metabolic Regulation**<br>**كمح 304**<br>**تنظيم أيضي** | Allosteric enzyme as a pace-maker enzymes and their role in metabolic regulation. Covalent and non-covalent modulation regulation of carbohydrate metabolism. Regulation of citric acid cycle. Regulation of oxidative phosphorylation. Hormonal regulation of fuel metabolism. Mechanism in switching the metabolism of liver between the well fed state and the starved state. Metabolic interrelationships of tissues. |
| **BCh306** | | **Cancer Biology**<br>**كمح 306**<br>**بيولوجيا السرطان** | Cellular and molecular basis of cancer. Genes implicated in tumor development and their mechanisms of action in normal cell growth and differentiation. Cell cycle and its regulation, modulation of cell death, apoptosis, signal transduction pathway control cell growth and differentiation. Tumor suppressor genes and genetic susceptibility to cancer. Mechanism of carcinogenesis by tumor viruses and chemical carcinogenesis. DNA repair and the fixation of mutations.<br>*Practical periods: direct application on the theoretical course.* |
| **BCh308** | | **Natural Products & its applications**<br>**كمح 308 منتجات طبيعية وتطبيقاتها** | Chemistry, classification and biological function of: alkaloids, terpenoids and carotenoids. Bacterial toxins and mycotoxins. Anthocyanins.<br>*Practical periods: Direct application on the theoretical course.* |
| **BCh310** | **BCh202** | **Genetic Engineering**<br>**كمح 310**<br>**هندسة وراثية** | Tools of cloning: Cloning vectors. Restriction enzymes DNA Ligase. Kinases. Hosting bacterial cells. Basic steps of gene cloning: Vector (insert preparation-ligation-transformation-screening). Types of Cloning Library construction. Genomic librarycDNA library. Application of cloning. Transgenic animals. Transgenic crops. Cloning of mammals. Gene silencing. Genomic library cDNA library. |
| **BCh312** | | **Neuroscience**<br>**كمح 312**<br>**علم الأعصاب** | Introduction to neuroscience. Cellular neuroanatomy: neurons and glia. Neural system & Organization of the vertebrate brain. Brain and behavior. Chemical control of the brain and brain disorders. Learning and memory. |
| **BCh314** | | **Environmental Pollution**<br>**كمح 314**<br>**التلوث البيئي** | Introduction to most common environmental pollutants. The major problems associated with pollution of the atmosphere, water, the land surface and the food chain. The causes of global warming, ozone depletion & enhanced N and S emissions and urban air pollution. How pollution is caused by nuclear fuel production, processing of spent fuel and disposal of radioactive wastes. The difference between persistent and biodegradable pesticides and how pesticides residues may be quantified. |

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| BCh331 | | **Food-Drug Interaction**<br>**كمح 331**<br>**التفاعل بين الغذاء والدواء** | Basic concepts of Drug interaction. Nutritional status of people on medication schedules and reviews how diseases and aging affect drug-nutrient metabolism. Pharmaceutical, dietetics and medicine topics that portray the mechanisms involved in drug food interactions and guides the student how to the interdisciplinary prevention or correction of negative food-drug interactions. Alcoholism and Nutrition, Nutrition and Drug regiment in older people. Obesity and appetite drugs. Non-prescription drugs and nutrient interactions. Herbal and dietary supplements interactions with drugs. Dietary counseling to prevent food-drug interactions. |
| BCh332 | | **Nutrition in life span**<br>**كمح 332**<br>**التغذية على مدى الحياة** | Nutritional requirements and challenges change throughout the human lifecycle and how alteration in nutritional requirements impact on human health. Investigating the influence of nutrition prior to and during conception. Nutritional requirements during infancy, childhood, adultness, pregnancy, lactation, and in elder people. Nutritional interventions designed to improve human health and well-being at specific age associated time points. |
| BCh333 | | **Nutritional Diseases**<br>**كمح 333**<br>**أمراض التغذية** | The methodology used to determine dietary, nutritional and health status and how evidence is gathered to determine the links between diet, nutrition and health. The relationship between diet and nutrition and the prevention and management of specific diseases and conditions such as obesity, anemia, and malnutrition. |
| BCh490 | | **Research Project**<br>**مشروع بحثي** | Participation in a library and laboratory research project by arrangement with department member. |
| BCh401 | | **Clinical Biochemistry**<br>**كمح 401 كيمياء حيوية طبية** | Samples for biochemical investigation and general quality control assurance. Pre-clinical affecting results. Complete routine analysis. Complete blood picture. Renal functions. Disorders of carbohydrate metabolism. Acid-base balance (respiratory aspects and renal aspects). Diagnostic tests for gastrointestinal and liver diseases. Lipids and lipoproteins disorders. Mascocardiac diseases and their measurements.<br>*Practical periods: Direct application on the theoretical course* |
| BCh403 | | **Immunology**<br>**كمح 403**<br>**علم المناعة** | An introduction to modern immnunological theory and practice covering the biology and chemistry of the immune response, including the chemistry, synthesis and biological properties of antibodies structure of antigens and the chemistry of antibody-antigen interactions. Receptor interleukins and associated mediators of immune cell function. Antigen processing and presentation, the major histocompitability complex, autoimmune diseases, hypersensitivity reactions. Immunochemical techniques (general principle, production of monoclonal and polyclonal antibodies, immunoelectrophoresis, radioimmunoassay "RIA", flouroimmunoassay "FIA", enzyme immunoassay "ELISA") |
| BCh405 | | **Endocrinology & Hormones**<br>**كمح 405**<br>**غدد صماء وهرمونات** | Mediators of hormonal action, classification of hormones. General mechanism of hormonal action. Pituitary and hypothalamic hormones. Pineal gland hormone. Thyroid hormones. Hormones that regulate calcium metabolism. Hormones of the adrenal cortex. Hormones of the adrenal medulla. Hormones of the gonads. Pancreatic Hormones (Non-endocrine hormones). |

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| BCh407 | | Instrumental Analysis كمح 407 التحليل الآلي | Spectrophotometrical analysis- Fluorometry- Electrophoresis. Chromatography methods and its applications. Introduction of electrochemistry. Electro-analytical techniques.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh409 | | Stem Cells & Cell Culture كمح 409 الخلايا الجذعية وزراعة الخلايا | Background and advantages of cell and tissue culture, and biology of cultured cells. Serum-free media, Primary Cell culture, Subculture and Cell lines, Cell separation and characterization. Cloning and Selection, Cell Differentiation, Transformation, immortalization, contamination and cryopreservation. Cell Quantitation.<br>*Practical periods: Direct application on the theoretical course* |
| BCh411 | | Laboratory Safety & Infection Control كمح 411 سلامة مختبرات ومكافحة عدوى | Control the instrument in standard. The design and operation of a quality control program in a clinical laboratory. The action necessary to provide adequate confidence that test results satisfy given requirements and standards. Such areas as statistics, patients preparation, specimen integrity, external proficiency control, internal quality control, analytical goals and laboratory management, and control the hazardous compounds |
| BCh413 | | Scientific writing كمح 413 الكتابة العلمية | Publication Ethical Standards (Guidelines and Procedures). Plagiarism and paraphrashing art. Basis of scientific writing. Difference between several types of publication forms. |
| BCh402 | BCh401 | Advanced Clinical Biochemistry كمح 402 كيمياء حيوية طبية متقدمة | Seminal fluid analysis. Sputum analysis. Cerebrospinal fluid analysis. Calculi analysis. Homeostasis mechanisms of the endocrine organs and their pathophysiology. Tumor markers. Amniotic fluid and examples of inborn errors of metabolism and their measurments. Autoimmune diseases investigations. |
| BCh404 | | Toxicology كمح 404 علم السموم | Biochemical action of toxicants and assessment of cellular damage by biochemical measurements. basis concepts in toxicology, history and branches, dose –response curves, statistically defined expression in toxicology, classification of toxicants and their mode of action, mutagens, and carcinogen, phytotoxins, zootoxin and environmental toxicants. |
| BCh406 | | Nanoscience Bioapplications كمح 406 التطبيقات الحيوية لعلم النانو | Basis of nanotechnology and its applications in biochemistry & in different medicinal, biochemical and industrial techniques. |
| BCh408 | | Immunohisto-chemistry كمح 408 الكيمياء المناعية للأنسجة | Cell Structure and the microscopic anatomy of tissues. Fixation technique of tissues. Different staining of cells (as hematoxylene and Eosin, Trichrome) & Using of different antibodies in determination of immunological paramaters.<br>*Practical periods: Direct application on the theoretical course.* |
| BCh410 | | Cell Signaling كمح 410 إشارات خلوية | The membrane in signaling, general signaling mechanisms, signaling in the nervous system, electrophysiology and bioelectric potentials. Signaling in the nervous system-channels. G-protein signaling, G-protein coupled receptors signaling, nitric oxide, sensory transduction in prokaryotes and eukaryotic microbes. Cytokine receptors and tyrosinekinas, chemoreception in eukaryotes, chemoreception in prokaryotes. Sensory transduction. Developmental signaling, development in Drosophila eye, JAK/STAT signaling, retinoic and steroid |

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| | | | hormones, growth factors, apoptosis for signaling, vesicle targeting, protein signaling in exocytes and endocytes, abnormal signaling in cancer. |
| **BCh412** | | **Bioinformatics**<br>**كمح 412 المعلوماتية الحيوية** | Introduction in a core number of biological databases and bioinformatics tools, and utilizing these data to answer biological questions. Computational applications in nucleic acid and protein sequences, analysis of mass protein fragments.<br>*Practical periods: Direct application on the theoretical course.* |
| **BCh414** | | **Vitamins & Co-enzymes**<br>**المساعدة كمح 414 فيتامينات والإنزيمات** | Introduction to vitamins. Chemistry, classifications and functions of vitamins, Water and fat soluble vitamins. Definition of coemzymes. The role of coenzymes in photosynthesis and respiration.<br>*Practical periods: Direct application on the theoretical course* |
| **BCh416** | | **Topics in Biochemistry**<br>**كمح 416 موضوعات في الكيمياء الحيوية** | Selected topics in different branches of biochemistry. |
| **BCh430** | | **Research Project in nutrition**<br>**كمح 440 مشروع بحثي في التغذية** | Participation in a library and laboratory research project by arrangement with department member. |
| **BCh431** | | **Therapeutic Nutrition (1)**<br>**كمح 431 التغذية العلاجية 1** | Care of clients with pathologies caused by or causing nutritional impairments or disorders. The relation between diet and the management of some chronic diseases as hypertension, diabetes, osteoporosis. |
| **BCh434** | **BCh431** | **Therapeutic Nutrition (2)**<br>**2 كمح 433 التغذية العلاجية** | Care of clients with pathologies caused by or causing nutritional impairments or disorders. The relation between diet and the management of some chronic diseases as hepatic disorders, renal disorders, and cardiovascular diseases. |
| **BCh440** | | **Research Project in Biotechnology**<br>**كمح 440 مشروع بحثي في التكنواوجيا الحيوية** | Participation in a library and laboratory research project by arrangement with department member. |
| **BCh207** | | **Biomolecules Chemistry**<br>**كمح 207 كيمياء الجزيئات حيوية** | The chemistry of biologically relevant aqueous solutions; structure and properties of biomolecules (amino acids, peptides and proteins, nucleotides and nucleic acids (DNA and RNA), carbohydrates classification and functions, lipids classifications and biomembranes.<br>Practical periods: direct application on the theoretical course. |
| **BCh214** | | **Metabolism of Biomolecules**<br>**كمح 214 أيض الجزيئات الحيوية** | Metabolism of carbohydrates, lipids, amino acids and proteins. Principles of enzymatic reactions in biochemistry with special reference to fermentation. Interaction of foreign substances within cellular enzymatic reactions.<br>*Practical periods: direct application on the theoretical course.* |
| **Chem234** | **Chem102** | **Fundamentals of Physical Chemistry** | Thermodynamics: Heat, Energy and work, First law of thermodynamics, Heat capacities, Adiabatic processes, Joule-Thomson effect, Thermochemistry, Second and third law of thermodynamics, Entropy and free energy. The phase rule equation: One-component systems, two component systems consisting of solid |

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| | | | and liquid phases, Compound formation, Three component systems. Reversible electrochemistry: Reversible and irreversible processes, Electrochemical galvanic and electrolytic cells, Determination of electrode potential, Standard cells, Nernst equation, Electromotive force series. Applications of electrode potentials and cell e.m.f. Chemical kinetics: The rate of chemical reaction, First, Second, Third and Zero-order reactions, The effect of temperature on reaction rates, Collision theory. Catalysis: Homogeneous catalysis, Acid-base catalysis, Enzyme catalysis, Heterogeneous catalysis, Catalysis poisoning.<br>*Practical periods: Direct application on the theoretical course* |
| **Mic222** | | **Basis of Microbiology** | Basis of microbiology. Historical aspects of microbiology science. Major contribution of scientists. kingdom concept of living organism. Diversity and systematic of the microbial kingdom. Microscopy. Stains and staining.<br>*Practical periods: Direct application on the theoretical course.* |
| **BPhy222** | | **Biophysics** | Radioactivity and radionuclide imaging: Causes of radioactivity. Radioactive decay rates. Activity. Decay constant. Radioactive half- life. Specific activity. Production of radionuclides. Neutron activation. Interaction of radiation with matter. Biological and effective half-life. Biological effect of radiation. Radiation protection. Bioelectricity: Membrane model system. Nernst potential. Nervous system and neuron. Amplification and measurements of bioelectric signals. Electrical signals from muscles. Bioelectricity of bone. Biomagnetism: Magnetic field influence on the blood system, ionic motion, operation of the heart and on cellular membrane. Biomechanics: Types of forces. Components of force. Torque. Center of gravity. Levers. Physics of therapeutic heat and cold. Heat and cold in therapy. Heating by ultrasonic waves. |
| **Mic140** | | **Fundamentals of microbiology** | History of Microbiology; Scientist of great concentration in microbiology, Diversity of the microbial world; Cell Structure and Organization, Why study Microbiology, Principles of Microscoope, Preparing Specimens for Optical Microscopes; stains and staining reactions, Control of Microbial Growth; Physical control methods, Chemical control agents, Microbial nutrition and cultivation; Macronutrients and micronutrients, Laboratory Cultivation of Microorganisms, Estimation of microbial growth.<br>*Practical periods: Direct application on the theoretical course.* |
| **Mic241** | | **Microbial diversity** | Eubacteria, Archaeobacteria, Cyanobacteria—General comparison, Morphology and structure of a typical Bacterium (Eubacterium). Gram staining (Gram-positive and Gram negative Bacteria) with reference to cell wall, Capsular, Endosperm and Flagellar staining techniques. General structure of Viruses, Detailed structure of animal viruses (pox Virus, Polio Virus, Human Immunodeficiency Virus: AIDS), Plant virus (TMV) & Bacteriophage, Differences between the structures of different types of Bactriophages. Mycology, General characteristics of Fungi; Range of thallus organization and Reproduction. |
| **Mic243** | | **Microbial Physiology** | Metabolism& Generation of ATP. Enzymes and their role in metabolism, Energy producing reactions (EMP, -HMP, TCA), Mixed acid fermentation (Butanol and butyric acid fermentation, Lactic acid fermentation), Anapleurotic reactions (Transport of nutrients), Protein biosynthesis and regulation of enzyme activity, Lipid metabolism, Role of microbes in nature, Microbial growth, Measurement |

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| | | | of Microbial growth, Media: natural, synthetic and semi-synthetic media, Physical factors affecting growth, Nutritional factors affecting growth, Vitamins and growth factors.<br>*Practical periods: Direct application on the theoretical course.* |
| **Mic245** | | **Principles of Biotechnology** | General introduction to fermentation technology ntroduction, scope and historical developments, importance of microbes in industry; microbial biomass, microbial enzymes, microbial metabolites and microbial recombinant products Isolation, screening and genetic improvement of industrially important organisms Fermentation, Definition, chronological development of fermentation industry, Submerged fermentation and solid state fermentation Media for industrial fermentation, major components, water, carbon sources, nitrogen sources, minerals, chelators, oxygen requirement, rheology, foaming and antifoaming agents Medium optimization Fermenter, functions of a fermenter, Design of a biofermenter, body constructon Types of fermenters: Waldhof type, tower type, air lift type, packed tower type , sterilization of the fermenter, aeration, porous sparger, orifice spurger, nozzle sparger, probes Recovery of fermentation products, foam separation, precipitation, filtration, centrifugation.<br>*Practical periods: Direct application on the theoretical course.* |
| **Mic247** | | **Microbiological techniques** | Laboratory safety and understanding warning signs, Isolation, purification and of quantification of biopolymers, Different types of polymerase chain reactions gel electrophoresis, Different types of sequencing, Molecular cloning, Different types of microscopes, Instruments used in microbiology, Preparation of permanent slides. |
| **Mic249** | | **Microbial Secondary Metabolites** | Definition and impact of microbial SM. Terpenoids: synthesis of IPP (isopentenyl pyrophosphate) in the cytosol and the plastid, role of terpenoids in the plant defense. Alkaloids: biosynthesis, functional groups and biological activity, definition of the main metabolic pathways. Biotechnological applications. Phenylpropanoids: biosynthesis and ecological functions. Phenols, polyphenols and tannins: classification and biosynthesis. Biotechnological applications. Biosynthesis of lignins. Flavonoids: biosynthesis, localization, ecological significance. Synthesis and modification of the color of flowers for commercial purposes. Biotechnological applications. Sulfur-containing SM. Polyketides, secondary metabolites produced by bacteria. Mode of biosynthesis, possibilities for biotechnology intervention. Metabolic engineering in the expression of SM. New trends in microbial secondary metabolities.<br>*Practical periods: Direct application on the theoretical course.* |
| **Mic242** | **Mic247** | **Fermentation Techniques** | General Introduction to Bioprocesses. Bioreactor design. Stirred tank, Fluidized-bed, Air-lift, Methods of fermentation, Batch, fed-batch, Continuous, perfusion. Energetics of growth, cell yields. Nutrient requirements and culture media. Metabolic engineering, Requirements for scale-up a. Multiple vs unit systems, Agitation systems/ control, Oxygen/ pH control d. Microcarriers. Fermentation of bioproducts by microorganisms. Primary metabolites. Secondary metabolites. Animal Cell technology, Cell types, Genetic technology for production, Principles of using animal cells in large-scale process. Products from animal cells, Viral vaccines, Monoclonal antibodies, Recombinant proteins. |

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| **Mic244** | | **Microbial growth** | The important metabolic processes that occur in prokaryotes and eukaryotic microorganisms under different environmental conditions will be discussed. Explain the central metabolic pathways starting from glucose, as well as other trophic variations found in prokaryotes including the use of organic compounds other than glucose, anaerobic fermentation, anaerobic respiration, chemolithotrophy and photosynthesis. The regulation of growth through control of gene expression and enzyme activity is also covered. Finally, development of the laboratory skills for students will be targeted. |
| **Mic341** | **Mic244** | **Industrial Microbiology** | The diversity of industrially relevant microbes, microbial and and fermentation technology. different applications of microbes in Agriculture, Environment, Food and Chemical industries. It also emphasisesthe role of microbes in enzymes and vaccine production. Finally, a comprehensive knowledge is also provided for genetic strain improvement for higher production.<br>*Practical periods: Direct application on the theoretical course.* |
| **Mic343** | **Mic244** | **Applied Medical Microbiology** | Micro-organisms in the biological system. Micro-organisms and disease, Pathogenicity of bacteria, Pathogenicity of virus, Pathogenicity of fungi as well as the related laboratory methodology.Bacterial physiology.factors. Bacterial genetics.Antibiotics and chemotherapeutics.Current research within medical microbiology. Immune system, Immunity against pathogenicity and virulence of microorganisms. New trends in medical microbiology and immunity.<br>*Practical periods: Direct application on the theoretical course.* |
| **Mic345** | | **Soil & Agriculture Microbiology** | Soil microorganisms in agro ecosystems: Types of microbial communities; soil microbial diversity: significance and conservation; effect of agricultural practices on soil organisms. Biological nitrogen-fixation: The range of nitrogen fixing organisms; mechanism of nitrogen fixation (biochemistry of nitrogenase); genetics of nitrogen-fixation. Rhizobium-Legume Association; Symplasmids, N2 fixation by non-leguminous plants. Chemical transformation by microbes: Organic matter decomposition, nutrient mineralization and immobilization; transformation of carbon and carbon compounds. Biodegradation of herbicides and pesticides. Biofertilizer: Mass cultivation of microbial inoculants; green manuring; algalization; Azolla. Microbial products and plant health: Plant growth promoting rhizobacteria (PGPR); significance of mycorrhizae. Microbial herbicides; biological control. |
| **Mic347** | | **Microtechniques and cell photography** | Introduction to microscopy, narcotization and fixation types, dehydration, clearing, embedding, sectioning and mounting are illustrated. In addition, the staining processes with different types of stains, synthetic and histochemical stains. Whole mounts, squashes and smears of different specimens. Principles and various types of microscopy. Introduction to optical and computational methods of image processing (digital imaging) and its applications in biology. Introduction to practical techniques used in molecular biology (western blotting, chromatography, recombinant DNA techniques, RNA isolation. |
| **Mic342** | **Mic244** | **Food Microbiology** | Fundamentals of food microbiology, characteristics of predominant microorganisms in food, sources of microorganisms in foods and food quality. It is also presenting beneficial uses of microorganisms in food industry, and how to |

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| | | | control microorganisms in foods. Besides, it provides a firm background in drinking water microbiology, and the role of microbes in wastewater treatment. *Practical periods: Direct application on the theoretical course.* |
| **Mic344** | **Mic341** | **Biofuel microbiology** | The characteristics of biomass resources, and the design and operations of the biomass energy systems. Key topics covered include the basics in production, availability and sustainability of biomass resources; characteristics of biomass as a fuel; design aspects on the pre-treatment, thermochemical conversion and biochemical conversion processes of biomass. In particular, the environmental aspects of biomass energy, economics and life-cycle analysis with case studies on biomass energy production. |
| **Mic441** | | **Biocontrol & Microbial fertilizers** | Biological control, one of the most important and benign tactics we have available to manage pests in agriculture. The concept of Bio fertilizers ,status scope and importance of Biofertilizers,Classification of Bio fertilizers.Nitrogen fixation. Structure and characteristic features of bacterial Bio fertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; ynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza. Production technology: Strain selection, sterilization, growth and fermentation,equipment, mass production of carrier based and liquid bio fertiizers. FCO specifications and quality control of bio fertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of bio fertilizers. |
| **Mic442** | | **Environmental biotechnology Technical** | Introduction to environmental biotechnology and focuses on the utilization of microbial processes in waste and water treatment, and bioremediation. Microbial energy metabolism, microbial growth kinetics and elementary chemostat theory, relevant microbiological processes, microbial ecology, approaches for studying microbial communities, and basic principles in bioremediation and biological water and waste treatment. |
| **Mic444** | | **Pharmaceutical Microbiology** | Introduction to pharmaceutically relevant microorganisms (viruses, bacteria, fungi and parasites), and their properties, structure, taxonomy, growth, and molecular mechanisms for gene regulation, transmission of genetic material and antimicrobial resistance development antimicrobial chemotherapy at the cellular and molecular level, including mechanisms of action, drug selection, drug interactions, side effects, misuse of drugs, antimicrobial resistance development and antibiotics in the environment. |