اللائحة الداخلية للدراسات العليا
كلية العلـــــوم - جـــامعة حلوان

Postgraduate Academic Rules and Regulations
(نظام الساعات المعتمدة)
Faculty of Science - Helwan University

(Credit hour system)

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مقدمـــــــــــة

انشئت كلية العلوم بجامعة حلوان بقرار جمهورى عام 1980، وبدأت الدراسة بها في عام 1983 في أقسام "الرياضيات" و"الفيزياء" و"الكيمياء"، بينما بدأت الدراسة في أقسام "النبات والميكروبيولوجي" و"علم الحيوان والحشرات" و"الجيولوجيا" في عام 1996.

رؤية الكلية

تطمح كلية العلوم جامعة حلوان إلى الريادة في تقديم خدمات تعليمية وبحثية متميزة ومتطورة في مجالات العلوم الأساسية والتطبيقية وإنتاج وإستثمار المعرفة.

رسالة الكلية

تعمل كلية العلوم جامعة حلوان على إعداد خريج متميز قادر على المنافسة في سوق العمل، وإنتاج وإستثمار المعرفة في مجالات العلوم الأساسية والتطبيقية وفقاً لمعايير الجودة من خلال الكوادر البشرية المتميزة ووجود برامج أكاديمية حديثة و متخصصة ذات منظومة تكنولوجيا متطورة في مجال التعليم والتعلم والبحث العلمي تساهم بشكل فاعل في خدمة المجتمع وتنمية البيئة.

قيم كلية العلوم

1- إتقان العمل والإنتماء
2- التسامح والإحترام
3- الشفافية والعدالة
4- حرية البحث
5- دعم قيم الجودة والتحسين المستمر العلمي
6- دعم الإبتكار ماديا و معنويا
7- الدعم الدائم لخلق مناخ تنظيمي ايجابي
8- التحفيز الموضوعي العادل
9- تبني الرقابة الإيجابية التي تنهض بالاداء

10- تبني روح الفريق
11- التفاعل الإيجابي بين أقسام الكلية
12- التنافسية والريادة
13- المشاركة الفعالة مع قطاعات المجتمع
14- التنمية البشرية المستمرة

الاهداف الاستراتيجية للكلية

الغاية الأولى: بيئة تعليمية تعتمد على التكنولوجيا الحديثة فى التعليم والتعلم طبقاً لمعايير الجودة.

الغاية الثانية: دراسات عليا متطورة وبحث علمى متميز.

الغاية الثالثة: كوادر بشرية متميزة مهنياً.

الغاية الرابعة: دور انتاجي وخدمي للكلية يسهم في النهوض بالمجتمع وتنمية البيئة.

الغاية الخامسة: مكانة مجتمعية مرموقة للكلية تعزز الثقة لدي الاطراف المستفيدة.

الباب الأول : الأحكام العامـــــــــــــــة

مادة (1): الأقسام العلمية والتخصصات:

تضم كلية العلوم جامعة حلوان الأقسام العلمية التالية:

جدول(1)
الاقسام العلمية وتخصصاتها والرمزالكودى لكل قسم

الرمز الكودى	التخصص	القسم العلمى
MAT	Mathematics	قسم الرياضيات
STA	Statistics	
COM	Computer Science	
PHY	Physics	قسم الفيزياء
BPH	Medical Biophysics	
SPA	Space Sciences	
CHM	Chemistry	قسم الكيمياء
BCH	Biochemistry	
BOT	Botany	قسم النبات والميكروبيولوجى
MIC	Microbiology	
ZOO	Zoology	قسم علم الحيوان
GEO	Geology	قسم الجيولوجيا
GPH	Gophysics	

مادة (2): الدرجات العلمية العليا

تمنح جامعة حلوان بناءً على موافقة مجلس كلية العلوم الشهادات والدرجات العلمية الآتية:

1- شهادة الدبلوم فى الدراسات العليا (جدول 2)
2- درجة الماجستير فى العلوم (M.Sc.) (جدول 3)
3- درجة دكتوراة الفلسفة فى العلوم (Ph.D.) (جدول 3)
4- درجة دكتور فى العلوم (D.Sc.) (جدول 3)

- يجوز أن تنشأ بالكلية برامج منفردة ومزدوجة أخرى بموافقة مجلس الجامعة بناءً على طلب مجلس الكلية وإقتراح مجالس الأقسام العلمية وبموافقة مجلس الكلية ومجلس الجامعة. ووفقاً لقانون تنظيم الجامعات وبنفس قواعد هذه اللائحة.
- يجوز الإشتراك مع هيئات من خارج الجامعة للحصول على الدبلوم والدرجات العلمية (ماجستير – دكتوراه الفلسفة) بعد موافقة مجلس الجامعة بناءً على طلب مجلس الكلية وإقتراح مجلس القسم العلمي.

* يستمر العمل باللائحة الدراسية الخاصة ببرنامج الدبلوم فى (الميكروبيولوجيا التطبيقية) الصادرة بالقرار الوزارى رقم (4097) بتاريخ 2023/10/2 وتلحق على هده اللائحة.

جدول (2)
دبلومات الدراسات العليا التى تمنحها جامعة حلوان بناءً على توصية مجلس الكلية

القسم العلمى	البرنامج الدراسى
قسم الكيمياء	- الكيمياء التحليلية Analytical Chemistry - الكيمياء التطبيقية Applied Chemistry - تحاليل الكيمياء الحيوية المهنى Professional biochemistry analyzes "برنامج نوعى بمصروفات "
قسم النبات والميكروبيولوجى	- *الميكروبيولوجيا التطبيقية Applied Michrobiology "برنامج نوعى بمصروفات "
الجيولوجيا	- الجيولوجيا التطبيقية Applied Geology
	- الجيوفيزياء التطبيقية Applied Gephysics

جدول (3):
درجات الماجستير فى العلوم ، دكتوراة الفلسفة فى العلوم، دكتور فى العلوم التي تمنحها جامعة حلوان بناءً على توصية مجلس الكلية

القسم العلمى	البرامج الدراسية
الرياضيات	1- الرياضيات البحتة 1-Pure MATematics 2- الرياضيات التطبيقية 2-Applied MATematics 3- الإحصاء الرياضي 3-Mathematical Statistics 4- علوم الحاسب 4- Computer Science
الفيزيـاء	1- فيزياء الجوامد التطبيقية 1-Applied Solid State Physics 2- فيزياء الالكترونيات 2- Electronic Physics 3- البصريات والليزر أو الأطياف الذرية 3- Optics and Laser or Atomic Spectra 4- الفيزياء النووية التطبيقية 4- Applied Nuclear Physics 5- الفيزياء الاشعاعية التطبيقية 5- Applied Radiation Physics 6- الفيزياء الحيوية الطبية 6-Medical Biophysics 7- فيزياء الفلك وعلوم الفضاء 7- Astronomy and space science 8- الفيزياء النظرية 8- Theoretical Physics
الكيمياء	1-الكيمياء اللاعضوية (الكيمياء غير العضوية) 1. Non organic (Inorganic Chemistry) 2- الكيمياء اللاعضوية (الكيمياء التحليلية) 2. Non organic (Analytical Chemistry) 3- الكيمياء اللاعضوية (الكيمياء الفيزيائية) 3. Non organic (Physical Chemistry) 4-الكيمياء العضوية 4. Organic Chemistry 5- الكيمياء التطبيقية 5.Applied Chemistry 6 - الكيمياء الحيوية 6. Biochemistry 7- درجة الماجستير فى التكنولوجيا الحيوية الجزيئية 7- Biotechnology "برنامج نوعى بمصروفات"

النبـــات والميكروبيولوجى	1- الميكروبيولوجي 1. Microbiology 2- فسيولوجيا النبات 2. Plant Physiology 3- البيئة النباتية والفلورا 3. Plant Ecology and Flora 4- التصنيف والفلورا 4. Plant Taxonomy and Flora 5- الوراثة 5. Genetics 6-الطحالب 6. Algae
علم الحيوان والحشرات	1- علم وظائف الأعضاء 1. Physiology 2- الخلية والأنسجة 2. Cytology & Histology 3- الوراثة وبيولوجيا الخلية الجزيئية 3. Genetics and Molecular Cell Biology 4- التشريح المقارن والأجنة 4. Comparative Anatomy and Embryology 5- اللافقاريات والطفيليات 5. Invertebrates & Parasitology 6- المناعة 6. Immunology 7- الحشرات 7. Entomology 8- البيئة الحيوانية 8. Animal Ecology
الجيولوجيا	1- الصخور والجيوكيمياء ورواسب الخامات 1. Petrology, Geochemistry and Ore Deposits 2- الصخور الرسوبية والترسيب 2. Sedimentary Rocks and Sedimentation 3- الطبقات والحفريات 3. Stratigraphy and Paleontology 4- الجيولوجيا البيئية 4. Environmental Geology 5- جيولوجيا البترول والمياه 5. Petroleum and HydroGeology 6- الجيوفيزياء 6. Geophysics 7-الجيولوجيا التركيبية والتكتونية 7. Structural Geology and Geotectonics

مادة (3): مواعيد القيد

تقدم طلبات الإلتحاق للدراسات العليا بالكلية قبل كل فصل دراسى خلال شهرى يوليو وأغسطس للفصل الأول وخلال شهرى ديسمبر ويناير للفصل الثانى وتعلن نتيجة القبول خلال الإسبوع الأول من شهر سبتمبر للفصل الأول و خلال الإسبوع الأول من شهر فبراير للفصل الثانى، ويكون قبول الطلاب بعد إستيفاء جميع المستندات وسداد الرسوم خلال أسبوعين من اعلان نتيجة القبول.

مادة (4): شروط عامة للقيد للدراسات العليا

1- موافقة جهة عمل الطالب (إن وجد) على قيده لدراسة الدرجة المتقدم لها.
2- سداد الرسوم الدراسية المقررة.
3- إستكمال جميع المستندات المطلوبة من إدارة الدراسات العليا.
4- الحصول على موافقة مجلس القسم المختص، وموافقة مجلس الكلية على القيد.
5- يجوز لمجلس القسم المختص أن يضيف شروطا أخرى يراها ضرورية لقبول الطلاب الجدد، يوافق عليها مجلس الكلية بما لايتعارض مع اللائحة الداخلية للكلية وقانون تنظيم الجامعات.
6- يجوز لمجلس القسم تحديد عدد الطلاب المقبولين حسب الإمكانات المتاحة بالقسم والكلية بتطبيق قواعد المفاضلة بين المتقدمين طبقا لخطة سنوية معتمدة من مجلس الكلية.
7- يتم تسجيل موضوعات الماجستير طوال العام بعد النجاح فى المقررات التمهيدية بنجاح بشرط أن يحقق معدلا تراكميا مقداره (C).
8- يتم تسجيل موضوعات الدكتوراه طوال العام بعد اجتيازه مقررات الفصل الدراسى الأول وعددها ثلاثة مقررات دراسية (6 ساعات معتمدة) بنجاح بشرط أن يحقق معدلا تراكميا مقداره (+C).

مادة (5): إيقاف القيد

يجوز لمجلس الكلية بناءً على اقتراح مجلس القسم المختص، ولجنة الدراسات العليا بالكلية أن يوقف قيد الطالب لمدة فصل دراسي أو أكثر بما لايتجاوز سنتين متتاليتين أو متفرقتين خلال دراسته لدرجة علمية إذا تقدم بعذر مقبول يمنعه من مواصلة دراسته أو بحثه، وتسقط مدة الإيقاف من المدة المحددة للدراسة. وبشرط ألا يكون إيقاف القيد عن سنوات سابقة وأن يكون إيقاف القيد فى المدة الأساسية

وليس فى فترات مد القيد وذلك لظروف يقبلها مجلس الكلية. فى حالة ان يكون مسجل لرسالة علمية ماجيستير/ دكتوراه يجب أخذ رأى المشرف الرئيسى على الرسالة ومجلس القسم.

مادة (6): المواظبة

أ- يتولى القائم بتدريس المقرر تسجيل حضور وغياب الطلاب فى المحاضرات النظرية والتطبيقية ويعتبر الدارس مسئولاً عن الدروس والواجبات والتكليفات التى تتم أثناء فترة غيابه.

ب- يحرم الطالب من حضور الامتحان النهائي لأى مقرر دراسى لم يحقق نسبة حضور فيه قدرها 75% من الساعات المعتمدة للمقرر بدون عذر مقبول إذا تم إنذار الطالب ثلاث إنذارات مع موافقة مجلس الكلية، وفى هذه الحالة يعتبر الطالب راسبا فى هذا المقرر ويرصد تقدير له **(F)** وتحسب عليه فرصة من فرص دخول الإمتحان مع إخطار الطالب بذلك عن طريق الكلية.

ت- إذا تغيب الدارس أكثر من 25% من الساعات المعتمدة بأي مقرر أو أكثر وكان غيابه بعذر يقبله مجلس الدراسات العليا بالجامعة بناءً علي موافقة مجلس الكلية يعتبر فى هذه الحالة منسحباً ، ويثبت له في سجله أنه منسحب بعذر عن هذا المقرر **(W)** ، أو منسحب بعذر عن جميع مقررات الفصل الدراسى **(CW)** ولا تدخل هذه المقررات فى حساب تقدير الطالب.

مادة (7): النظام الكودى للمقررات

1- تكود المقررات بوضع الرمز الكودى للتخصص العام كما هو موضح فى جدول رقم (1) يليه الرقم الدال على المقرر.

2- تقسم مقررات الدراسات العليا إلى:

أ- مقررات (كود 500) تدرس أساسا لطلبة الدبلوم.

ب- مقررات (كود 600) تدرس أساسا لطلبة الماجستير.

ج- مقررات (كود 700) تدرس أساسا لطلبة دكتوراة الفلسفة فى العلوم.

3- يوضع الرقم الدال على مستوى المقررفى خانة المئات ثم رقم المقررفى خانتى الآحاد والعشرات.

4- لمجلس القسم الحق فى إضافة مقررات جديدة لقائمة المقررات في حدود الأرقام المخصصة للبرنامج بعد موافقة مجلس الكلية.

مادة (8): المقررات الدراسية

1- تدرس مقررات الدراسات العليا خلال عام أكاديمى واحد (فصلين دراسيين) بالنسبة للدبلوم وتمهيدي الماجستير وتأهيلي الدكتوراه. وتقوم مجالس الأقسام المختصة باعداد قائمة بالمقررات الدراسية والساعات المعتمدة المخصصة لها والأقسام التى تقوم بتدريسها ويتم إعتمادها من لجنة الدراسات العليا والبحوث ثم مجلس الكلية. ويعتمد مجلس الكلية المحتوى العلمى لمقررات الدراسات العليا بعد تحديدها واعتمادها من مجالس الأقسام المختصة.

2- يجوز للأقسام العلمية اقتراح مقررات تكميلية في التخصص المطلوب القيد فيه للدراسة التمهيدية لدرجة الماجستير وذلك من المقررات الدراسية فى مرحلة البكالوريوس.

3- يجوز للأقسام العلمية اقتراح مقررات تكميلية من كود 600 وذلك قبل تسجيل الطالب لرسالة الماجستير في تخصص مخالف للدراسة التمهيدية للماجستير.

4- لا يتجاوز عدد المقررات التكميلية أربع مقررات (8 ساعات معتمدة) وفى حالة زيادتها عن أربعة مقررات توزع على فصلين دراسيين ويشترط النجاح فى هذه لمقررات قبل القيد لمرحلة الماجستير.

5- الفصل الدراسى الصيفى (الاختياري) تبدأ الدراسة في السبت الأول من يوليو. مدة الدراسة 8 أسابيع تشمل الاختبارات النهائية ويتم تكثيف الدراسة بواقع محاضراتين اسبوعيا وتعادل عدد الساعات المعتمدة لكل مقرر في الفصل الدراسي الاساسي . يتم تسجيل الدارس للمقررات الدراسية فى حدود المقررات المطروحة والمعلنه من قبل القسم العلمى بحد أقصي الأسبوع الاول. ويشترط الا يزيد تسجيل الدارس عن مقررين سواء في حالة الرسوب او رفع المعدل التراكمى او دخول مقررات لم يسبق له دخولها.

مادة (9): الساعات المعتمدة

1- بالنسبة للمحاضرات النظرية: تحتسب ساعة معتمدة واحدة لكل محاضرة مدتها ساعة واحدة أسبوعيا خلال الفصل الدراسى الواحد.

2- بالنسبة للدروس العملية والتدريبات التطبيقية: تحتسب ساعة معتمدة واحدة لكل فترة عملية أو تدريبية مدتها من 2-3 ساعات أسبوعياً خلال الفصل الدراسى الواحد.

3- الحد الأدني للمقررات النظرية فقط أو النظري وعملي هو ساعتين معتمدتين.

4- يخصص لكل ساعة معتمدة ساعة للإمتحان التحريرى.

مادة (10): تقدير درجات النجاح والرسوب

1- يحدد التقدير العام فى المقررات الدراسية وكذلك فى التقدير العام للطالب بأحد التقديرات الآتية:

جدول (4): العلاقة بين الدرجات والنقاط المكتسبة والتقديرات

التقدير	النسبة المئوية	النقاط	التقـــــــدير بالأحرف
إمتياز	من 97% إلى 100%	4	A+
	من 93% الي اقل من 97%	3.77	A
	من 90% إلى أقل من 93%	3,57	A-
جيد جداً	من85% إلى أقل من 90%	3,33	B+
	من 80% إلى أقل من85%	3	B
	من 75% إلى أقل من 80%	2,67	B-
جيد	من 70% إلى أقل من 75%	2,33	C+
	من 65% إلى أقل من 70%	2	C
مقبول	من 60% إلى أقل من 65%	1,67	C-
ضعيف	من 50% إلى أقل من 60%	1,33	D
راسب	أقل من 50%	صفر	F
	المنسحب من مقرر بعذر Withdrawal	——	W
	يرصد للطالب المنسحب للفصل الدراسي بعذر مقبول Complete Withdrawal	——	CW
	المنسحب اجباريا من مقرر Forced Withdrawal	——	FW
	الطالب الذي لم يكمل متطلبات المقرر Incomplete	——	I
	يرصد للطالب المسجل لساعات الرسالة العلمية ولم تكتمل بعد IN Progress	——	IP

2- يمنح الطالب شهادة بتقديرات المواد، باللغة العربية أو اللغة الإنجليزية بناءً على طلبه يذكر فيها إسم المادة والتقدير والنسبة المئوية وكذلك الساعات المعتمدة.

3- تحسب النقاط النهائية للمقرر والمعدل الفصلى والتراكمى للمقررات الدراسية كما يلى:

النقاط النهائية للمقرر = قيمة رمز التقدير × عدد الساعات المعتمدة للمقرر

المعدل الفصلى = مجموع النقاط التى حصل عليها الطالب فى جميع مقررات الفصل الواحد / مجموع الساعات المعتمدة لهذه المقررات فى الفصل الواحد

المعدل التراكمى= مجموع النقاط التى حصل عليها الطالب فى جميع المقررات التى درسها فى جميع الفصول / مجموع الساعات المعتمدة لهذه المقررات فى جميع الفصول

4- يتم تقييم الطالب فى المقررات النظرية والعملية بناءً على العناصر التالية:

5- فى حالة المقررات التى تشتمل على دراسة نظرية فقط يخصص 40% للأعمال الفصلية (تكليفات – إختبارات) ، وإمتحان تحريرى درجته (60%) من الدرجة الكلية للمقرر.

6- فى حالة المقررات التى تشتمل على دراسة عملية فقط يخصص 80% من درجة المقرر للتقييم المستمر خلال الدروس العملية أثناء الفصل الدراسى، 20% من درجة المقرر لاختبار نظري العملى، وذلك في المقررات التي تتطلب ذلك.

7- فى حالة المقررات التى تشتمل على دراسة نظرية ودراسة عملية تطبيقية يخصص نسبة 20% من درجة المقرر للإختبارات الدورية والتكليفات، 20% من درجة المقرر للتقييم المستمر بالعملى، 60% للإمتحان التحريرى النهائى.

مادة (11): الإمتحانات

1-يحدد مجلس الكلية فى بداية كل عام دراسى مواعيد الإمتحانات الفصلية.

2-يمنح الطالب فرصة واحدة فقط لإعادة الامتحان فى المقررات التى يرسب فيها عندما تطرح للدراسة.

3-يسمح للطلاب الراسبين بالإلتحاق بفصل دراسى صيفى بعد موافقة مجلس الكلية و مجلس الجامعة.

4-يجوز لمجلس الكلية قبول إعتذار الطالب عن عدم دخول الإمتحان لمرتين فقط خلال دراسته اذا تقدم بطلبه قبل بدء الإمتحان خلال 24 ساعة من تاريخ عقد الإمتحان مدعماً بعذر يقبله مجلس القسم ويعتمده مجلس الكلية.

مادة (12): إعادة القيد

إذا تم إلغاء قيد الطالب لأحد الأسباب المذكورة فى المواد (21، 29، 38) باللائحة يجوز لمجلس الكلية بناءً على إقتراح مجلس القسم المختص وموافقة مجلس الدراسات العليا إعادة قيده، ويراعى أن تطبق عليه القواعد التى تطبق على الطالب المستجد، ويجوز أن يعفى من بعض مقررات السنة التمهيدية إذا لم يمض على نجاحه فيها أكثر من ثلاث سنوات بناءً على موافقة القسم المختص. وعلى الطالب أن يتقدم بطلب إعادة القيد فى المواعيد المحددة لذلك طبقاً للمادة (3) والشروط العامة للقيد طبقاً للمادة (4) والشروط الخاصة بالقيد لكل درجة والمبينة بهذه اللائحة.

مادة (13): الإرشاد الأكاديمي

يحدد مجلس القسم والكلية مرشدا أكاديميا لطلاب الدرسات العليا لمتابعتهم خلال الدراسة بالكلية، على أن يكون من بين أعضاء هيئة التدريس فى نفس التخصص كلما أمكن وذلك لتقديم النصح والإرشاد للطالب خلال فترة دراسته فى إختيار المقررات.

مادة (14): الرسائل العلمية

1- يعين مجلس الكلية بناءً على إقتراح مجلس القسم المختص وتوصية لجنة الدراسات العليا والبحوث مشرفا رئيسيا على الطالب من بين الأساتذة أو الأساتذة المساعدين بالكلية ويجوز إشتراك أحد المدرسين في الإشراف ويجوز بموافقة مجلس الكلية أن يشارك فى الإشراف من فى مستواهم فى التخصص من خارج الكلية وفى جميع الحالات لا يزيد عدد المشرفين عن ثلاثه فى الماجستير وأربعة فى الدكتوراه، إلا فى حالة الاستثناء لحاجة الرسالة ، مع مراعاة التخصص الدقيق لكل منهم.

2- يمكن إضافة مشرف أجنبى إلى لجنة الإشراف فى حالة فتح قناة علمية مع جامعة بالخارج، مع الإلتزام بعدد المشرفين فى بند (1).

3- فى حالة سفر أحد المشرفين إلى الخارج، لمجلس الكلية أن يترك لجنة الإشراف كما هى أو يضيف إليها عضو جديد أو يرفع اسم المشرف الذى سافر إلى الخارج من لجنة الإشراف بناءً على إقتراح

مجلس القسم المختص وموافقة لجنة الدراسات العليا والبحوث بناءً على التقرير الذى يقدمه المشرف المسافر عن مدى ماتم انجازه من خطة الدراسة والمدة التى قضاها فى الإشراف على الرسالة منذ بدء التسجيل وحتى موعد السفر مدعما برأى المشرف الرئيسى مع عدم التعارض مع بند (1) من هذه المادة.

4- يقدم المشرف الرئيسي كل ستة أشهر تقريرا إلى مجلس القسم المختص عن مدى تقدم الطالب في دراسته وللمشرف الرئيسى أن يوصى باستمرار القيد أو إلغائه.

5- يقوم الطالب المقيد لدرجة الماجستير أو الدكتوراه بعمل محاضرة (سيمينار) قبل التسجيل وكذلك قبل تشكيل لجنة الحكم والمناقشة.

6- يتقدم المشرف الرئيسى بمقترح إلى مجلس القسم المختص بتشكيل لجنة الحكم على الرسالة طبقاً للبند (1) من هذه المادة تمهيداً للعرض على مجلس الكلية مدعما بالمستندات التالية:-

أ- تقرير عن صلاحية الرسالة للتحكيم موضحاً به عنوان الرسالة باللغتين العربية والانجليزية وموقعا عليه من المشرفين أو أغلبيتهم على أن يكون من بينهم المشرف الرئيسي.

ب- لا يجوز التقدم برسالة الماجستير إلا بعد عام من تاريخ موافقة الجامعة على التسجيل للرسالة والتقدم برسالة الدكتوراه إلا بعد عامين من تاريخ موافقة الجامعةعلى التسجيل.

ج- يقدم الطالب قبل التقدم بالرسالة لمجلس القسم المختص ما يفيد قبول بحث واحد للنشر من النتائج العلمية التي تم التوصل إليها فى رسالة الماجستير وبحثين من رسالة الدكتوراه ويكون النشر في مجلة علمية متخصصة مفهرسة ومحكمة وتصدرها هيئة علمية بصفة منتظمة.

7- يشكل مجلس الكلية بناءً على إقتراح مجلس القسم المختص وبموافقة لجنة الدراسات العليا والبحوث لجنة للحكم على الرسالة من ثلاثة أعضاء أحدهم من لجنة الإشراف على الرسالة والعضوان الآخران من خارج الجامعة من بين الأساتذة بالجامعات أو المراكز أو معاهد البحوث العلمية المتخصصة من داخل أو خارج الجمهورية، وفى حالة تعدد تخصصات المشرفين على الرسالة يجوز أن يزيد عدد أعضاء اللجنة عن ثلاثة مع مراعاة أحكام المادة (104) من اللائحة التنفيذية لقانون تنظيم الجامعات.

8- يقوم كل عضو من أعضاء لجنة الحكم بإعداد تقرير فردى عن الرسالة في خلال شهر من إستلام الرسالة وتعرض هذه التقارير جميعا فى المناقشة العلانية، ويعد تقرير جماعى للعرض على مجلس القسم المختص ثم مجلس الكلية تمهيدا لعرضه على مجلس الجامعة، و للمحكم أن يوصى في تقريره بإحدى التوصيات التالية :

أ- قبول الرسالة كما هي.

ب- قبول الرسالة بعد إجراء بعض التصويبات الطفيفة.

ج- تأجيل المنح لإجراء التصويبات وبحد أقصى ستة أشهر.

د- رفض الرسالة.

9- ضوابط إختيار المحكمين:

أ- أن تكون الدرجة العلمية للمحكم الخارجى هي درجة أستاذ أو أستاذ مساعد.

ب- ألا يزيد عدد الرسائل التي يقوم بتحكيمها المحكم الواحد عن رسالتين مقدمتين من ذات القسم و الكلية في العام الجامعي الواحد.

ج- أن يكون تخصص المحكم فى نفس التخصص العام للرسالة.

د- لايجوز أن يكون المحكمين الخارجيين من نفس الجامعة.

10- لمجلس الكلية عند الضرورة تعديل تشكيل لجنة الحكم على الرسالة إذا رأى ما يستوجب ذلك.

الباب الثانى : دبلوم الدراسات العليا

مادة (15): شروط القيد

يشترط لقيد الطالب بأي من دبلومات الدراسات العليا- بالإضافة إلى الشروط العامة الواردة في المادة (4) أن يكون حاصلا على درجة بكالوريوس العلوم من إحدى كليات العلوم بالجامعات المصرية أو درجة معادلة لها ومعترف بها من المجلس الأعلى للجامعات وذلك في التخصصات التي يحددها مجلس الكلية بناءا على اقتراح مجلس القسم المختص.

مادة (16): مدة الدراسة

مدة الدراسة لنيل أي من دبلومات الدراسات العليا عام أكاديمى يتفرغ خلاله الطالب لدراسته النظرية والعملية والتدريبيات وعدد الساعات المعتمدة المخصصة لأى من دبلومات الدراسات العليا لا يقل عن 24 ساعة معتمدة، ويجوز لمجلس القسم المختص أن يكلف الطالب بدراسة بعض مقررات مرحلة البكالوريوس ولا تحتسب ضمن الساعات المعتمدة للدبلوم.

مادة (17): المقررات الدراسية

1- تحدد هذه اللائحة المقررات الدراسية وعدد ساعات الإمتحان وكذلك عدد الساعات المعتمدة المخصصة لكل درجة دبلوم.
2- تدرس المقررات على مدار العام الأكاديمي ويتقدم الطالب للإمتحان في نهاية كل فصل دراسي في المقررات التي درسها .
3- يدرس الطالب المقررات الدراسية من الكود 500 ويجوز دراسة بعض المقررات من الكود 600 الخاص بالماجستير.

مادة (18): متطلبات الدراسة

1- إجمالى عدد الساعات المعتمدة لنيل دبلوم الدراسات العليا 24 ساعة معتمدة.
2- يقوم القسم المختص بتحديد المقررات الدراسية للطالب طبقاً لبرنامجه الدراسي من بين المقررات المعتمدة من مجلس الكلية بحيث لا يقل عدد الساعات الإجمالية التي ينبغي على طالب الماجستير أن يدرسها عن 20 ساعة معتمدة من الكود 500 (عدد 18 ساعة معتمدة للمقررات الاساسية +عدد

8 ساعات معتمدة للمقررات الاختيارية) ويعتمد وكيل الكلية للدراسات العليا والبحوث ومجلس الكلية هذه المقررات الدراسية كما جاء في المادة (23).

مادة (19): معادلة المقررات

يجوز لمجلس الكلية بناءً على إقتراح مجلس القسم وتوصية لجنة الدراسات العليا والبحوث إحتساب مقررات على مستوى الدراسات العليا سبق للطالب دراستها بالكلية أو في أى معهد علمي معترف به من المجلس الأعلى للجامعات خلال الثلاث سنوات السابقة لقيده بالدبلوم.

مادة (20) شروط منح شهادة دبلوم الدراسات العليا:

يمنح مجلس الجامعة بناءً على توصية مجلس الكلية وموافقة مجلس القسم المختص شهادة دبلوم الدراسات العليا في احد التخصصات الواردة فى جدول (2) في حالة استيفاء الطالب للشروط الآتية:

1- اجتياز الطالب بنجاح جميع المقررات الدراسية بمعدل تراكمى لايقل عن (C).
2- يقدم الطالب ما يفيد إجتيازه بنجاح دورات التحول الرقمى وفقا لقرار المجلس الاعلى للجامعات.

مادة (21): إلغاء القيد

يلغى قيد طالب الدبلوم إذا لم يحصل على الدبلوم في مدة اربعة فصول دراسية من تاريخ القيد.

الباب الثالث : درجة الماجستير فى العلوم (M.Sc.)

مادة (22): مجالات الدراسة

تمنح جامعة حلوان بناءً على إقتراح مجلس الكلية درجة الماجستير في العلوم من خلال الدراسة بالأقسام العلمية الموضحة في الجدول رقم (1) وفى التحصصات الواردة بمادة (2) والموضحة بجدول (3). ويوضح في الشهادة إسم القسم العلمي (والتخصص) وعنوان الرسالة.

مادة (23): شروط القيد

يشترط لقيد الطالب لدرجة الماجستير بالإضافة إلى الشروط الواردة في المادة (4) الشروط الآتية:

1- أن يكون حاصلا على درجة البكالوريوس في العلوم من إحدي كليات العلوم بالجامعات المصرية أو أى درجة معادلة لها من أى معهد آخر معترف به من المجلس الأعلى للجامعات وبتقدير جيد على الأقل.

2- يجوز لمجلس الكلية بناءً على موافقة مجلس القسم المختص قبول قيد الطالب لدرجة الماجستير إذا كان حاصلاً على بكالوريوس العلوم بتقدير عام أقل من جيد بالإضافة إلى إحدي دبلومات الدراسات العليا بتقدير عام جيد جدا على الأقل في نفس التخصص من إحدى كليات العلوم المعترف بها من المجلس الأعلى للجامعات.

3- يجوز لمجلس الكلية بعد أخذ رأى مجلس القسم المختص قبول الطلاب غير المصريين الحاصلين على درجة البكالوريوس في العلوم من أى كلية أو معهد علمي معترف به من المجلس الأعلى للجامعات بشرط حصوله على تقدير عام مقبول على الأقل.

4- أن يتفرغ الطالب يومين على الأقل أسبوعيا ليتابع الدراسة والبحث لمدة عامين على الأقل.

5- سداد الرسوم الدراسية المقررة.

مادة (24): مدة الدراسة

1- الحد الأدنى لمنح درجة الماجستير هو سنه ميلادية من تاريخ موافقة مجلس الجامعة على تسجيل موضوع البحث للرسالة العلمية.

2- الحد الأقصى لمنح درجة الماجستير هو خمس سنوات ميلادية من تاريخ القيد مع مراعاة حالات وقف القيد ويجوز مد القيد بحد أقصى عامين بناءً على طلب المشرف الرئيسي وموافقة مجلس القسم المختص ولجنة الدراسات العليا والبحوث ومجلس الكلية.

3- يشترط لتسجيل رسالة الماجستير عدم مرور أكثر من ثلاث سنوات على اجتياز الطالب امتحانات السنة التمهيدية للماجستير.

مادة (25): المقررات الدراسية

يحدد مجلس القسم المختص قبل بدء الدراسة المقررات الدراسية التي سيتم تدرسيها للطالب خلال العام الدراسي وذلك من بين قائمة المقررات الدراسية من الكود 600 طبقا للجداول المرفقة. وتعتمد هذه المقررات من وكيل الكلية للدراسات العليا والبحوث ومجلس الكلية.

مادة (26): متطلبات الدراسة

3- إجمالى عدد الساعات المعتمدة لنيل درجة الماجستير 40 ساعة معتمدة (20 ساعة معتمدة للمقررات الدراسية و20 ساعة معتمدة للرسالة).

4- يقوم القسم المختص بتحديد المقررات الدراسية للطالب طبقاً لبرنامجه الدراسي من بين المقررات المعتمدة من مجلس الكلية بحيث لا يقل عدد الساعات الإجمالية التي ينبغي على طالب الماجستير أن يدرسها عن 20 ساعة معتمدة من الكود 600 (عدد 12 ساعة معتمدة للمقررات الاساسية +عدد 8 ساعات معتمدة للمقررات الاختيارية) ويعتمد وكيل الكلية للدراسات العليا والبحوث ومجلس الكلية هذه المقررات الدراسية كما جاء في المادة (23).

5- يقوم الطالب بإجراء بحث في موضوع يحدده له المشرف الرئيسي ويعتمد من مجلس القسم المختص ولجنة الدراسات العليا والبحوث ومجلس الكلية ويقدم الطالب رسالة وتقدر لها 20 ساعة معتمدة.

مادة (27): معادلة المقررات

يجوز لمجلس الكلية بناءً على إقتراح مجلس القسم المختص وتوصية لجنة الدراسات العليا والبحوث بالكلية إحتساب مقررات على مستوى الدراسات العليا فى نفس التخصص سبق للطالب دراستها بالكلية أو في معهد علمي أو جامعة أخرى معترف بها من المجلس الأعلى للجامعات والنجاح فيها خلال الثلاث سنوات السابقة للقيد بالماجستير.

مادة (28) شروط منح الدرجة:

يمنح مجلس الجامعة بناءً على توصية مجلس الكلية وموافقة مجلس القسم المختص درجة الماجستير فى احد التخصصات الواردة فى جدول (3) في حالة استيفاء الطالب للشروط الآتية:

3- اجتياز الطالب بنجاح جميع المقررات الدراسية بمعدل تركمى لايقل عن (C).
4- مرور سنة ميلادية على الأقل على بدء التسجيل (موافقة مجلس الدراسات العليا بالجامعة).
5- اجتياز الطالب امتحان اللغة الإنجليزية لمستوى التويفل الدولي أو المحلى طبقا لقرارات مجلس الجامعة الصادرة وتعديلاتها بهذا الشأن.
6- يحدد المشرف الرئيسي للطالب موضوع البحث ويعتمد من مجلس القسم المختص ومجلس الكلية ويقدم الطالب رسالة بنتائج البحث بحيث تمثل إضافة جديدة في فروع التخصص وذلك مع مراعاة المدد الزمنية المنصوص عليها في المادة (24) من هذه اللائحة.
7- يتقدم الطالب برسالة متضمنة نتائج أبحاثه ويشترط قبول الرسالة من لجنة الحكم والتوصية بمنح الدرجة.
8- يقدم الطالب ما يفيد إجتيازه بنجاح دورات التحول الرقمى وفقا لقرار المجلس الاعلى للجامعات قبل التقدم بصلاحية الرسالة لمجلس القسم المختص.
9- يقدم الطالب ما يفيد قبول بحث واحد للنشر على الاقل من النتائج العلمية التي توصل إليها من بحوث الرسالة فى مجلات دولية علمية محكمة تصدرها هيئة علمية بصفة منتظمة ومفهرسة علي احدى قاعدتى بيانات Scopus و Web of Science وذلك قبل التقدم بخطاب صلاحية الرسالة على لجنة الحكم والمناقشة لمجلس القسم المختص.
10-أن يجتاز الطالب المناقشة العلنية في موضوع الرسالة بنجاح

مادة (29): إلغاء القيد

يقوم مجلس الكلية بإلغاء قيد الطالب لدرجة الماجستير في الحالات الآتية:

1- عدم اجتياز الطالب المقررات في السنة التمهيدية للماجستير خلال أربعة فصول دراسية على الأكثر، مع مراعاة المادة (11) ويجوز أن يمنح الطالب الراسب في مادة أو مادتين فقط فرصة ثالثة وأخيرة وذلك بعد تسديد الرسوم الدراسية المقررة طبقا للقواعد المنظمة وبعد موافقة مجلس الكلية ومجلس الدراسات العليا.

2- إنقطاع الطالب عن الدراسة أو عدم جديته في البحث وذلك بموافقة مجلس القسم المختص ولجنة الدراسات العليا والبحوث بناءً على تقرير من المشرفين وبعد إنذاره.
3- رفض لجنة الحكم الرسالة وتوصيتها بعدم منح الدرجة.
4- عدم منح الدرجة خلال المدد المنصوص عليها في المادة (22) باللائحة مع مراعاة حالات وقف القيد.

الباب الرابع : درجة دكتوراه الفلسفة فى العلوم (Ph.D.)

مادة (30) مجالات الدراسة:

تمنح جامعة حلوان بناءً على توصية مجلس القسم وموافقة مجلس الكلية درجة دكتوراه الفلسفة في العلوم من خلال الدراسة بالأقسام العلمية الموضحة في الجدول (2) وفى التحصصات الواردة بمادة (2) والموضحة بجدول (3). ويوضح فى الشهادة إسم القسم العلمي والتخصص وعنوان الرسالة.

مادة (31): شروط القيد والتسجيل

يشترط لقيد طالب لدرجة دكتوراه الفلسفة فى العلوم الآتي:

1- الشروط العامة الواردة في المادة (4) من اللائحة.

2- أن يكون الطالب حاصلا على درجة الماجستير في العلوم في مجال التخصص من إحدى كليات العلوم بالجامعات المصرية أو أى درجة معادلة لها من معهد علمي أخر معترف به من المجلس الأعلى للجامعات.

3- يجوز قيد الطالب في تخصص مخالف لتخصص الماجستير بنفس القسم العلمي و بعد موافقة مجلس القسم وذلك بفرض ما يلزم من المقررات التكميلية تحددها الأقسام العلمية وبموافقة مجلس الكلية، طبقا لمتطلبات القسم المختص وبعد اقتراح المشرف الرئيسى، ولا تحسب هذه الساعات ضمن الساعات المذكورة في المادة (34).

4- أن يتقدم بطلب إلى مجلس القسم المختص برغبته فى التسجيل فى تخصص معين ويتم إعتماد موافقة لجنة الاشراف وتحديد مجال وخطة البحث والمقررات النظرية من المشرف الرئيسى (طبقا للمادة 33) ثم يعرض الأمر- بعد إستيفاء جميع المستندات- على لجنة الدراسات العليا ثم مجلس الكلية.

5- سداد الرسوم الدراسية المقررة.

مادة (32): مدة الدراسة

1- الحد الأدنى للحصول على درجة الدكتوراه هو سنتان ميلاديتان من التسجيل (تاريخ موافقة مجلس الجامعة).

2- الحد الأقصى للحصول على درجة الدكتوراه هو خمس سنوات ميلادية من تاريخ القيد مع مراعاة حالات وقف القيد. ويجوز مد القيد بحد أقصى عامين ميلاديين بناءً على طلب المشرفين وموافقة

مجلس القسم المختص ولجنة الدراسات العليا والبحوث ومجلس الكلية ومجلس الدراسات العليا بالجامعة.

مادة (33): الإشراف

بالإضافة إلى البنود الواردة في المادة (14) بنود (2 ،3 ،4)، يجوز أن يكون الإشراف على طالب الدكتوراه مشتركا بين أعضاء لجنة الإشراف من الجامعة وإحدى الجامعات أو المعاهد الأجنبية المعترف بها من المجلس الأعلى للجامعات وبما لا يخل بالمادة (14) من هذه اللائحة.

مادة (34): خطة الدراسة لدرجة دكتوراه الفلسفة فى العلوم

1- إجمالى عدد الساعات المعتمدة لنيل درجة دكتوراه الفلسفه 60 ساعة معتمدة (12 ساعة معتمدة للمقررات الدراسية ويخصص للرسالة 48 ساعة معتمدة).

2- يقوم القسم المختص بتحديد المقررات الدراسية للطالب بعد إقتراح المشرف الرئيسى المقررات الدراسية للطالب طبقا لبرنامجه الدراسى والتخصص الدقيق له التي تلائم موضوع الرسال، بحيث لا يقل عدد الساعات الإجمالية التي ينبغي على طالب الدكتوره أن يدرسها عن 12 ساعة معتمدة من الكود 700 ويعتمد وكيل الكلية للدراسات العليا والبحوث ومجلس الكلية هذه المقررات الدراسية كما جاء في المادة (25).

3- اجتياز الطالب لدورات اللغة و الدورات المقررة طبقا لقرارات مجلس الجامعة بهذا الشأن

4- يحدد المشرف الرئيسي للطالب موضوع البحث ويعتمد من مجلس القسم المختص ومجلس الكلية ويقدم الطالب رسالة بنتائج البحث بحيث تمثل إضافة جديدة في فروع التخصص وذلك مع مراعاة المدد الزمنية المنصوص عليها في المادة (32) من هذه اللائحة.

5- يجوز لمجلس القسم المختص بناءً على طلب من المشرف الرئيسي أن يوافق على تعديل موضوع البحث ولمرة واحدة فقط خلال دراسة الدكتوراه ويجوز أن يتم ذلك مع أو بدون تغيير المشرفين. ويعتمد ذلك التعديل من مجلس الكلية والجامعة.

مادة (35): معادلة المقررات

يجوز لمجلس الكلية بناءً على إقتراح مجلس القسم المختص إحتساب مقررات طبقا لقواعد القسم المختص – سبق للطالب دراستها في مستوى الدكتوراه بالكلية في معهد علمى معترف به من المجلس الأعلى للجامعات والنجاح فيها خلال الثلاث سنوات السابقة للقيد.

مادة (36): القواعد الخاصة بالمقررات الدراسية لدرجة دكتوراه الفلسفة فى العلوم

1- أن تكون كل المقررات الاختيارية الدراسية فى إطار التخصص بما يخدم النقطة البحثية للطالب.

2- يحق للقسم إضافة مقررات جديدة لكي يواكب التطور العلمي باستمرار بعد موافقة مجلس الدراسات العليا واعتماد مجلس الكلية، وموافقة مجلس الجامعة.

3- يتم إخطار إدارة الدراسات العليا بالكلية عن طريق مجلس القسم بالمقررات التي سوف يدرسها الطالب والمحتوى العلمي لكل مقرر قبل بدء الدراسة وترفق بملف تسجيل الطالب.

4- يجب على الطالب إجتياز مقررات الفصل الدراسى الأول وعددها ثلاثة مقررات دراسية (6 ساعات معتمدة) بنجاح بشرط أن يحقق معدلا تراكميا مقداره (C^+) وذلك قبل التسجيل.

5- يعقد الإمتحان النظرى فى المقررات الدراسية للدكتوراه فى نهاية كل فصل دراسى، ويجوز للضرورة عقد الامتحان في سبتمبر، وعلى الأقسام إخطار الدراسات العليا بالكلية بأسماء الطلبة والمقررات التي سوف يؤدون الإمتحان فيها قبل موعد الإمتحان بشهرين على الأقل حتى يتسنى وضع جدول الإمتحان في وقت مناسب.

مادة (37): شروط منح الدرجة

يمنح مجلس الجامعة بناءً على توصية لجنة الدراسات العليا ومجلس الكلية وموافقة مجلس القسم المختص درجة دكتوراه الفلسفة فى احد التخصصات الموضحة فى جدول (3) وفى حالة إستيفاء الطالب للشروط الآتية:

1- إجتياز الطالب المقررات الدراسية بواقع 12 ساعة معتمدة بنجاح وتحقيق ومعدل تراكمي لايقل عن C^+.

2- مرور سنتين ميلاديتين على الأقل من تاريخ التسجيل (موافقة مجلس الدراسات العليا بالجامعة).

3- أن يحصل علي مستوي اللغة الأجنبية و الدورات المقررة المطلوبة طبقا لقرارات مجلس الجامعة الصادرة وتعديلاتها بهذا الشأن.

4- قبول الرسالة من لجنة الحكم والتوصية بمنح الدرجة.

5- يقدم الطالب ما يفيد قبول بحثين للنشر من النتائج العلمية التي توصل إليها من بحوث الرسالة على الاقل واحد منهما يتم قبوله للنشر فى مجلة دولية علمية محكمة تصدرها هيئة علمية بصفة منتظمة ومفهرسة علي احدى قاعدتى بيانات Scopus و Web of Science وذلك قبل التقدم بخطاب صلاحية الرسالة على لجنة الحكم والمناقشة لمجلس القسم المختص.

6- أن يجتاز الطالب المناقشة العلنية في موضوع الرسالة بنجاح

مادة (38): إلغاء القيد

يقوم مجلس الكلية بإلغاء قيد الطالب لدرجة دكتوراه الفلسفة فى العلوم في الحالات الآتية:

1- إنقطاعه عن الدراسة أو عدم جديته في البحث وذلك بموافقة مجلس القسم المختص ولجنة الدراسات العليا والبحوث وبناءً على تقرير من المشرفين بعد إنذاره.

2- إذا رفضت لجنة الحكم الرسالة.

3- إذا لم يمنح خلال المدة المنصوص عليها في البند (2) من المادة (32) من اللائحة.

الباب الخامس : درجة دكتور فى العلوم (D.Sc.)

مادة (39): شروط التقدم ونيل درجة دكتور فى العلوم D.Sc.

1- أن يكون المتقدم حاصلا على درجة دكتوراه الفلسفة في العلوم قبل عشرة سنوات على الأقل من تاريخ التقدم للحصول على الدرجة .

2- أن يقدم بحوثا مبتكرة منشورة لم يسبق له التقدم بها للحصول على أي درجة علمية، ويراعى الآتي:

أ- أن يتضمن الإنتاج العلمي المقدم بحوثا باللغة الإنجليزية.

ب- وفقا لسكوبس أن يكون للمتقدم معامل هيرش (HI) لا يقل عن 15 وعدد الاستشهادات لا يقل عن 1000 أما بالنسبة لجوجل اسكولار لا يقل عن 40 وعدد استشهادات لا يقل عن 2000 مما يعزز موقف المتقدم لدى المحكمين.

ت- يقدم بيانا مكتوبا بالرسائل العلمية التى أشرف عليها باللغة الإنجليزية ودوره فى الإشراف.

د- على المتقدم أن يبين الإتجاهات العامة لبحوثه وما قدمه للعلم من فائدة ملموسة في البحوث المشتركة وما أشرف عليه من الرسائل.

3- للمتقدم علاوة على ذلك أن يقدم بيانا بالأنشطة العلمية والإنشائية المبتكرة وغير المنشورة التي تدل على إضافات جديدة للعلم.

4- يتقدم طالب الدرجة إلى عميد الكلية بإنتاجه العلمى ويقوم عميد الكلية بالعرض على مجلس الكلية، ويقوم المجلس بتحويل الانتاج العلمى للمتقدم إلى لجنة مختصة بهذه الدرجة لمخاطبة أساتذة فى نفس التخصص من بين الحاصلين على درجة دكتور في العلوم (D.Sc.) أو إحدى الجمعيات العلمية المتخصصة من خارج الوطن للحصول على موافقة ثلاثة ممتحنين ، يوافق عليهم مجلس الكلية لتقييم الإنتاج العلمى المقدم.

5- يقدم أعضاء لجنة الحكم مجتمعين أو فرادى تقرير عن مدى أصالة المتقدم فى مجال تخصصه ومدى صلاحية الإنتاج العلمى له والتوصية بمنح الدرجة

الأحكام

مادة (40): سريان اللائحة

تطبق هذه اللائحة ابتداء من العام الدراسى التالى لصدور القرار الوزارى باعتماد هذه اللائحة

مادة (41):

تطبق هذه اللائحة على الطلاب المستجدين فى بداية العام الدراسى التالى لاعتمادها و الطلبة المقيدين لأحكام اللائحة السابقة يستمر معاملتهم طبقا لتلك اللائحة لحين تخرجهم

الباب السادس: البرامج الاكاديمية
Academic Programs

أولا: برامج دبلوم الدراسات العليا
Diploma Programs

قسم الكيمياء

1-دبلوم الدراسات العليا فى الكيمياء التحليلية
(Analytical Chemistry Diploma Program)

(24 Credit hours)

Core Courses (16 Credit hours) المقررات الاجبارية (عدد 16 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM501	Colored and spectral analysis	2	-	-	2
CHM502	Chromatographic analysis	2	-	-	2
CHM503	Radioanalytical chemistry	2	-	-	2
CHM504	Practical: Industrial and water analysis (I)	-	4	-	2
CHM505	Sensors in analysis	2	-	-	2
CHM506	X-ray analysis	2	-	-	2
CHM507	Electroanalytical methods of analysis	2	-	-	2
CHM508	Practical: Industrial and water analysis (II)	-	4	-	2
Core Elective courses (8 Credit hours) المقررات الإختيارية يختار الطالب 8 ساعات معتمدة من المقررات الاتية					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM509	Analytical methods in some industrial sectors	2	-	-	2
CHM510	Pollution management and control	2	-	-	2
CHM511	Solar and nuclear energy	2	-	-	2
CHM512	Characterization techniques	2	-	-	2
CHM513	Solid-phase extraction	2	-	-	2
CHM 514	Instrumental analysis	2	-	-	2

2- دبلوم الدراسات العليا فى الكيمياء التطبيقية
(Applied Chemistry Diploma Program)
(24 Credit hours)

Core Courses (16 Credit hours) المقررات الاجبارية (عدد 16 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM515	Industrial Organisation/ Chemical Technology/ Unit operations	2	-	-	2
CHM516	Solid waste management	2		-	2
CHM517	Surface and colloid chemistry	2	-	-	2
CHM518	Analytical methods in chemical industries	2	-	-	2
CHM519	Practical I	-	2	-	1
CHM520	Total Quality management	2	-	-	2
CHM521	Advanced Techniques in Electrochemistry	2	-	-	2
CHM522	Advanced materials and Techniques	2	-	-	2
CHM523	Nano technology and applications	2	-	-	2
CHM524	Practical II	-	2	-	1
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM525	Chemistry and technology of textiles and dyes	2	-	-	2
CHM526	Chemistry and technology building materials	2	-	-	2
CHM527	Chemistry and technology of paints	2	-	-	2
CHM528	Chemistry and technology of printing inks	2	-	-	2
CHM529	Chemistry and technology of Ferrous and non-ferrous materials	2	-	-	2
CHM 530	Chemistry and Technology of Petrochemicals	2	-	-	2

CHM531	Chemistry and technology of plastics	2	-	-	2
CHM532	Chemistry and technology of paper and paperboard	2	-	-	2
CHM533	Chemistry and Technology of fertilizers	2	-	-	2
CHM534	Chemistry of basic industries	2	-	-	2

قسم الجيولوجيا

1-دبلوم الدراسات العليا فى الجيولوجيا التطبيقية
(Applied Geology Diploma Program)

(24 Credit hours)

Core Courses (16 Credit hours) **المقررات الاجبارية (عدد 16 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO501	Mineral Exploration	2	-	-	2
GEO502	Applied Structural Geology	2	-	-	2
GEO503	Applications of Remote Sensing in Geology	2	-	-	2
GEO504	Ore Deposits of Egypt	2	-	-	2
GEO505	Applied Mining Geology	2	-	-	2
GEO506	Environmental Geology	2	-	-	2
GEO507	Petroleum Provinces of Egypt	2	-	-	2
GEO508	Advanced hydroGeology	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO509	Rock Mechanics	2	-	-	2
GEO510	Sedimentary Basin Analysis	2	-	-	2
GEO511	Using Geochemical Data	2	-	-	2
GEO512	Well Logging	2	-	-	2
GEO513	Ore Microscopy	2	-	-	2
GEO514	Mineral Processing Technology	2	-	-	2
GEO515	Applied Mineralogy	2	-	-	2
GEO 516	Statistics and Data Analysis in Geology	2	-	-	2

2-دبلوم الدراسات العليا فى الجيوفيزياء التطبيقية
(Applied Geophysics Diploma Program)

(24 Credit hours)

Core Courses (16 Credit hours) **المقررات الاجبارية (عدد 16 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GPH501	Seismic Methods (refraction and reflection)	2	-	-	2
GPH502	Gravity Method	2	-	-	2
GPH503	Geomagnetic Method	2	-	-	2
GPH504	Electric Method	2	-	-	2
GPH505	Earthquake Seismology	2	-	-	2
GPH506	Petrophysics	2	-	-	2
GPH507	Petroleum exploration (Geophysical Perspective)	2	-	-	2
GPH508	Geophysical exploration for minerals and groundwater	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GPH509	Electromagnetic Method	2	-	-	2
GEO512	Well logging	2	-	-	2
GPH510	Computer Science in Geophysics	2	-	-	2
GPH511	Engineering Geophysics	2	-	-	2
GPH512	Reservoir Geophysics	2	-	-	2
GPH513	Application of Geophysics in Mining	2	-	-	2
GPH514	Marine Geophysics	2	-	-	2
GPH515	Geothermal exploration	2	-	-	2
GPH516	Global environment	2	-	-	2
GPH517	Space Geophysics	2	-	-	2

برامج الماجستير

M.Sc. Programs

قسم الرياضيات

1- برنامج الماجستير فى العلوم تخصص الرياضيات البحتة
(M.Sc. Pure Mathematics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) **المقررات الاجبارية (عدد 12 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
MAT601	Module Theory	2	-	-	2
MAT602	Advanced Ordinary Differential Equations	2	-	-	2
MAT603	Numerical Analysis	2	-	-	2
MAT604	Functional Analysis	2	-	-	2
MAT605	Partial Differential Equations	2	-	-	2
MAT606	Operations Research	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
MAT607	Advanced Real Analysis	2	-	-	2
MAT608	Applied Geometry for Computer Graphics and Vision	2	-	-	2
MAT609	Optimization Theory	2	-	-	2
MAT610	Complex Analysis	2	-	-	2
MAT611	Discrete and Computational Geometry	2	-	-	2
MAT612	Eigenvalue and Boundary Value Problems	2	-	-	2
MAT613	Finite Group Theory	2	-	-	2
MAT614	Fourier Analysis	2	-	-	2

MAT615	Algebraic & Differential Geometry	2	-	-	2
MAT616	Algebraic Graph Theory	2	-	-	2
MAT617	Advanced Topological Spaces	2	-	-	2
MAT618	Number Theory	2	-	-	2
MAT619	Combinatorics	2	-	-	2
MAT620	Commutative Ring Theory	2	-	-	2
MAT621	Nonlinear Partial Differential Equations	2	-	-	2
MAT622	Selected Topics in Mathematics	2	-	-	2
Thesis (20 Credit hours)					
MAT639	Dissertation				20

2-برنامج الماجستير فى العلوم تخصص الرياضيات التطبيقية
(M.Sc. Applied Mathematics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours)
المقررات الاجبارية (عدد 12 ساعة معتمدة)

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
MAT623	Electrodynamics	2	-	-	2
MAT624	Space Mechanics (1)	2	-	-	2
MAT625	Fluid Dynamics (1)	2	-	-	2
MAT605	Partial Differential Equations	2	-	-	2
MAT626	Quantum Mechanics	2	-	-	2
MAT627	Mathematical Modeling	2	-	-	2

Core Elective courses (8 Credit hours)
المقررات الإختيارية
يختار الطالب 8 ساعات معتمدة من المقررات الاتية

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
MAT612	Eigenvalue and Boundary Value Problems	2	-	-	2
MAT621	Nonlinear Partial Differential Equations	2	-	-	2
MAT628	General Relativity	2	-	-	2
MAT629	Optimal Control theory	2	-	-	2
MAT630	Dynamical Systems	2	-	-	2
MAT631	Elasticity	2	-	-	2
MAT632	Mathematical Methods	2	-	-	2
MAT633	Space Mechanics (2)	2	-	-	2
MAT634	Fluid Dynamics (2)	2	-	-	2
MAT635	Quantum Computation	2	-	-	2
MAT636	Mathematical Biology	2	-	-	2

MAT637	Computational Methods	2	-	-	2
MAT638	Selected Topics in Applied Mathematics	2	-	-	2
Thesis (20 Credit hours)					
MAT639	Dissertation				20

3-برنامج الماجستير فى العلوم تخصص الإحصاء
(M.Sc. Statistics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
STA601	Probability Theory	2	-	-	2
STA602	Order Statistics	2	-	-	2
STA603	Statistical Packages	2	-	-	2
STA604	Statistical Inference	2	-	-	2
STA605	Theoretical Statistics	2	-	-	2
STA606	Reliability Theory	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
STA607	Data Analysis	2	-	-	2
STA608	Experimental Design	2	-	-	2
STA609	Sampling Theory	2	-	-	2
STA610	Time series Analysis	2	-	-	2
STA611	Bayesian Statistics	2	-	-	2
STA612	Biostatistics	2	-	-	2
STA613	Linear Models	2	-	-	2
STA614	Nonparametric Statistics	2	-	-	2
STA615	Simulation	2	-	-	2
STA616	Selected Topics In Statistics	2	-	-	2
MAT609	Optimization Theory	2	-	-	2

COM603	Data Science	2	-	-	2
Thesis (20 Credit hours)					
STA617	Dissertation				20

4-برنامج الماجستير فى العلوم تخصص علوم الحاسب
(M.Sc. Computer Science Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
COM601	Pattern Analysis	2	-	-	2
COM602	Advanced Artificial Intelligence	2	-	-	2
COM603	Data Science	2	-	-	2
COM604	Advanced Algorithms and Complexity	2	-	-	2
COM605	Computer Vision	2	-	-	2
COM606	Data Mining	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
COM607	Natural Language Processing	2	-	-	2
COM608	Introduction to Deep and Reinforcement Learning	2	-	-	2
COM609	Trends in Big Data Management	2	-	-	2
COM610	Digital Transformation	2	-	-	2
COM611	Explainable Artificial Intelligence	2	-	-	2
COM612	Internet of Things	2	-	-	2
COM613	Wireless Networks and Mobile Computing	2	-	-	2
COM614	Evolutionary Computation	2	-	-	2
Thesis (20 Credit hours)					
COM615	Dissertation				20

قسم الفيزياء

1-برنامج الماجستير فى العلوم تخصص فيزياء الجوامد التطبيقية
(M.Sc. Applied Solid State Physics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) **المقررات الاجبارية (عدد 12 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY601	Advanced Solid-State Physics	2	-	-	2
PHY602	X-ray diffraction and crystallography	2	-	-	2
PHY603	Semiconductor Physics and Devices	2	-	-	2
PHY604	Magnetism and Magnetic Materials	2	-	-	2
PHY605	Microscopy and Spectroscopy Techniques for Characterization of Solids	2	-	-	2
PHY606	Introduction to functional materials and nanotechnology	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY607	Advanced Topics in Theoretical Physics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
PHY609	Nanophysics	2	-	-	2
PHY610	Nanomaterials	2	-	-	2
PHY611	Surface and interface Physics	2	-	-	2
PHY612	Quantum Information Technology	2	-	-	2
PHY613	Nanocomposite Science and Technology	2	-	-	2
PHY614	Superconductivity and Superfluidity	2	-	-	2

PHY615	Materials for energy conversion and storage	2	-	-	2
PHY616	Physics of thin films	2	-	-	2
PHY617	Optoelectronics and optical communication	2	-	-	2
PHY618	Spintronics: Fundamentals and applications	2	-	-	2
PHY619	Physics of polymers	2	-	-	2
PHY620	Physics of Dielectric Materials	2	-	-	2
Thesis (20 Credit hours)					
PHY686	Dissertation				20

2-برنامج الماجستير فى العلوم تخصص فيزياء الإلكترونيات
(M.Sc. Physical Electronics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours)
المقررات الاجبارية (عدد 12 ساعة معتمدة)

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY601	Advanced Solid-State Physics	2	-	-	2
PHY603	Semiconductor Physics and Devices	2	-	-	2
PHY621	Advanced Physical Electronics	2	-	-	2
PHY622	Semiconductor Electronics	2	-	-	2
PHY623	Advanced Electronic Circuits	2	-	-	2
PHY624	Solid State Electronics	2	-	-	2

Core Elective courses (8 Credit hours)
المقررات الإختيارية
يختار الطالب 8 ساعات معتمدة من المقررات الاتية

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY607	Advanced Topics in Theoretical Physics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
PHY625	IC Technology and Fabrication	2	-	-	2
PHY609	Nanophysics	2	-	-	2
PHY626	Microwaves	2	-	-	2
PHY606	Introduction to functional materials and nanotechnology	2	-	-	2
PHY612	Quantum Information Technology	2	-	-	2
PHY627	Nanoelectronics and Photonics	2	-	-	2
PHY628	Computational Systems in Electronics	2	-	-	2
PHY617	Optoelectronics and optical communication	2	-	-	2

PHY618	Spintronics: Fundamentals and applications	2	-	-	2
Thesis (20 Credit hours)					
PHY686	Dissertation				20

3-برنامج الماجستير فى العلوم تخصص البصريات والليزر أو الأطياف الذرية
(M.Sc. Optics and Laser or Atomic Spectroscopy Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY629	Non-Linear optics I	2	-	-	2
PHY630	Light diffraction from the Geometrical aperture	2	-	-	2
PHY631	Light scattering from rough surfaces	2	-	-	2
PHY632	speckle the pattern Statistics of	2	-	-	2
PHY633	Image processing	2	-	-	2
PHY634	Laser speckle characteristics	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY635	Fiber optics	2	-	-	2
PHY636	Fourier optics	2	-	-	2
PHY637	Plasma diagnostics	2	-	-	2
PHY638	Modern optics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
PHY639	Atomic and molecular spectrum	2	-	-	2
PHY640	Laser material interaction	2	-	-	2
PHY641	Nonlinear optics II	2	-	-	2
PHY642	Holography	2	-	-	2
PHY607	Advanced Topics in Theoretical Physics	2	-	-	2

PHY627	Nanoelectronics and Photonics	2	-	-	2
Thesis (20 Credit hours)					
PHY686	Dissertation				20

4-برنامج الماجستير فى العلوم تخصص الفيزياء النووية التطبيقية
(M.Sc. Applied Nuclear Physics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY643	Nuclear Spectroscopy	2	-	-	2
PHY644	Nuclear Materials	2	-	-	2
PHY645	Fission and Fusion Reactions	2	-	-	2
PHY646	Nuclear Spectrometry.	2	-	-	2
PHY647	Plasma Physics and Controlled Fusion.	2	-	-	2
PHY648	Elementary Particle and High Energy Physics	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY607	Advanced Topics in Theoretical Physics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
PHY649	Trace element analysis.	2	-	-	2
PHY650	Experimental techniques in nuclear and particle physics.	2	-	-	2
PHY651	Meson physics	2	-	-	2
PHY652	Nuclear astrophysics.	2	-	-	2
PHY653	Applications of nuclear radiation.	2	-	-	2
PHY654	Neutron activation analysis	2	-	-	2
Thesis (20 Credit hours)					
PHY686	Dissertation				20

5-برنامج الماجستير فى العلوم تخصص الفيزياء الإشعاعية التطبيقية
(M.Sc. Applied Radiation Physics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY655	Radiation Sources	2	-	-	2
PHY656	Radiation Protection and safety	2	-	-	2
PHY657	Radiation Detection and Instrumentation	2	-	-	2
PHY658	Radiation Physics in medicine	2	-	-	2
PHY659	Non-Destructive Nuclear Techniques	2	-	-	2
PHY660	Irradiation Facilities and Data Acquisition Systems	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY661	Mathematical and Computational Methods in Radiation Physics	2	-	-	2
PHY662	Advanced Topics in Applied Radiation Physics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
PHY663	Techniques in Recent Advanced Radiotherapy	2	-	-	2
PHY664	Neutrons Non-Destructive Techniques	2	-	-	2
PHY665	Radiopharmaceuticals	2	-	-	2
PHY666	Reactor Physics and Nuclear Plants	2	-	-	2
PHY667	Data Processing in radiation	2	-	-	2
Thesis (20 Credit hours)					
PHY686	Dissertation				20

6-برنامج الماجستير فى العلوم تخصص الفيزياء الحيوية الطبية
(M.Sc. Medical Biophysics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours)
المقررات الاجبارية (عدد 12 ساعة معتمدة)

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
BPH601	Computational biophysics	2	-	-	2
BPH602	Modern Biophysics	2	-	-	2
BPH603	Molecular Spectroscopy	2	-	-	2
BPH604	Bioenergetics	2	-	-	2
BPH605	Physics of Radiation Therapy	2	-	-	2
BPH606	Medical Biostatistics	2	-	-	2

Core Elective courses (8 Credit hours)
المقررات الإختيارية
يختار الطالب 8 ساعات معتمدة من المقررات الاتية

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY631	Advanced Topics in Theoretical Physics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
BPH607	Cancer Biology	2	-	-	2
BPH608	Advanced Anatomy	2	-	-	2
BPH609	Pharmacology	2	-	-	2
BPH610	Genetic Engineering	2	-	-	2
BPH611	Programming.	2	-	-	2
BPH612	Physics of Medical Imaging	2	-	-	2
BPH613	Nanobiotechnology	2	-	-	2
BPH614	Drug Discovery and Design	2	-	-	2
BPH615	Biomechanics	2	-	-	2

BPH616	Bioacoustics	2	-	-	2
PHY619	Physics of polymers	2	-	-	2
BPH617	Thermodynamic of biological processes	2	-	-	2
BPH620	Photobiology	2	-	-	2
BPH621	Bioinformatics	2	-	-	2
BPH622	Artificial Intelligence	2	-	-	2
BPH623	Advanced Biomaterials	2	-	-	2
Thesis (20 Credit hours)					
BPH624	Dissertation				20

7-برنامج الماجستير فى العلوم تخصص فيزياء الفلك وعلوم الفضاء
(M.Sc. Astrophysics and Space Science Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
SPA601	Space Environment	2	-	-	2
SPA602	Advanced Space Plasma	2	-	-	2
SPA603	Fundamentals of Remote Sensing	2	-	-	2
SPA604	Meteorology and Climate Science	2	-	-	2
SPA605	Geophysics	2	-	-	2
SPA606	Space Geodesy	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
SPA607	Remote Sensing and GIS Applications	2	-	-	2
SPA608	Artificial Intelligence for Space Applications	2	-	-	2
SPA609	Space Chemistry	2	-	-	2
SPA610	Satellite Orbits and Sensors	2	-	-	2
SPA611	Photogrammetry	2	-	-	2
SPA612	GNSS Remote Sensing	2	-	-	2
SPA613	Image Interpretation and Analysis	2	-	-	2
SPA614	Space Mission Design and Operation	2	-	-	2
SPA615	Geoinformatics	2	-	-	2
SPA616	Geological Remote Sensing	2	-	-	2

PHY607	Advanced Topics in Theoretical Physics	2	-	-	2
PHY608	Advanced Quantum Mechanics	2	-	-	2
Thesis (20 Credit hours)					
SPA617	Dissertation				20

8-برنامج الماجستير فى العلوم تخصص الفيزياء النظرية
(M.Sc. Theoretical Physics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY668	Mathematical Physics (III)	2	-	-	2
PHY669	Quantum Physics (III)	2	-	-	2
PHY670	(III) Classical Mechanics	2	-	-	2
PHY671	Statistical Physics I	2	-	-	2
PHY672	Physics of Particles and Fields	2	-	-	2
PHY673	Classical Electrodynamic II	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
PHY674	Computational Physics (I)	2	-	-	2
PHY675	Density Functional Theory (I)	2	-	-	2
PHY676	Physics Beyond the Standard Model (I)	2	-	-	2
PHY677	Astrophysics and Cosmology (I)	2	-	-	2
PHY678	Relativity and Gravity (I)	2	-	-	2
PHY679	Fluid Dynamics (I)	2	-	-	2
PHY680	Computational Physics (II)	2	-	-	2
PHY681	Density Functional Theory (II)	2	-	-	2
PHY682	Physics Beyond the Standard Model (II)	2	-	-	2
PHY683	Astrophysics and Cosmology (II)	2	-	-	2
PHY684	Relativity and Gravity (II)	2	-	-	2

PHY685	Fluid Dynamics (II)	2	-	-	2
Thesis (20 Credit hours)					
PHY686	Dissertation				20

قسم الكيمياء

1-برنامج الماجستير فى العلوم تخصص الكيمياء اللاعضوية
(M.Sc. Nonorganic Chemistry rogram)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM601	Advanced analytical chemistry	2	-	-	2
CHM602	Industrial inorganic chemistry and energy (I)	2	-	-	2
CHM603	Advanced materials for energy storage and conversion	2	-	-	2
CHM604	Chemical separation techniques	2	-	-	2
CHM605	Industrial inorganic chemistry and energy (II)	2	-	-	2
CHM606	Advanced materials (nanomaterials, porous and functional materials)	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
M.Sc. Inorganic Chemistry pathway					
CHM607	Radiactive Activation Analysis	2	-	-	2
CHM608	Group theory application	2	-	-	2
CHM609	Inorganic reaction mechanisms	2	-	-	2
CHM610	Physical inorganic chemistry	2	-	-	2
M.Sc. Analytical Chemistry Pathway					
CHM611	Instrumental analysis	2	-	-	2
CHM612	Electroanalytical methods	2	-	-	2

CHM613	X-ray analysis	2	-	-	2
CHM614	Pollution control and management	2	-	-	2
CHM615	Characterization techniques	2	-	-	2
CHM616	Solid phase extraction	2	-	-	2
M.Sc. Physical Chemistry Pathway					
CHM617	Advanced molecular spectroscopy	2	-	-	2
CHM618	Advanced quantum chemistry	2	-	-	2
CHM619	Advanced solid-state chemistry	2	-	-	2
CHM620	Advanced surface chemistry	2	-	-	2
CHM621	Advanced catalysis	2	-	-	2
CHM622	Advanced chemistry of colloids	2	-	-	2
CHM623	Advanced physical chemistry of polymers	2	-	-	2
Thesis (20 Credit hours)					
CHM658	Dissertation				20

2-برنامج الماجستير فى العلوم تخصص الكيمياء العضوية
(M.Sc. Organic Chemistry Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM624	Design, synthesis and structure elucidation of a heterocyclic target system	2	-	-	2
CHM625	Spectroscopy and molecular structure determination of organic compounds	2	-	-	2
CHM626	Polymer Science and Technology	2	-	-	2
CHM627	Natural Products Chemistry	2	-	-	2
CHM628	Physical-Organic Chemistry and Chemical Reaction Mechanisms	2	-	-	2
CHM629	Bio-organic Chemistry	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM630	Stereochemistry	2	-	-	2
CHM631	Organic Chemistry and Nanotechnology	2	-	-	2
CHM632	Textile and Dyes	2	-	-	2
CHM633	Medicinal Chemistry	2	-	-	2
CHM634	Photochemistry and Pericyclic Chemistry	2	-	-	2
CHM635	Organometallic Chemistry	2	-	-	2
CHM636	Advanced Environmental chemistry	2	-	-	2
Thesis (20 Credit hours)					
CHM658	Dissertation				20

3-برنامج الماجستير فى العلوم تخصص الكيمياء التطبيقية
(M.Sc. Applied Chemistry Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM637	Industrial Organization/ Chemical Technology/ Unit operations	2	-	-	2
CHM638	Surface and colloid chemistry	2	-	-	2
CHM639	Advanced materials and Technologies	2	-	-	2
CHM640	Solid waste management	2	-	-	2
CHM641	Total Quality management	2	-	-	2
CHM642	Advanced Analytical Chemistry	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
CHM643	Chemistry and technology of cement and concrete	2	-	-	2
CHM644	Chemistry and technology of ceramics	2	-	-	2
CHM645	Chemistry and technology of glass	2	-	-	2
CHM646	Chemistry and Technology of fertilizers	2	-	-	2
CHM647	Chemistry and technology of paints	2	-	-	2
CHM648	Chemistry and Technology of Petrochemicals	2	-	-	2
CHM649	industrial environmental aspects	2	-	-	2
CHM650	Sustainable chemistry	2	-	-	2
CHM651	Chemistry and technology of textiles and dyes	2	-	-	2

CHM652	Chemistry and technology of paper and paperboard	2	-	-	2
CHM653	Nano Technology and applications	2	-	-	2
CHM654	Chemistry of basic industries	2	-	-	2
CHM655	Industrial corrosion and protection	2	-	-	2
CHM656	Industrial polymers	2	-	-	2
CHM657	Chemistry and technology of printing inks	2	-	-	2
Thesis (20 Credit hours)					
CHM658	Dissertation				20

4-برنامج الماجستير فى العلوم تخصص الكيمياء الحيوية
(M.Sc. Biochemistry Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
BCH601	Advanced metabolism and its disorders	2	-	-	2
BCH602	Advanced molecular biology and its applications in genetic engineering	2	-	-	2
BCH603	Protein production and analysis	2	-	-	2
BCH604	Applied immunology	2	-	-	2
BCH605	Advanced cancer biology	2	-	-	2
BCH606	Advanced biochemical instrumental analysis	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
BCH607	Bionano concepts and its application.	2	-	-	2
BCH608	Advanced enzymology.	2	-	-	2
BCH609	Advanced nutritional biochemistry.	2	-	-	2
BCH610	Stem cells and regenerative medicine.	2	-	-	2
BCH611	Bioinformatics.	2	-	-	2
BCH612	Protein and antibody engineering.	2	-	-	2
BCH613	Advanced clinical biochemistry.	2	-	-	2
BCH614	Research methodology and biostatistics.	2	-	-	2
BCH615	Introduction to the state of the art of cell culture technologies.	2	-	-	2
Thesis (20 Credit hours)					
BCH616	Dissertation				20

قسم النبات والميكروبيولوجى

1-برنامج الماجستير فى العلوم تخصص النبات
(M.Sc. Botany Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
BOT601	Experimental Design in Biology	2	-	-	2
BOT602	Advanced Stress Physiology in Plants	2	-	-	2
BOT603	Bioindicators	2	-	-	2
BOT604	Advanced Molecular Genetics	2	-	-	2
BOT605	Advanced Plant Enzymology	2	-	-	2
BOT606	Advanced Taxonomy	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
Plant physiology pathway					
BOT607	Advanced Plant Growth Hormons	2	-	-	2
BOT608	Assimilation of mineral nutrients in Plants	2	-	-	2
BOT609	Physiology of Herbal Medicine	2	-	-	2
BOT610	Tissue culture and Biotechnology	2	-	-	2
BOT611	Applications of Nano-technology in Plants	2	-	-	2
BOT612	Molecular Biology Tools	2	-	-	2
Plant Ecology and Flora Pathway					
BOT613	Climate change and Plants	2	-	-	2

BOT614	Advanced Topics in Ecology	2	-	-	2
BOT615	Plant Functional Ecology	2	-	-	2
BOT616	Biodiversity and Conservation of Plants	2	-	-	2
BOT617	Phylogeny and Plant Biosystematics	2	-	-	2
BOT618	Phytoremediation	2	-	-	2
Plant Taxonomy and Flora Pathway					
BOT619	Climate change and Plants	2	-	-	2
BOT620	Biodiversity and Conservation of Plants	2	-	-	2
BOT621	Plant Families	2	-	-	2
BOT622	Sources of Taxonomic Information	2	-	-	2
BOT623	Phylogeny and Molecular Evolution	2	-	-	2
BOT624	Recent Topics in Plant Genetic Diversity	2	-	-	2
Genetics Pathway					
BOT625	Phylogeny and Molecular Evolution	2	-	-	2
BOT626	Environmnetal Genetics	2	-	-	2
BOT627	Plant Breeding and Genetics	2	-	-	2
BOT628	Advanced Plant Cytogenetics	2	-	-	2
BOT629	Genomics and Epigenomics	2	-	-	2
BOT630	Genetic Engineering and Gene Editing	2	-	-	2
Alage Pathway					
BOT631	Advanced Plant Growth Hormones	2	-	-	2
BOT632	Applications of Nano-technology in Plants	2	-	-	2
BOT633	Molecular Biology Tools	2	-	-	2
BOT634	Advanced Taxonomy of Alage	2	-	-	2
BOT635	Ecology and Physiology of Algae	2	-	-	2
BOT636	Biotechnology of Algae	2	-	-	2
Thesis (20 Credit hours)					
BOT637	Dissertation				20

2-برنامج الماجستير فى العلوم تخصص الميكروبيولوجى
(M.Sc. Microbiology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
MIC601	Plant-Microbe Interaction	2	-	-	2
MIC602	Microbial Genetics and Biotechnology	2	-	-	2
MIC603	Experimental design for biology	2	-	-	2
MIC604	Fermentations Chemistry	2	-	-	2
MIC605	Advanced Yeasts	2	-	-	2
MIC606	Microbiology of Extreme Environments	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
MIC607	Advanced Plant Virology	2	-	-	2
MIC608	Microbial Communication in Food	2	-	-	2
MIC609	Microbial biotransformation	2	-	-	2
MIC610	Radiation Biology	2	-	-	2
MIC611	Nano-Biotechnology and Applications	2	-	-	2
MIC612	Microbial Antibiotics	2	-	-	2
MIC613	Separation Techniques and Instrumental Analysis	2	-	-	2
Thesis (20 Credit hours)					
MIC614	Dissertation				20

قسم علم الحيوان والحشرات

1-برنامج الماجستير فى العلوم تخصص فسيولوجى
(M.Sc. Physiology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours)
المقررات الاجبارية (عدد 12 ساعة معتمدة)

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO601	Neurophysiology	2	--	--	2
ZOO602	Endocrinology	2	--	--	2
ZOO603	Hematology	2	--	--	2
ZOO604	Drugs Affecting Nervous System	2	--	--	2
ZOO605	Enzymology	2	--	--	2
ZOO606	Toxicology	2	--	--	2

Core Elective courses (8 Credit hours)
المقررات الإختيارية
يختار الطالب 8 ساعات معتمدة من المقررات الاتية

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO607	Physiology of Respiration and Excretion	2	--	--	2
ZOO608	Ecology	2	--	--	2
ZOO609	Cardiovascular and Muscular Physiology	2	--	--	2
ZOO610	Environmental Pollution	2	--	--	2
ZOO611	Immunology	2	--	--	2
ZOO612	Cell Signaling	2	--	--	2
ZOO613	Free Radicals	2	--	--	2
ZOO614	Ethology	2	--	--	2

ZOO615	General Histopathology	2	--	--	2
ZOO616	Molecular Biology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

2-برنامج الماجستير فى العلوم تخصص الخلية والأنسجة
(M.Sc. Cytology & Histology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO617	General Histology	2	--	--	2
ZOO618	General Histopathology	2	--	--	2
ZOO619	Immunohistochemistry	2	--	--	2
ZOO620	Stem Cells and Tissue Culture	2	--	--	2
ZOO621	Histochemistry	2	--	--	2
ZOO622	Cell Ultra Structure	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO623	Special Histopathology	2	--	--	2
ZOO624	Neurohistology	2	--	--	2
ZOO625	General Cytopathology	2	--	--	2
ZOO626	Histology of Immune System	2	--	--	2
ZOO627	Electron Microscope	2	--	--	2
ZOO628	Hematology	2	--	--	2
ZOO616	Molecular Biology	2	--	--	2
ZOO606	Toxicology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

3-برنامج الماجستير فى العلوم تخصص الوراثة وبيولوجيا الخلية الجزيئية
(M.Sc. Genetics and Molecular Cell Biology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO629	Molecular Cell Biology	2	--	--	2
ZOO616	Molecular Biology	2	--	--	2
ZOO630	Advanced Genetics	2	--	--	2
ZOO631	Human Genetics	2	--	--	2
ZOO632	Cancer Biology	2	--	--	2
ZOO633	Cytogenetics	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO634	Radiobiology	2	--	--	2
ZOO635	Tissue Culture	2	--	--	2
ZOO636	Genetic Engineering	2	--	--	2
ZOO637	Drugs	2	--	--	2
ZOO638	Population Genetics	2	--	--	2
ZOO639	Developmental Genetics	2	--	--	2
ZOO606	Toxicology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

4-برنامج الماجستير فى العلوم تخصص التشريح المقارن والأجنة
(M.Sc. Comparative Anatomy & Embryology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) **المقررات الاجبارية (عدد 12 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO640	Comparative anatomy	2	--	--	2
ZOO641	Embryology	2	--	--	2
ZOO642	Histology	2	--	--	2
ZOO643	Developmental Biology	2	--	--	2
ZOO644	Experimental Animal	2	--	--	2
ZOO645	Cranial Nerves	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO646	Advanced Taxonomy	2	--	--	2
ZOO647	Biodiversity	2	--	--	2
ZOO648	Evolutionary Morphology	2	--	--	2
ZOO649	Skeletal System	2	--	--	2
ZOO650	Neurophysiology	2	--	--	2
ZOO616	Molecular Biology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

5-برنامج الماجستير فى العلوم تخصص اللافقاريات والطفيليات
(M.Sc. Parasitology & Invertebrates Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) **المقررات الاجبارية (عدد 12 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO651	Advanced Biology of Protozoa and Myxozoa	2	--	--	2
ZOO652	Biology of Free-Living Protozoa	2	--	--	2
ZOO653	Immunoparasitology	2	--	--	2
ZOO654	Biology of Helminthology	2	--	--	2
ZOO655	Molecular Parasitology	2	--	--	2
ZOO656	Biology of Higher Invertebrates	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO657	Ultrastructure of Protozoology	2	--	--	2
ZOO658	Biology of Minor Phyla	2	--	--	2
ZOO659	Medical Entomology for Disease Control	2	--	--	2
ZOO660	Experimental Design in Zoology	2	--	--	2
ZOO661	Ultrastructure of Helminthology	2	--	--	2
ZOO662	Molecular Studies of Invertebrates	2	--	--	2
ZOO663	Immunodiagnosis	2	--	--	2
ZOO664	Eco parasitology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

6-برنامج الماجستير فى العلوم تخصص المناعة
(M.Sc. Immunology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO665	Immunochemistry	2	--	--	2
ZOO666	Applied Immunology	2	--	--	2
ZOO667	Molecular Biology	2	--	--	2
ZOO668	Molecular Immunology	2	--	--	2
ZOO669	Diagnostic Immunology	2	--	--	2
ZOO670	Immunoparasitology	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO671	Medical Microbiology	2	--	--	2
ZOO672	Pathology	2	--	--	2
ZOO673	Chronobiology	2	--	--	2
ZOO674	Biostatistics Analysis	2	--	--	2
ZOO675	The Relationship between the Nervous System and the Immune System	2	--	--	2
ZOO676	Medical Parasitology	2	--	--	2
ZOO677	Comparative immunology	2	--	--	2
ZOO606	Toxicology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

7-برنامج الماجستير فى العلوم تخصص الحشرات
(M.Sc. Entomology Science Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO678	Insect Diversity and Taxonomy	2	--	--	2
ZOO679	Insect Physiology and Molecular Biology	2	--	--	2
ZOO680	Insect Ecology	2	--	--	2
ZOO681	Morphology of Insects	2	--	--	2
ZOO682	Advanced Applied Entomology	2	--	--	2
ZOO683	Insects Affecting Human and Animal Health	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO684	Honey Bee Biology and Beekeeping, and Human Life	2	--	--	2
ZOO685	Insect Behavior and Chemical Ecology	2	--	--	2
ZOO686	Conceptual Methods in Ecology and Evolution	2	--	--	2
ZOO687	Insect-Plant Relationships	2	--	--	2
ZOO688	Phylogenetic Systematics	2	--	--	2
ZOO689	Special Problems in Entomology and Acarology	2	--	--	2
ZOO690	Scientific Publishing: Process and Ethics	2	--	--	2
ZOO691	Insect Pests of Household, Man, and Animals	2	--	--	2
ZOO692	Insect Physiology	2	--	--	2

ZOO693	Integrated Pest Management	2	--	--	2
ZOO694	Insect Classification and Biodiversity	2	--	--	2
ZOO695	Agricultural Pests and Their Management	2	--	--	2
ZOO696	Stored Product Pests and Their Management	2	--	--	2
ZOO697	Beneficial Insects	2	--	--	2
ZOO698	Plant Resistance to Insect Pests	2	--	--	2
ZOO699	Insecticides and Their Application	2	--	--	2
ZOO6100	Range and Forest Entomology	2	--	--	2
ZOO6101	Biological Control of Insect Pests	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

8-برنامج الماجستير فى العلوم تخصص البيئة الحيوانية
(M.Sc. Animal Ecology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO6102	Ecosystem	2	--	--	2
ZOO6103	Desert, Marine and Fresh Water Ecology	2	--	--	2
ZOO6104	Fish Biology and Fisheries	2	--	--	2
ZOO6105	Aquaculture	2	--	--	2
ZOO6106	Water Pollution and Treatments	2	--	--	2
ZOO6107	Air Pollution and Treatments	2	--	--	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
ZOO6108	Egyptian Environment and Natural Reserves	2	--	--	2
ZOO6109	Fish Taxonomy	2	--	--	2
ZOO6110	Fish Feeding and Physiology	2	--	--	2
ZOO6111	Chemistry of Pesticides and Heavy Metals	2	--	--	2
ZOO6112	Freshwater Invertebrate Ecology	2	--	--	2
ZOO6113	Methods for Evaluating Environmental Impacts	2	--	--	2
ZOO6114	Fauna Egyptian and Geographical Distribution	2	--	--	2
ZOO606	Toxicology	2	--	--	2
ZOO6115	Behavioral Ecology	2	--	--	2
Thesis (20 Credit hours)					
ZOO6116	Dissertation				20

قسم الجيولوجيا

1-برنامج الماجستير فى العلوم تخصص الصخور والجيوكيمياء ورواسب الخامات
(M.Sc. Petrology, Geochemistry and Ore Deposits Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) **المقررات الاجبارية (عدد 12 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO601	Igneous Petrology	2	-	-	2
GEO602	Geochemistry	2	-	-	2
GEO603	Ore Deposits	2	-	-	2
GEO604	Metamorphic Petrology	2	-	-	2
GEO605	Mineralogy	2	-	-	2
GEO606	Ore Mineralogy	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO607	Application of GIS and remote sensing in Environmental Geology	2	-	-	2
GEO608	Exploration of Mineral Deposits	2	-	-	2
GEO609	Isotope Geology	2	-	-	2
GEO610	Industrial Minerals	2	-	-	2
GEO611	New Topics	2	-	-	2
GEO612	Geochemical Techniques	2	-	-	2
GEO613	Mining Geology	2	-	-	2
GEO614	Ore Dressing	2	-	-	2

GEO615	Sedimentary Petrology	2	-	-	2
GEO616	New Topics	2	-	-	2
Thesis (20 Credit hours)					
GEO689	Dissertation				20

2-برنامج الماجستير فى العلوم تخصص جيولوجيا البترول والمياه
(M.Sc. Petroleum Geology and HydroGeology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) **المقررات الاجبارية (عدد 12 ساعة معتمدة)**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO617	Petroleum Geology	2	-	-	2
GEO618	Sandstone reservoir	2	-	-	2
GEO619	Advanced HydroGeology	2	-	-	2
GEO620	Petroleum Traps	2	-	-	2
GEO621	Sedimentary Environments	2	-	-	2
GEO622	HydroGeochemistry	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO607	Application of GIS and remote sensing in Environmental Geology	2	-	-	2
GEO623	Sequence Stratigraphy	2	-	-	2
GEO624	Petroleum Geochemistry	2	-	-	2
GEO625	Applied Sedimentology	2	-	-	2
GEO626	Groundwater Modeling Techniques	2	-	-	2
GEO627	Groundwater quality and contaminant hydroGeology	2	-	-	2
GEO628	Methods of groundwater Exploration	2	-	-	2
GEO629	HydroGeophysics	2	-	-	2
GEO630	Well-logging	2	-	-	2
GEO631	Structural Geology	2	-	-	2

GEO632	Seismic Stratigraphy	2	-	-	2
GEO633	Petroleum Provinces	2	-	-	2
GEO634	Isotope hydroGeology	2	-	-	2
GEO635	Watershed analysis and management	2	-	-	2
GEO636	Environmental HydroGeology	2	-	-	2
GEO637	Geospatial data analysis	2	-	-	2
Thesis (20 Credit hours)					
GEO689	Dissertation				20

3-برنامج الماجستير فى العلوم تخصص الجيولوجيا البيئية
(M.Sc. Environmental Geology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO638	Environmental Geology	2	-	-	2
GEO639	Environmental sustainability	2	-	-	2
GEO607	Application of GIS and remote sensing in Environmental Geology	2	-	-	2
GEO640	Engineering Geology	2	-	-	2
GEO641	Water resources	2	-	-	2
GEO642	Spectral Geology	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO643	Soil and rock mechanics	2	-	-	2
GEO644	Exploration of Mineral Deposits	2	-	-	2
GEO609	Isotope Geology	2	-	-	2
GEO645	Energy resources	2	-	-	2
GEO646	Physical and chemical properties of soil	2	-	-	2
GEO647	Environmental management	2	-	-	2
GEO648	Advanced Environmental Geophysics	2	-	-	2
GEO649	Natural Hazards &Disaster risk reduction	2	-	-	2
Thesis (20 Credit hours)					
GEO689	Dissertation				20

4-برنامج الماجستير فى العلوم تخصص الطبقات والحفريات
(M.Sc. Stratigraphy and Paleontology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO650	Lithostratigraphy	2	-	-	2
GEO651	Macropaleontology	2	-	-	2
GEO652	The Phanerozoic Eon of Egypt	2	-	-	2
GEO653	Biostratigraphy	2	-	-	2
GEO654	Micropaleontology	2	-	-	2
GEO655	Environmental stratigraphy and facies modelling	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO656	Historical Geology	2	-	-	2
GEO657	Paleoecology and microfacies	2	-	-	2
GEO658	Palynology	2	-	-	2
GEO659	Sedimentary basin analysis	2	-	-	2
GEO660	Vertebrate Paleontology	2	-	-	2
GEO661	Sequence stratigraphy	2	-	-	2
GEO662	Biostatistics applications in paleontology	2	-	-	2
GEO663	Marine Paleobiology	2	-	-	2
Thesis (20 Credit hours)					
GEO689	Dissertation				20

5-برنامج الماجستير فى العلوم تخصص الصخور الرسوبية والترسيب
(M.Sc. Sedimentary and Sedimentation Geology Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO664	Sedimentary Rocks	2	-	-	2
GEO665	Geochemistry of Sedimentary Rocks	2	-	-	2
GEO666	Sedimentary Basin Analysis (1)	2	-	-	2
GEO667	Applied Sedimentology	2	-	-	2
GEO668	Clay Mineralogy	2	-	-	2
GEO669	Sedimentary Basin Analysis (2)	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO607	Application of GIS and remote sensing in Environmental Geology	2	-	-	2
GEO670	Heavy Minerals	2	-	-	2
GEO609	Isotope Geology	2	-	-	2
GEO671	Stratigraphy	2	-	-	2
GEO672	Evaporites	2	-	-	2
GEO639	Environmental Geology	2	-	-	2
GEO631	Structural Geology	2	-	-	2
GEO661	Sequence Stratigraphy	2	-	-	2
GEO673	Facies Analysis	2	-	-	2
Thesis (20 Credit hours)					
GEO689	Dissertation				20

6-برنامج الماجستير فى العلوم تخصص الجيولوجيا التركيبية والتكتونية
(M.Sc. Structural Geology and Geotectonics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO631	Structural Geology	2	-	-	2
GEO674	Remote Sensing	2	-	-	2
GEO675	Special Course	2	-	-	2
GEO676	Analysis of Geological structures	2	-	-	2
GEO677	Geotectonics	2	-	-	2
GEO678	Special Course	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO679	Petroleum Geology	2	-	-	2
GEO680	Applied Geophysics	2	-	-	2
GEO681	Advanced Stratigraphy	2	-	-	2
GEO682	Field Geology	2	-	-	2
GEO683	Structures of Igneous intrusion	2	-	-	2
GEO684	Microtectonics	2	-	-	2
GEO602	Geochemistry	2	-	-	2
GEO685	Earthquake Seismology	2	-	-	2
GEO686	Sedimentary Basins	2	-	-	2
GEO687	Metamorphic Rocks	2	-	-	2
GEO688	Geology of Arabian Nubian shield	2	-	-	2
Thesis (20 Credit hours)					
GEO689	Dissertation				20

7-برنامج الماجستير فى العلوم تخصص الجيوفيزياء
(M.Sc. Geophysics Program)

(40 Credit hours – 20 Courses + 20 Thesis)

Core Courses (12 Credit hours) المقررات الاجبارية (عدد 12 ساعة معتمدة)					
Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GEO685	Earthquake Seismology	2	-	-	2
GPH601	Advanced Potential techniques	2	-	-	2
GPH602	Advanced Well Logging	2	-	-	2
GPH603	Mathematical method in Geophysics	2	-	-	2
GPH604	Advanced seismic Method	2	-	-	2
GPH605	Electric and Electromagnetic Methods	2	-	-	2
Core Elective courses (8 Credit hours) **المقررات الإختيارية** **يختار الطالب 8 ساعات معتمدة من المقررات الاتية**					
	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
GPH606	Geophysical exploration of Hydrocarbon	2	-	-	2
GPH607	Modeling of Groundwater Aquifers	2	-	-	2
GPH608	Advanced mineral exploration (Geophysical Perspective)	2	-	-	2
GEO631	Structural Geology	2	-	-	2
GPH609	Basin Analysis	2	-	-	2
GPH610	Subsurface Geology	2	-	-	2
GPH611	Advanced Petrophysics	2	-	-	2
GPH612	Environmental Geophysics	2	-	-	2
GPH613	Engineering Geophysics	2	-	-	2
GPH614	Machine learning in Geophysics	2	-	-	2
GEO659	Sedimentary basin Analysis	2	-	-	2
Thesis (20 Credit hours)					
GPH615	Dissertation				20

برامج درجة دكتوراه الفلسفة فى العلوم

Ph.D. Programs

Ph.D Degree Courses

See Table (3) for Topics

(60 Credit hours – 12 Courses + 48 Thesis)

يتم منح درجة دكتوراه الفلسفه فى العلوم فى نفس التخصصات الواردة بالمادة (2) والموضحة بجدول 3 من هذه اللائحة ويعتمد المقررات الدراسية الأساسية والمرتبطة والتخصصية الخاصة بدرجة دكتوراه الفلسفة فى العلوم فى التخصصات الموضحة بجدول (3) بواسطة لجنة الدراسات العليا ومجلس الكلية بناء على اقتراح مجالس الأقسام العلمية المختصة

First Semester

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
Xxxx701	Main Course	2	--	--	2
Xxxx702	Related Course	2	--	--	2
Xxxx703	Specialized Course	2	--	--	2
Total		**6**			**6**

Second Semester

Course Code	Course Title	Hours			
		Lecture	Practical	Tutorial	Credit
Xxxx704	Main Course	2	--	--	2
Xxxx705	Related Course	2	--	--	2
Xxxx706	Specialized Course	2	--	--	2
Total		**6**			**6**

Xxxx هى كود البرنامج لكل قسم توضع قبل رقم الكورس

المحتوى العلمى للمقررات الدراسية
Courses Description

مقررات قسم الرياضيات
تمهيدي ماجستير

1-برنامج الرياضيات البحته

1- Pure MATematics Program

I: Core Pure MATematics Courses (2 credit hours for eCHM course)

MAT601 (Module Theory) **نظرية النمذجة**

Basic concepts of module theory: submodules, quotient modules, direct sums, homomorphisms, finitely generated, cyclic, free and torsion modules, annihilator ideals. Matrices and finitely generated modules over a principal ideal domain: Equivalence of matrices, structure theory of modules, applications to abelian groups and to vector spaces with a linear transformation.

MAT602 (Advanced Ordinary Differential Equations) **معادلات تفاضلية عادية متقدمة**

Linear differential equations and uniqueness, higher order linear differential equations, Variation of parameters, nonlinear differential equations, and stability. The existence and uniqueness theorem, Boundary value problems and Sturm- Liouville theory.

MAT603 (Numerical Analysis) **تحليل عددي**

Interpolation by polynomials and trigonometric functions, Data fitting, Numerical integration. Finding minimum points, Eigenvalue problems. Ordinary differential equations (Multi-Step Methods), Numerical solutions to boundary value problems for partial differential equations. System of linear equations, Iterative methods for large system of linear equations.

MAT604 (Functional Analysis) **تحليل دالي**

Topological Vector space, BanCHM space, Hahn-BanCHM Theorem, Operator Theory, Fredholm Theory, Hilbert space, Distribution, Fourier Transform, BanCHM Algebra, Spectral theory.

MAT605 (Partial Differential Equations) **معادلات تفاضلية جزئية**

Cauchy Problem, Laplace Equation, Hilbert Space Method, Sobolev space, Potential Method, Heat Equation, Wave Equation.

MAT606 (Operations Research) **بحوث العمليات**

Integer Programming; Stochastic Programming; Fuzzy Programming; Rough Programming; Dynamic Programming; Geometric Programming; Quadratic Programing.

Elective Courses

MAT607 (Advanced Real Analysis) **تحليل حقيقي متقدم**

Lebesgue Measure and Integral, Differentiation, Classical BanCHM space, Maximal Function, Measure Theory, Representation Theorem, Basic Theory of Functional Analysis.

MAT608 (Applied Geometry for Computer Graphics and Vision)

الهندسة التطبيقية للرسومات الحاسوبية والرؤية

Differential Geometry of curves and surfaces, Computational algebraic Geometry and topology of manifolds needed for computer vision and Geometric design, Morphology for pattern recognition and wavelet and fractal Geometry for image data compression.

MAT609 (Optimization Theory) **نظرية التحسين**

Introduction to Optimization; Classical Optimization Techniques; One-Dimensional Minimization Methods; Unconstrained Optimization Techniques; Nonlinear Optimization Problems with Several Variables; Constrained Optimization Techniques; Further Topics in Optimization.

MAT610 (Complex Analysis) **التحليل المركب**

Analytic Function, Complex Integral, Singularity, Maximum Principle, Runge Theorem, Riemann Mapping Theorem, Analytic Continuation and Riemann Surface, Harmonic Function, Picard Theorem.

MAT611 (Discrete and Computational Geometry) **الهندسة المتقطعة والحسابية**

Discrete Geometry is intimately connected to computational Geometry. This course will cover basic concepts of discrete Geometry, including convexity, incidence problems, convex polytopes, arrangements of Geometric objects, lower envelopes, crossing numbers. In addition, we will study how to design optimal algorithms for Geometric problems, by exploiting these combinatorial and Geometric properties.

MAT612 (Eigenvalue and Boundary Value Problems) **مسائل القيم الذاتية والحدية**

Best uniform approximation, Condition numbers, Krylov method, Eigenvalue problems, Several Time Scale.

MAT613 (Finite Group Theory) **نظرية المجموعات**

Basic properties of finite groups, Group actions and Sylow Theorem, Free groups, The structure theory, Classify the groups of special orders, p-groups, Solvable and nilpotent groups, Frattini subgroups, Fitting subgroups, Sylow basis for solvable groups.

MAT614 (Fourier Analysis) **تحليل فوريير**

Basic Properties of Fourier Series, Uniform Convergence, Convergence & Divergence at a point, Hardy-Littlewood Maximal function, Fourier Transform on Lebesgue space. After a brief review of the theories of Fourier transforms, Schwartz space and oscillatory integrals, we will cover a selection of modern topics in harmonic analysis including restriction theorems, Bochner-Riesz operators, the Kakeya maximal operators, the spherical maximal theorem, convolution operators and their applications to partial differential equations and the theory of Besicovitch sets.

MAT615 (Algebraic and Differential Geometry) **الجبر والهندسة التفاضلية**

Complex variety, Hilbert's nullstellensatz, Riemann surfaces and algebraic curves, Residues, Quadric Line Complex. Algebraic varieties, Algebraic curves, Geometry on elliptic curves, Elliptic curves on local fields, Elliptic curves on global fields. Theory of connections, Manifolds, Riemann tensor, Sectional Ricci curvature, Scalar curvature, Jacobi fields, Geometric invariants, Gauss-Bonnet Theorem, Gauge transformation, Curvature & Topology.

MAT616 (Algebraic Graph Theory) **نظرية الرسم الجبري**

The aim is to learn algebraic methods utilizing the well-developed matrix theory and group theory in the study of graph theory and its applications. It is also to learn algebraic aspect of discrete MATematics and give a Mathematical foundation for related areas of combinatorics, such as, distance-regular graphs, association schemes and t-designs. Graphs and these combinatorial objects will be studied through an investigation of their structures, existence, and constructions.

MAT617 (Advanced Topological Spaces) **الفراغات التوبولوجية المتقدمة**

Topological spaces, Generating Topological spaces by relations. Topological Spaces and Rough Sets. Nano-Topological Spaces and their applications. Topological Spaces and Graph.

MAT618 (Number Theory) **نظرية الأعداد**

Arithmetic on number fields, Dirichlet unit Theorem, Ideal class group, Prime ideal decomposition, Hilbert Theory, Introductory class field Theory. Arithmetic of modular forms, Elliptic curves, Zeta function, L-series, Distribution of prime numbers.

MAT619 (Combinatorics) **التوافقيات**

Voltage graph, Group actions on graphs, Cayley graph, Embedding of graphs, Map Colorings, Genus of groups, Graph and matrices. Combinatorial Enumerations, Polya Theory, Interconnection network, Block design, Finite Geometry.

MAT620 (Commutative Ring Theory) **نظرية الحلقات التبادلية**

Chain conditions, Prime ideals, Flatness, Completion and the Artin-Rees lemma, Valuation rings, Krull rings, Dimension Theory, Regular sequences, Cohen-Macaulay rings, Gorenstein rings, Regular rings, Derivations, Complete local rings. Rings and Ideals, Quotient ring, Module, Primary decomposition, Noetherian ring, Artinian ring, Discrete valuation ring, Dedekind domain, Completion, Dimension Theory.

MAT621 (Nonlinear Partial Differential Equations) **معادلات تفاضلية جزئية غير خطية**

Schauder Theory, Fixed Point Theory, Harnack Inequality & Local Regularity or Fluid Equation, Existence & Uniqueness of the Solutions of Equations from Mathematical Physics.

MAT622 Selected Topics in Pure MATematics

2 برنامج الرياضيات التطبيقية

2- Applied Mathematics Program

I: Core Applied MATematics Courses (2 credit hours for course)

MAT623 (Electrodynamics) **الديناميكا الكهربائية**

Maxwell Equations - Green Functions of Electrostatics - Calculations in Electrostatics - Green Functions of Electrodynamics - Calculations in Electrodynamics - Electrodynamics in Media - Waveguides and Cavities - Advanced Topic.

MAT624 (Space mechanics (1) - Introduction to Orbital Mechanics)

ميكانيكا الفضاء (1) – مقدمة في ميكانيكا المدار

Orbital Mechanics I - dynamics of spaceflight; concept of gravitational well; orbital motion; Kepler's Laws; the case of circular, elliptic, parabolic, and hyperbolic orbits - orbital maneuvers; calculating time between two positions in the orbit- circular restricted three body problem.

MAT625 (Fluid Dynamics (1)) **ديناميكا الموائع (1)**

Review on the basic concepts and fundamental equations (Properties of fluids, Fluid kinematics, Conservation of mass, Conservation of momentum, Constitutive equation for Newtonian fluid), Navier-Stokes Equations in cylindrical and spherical coordinate systems, The energy equation (First law of thermodynamics), Simplified form of the energy equation (Energy equation for ideal gas and Energy equation for incompressible fluid with constant viscosity and thermal conductivity), Boundary conditions for viscous heat-conducting flow, Mathematical character of basic equations, The dimensionless parameters in viscous and heat-conducting flow, Boundary layer approximations, Exact one-dimensional solutions of some Newtonian viscous-flow with dissipation (Couette flow, Poiseuille flow and rotating flow), Exact solution of the steady state boundary layer equations in two-dimensional flow (Impulsively started plate: Similarity Solutions).

MAT605 (Partial Differential Equations) **معادلات تفاضلية جزئية**

From Pure MATematics

MAT626 (Quantum Mechanics) **ميكانيكا الكم**

Revision of non-relativistic quantum mechanics, spin classifications: boson and Fermion's systems, Second quantization, time-independent perturbation theory, spin angular momentum, the Klein-Gordon Equation and Lorentz Invariance of the Klein-Gordon Equation, Pauli and Dirac Matrices, Pauli-Dirac Representation, Dirac Equation: Free Particle at Rest, Interpretation of – Energy Solutions, the solution of Dirac Equation.

MAT627 (Mathematical Modeling) **النماذج الرياضية**

Concepts of Mathematical Modeling- Modeling change: Modeling change with Difference Equations - Modeling change with Systems of Difference Equations - The Modeling Process: Modeling Using Proportionality - Modeling Using Geometric Similarity - Choosing a Best Model - Deterministic Behavior - Random Behavior - Simulating Probabilistic Behavior – Probabilistic Modeling with Discrete Systems - Modeling Component and System Reliability -

Linear Regression - Modeling with Decision Theory : Decision Trees - Sequential Decisions and Conditional Probabilities - Decisions Using Alternative Criteria - Modeling with a Differential Equation - Modeling with Systems of Differential Equations - Stability analysis of the model - Illustrative Modeling Examples in (physics – chemistry – biology – epidemics – medicine - Military - bioreactors).

Elective Courses

MAT612 (Eigenvalue and Boundary Value Problems)

مسائل القيم الذاتية والحدية

From Pure MATematics.

MAT621 (Nonlinear Partial Differential Equations) **معادلات تفاضلية جزئية غير خطية**

From Pure MATematics.

MAT628 (General Relativity) **النسبية العامة**

Schwarzschild's solution and the deflection of light- Relativistic cosmology (world models)- Static world models: Einstein's model and its properties- De Sitter model and its properties. Radius of the observable universe- Rigorous solutions- Solution having spherical symmetry – Solution having axial symmetry – Generalized field theories (unified field theory)- Generalize general Relativity- Non – symmetric theory- Tetrad space- Affine connections.

MAT629 (Optimal Control Theory) **نظرية التحكم الأمثل**

Basic concepts of optimal control - dynamic programming - Pontryagin's principle - numerical techniques for optimization -Calculus of Variations - Optimal Control Without Restrictions On The State Variables - Mixed Constraints - Pure State Constraints - Mixed and Pure State Constraints- deterministic optimal control systems governed by ordinary differential equations, applications: physical problems - economic problems- epidemic problems- marketing problems.

MAT630 (Dynamical Systems) **الأنظمة الديناميكية**

Linear Discrete Dynamical Systems - Nonlinear Discrete Dynamical Systems – Differential Dynamical Systems - autonomous Systems and nonautonomous Systems - The Tent Map and Graphical Iterations - Fixed Points and Periodic Orbits - The Logistic Map, Bifurcation Diagram - and Feigenbaum Number - Gaussian and Hénon Maps - Complex Iterative Maps – Boundaries of Periodic Orbits - Calculating Fractal Dimensions - nonlinear autonomous system Linearization and Hartman's Theorem - Limit Cycles - Hamiltonian Systems, Lyapunov Functions, and Stability - Three-Dimensional Autonomous Systems and Chaos - Poincaré Maps and Nonautonomous Systems.

MAT631 (Elasticity) **نظرية المرونة**

Introduction (Equations of elasticity)- Extension, Torsion, and Flexure of beams- Two – dimensional electrostatic problems - Three - dimensional problems- Thermoelastic problems – Variation methods.

MAT632 (Mathematical Methods) **الطرق الرياضية**

Lie Symmetry analysis of differential equations - differential transform method – homotopy analysis method – homotopy perturbation method – A domain method – Discrete Symmetry analysis of differential equations – fractional differential equations.

MAT633 (Space mechanics (2) – Orbital Mechanics in space)

ميكانيكا الفضاء (2) ميكانيكا المدارات في الفضاء

3D- orbital elements- reference frames and transformation of coordinates- Equations of motion under conservative and nonconservative forces (Lagrange' planetary and gauss's equations of motion) perturbations of orbital motion: Earth oblateness and drag force – Rendezvous in Low Earth Orbit (LEO).

MAT634 (Fluid Dynamics (2)) **ديناميكا الموائع (2)**

Magnetohydrodynamics (Fundamentals of Electromagnetism; The governing equations), The Boussinesq approximation, Similarity solutions for two-dimensional flow with heat transfer, Flow through porous medium, Nano-Fluid models, Boundary layer equations of non-Newtonian fluid, micropolar fluid model, Computational fluid dynamics.

MAT635 (Quantum Computation) **الحسابات الكمية**

Quantum Computing – The Circuit Model and the Deutsch-Jozsa Algorithm – Simon's Algorithm – The Fourier Transform – Shor's Factoring Algorithm – Hidden Subgroup Problem – Grover's Search Algorithm – Quantum Walk Algorithms – Hamiltonian Simulation = The HHL Algorithm = Quantum Query Lower Bounds – Quantum Complexity Theory – QMA and the Local Hamiltonian Problem – Quantum Encodings, with a Non-Quantum Application – Quantum Communication Complexity – Entanglement and Non-Locality – Quantum Cryptography.

MAT636 (Mathematical Biology) **علم الأحياء الرياضي**

A variety of topics in population biology, single and competing species ecological models, enzyme reaction kinetics, molecular motors, epidemiology, and infectious diseases. Discrete and continuous biological systems, SIR models, Models in Immunology and tumor-immune interactions, Steady states, Stability, Bifurcations, Simulations of model solutions.

MAT637 (Computational Methods) **الطرق الحسابية**

Introduction- Turbulence and its modelling- Moments of different fluctuating variables- Higher-order moments- Probability density function- Direct numerical simulation- The finite volume method for some problems- Solution algorithms for pressure - velocity coupling- Solution of discretized equations- Jacobi iteration method- Gauss-Seidel iteration method- Relaxation methods- Implicit method for two- and three-dimensional problems- Numerical errors.

MAT638 Selected Topics in Applied MATematics

3-برنامج الإحصاء

3- Statistics Program

I: Core Statistical Courses (2 credit hours for eCHM course)

STA601 (Probability Theory) **نظرية الإحتمالات**

This course aims to provide students with important concepts and tools in probability theory, which should include the following topics: Bivariate and multivariate random variables, bivariate normal distribution, conditional distributions, functions of random variables and random vectors, transforms such as probability generating functions, moment generating functions, and characteristic functions. The course also deals with the sum of independent random variables and the Central Limit Theorem.

STA602 (Order Statistics) **الإحصاءات المرتبة**

This course introduces the general theory of order statistics and its applications. Topics covered include basic distribution theory for order statistics from continuous distributions, moments, relations, bounds, and approximations. Order statistics from specific distributions, order statistics in statistical inference. Some characterization results from order statistics. Basic asymptotic theory of order statistics with a focus on extreme order statistics.

STA603 (Statistical Packages) **حزم إحصائية**

Programming and computing techniques for data science include data acquisition, organization, visualization, modeling, and inference for scientific applications. Probability: distributions, expectations, variance, covariances, Central Limit Theorem, statistical inference of univariate data. Results in computing: presentation and interactive communication of results in substantial projects. Software development with an emphasis on R, plus other key software tools.

STA604 (Statistical Inference) **الإستدلال الإحصائي**

This course covers the fundamental concepts in the theory of estimation and hypothesis testing, such as sufficient statistics, minimum variance unbiased estimation, maximum likelihood estimation, Bayesian estimation, confidence intervals, bias, consistency, mean square error. Interval estimation: Pivotal quantities. Size and coverage probability. Hypothesis testing, Type I errors and Type II errors, P-values, and statistical significance: At the end of this course, the students should also be able to solve exercises using suitable software such as R or MATematica.

STA605 (Theoretical Statistics) **الإحصاء النظري**

This course covers the fundamental concepts in statistical theory, including modes of, Rao-Blackwell theorem, Cramer-Rao bound. Point estimation: Optimal unbiased and equivariant estimation; Hypothesis testing and confidence intervals: uniformly most powerful tests, uniformly most accurate confidence intervals, optimal unbiased and invariant tests. Properties of the maximum likelihood estimators. Hypothesis testing: Likelihood ratio test. most powerful tests. The Neyman-Pearson framework and quadratic forms.

STA606 (Reliability Theory) **نظرية الموثوقية**

In the course, the basic concepts of reliability theory are studied. Some reliability functions and measures are discussed in detail, including the reliability function, the failure rate function, the meantime to failure, and the mean residual, for important lifetime distributions. Different methods of estimation, based on both complete and censored data, as well as using appropriate statistical software to fit lifetimes to a specific distribution, should be included.

II: Elective Statistical Courses (2 credit hours for eCHM course)

STA607 (Data Analysis) **تحليل البيانات**

This course aims to make the students aware of the basic concepts of data analysis and discusses the following topics: Multiple regression and the general linear model; design concepts for experiments and studies; analysis of variance for standard designs; the analysis of covariance; and communicating and documenting the results of analyses.

STA608 (Experimental Design) **تصميم التجارب**

This course will provide students with the basic concepts of experimental design. The session will start with an overview of factorial design. The 2^k factorial design, two-level, three-level, and mixed-level fractional factorial designs, and nested and split plot designs are also covered in the course. The practical session aims to teCHM students how to solve Mathematical problems using tools such as R, MATematica, SPSS, or MINITAB.

STA609 (Sampling Theory) **نظرية المعاينة**

This course aims to make the students familiar with sampling theory and some of its applications. We'll start with the most common sampling types, such as simple random, stratified, systematic, and double sampling, in this course. The course will also cover estimations such as mean, total, proportion, and variance estimations for various sampling methods, ratio estimates, and regression estimates. We'll wrap things up with a well-designed survey.

STA610 (Time series Analysis) **تحليل السلاسل الزمنية**

This course aims to provide tools for empirical work with time series data and is an introduction to the theoretical foundation of time series models. To emphasize the application of the theory to real (or simulated) data, we will use R or MATematica in our analysis. Students are expected to prepare a project report based on real-life data. After completing this course, a student will be able to analyze univariate and multivariate time series data using available software.

STA611 (Bayesian Statistics) **إحصاءات بايز**

This course will treat Bayesian statistics at a relatively advanced level. The course will provide a discussion of the Mathematical and theoretical foundations for Bayesian inferential procedures. We will examine the construction of priors and the asymptotic properties of likelihoods and posterior distributions. The discussion will include, but not be limited to, the case of finite-dimensional parameter space. There will also be some discussions on the computational algorithms useful for Bayesian inference.

STA612 (Biostatistics) **الإحصاء الحيوي**

The purpose of the course is to teCHM fundamental concepts and techniques of descriptive and inferential statistics with applications in health care, medicine, public health, and epidemiology. Basic statistics, including probability, descriptive statistics, inference for means and proportions, and regression methods are presented. The analytic methods and applications will be linked to topics including health promotion, epidemiology, and program evaluation.

STA613 (Linear Models) **النماذج الخطية**

This is a post-introductory course to linear models in which there will be a deeper look into linear algebraic tools for statistics. Multivariate regression will be performed with a special focus on inferential aspects. Review of matrices, quadratic forms, simple and multiple linear regression, multivariate normal distribution, analysis of variance, model validation, diagnostics, variable selection, polynomial regression, transformation of variables, and analysis of covariance.

STA614 (Nonparametric Statistics) **الإحصاء الامعلمي**

This course is designed to introduce nonparametric statistics. In the first part of the course, different tests, depending on their ranking, are looked at. In the second part, the nonparametric estimation methods are discussed. In particular, the kernel density estimator and its mean squared error are demonstrated. In addition, the methods for selecting the optimal bandwidth for the estimators are explained.

STA615 (Simulation) **المحاكاة**

This course aims to make students be able to use computer simulation of random variables and stochastic models to solve real life problems by generating data of future scenarios under the assumption of a given model. It is a complementary course of an advanced course in probability theory and aims to train students to understand the theoretical background of most known algorithms of simulation of random variables.

STA616 Selected Topics in Statistics

MAT609 (Optimization Theory) **نظرية التحسين**

From Pure Mathematics

COM603 (Data Science) **علم البيانات**

From Computer Science

4-مقررات برنامج علوم الحاسب

4- Computer Science Program

COM601 (Pattern Analysis) **تحليل النمط**

Decision Theory, Linear Discriminants, Logistic Regression, Principal Components Analysis, Support Vector MCHMines, Vector Quantization, Mixture of Gaussian, Expectation-Maximization, Clustering, Mixture of Gaussian, Case Studies, and applications: object classification.

COM602 (Advanced Artificial Intelligence) **الذكاء الإصطناعي المتقدم**

Selected topics in Artificial Intelligence (A.I.); could include AI programming techniques, pattern matching systems, natural language systems, rule-based systems, constraint systems, mCHMine learning systems, and cognitive systems. Applications could include areas in Finance, Medicine, Manufacturing, Smart Cities, Semantic Web, Healthcare, Fraud Detection, Intrusion Detection, Autonomous Vehicles, Opinion mining, Sentiment Analysis, or similar areas.

COM603 (Data Science) **علم البيانات**

This course explores data analytics, including the processing, analyzing, and visualizing techniques that uncover patterns and trends in large-scale databases. Students learn about data mining tools and database systems and how to generate presentations that help organizations use this valuable data.

COM604 (Advanced Algorithms and Complexity) **الخوارزميات التقدمة والمعقدة**

Algorithmic techniques to handle big data arising from, for example, social media, mobile devices, sensors, financial transactions. Algorithmic techniques may include locality-sensitive hashing, dimensionality reduction, streaming, clustering, VC-dimension, external memory, core sets, link analysis and recommendation systems. Next this course discusses inherently hard problems for which no exact good solutions are known and how to solve them in practice. Techniques for proving NP-complete problems.

COM605 (Computer Vision) **الرؤية بالحاسب**

Image formation, image filtering and features detection, SIFT and HOG, segmentation, object detection with sliding windows, bag of words, OpenCV library, camera 3D to 2D projection, stereo vision, shape from X, object registration, model matching, and virtual reality.

COM606 (Data Mining) **تنقيب البيانات**

Theoretical aspects of data mining techniques including classification, association, predication, and cluster analysis. Related fields from which data mining draws, like database technology, artificial intelligence, and mCHMine learning, will be emphasized. Model selection, model evaluation and statistical significance testing. ApproCHMes for coping with Big Data. Selected applications of data mining and concept learning.

Computer Science Elective Courses

COM607 (Natural Language Processing) **معالجة النصوص اللغوية**

Overview of both rule-based or symbolic methods and statistical methods as approCHMes to Natural Language Processing (NLP), with more emphasis on the statistical ones. Applications such as information retrieval, text categorization, clustering, and statistical mCHMine translation could be discussed. This course is equivalent to COMP 5505 at Carleton University.

COM608 (Introduction to Deep and Reinforcement Learning)
مقدمة في التعلم العميق والمعزز

Fundamental of mCHMine learning; multi-layer perceptron, universal approximation theorem, back-propagation; convolutional networks, recurrent neural networks, variational auto-encoder, generative adversarial networks; components and techniques in deep learning; Markov Decision Process; Bellman equation, policy iteration, value iteration, Monte-Carlo learning, temporal difference methods, Q-learning, SARSA, applications.

COM609 (Trends in Big Data Management) **إتجاهات في إدارة البيانات الضخمة**

The list of topics covered in the course generally spans: Data Exploration, Data Cleaning, Data Integration, Data Mining, Data Lake Management, Knowledge Graphs, Graph Processing, Question Answering, Blockchain, Crowdsourcing, Internet of Things, Text Processing, and Training via Weak Supervision. The common characteristic among all these topics is the large scale of data.

COM610 (Digital Transformation) **التحول الرقمي**

This course presents The Basics of Digital Transformation, Digital Transformation - Definition and Core Concepts, Processes and Methods - Design Thinking and Lean Startup, Overview of Emerging Technologies, Cloud Technologies, Big Data, Changes in Culture - The Digital DNA, Digitization Project.

COM611 (Explainable Artificial Intelligence) **الذكاء الاصطناعي القابل للتفسير**

This course introduces Explainable AI (XAI), providing an overview of relevant concepts such as interpretability, transparency, and black-box mCHMine learning methods. The course provides an overview of state-of-the-art methods for generating explanations, and touches upon issues related to decision-support, human interaction with AI/intelligent systems and their evaluation.

COM612 (Internet of Things) **انترنت الأشياء**

The course examines security challenges related to the Internet of Things (IoT), with a focus on consumer IoT devices, software aspects including engineering design, security of communications protocols and wireless access, cryptographic mechanisms, device integration and configuration, and security of IoT applications and platforms.

COM613 (Wireless Networks and Mobile Computing)
الشبكات اللاسلكية والحوسبة المتنقلة

Computational aspects and applications of design and analysis of mobile and wireless networking. Topics include Physical, Link Layer, Media Access Control, Wireless, Mobile LANs (Local Area Networks), Ad-Hoc, Sensor Networks, Power Consumption optimization, Routing, Searching, Service Discovery, Clustering, Multicasting, Localization, Mobile IP/TCP (Internet Protocol/Transmission Control Protocol), File Systems, Mobility Models, Wireless Applications.

COM614 (Evolutionary Computation) **الإحتساب التطوري**

Study of algorithms based upon biological theories of evolution, applications to mCHMine learning and optimization problems. Possible topics: Genetic Algorithms, Classifier Systems, and Genetic Programming. Recent work in the fields of Artificial Life (swarm intelligence, distributed agents, behavior-based AI) and of connectionism.

PHY601 (Advanced Solid-State Physics)

فيزياء جوامد متقدمة

Electronics in a periodic potential-Scattering in metals- Transport in metals- Phonons- free electrons and interactions- Landau theory on phase transitions - Strongly correlated systems - Plasmons, polaritons, and polarons – optical processes and excitons.

PHY602 (X-Ray Diffraction and crystallography)

حيود الأشعة السينية وعلم البللورات

Point group and space group in crystals - Classification of materials scattered by x - ray powder diffraction techniques - Data collection - Data reduction - Analytical function used in powder diffraction line profile analysis - Pattern decomposition and deconvolution of line profile shapes - Determination of unit cell parameters and refinement - Investigation of new materials - Determination of crystallite size and crystallite imperfections - The identification of phase diagram by x-ray diffraction (parametric method) determination of sample purity - Order and disorder in materials - The determination of the percentage disorder in materials - Determination of phase analysis by using the (ICDD) powder diffraction file - Determination of phase change under non ambient condition - The structure analysis of polycrystalline materials and of amorphous materials - Electron diffraction techniques - Interpretation of electron diffraction patterns.

PHY603 (Semiconductors physics and devices)

فيزياء أشباه الموصلات وأجهزتها

Electronic structure, charge carrier statistics, and transport properties in semiconductors, fabrication technology for semiconductor devices and integrated circuits, charge transport in p-n junctions and metal-semiconductor contacts, the principles of field effect (MOSFET) and bipolar junction (BJT) transistors, the principles of light-emitting diodes (LED) and laser diodes (LD), photoconductors/photodiodes, and photovoltaic solar cells.

PHY604 Magnetism and magnetic materials

المغناطيسية والمواد المغناطيسية

Magnetism of isolated atoms: diamagnetism, paramagnetism, Hundt's rules. Crystal field, Magnetic interactions: dipolar magnetic interaction, exchange interaction. Magnetic order: ferromagnetism, antiferromagnetism and ferrimagnetism. Weiss-Néel'smodel, Magnetic domains. Kondo effect and Hubbard's model.

PHY605 Microscopy and spectroscopy techniques for characterization of solids

التقنيات الميكروسكوبية والطيفية لدراسة المواد

Electrical Techniques – 2-Probe, 4-Probe, I-V, C-V, DLTS, Hall Measurements, Optical Techniques – IR, UV, VIS Spectroscopy, Ellipsometry, Raman, Micro-Raman, SERS, FTIR

Analytical Techniques – X-RAY TECHNIQUES - Techniques based on measuring the energy or angular distribution of scattered X-rays, X-ray fluorescence spectroscopy - Basics- core hole formation, fluorescence yield, transport ("ZAF"); Surface analysis – TXRF; Microscopy – x-ray beam manipulation Inelastic scattering- X-ray absorption spectroscopy; Basics- edges and extended fine structure; XANES and EXAFS quantitation; Surface sensitivity; Experimental methods Wide angle elastic scattering (XRD); atomistic -form factors; unit cell – structure factors, Bragg equation, reciprocal lattice, Laue equations; Experimental methods- transmission, reflection, thin film, in-situ; Other information- particle size distributions, etc. Small angle scattering- SAXS; Basics- what SAXS sees; Mathematical modeling; Experimental methods ELECTRONMICROSCOPIES Transmission electron microscopy (TEM/STEM) Electron interactions in solids, Atomic Force Microscopy (AFM) Basics; Experimental methods; Spectroscopy in Scanning Probe Microscopy ELECTRON SPECTROSCOPIES- techniques based on measuring the energy distribution of emitted electrons Photoelectron spectroscopy Basics- energy balance, element identification; Basics- relaxation, chemical states, Surface sensitivity. Auger Electron Spectroscopy. Electron excitation; The Auger spectrum - energy balance; Chemical effects; Quantization; Imaging- meaning and non-meaning of maps. Experimental methods; Surfaces of real-world things; Below the surface- profiling, variable energy;Hardware and software. Samples and handling. XPS technique.

PHY606 Introduction to functional materials and nanotechnology

مقدمة فى المواد الوظيفية وتكنولوجيا النانو

A brief history, scales and sizes, size effects, elegant examples from nature and materials science, - Functional materials applications: 2D, 1D, and 0D - Thin films and interfaces, nanotubes, nanowires and nanoparticles, bio-nanotechnology and medical applications, surface coatings, sensors, energy applications - batteries, supercapacitors, water splitting, fuel cells, H2 storage, catalysis, nano-optics - near field optics, plasmonics; nanoelectronics - dimensionality, Coulomb blockade, resonant tunnelling, electron localisation. - Functional materials characterization: Spectroscopy (UV-VIS-IR, THz, Raman, XRD, XAS, XPS/UPS, EPR/ESR/NMR, RBS, SIMS), Microscopy (SPM, TEM, SEM, …). - Functional materials synthesis: a brief history of human history and materials, energy and matter - units and terminology, Fabrication techniques: nanolithography/imprint, MBE, PLD, ALD, VLS, sputtering, thermal/e-beam evaporation, CVD, arc synthesis, liquid based synthesis, self-assembly, Langmuir-Blodgett technique. - Functional materials and nanotechnology - Environmental, health and safety: pollutant classifications, nanoparticle hazards, environmental and health impact. - Fundamental concepts and examples of heat and charge transport in nanostructures and nanomaterials - Ferroic nanomaterials: phenomenology and applications - Advanced functional dielectric materials - Capacitance, basics of the dielectrics, polarization, ordering, and ferroelectricity including applications in novel electronic devices. - Structural and electrical property mapping: X-ray diffraction, reciprocal space, Bragg's law; scanning probe microscopy (SPM) instrumentation- basics of contact, non-contact SPM techniques, advanced electrical characterization techniques such as piezoresponse force microscopy imaging and spectroscopy, and Kelvin probe force microscopy.

PHY607 Advanced Topics in Theoretical Physics

موضوعات متقدمة فى الفيزياء النظرية

Group theory: Axioms of group theory - Abstract group - Subgroups - Groups of proper rotation - Improper rotation - Symmetry groups - Matrix representation - Reducible and irreducible representation - Group characters - Group theory and Schrodinger equation - Spatial and spin symmetry special functions : Gamma function (Factorial function) - Recurrence relation - Laplace transform - Double factorials - Diagamma - Polygamma - Stirling series - Beta function - Incomplete functions - Fourier Analysis - Fourier series in complex from - Fourier transform - Development of Fourier integrals - Convolution of - functions - Bessel differential equation - Generating functions - Bessel functions - Recurrence relations - Modified Bessel function - Applications in electrodynamics- Legendre functions- Recurrence relations - Spherical harmonics

PHY608 Advanced Quantum Mechanics

ميكانيكا الكم المتقدم

History and postulates of quantum mechanics- Quantum states and wave functions, quantum measurements-Hilbert space, Dirac notation, Hermitian operators -Spin and angular momentum, the Bloch sphere, spin resonance -The quantum harmonic oscillator, coherent states -Time-independent perturbation theory, the Wentzel–Kramers–Brillouin (WKB) method -Composite systems and entanglement -Bell's inequaility and the EPR paradox -Quantum computing, Deutsch's algorithm, Grover's algorithm-Quantum teleportation and communication -Open quantum systems and decoherence.

PHY609 NanoPhysics

الفيزياء النانونية

Introduction to nanophysics and nanotechnology – scaling laws and limits to smallness; quantum nature of nanoworld; nano fabrication (top-down and bottom-up process); nanoscopy (electron microscopy, atomic force microscopy, scanning tunneling microscopy) - Properties and application of dielectric and metal nanostructures - individual nanoparticles and nanoclusters; nanostructured materials; carbon nanostructures; nanomagnets. - Properties and application of semiconductor nanostructures - fabrication of semiconductor nanowires and quantum dots; electronic and optical properties(2D and 3D quantum confinement); optical spectroscopy of semiconductor nanostructures (local probe techniques); quantum dots nanowire- and quantum- dot-based electronic and photonic devices.

PHY610 Nanomaterials

المواد النانونية

Characterization Methods, Fabrication Methods, Materials, Structure and the Nanosurface , Energy at the Nanoscale, The Material Continuum , Nanothermodynamics, Chemical Interactions at the Nanoscale , Carbon-Based Nanomaterials , Chemical Synthesis and Modification of Nanomaterials , Natural Nanomaterials , Modeling Nanomaterials , Biomolecular Nanoscience , Societal Implications of Nanoscience and Nanotechnology

PHY611 Surface and interface Physics

فيزياء السطوح والحدود البينية

Surface structure, stability and reactivity. Surface crystallography. Reconstructions and relaxation. Surface electronic structure. Experimental methods for surface electronic structure.

Adsorption of atoms and molecules. Different types of bonding. Kinematics and dynamics of surface processes. Reactions on surfaces. Heterogeneous catalysis. Epitaxial growth. Layer-by-layer growth and island formation. Properties of interfaces. Adhesion and segregations. Research presentations are also given, e.g. on magnetic overlayers, clusters, bio surfaces, nano-porous materials. Techniques: x-ray photoelectron spectroscopy (XPS), low energy electron diffraction (LEED) and scanning tunnelling microscopy (STM).

PHY612 Quantum Information Technology

تكنولوجيا الكم المتقدم

Density operators, projective and generalised measurements, no-cloning theorem, quantum copying, open quantum systems: Lindblad's equation, Qubits: physical realisations and the Bloch sphere, quantum entanglement, quantum teleportation Quantum key distribution, Entropy (von Neumann), distance measures for quantum information: trace distance and fidelity

Completely positive maps, Kraus representations. Applications such as quantum computers and quantum cryptography.

PHY613 Nanocomposite Science and Technology

علوم وتكنولوجيا المركبات النانونية

Ceramic/Metal Nanocomposite Systems. Preparation technologies: mechanical alloying, sol-gel synthesis, melt spraying. Structures: particles, thin films, wires, porous systems. Applications: electrical, magnetic, optical. Nanocomposites based on polymer matrix : polymer / polymer, ceramic / polymer, metal / polymer, carbon nanotube / polymer. Preparation technologies: solid mixture, solutions mixing, in-situ polymerization, polymer coatings, other coatings. Applications: mechanical, electrical, optical. Natural nanocomposites: Nanocomposites synthesized biologically; Nanocomposites synthesized by mimicking natural processes; Packaging proteins. Nanocomposite materials modeling: current issues. Multiscale modeling. Multi-physics modeling

PHY614 Superconductivity and Superfluidity

الموصلات فائقة التوصيل والتدافق

Bose-Einstein condensates. Superfluidity. Classical and quantum fluids. The superfluidity of He(II). Flux quantisation and vortices. Superconductivity. Discovery; basic properties of superconductors (electric, magnetic and thermodynamic). Type I and type II superconductivity. London's model. Gunzburg-Landau model. The BCS theory of superconductivity. Non-conventional superconductivity and superfluidity.

PHY615 Materials for energy conversion and storage

المواد لتحويل وتخزين الطاقة

Introduction to anisotropy and tensors Thermodynamic formulation of physical interactions: Thermal, mechanical, electrical, & magnetic interactions Piezo-, pyro-, & ferro-electricity , Electro-physical energy transformation processes, Materials challenges for piezoelectric generators and capacitors; the latest developments in new materials, Thermoelectricity: Transport of Charge and heat Thermoelectric Phenomena Materials challenges for thermoelectric generators, Solid-state ionics and ionic conductors Electrode processes and electrode materials Fuel cells: SOFCs and PEM fuel cells Batteries: Li-ion and Li-air batteries, Electrochemical Capacitors, Mixed ionic-electronic conductors (MIECs) for hydrogen

production and fuel reformation, Materials challenges for electrochemical energy, Photo-electrochemical solar cells, Fundamentals of photo-electrochemical processes, Materials challenges, Recent developments of novel materials, Nuclear systems and materials challenges Materials degradation under radiation, Fundamentals of photovoltaic materials, Thin-film, multijunction photovoltaic cells Materials challenges for high-efficiency solar cells, Latest development in new materials

PHY616 Physics of thin films

فيزياء الشرائح الرقيقة

Overview of thin film technology Introduction to the Apple Model, Crystal structures of thin films, Defects in thin films (vacancies and interstitials, dislocations, grain boundaries etc.) Nanocrystalline, polycrystalline and epitaxial thin films, Diffusion, Surface, thin film nucleation and growth models (2D, 3D, and 2D-3D combination), Epitaxy Homoepitaxy and heteroepitaxy; Lattice matching epitaxy and domain matching epitaxy; Superlattice structures and quantum wells.Vacuum Science and Technology, Thin film growth techniques (Physical Vapor Deposition- Sputtering, MBE, Laser MBE, PLD and E-bean evaporation) (HW4) Thin Film Lab Sessions (thin film deposition and property measurements),Thin film growth techniques (Chemical Vapor Deposition- CVD, PECVD, MOCVD), Special topics in thin films for electrical and optical devices (LED), Special topics in thin films for Solid Oxide Fuel Cells, Solar Cells and other applications

PHY617 Optoelectronics and optical communication

الالكترونيات البصرية والموصلات الضوئية

Optical processes in semiconductors, materials properties, charge carrier dynamics. Wave guide optics, fibre optics and optical communication. Quantum structures and microcavities. Light emitting devices: LEDs and laser diodes. Light-absorbing devices: detectors, camera chips and solar cells.

PHY618 Spintronics: Fundamentals and applications

أساسيات وتطبيقات الاسبنترونك

Introduction to Spintronics GMR, Datta-Das, Spin relaxation, Spin injection, Spin detection, Electron Spin in Solids Pauli equation, Spin-Orbit coupling, Zeeman splitting, Current density, Magnetization, Bloch states with SO coupling, Electronic structure of GaAs, Dresselhaus and Rashba spin splitting, Optical orientation and spin pumping, Stern-GerlCHM experiments with electron spins, Detection of free electron spin, Spin Relaxation and Spin Dephasing Bloch equations, T_1 and T_2 times, Elliot-Yafet mechanism with phonons, Dyakonov-Perel, Bir-Aronov-Pikus, hyperfine coupling mechanisms, density matrix, pure and mixed states, spin kinetic equation, motional narrowing, Spin Injection Spin-polarized transport, Electrochemical potential, Spin accumulation, Spin diffusion, FN junction, Rashba formalism of linear spin injection, Equivalent circuit model, Silsbee-Johnson spin-charge coupling, Spintronic Devices Datta-Das spin-FET, P-N junctions, Magnetic bipolar diode, Magnetic bipolar transistor, Magnetic tunneling devices, introduction to Quantum Transport Quantum vs. semiclassical transport, Weak and strong localization, Mesoscopic fluctuations, Quantum point contact, Quantum Hall bar, Aharonov-Bohm rings, Semiconductor Spintronics, Quantum spin-polarized transport, Pure spin currents, Spin-orbit interaction in semiconductors, Spectral problem of the Rashba Hamiltonian, Geometric spin phases, Diluted magnetic semiconductors, Quantum Transport Theory with Lattice Hamiltonians Tight-binding Hamiltonian, Mesoscopic

Kubo vs. Landauer formula, Scattering approCHM to spin-charge quantum transport, Real-space Green functions, Spin Decoherence Spin current density matrix, Two-level system decoherence, T_2 and T^*_2 times: True vs. false vs. fake decoherence, Entanglement and quantum teleportation, Spin-orbit entanglement, D'yakonov-Perel' mechanism in confined systems, Quantum Spintronic Devices Non-ballistic Datta-Das spin-FET, Aharonot-Casher mesoscopic rings, Spin Hall bars, Spin qubits

PHY619 Physics of polymers

فيزياء البوليمرات

General notions, classification criteria. Structure of macromolecular compounds. Aggregation and phase states, transition temperatures. Elements of polymerization reaction thermodynamics. Physico-chemical properties of polymer materials of interest in applications. Polymer materials with special properties: intelligent composite materials, interpenetrated polymer networks, liquid crystals in various materials, drug carrier polymers, metalocenes, polymers with biomedical applications, polymer membranes, carbon fibers and carbon fiber composites, conductor and semiconductor polymers, polymer sensors, biodegradable polymers. Techniques for complex polymer materials characterization. Applications in making of polymers with selected surface properties

PHY620 Physics of Dielectric Materials

فيزياء المواد العازلة

Definitions. Multipole development. Electrical dipole, Electrical field equations in substances, General properties of dielectrics. Polarisation. Fundamental equation of dielectrics, Applications. Plan-parallel dielectric. The image method applied to dielectrics. Dielectric sphere, Energy and forces acting on the dielectrics. Volumic, superficial forces, Local field: Lorentz; Onsager, Polarisation mechanisms in dielectrics: induced, orientational, electronic, ionic, interfacial and lattice polarizations; combined mechanisms, Relaxarea dielectrica. Mecansime microscopice care conduc la o relaxare Debye, Dielectric breakdown, Applications of dielectrics, Ferro, piro, piezo-electricity: phenomenology, theory and applications

2– برنامج فيزياء الإلكترونيات (Physical Electronics Program)

PHY621 Advanced Physical Electronics

Intrinsic and extrinsic properties of semiconductors, semiconductor diodes, semiconductors diode circuit, The field effect transistor, The Bipolar junction transistor, The use of semiconductor devices in analog and digital circuits and optoelectronics applications. Basic models of optoelectronic devices: photodetectors and lasers, Advanced devices.

PHY622 Semiconductor Electronics

فيزياء الالكترونيات

Transistor audio power amplifier - Performance quantities of power amplifiers - Classification of power amplifiers - Single ended class power amplifier - Stages of practical power amplifier - Push-pull amplifier - Tuned amplifiers - Analysis of parallel tuned circuit - Frequency response of tuned amplifier - Single tuned amplifier - Double tuned amplifier -Radio broadcasting transmission and reception – Modulation - Types of modulation - Analysis of amplitude modulated wave - Side band frequencies in AM wave - Power in AM wave- Limitation of amplitude modulation - Frequency modulation – Demodulation thermal agitation

noise – Noise in a semiconductor - Inference and cross talk - Signal to noise ratio - Noise factor

PHY623 Advanced Electronic Circuits

دوائر الكترونية متقدمة

Multilayer neural networks - Multilayer model - The multilayer learning algorithm - Behaviour of multilayer network - Some applications - Electronic data publishing system - Hopfield fully-connected neural networks.

PHY624 Solid State Electronics

الكترونيات الحالة الصلبة

Photovoltaic effect (PV) - Physical aspects of solar cell efficiency - Typical single crystal silicon solar cell - Advances in single crystal silicon solar cell - Solar arrays - Solar array construction - PV support equipement - PV's future**.**

PHY625 IC Technology and Fabrication

تصنيع وتكنولوجيا الدوائر المتكاملة

Introduction to IC Fabrication Technology, Introduction to Cleanroom, Oxidation, Photo-Lithography, Etching, Doping , Chemical Vapor Deposition (CVD), Metallization, Process Simulation , Isolation Processes, Process Integration, Process and Device Characterization

PHY626 Microwaves

موجات قصيرة

Introduction to microwave (Frequencies – Devices – Systems - Units of measure) - Electric and magnetic wave equations - Uniform plane waves and reflection - Plane waves propagation in free space and in lossy media - Transmission line equations and solutions - Standing wave and standing wave ratio - Rectangular wave guides - Solution of wave equations TE modes and TM modes) - Power transmission and loss - Excitations of modes in rectangular wave guides - Circular wave guides - Solutions of wave equations in cylindrical coordinates - TE modes and TM modes in circular wave guides - Power transmission in circular wave guides or coaxial line - Power-losses in circular wave guides or coaxial line - Excitation modes in circular wave guides - Characteristics of standard circular wave guides - Rectangular and circular cavity resonator - Q factor of cavity resonator - Microwave hybrid circuits

PHY627 Nanoelectronics and photonics

الالكترونيات النانونية والفوتونيات

Optical properties , Photonic crystals, optical properties of semiconductors, band edge energy, band gap, dependence on nanocrystallins size, Quantum dots, optical transitions, absorptions, interband transitions, quantum confinements. Fluorescence/luminescence, photoluminescence/fluorescence, optically excited emission, electroluminescence, Laser emission of quantum dot, Photo fragmentation and columbic explosion, phonons in nanostructures, luminescent quantum dots for biological labeling. Unit-III: Electronic properties, Energy bands and gaps in semiconductors, Fermi surfaces ,localized particle, donors, acceptors, deep traps, excitons, mobility, size dependent effects, conduction electrons and dimensionality Fermi gas and density of states, semiconducting nanoparticles Unit-IV: Electronic Properties of Copper and Silicon (NM): Direct and reciprocal lattices of the fcc structure, Brillouin zone for the fcc structure, Copper and alloy formation, Silicon. Silicon

band structure. Unit-V: Nanophotonics: Photonic crystals, Photonic Bandgap, Defects in Photonic Crystals: Localization of Light, Control of Dispersion and the Slowing and Storage of Light, High-Efficiency Optical Sources, Photonic Crystal Waveguides and Fibers.

PHY628 Computational Systems in Electronics

الانظمة الحسابية فى الالكترونيات

Computer circuits: Analogue/Digital - Basic digital devices - Microprocessor - Fundamentals - The microprocessor - Programming the microprocessor - Interfacing the microprocessor**.**

3– برنامج البصريات والليزر أو الاطياف الذرية (Optics and Laser or Optical Spectroscopy program)

PHY629 Non-Linear Optics I

بصريات لا خطية 1

Dispersion theory- The electron oscillator model: refractive index and polarizability- Nonlinear electron oscillator model: perturbative solution of the nonlinear oscillator equation- Second harmonic generation- Phase matching- Three wave mixing- Parametric amplification- Parametric oscillation- Tuning of parametric oscillation.

PHY630 Light Diffraction from Geometrical Optics

حيود الضوء من الفتحات الهندسية

Huygens-Fresnel principal- Kirchhoff's diffraction theory-Fraunhofer and Fresnel diffraction- Fraunhofer and Fresnel diffraction at apertures of various Geometry: circular, rectangular, and triangular apertures- Fraunhofer diffraction in optical instruments- Resolving power of image formic systems- The three light dimensional distribution near focus- The correlation functions of light beams.

PHY631 Light scattering from Rough Surfaces

تشتت الضوء من الأسطح الخشنة

Rayleigh criterion for scattering- Kirchhoff's solution for scattering from rough surfaces- Periodicity rough surfaces- Random rough surfaces- The statistical distribution of the scattered field and the probability theory.

PHY632 Statistics of speckle pattern

إحصائيات نماذج البقع الرقشاء

Speckle and its origin- First-order statistics of polarized speckle pattern- First- order statistics of sums of speckle patterns- Second-order statistical properties of speckle- Auto-correlation function and power spectral density- Effects of surface structure on monochromatic and polarized speckle pattern- Effect of finite correlation area of the wave at the rough surface- Relation between the correlation function of the surface and the mutual intensity of the reflected intensity- Dependence of speckle correlation on surface roughness

PHY633 Image Processing

معالجة الصور

Introduction to image enhancement in spatial domain-Discrete time Fourier transform- Image enhancement in frequency domain- Smoothing frequency domain filters- Butterworth low pass filter- Morphological image processing.

PHY634 Laser Spectral Characteristic

خصائص البقع الرقشاء الليزرية

Intensity saturation gain coefficient for homogenous and in-homogenous atomic broadening- Three and four energy level systems to initiate optical pumping- Continuous He-Ne laser and pulsed ruby laser- Optical resonators containing amplifying media- Fabry-Perot resonator as optical spectrum analyzer- Spectral intensity of multimode laser- Spectral profile of laser: its power and spectral width.

PHY635 Fiber Optics

ألياف بصرية

Introduction to optical fiber- Wave Propagation -Maxwell's Equations - Dispersion in Single-Mode Fibers - Dispersion-Induced Limitations -Fiber Losses- Fiber Manufacturing - Optical Transmitters -Optical Receivers-Lightwave Systems- Optical Amplifiers.

PHY636 Fourier Optics

بصريات فوريير

Fourier transformation: one -dimensional transform of the Gaussian function- Two-dimensional transforms: transform of thew cylinder function- The lens as Fourier transform – The Dirac delta function – Displacement and phase-shift: sines and cosines-Optical applications: Linear system- Convolution integral and theorem- Transform of the Gaussian wave packet- Fourier methods in diffraction theory- Single slit diffraction- Three slits apodization- The array theorem- Spectra and correlation: Parseval's formula- The Lorenz's profile- Auto- and cross-correlation- Transfer functions: More formula discussion- Problems.

PHY637 Plasma Diagnostic

تشخيصات البلازما

Introduction to plasma physics: Deby-length-Plasma parameters- Plasma concepts and Terminology distributions function- Magnetic pressure- Particle drift plasma frequency-Waves in plasmon- Plasma stability- Plasma production- Light scattering by plasma- Plasma radiation- Determination of plasma parameters from measured spectra- Laser as a tool for plasma diagnostic.

PHY638 Modern Optics

بصريات حديثة

Introduction to modern optics: Stope, apertures, pupils and diffraction- Optical materials: Plastic optical materials, absorption filters, Diffusing materials and projection screens and polarizing materials- Optical coating: Dielectric reflection and interference filters, Reflectors and Reticle- Principal of photometry.

PHY639 Atomic and molecular spectra

أطياف ذرية وجزيئية

Introduction in spectroscopy: atomic structure, molecular structure, radiation, and scattering process- Spectroscopy of inner electrons: x-ray spectroscopy, photoelectron spectroscopy and Auger electron spectroscopy-Optical spectroscopy: Light sources, Spectral resolution

instruments, Detectors, Optical components and materials: Interference filters and mirrors, Absorption filters, Polarizers, Optical materials and Influence of the transmission media.

PHY640 Laser Material Interaction

تفاعل الليزر مع المادة

Introduction in lasers- Fundamentals of Laser Surface Processing: Light Propagation in Materials, Energy Absorption Mechanisms, The Heat Equation, Material Response, Thermally Activated Processes, Surface Melting, Ablation- Laser Surface Processing Applications: Heat treatment of metal, Non-melt laser annealing (NLA), Laser surface melting, Laser cleaning and Laser surface texturing- Surface Texturing for Enhanced Optical Properties: photovoltaic arrays, Photodiodes and Digital imaging sensors- Surface Texturing for Enhanced Biological Interactions: Biomaterial surface properties, Laser heat treatments, and Laser surface texturing laser.

PHY641 Non-Linear Optics II

بصريات لا خطية 2

Nonlinear susceptibility- Nonlinear optics higher order process- Four-wave mixing- Third harmonic generation- Resonance enhancement of nonlinear susceptibility- Multi-photon absorption and emission- Raman scattering: Stimulated Raman scattering, Coherent anti-stocks Raman scattering and stimulated Brillouin scattering.

PHY642 Holography

التصوير المجسم

An introduction in holography: Photography, Holography recording and formation, Reconstruction, Types of holograms, and Holographic materials- Digital holography: Fast Fourier Transforms for Digital Holography- Holographic Interferometry- Fresnel ApproCHM to Digital Holography- Holographic Spectral Filters- Volumetric Holographic Imaging of Living Tissue- Holography and Structured Illumination for Super Resolved Imaging.

4-برنامج الفيزياء النووية التطبيقية (Nuclear Applied physics and its applications Program)

PHY643 Nuclear Spectroscopy

الأطياف النووية

Alpha, beta and gamma decay processes; Theory of gamma decay; Quantum mechanical tunneling. The Gamow factor, alpha decay spectroscopy; Types of beta decay processes; X-rays following beta decay, the Fermi theory of beta decay .Energetics of gamma decay, internal conversion, isometric transitions, branching ratios and life-times of excited states; Radiation sources and fields ;Review of the interaction of gamma rays with matter; Charged particle accelerations; Ion sources and principles of acceleration; A survey of accelerator types . Principles of radiation detection . Review of interaction of radiation with matter; Ionizations and excitations.

PHY644 Nuclear materials

المواد النووية

Fission Reactor Materials-Types of nuclear fission reactor. Structural Materials-Modulator and reflector. Coolants-Nuclear fuel materials. Cladding Materials-Control element materials. Fusion Reactor Materials-Research and development of fusion reactor. Classification of fusion

reactor (tokamak) materials. Structural Materials-Superconducting materials. Blanket Materials-Plasma-facing materials. Radiation Effects-Neutron damage . Atomic displacement - Irradiation effect on material properties. Activation by Neutrons-Tritium Technology for Fusion Reactor. Fuel cycle of fusion reactor- Carbon/graphite materials Plasma -wall interaction- Super- permeation of tritium Hydrogen recycling-Particle reflection-Trapping and inventory of tritium.

PHY645 Fission and Fusion Reactions

تفاعلات الإنشطار والإندماج

Reactor Fundamentals / Nomenclature / Nuclear Reactions / Nuclear Stability Neutron Sources / Binding Energy / Fission Process / Chart of Nuclides Radioactive Decay / Cross-Sections Compound Nucleus / Resonances / Neutron Scattering Neutron Slowing Down / Neutron Flux / Moderators / Energy Condensation Power Reactors I (LWRs / Neutron Life Cycle) Power Reactors II (CANDU / Advanced LWRs, Gas Reactors, …) Transport Equation Kinetics Approximation Delayed Neutrons / Photoneutrons / Inhour Diffusion Equation - One Group Diffusion – Two Groups Control Rods / Burnable Poisons Reactivity Feedback / Transients Reactor Control / Xenon / Samarium Depletion / MA

PHY646 Nuclear Spectrometry

المطيافية النووية

Basics and Units of Radioactivity, Interaction of Radiations with Matter ,Fundamental of Radiation Measurements and Detection ,Types of detection equipment and capabilities ,Detector Principles, Calibration of Gamma Systems , Counting statistics, Phenomenon/Implication of Dead Time, Instrument nonlinearity, Calibration and Managing errors in calibrations, Gamma Ray Spectroscopy, Twenty Principles of Excellence in Gamma Spectroscopy, Gamma Spectroscopy check list, Shielding, Counting Samples, Laboratory Exercises, Treatment of background radiation

PHY647 Plasma Physics and Controlled Fusion.

فيزياء البلازما والاندماج المتحكم فيه

Plasma state, different types of plasma, parameters that characterize them; motion of charged particles in electric and magnetic fields; single particle approCHM, fluid approCHM and kinetic statistical approCHM, different plasma phenomena; concept of cutoff and resonance and various types of waves in plasmas; interaction between particles and waves; technical applications of plasma and important methods for the production and diagnostics of plasma in the laboratory; principles of confinement in a toroidal magnetic field configuration and the basic principles of tokamak operation; use of thermonuclear fusion for energy production, plasma confinement problems and current directions of research; an understanding of the processes related to plasmas in the near Earth environment, interplanetary space and astrophysical objects.

PHY648 Elementary Particle and High Energy Physics

الجسيمات الأولية وفيزياء الطاقة العالية

The concepts of particle physics and how are they implemented, the properties of atomic nuclei and how can one use them, accelerate and detect particles and measure their properties, particle reactions at high energies and particle decays, electromagnetic interactions, strong interactions, weak interactions work and why are they so special, the mass of objects at the

subatomic level and the Higgs boson intervene, new phenomena beyond the known ones, particle physics concerning astrophysics and the Universe as a whole.

PHY649 Trace element analysis.

تحليل عنصر التتبع

Biological, Environmental and Geological Materials, Trace Element Analysis , Neutron Activation Analysis, Exposure, Biological Materials Hair samples, Nails, Blood samples, Environmental Materials River, Lake, BeCHM sediments, Atmospheric Dust , Geological Materials Ocean floor cores, Volcanic lava rocks, Mountain Rocks, Lunar rocks, Mars soils…

PHY650 Experimental techniques in nuclear and particle physics.

التقنيات التجريبية فى الفيزياء النووية والجسيمية

The course teCHMes the physics of particle detectors and presents various sub detectors used in particle physics accelerator experiments such as the LHC. The first part covers the energy loss of charged particles in matter (Bethe-Bloch equation, Cherenkov effect, bremsstrahlung), interactions of photons in matter, drift and diffusion of electrons and ions in matter in electric and magnetic fields. Important quantities such as radiation length, interaction length, critical energy, efficiency and resolution are introduced. The second part discusses specific subdetectors that are used to measure ionization, particle positions, vertices, momentum, electromagnetic energy, hadronic energy, timing and particle type. It further discusses trigger systems and data acquisition. The course is accompanied by three tutorials on statistics and one tutorial on the LHC.

PHY651 Meson physics

فيزياء الميزون

The constituents and nuclear models of the atomic nucleus. Understand binding energies and interactions between particles have knowledge of strong, weak and electromagnetic interaction and radioactive decay, Have knowledge of nuclear reactions in nucleosynthesis and laboratory experiments understand fusion and fission reactions, Know about the standard model/quark model be familiar with different particles (baryons, mesons, leptons, antiparticles) , Understand relativistic effects have knowledge of nuclear astrophysics be familiar with different experimental methods in the field,

PHY652 Nuclear Astrophysics

الفيزياء الفلكية النووية

Selected features of astronomy ‘observing the universe’ and of astrophysics ‘explaining the universe, General characteristics of thermonuclear reactions, sources of nuclear energy, Maxwell-Boltzmann velocity distribution Cross section, stellar reaction rates, mean lifetime; astrophysical s- factor, abundance evolution Neutron and charged particle induced non-resonant reactions, reactions through narrow and broad resonances, p-p chain, CNO, NeNa and MgAl cycles ,Creation and survival of 12C, Nucleosynthesis beyond iron peak (s – process, r – process, p – process), General aspects of experiments: Accelerators for beams of charged particles, neutrons and gamma rays, detectors, target materials, electronic pulse processing modules, Experimental methods to study nuclear astrophysics: Activity method, Coulomb dissociation, Trojan Horse and ANC methods; radioactive ion beams

PHY653 Applications of nuclear radiation.

تطبيقات فى الأشعاع النووي

Knowledge the candidate should have knowledge about: - Constituents and properties of nuclei, nuclear reactions and accompanying radiations, as well as mechanisms for the interaction of radiation with matter. - This includes: nuclear models and nuclear properties, nuclear reactions, with emphasis on alpha, beta and gamma radiation related to strong, weak and electromagnetic interactions, mechanisms for the interaction of radiation with matter, radiation dosimetry, biological effects of ionizing radiation, radiation protection, nuclear power, fusion reactions, industrial and medical applications og nuclear methods and ionizing radiation. Skills the candidate should be able to: - To find and use relevant tables and data to assess and evaluate the occurrence and effects of nuclear processes and ionizing radiation-

PHY654 Neutron activation analysis.

تحليل التنشيط النيترونى

Standards, calibrators, and reference materials', focusing on international standards and reference materials within NAA for calibration, method validation and quality control, 'Sample preparation', providing approCHMes for the prevention of contamination and element loss, drying techniques and on homogenization and representativeness, and 'Maintenance of Instrumentation', zooming in on preventative maintenance for gamma ray spectrometers to help users improve the lifetime and quality of their instrumentation

5– برنامج الفيزياء الإشعاعية التطبيقية (Applied radiation physics program)

PHY655 Radiation Sources.

المصادر الأشعاعية

On part I, the following topics will be presented: introduction to radiation physics (classification of radiation, quantities, units, basic radiation interaction processes, dosimetric principles), basic principles for particle accelerators, electron-, proton- and ion accelerators, nuclear reactions and fission and fusion processes. On part II, the following topics will be presented: general laws of radioactivity, radioactive decay processes, radioactive decay series and production of radioactive nuclei

PHY656 Radiation Protection and safety.

الوقاية والأمان الإشعاعى

Review and effects of radiation, Radiation protection framework Interactions and units, Instrumentation, Sources of exposure, Risks and effects (including , pregnancy), RP Culture and ethics, Radiation protection in hospitals, Diagnostic radiology, External beam radiotherapy, BrCHMytherapy, Nuclear medicine, PET & cyclotrons, Non-Ionising radiation protection (optional), Medical lasers, Ultrasound, Ultra-violet, Safety issues in MRI, Microwave and RF lasers

PHY657 Radiation Detection and Instrumentation

الكشف عن الإشعاع وأجهزته

Introduction, Review of Radiation Sources. Radiation Interactions, Kerma– Exposure – Dose. Counting Statistics and Error Propagation.General Properties of Radiation Detectors I. General Properties of Radiation Detectors II.Cavity Chamber Theory – I.Cavity Chamber Theory – II.Introduction, Review of Radiation Sources. Ionization Chambers I.Ionization Chambers II.Proportional Counters – I.Proportional Counters – II.Geiger-Muller Counters.Scintillation

Detector Principles – I.Scintillation Detector Principles – II.Scintillation Detector Principles – III.Photomultiplier tubes, Radiation Spectroscopy with Scintillators. Pulse Processing and Shaping, Linear and Logic Pulse Functions – I.Linear and Logic Pulse Functions – II.Semi-conductor Diode Detectors – I.Semi-conductor Diode Detectors – II, Germanium Gamma Ray Detectors. Film. Thermoluminescent Dosimeters – I.

PHY658 Radiation Physics in medicine

الفيزياء الأشعاعية فى الطب

UNIT I ATOMIC PHYSICS AND NUCLEAR TRANSFORMATION

Structure of matter - atom - nucleus -atomic mass and energy units -distribution of orbital electrons - atomic energy levels -nuclear forces -nuclear energy levels- particle radiation - Electromagnetic radiation- Binding energy - General properties of alpha, beta and gamma rays. Laws of equilibrium – modes of radioactive decay - nuclear isomerism -nuclear reactions - natural and artificial radioactivity - reactor and cyclotron produced isotopes - fission products – fusion - Criticality conditions – four factor formula. UNIT II INTERACTION OF RADIATION WITH MATTER

Interaction of electromagnetic radiation with matter, Thomson scattering, Rayleigh scattering, Compton scattering (Klein-Nishina differential cross section), Photoelectric absorption, Pair production – Interaction of light (electrons and positrons) and heavy charged particles with matter –specific ionization – Cerenkov radiation-mass-energyattenuation and absorption coefficient - Bethe-Block formalism for energy loss by heavy charged particles, mass-collision – Bragg peak, mass-radioactive stopping power, range and path length of charged particles, CSDA range (continuous slowing down approximation) - Interaction of neutron with matter.

UNIT III DOSIMETRIC CONCEPTS AND QUANTITIES

Introduction -Exposure-Roentgen - photon fluence and energy fluence -KERMA-Kerma and absorbed dose -CEMA -Absorbed dose -stopping power - relationship between the dosimetric quantities - cavity theories – Bragg gray cavity– spencer- Attix cavity – Burlin cavity theory – stopping power ratio. Bremsstrahlung radiation, Bragg's curve.

UNIT IV PRINCIPLES OF RADIATION DETECTION AND DOSIMETERS

Principles of Radiation detection – properties of dosimeters - Theory of gas filled detectors – Ion chamber dosimetry systems - free air ion chamber – parallel plate chamber - ionization chamber – proportional chamber - GM counter – condenser type chambers and thimble chambers working and different applications – film dosimeteryLuminescence dosimetry – semiconductor dosimetry – Gel dosimetry - – radiographic and radiochromic films – scintillation detections.

UNIT V RADIATION MONITORING INSTRUMENTS

Introduction – operational quantities for Radiation monitoring – Area survey meters – Ionization chambers – proportional counters – neutron area survey meters – GM survey meters – scintillation detectors – Personal monitoring – film badge – TLD – Properties of personal monitors - Radiophtoluminesce glass dosimetry system - OSLD.

PHY659 Non-Destructive Nuclear Techniques

التقنيات النووية الغير تالفة

Industrial radiography, which uses short X-rays, gamma rays and neutrons to penetrate materials; Ultrasonic radiography, which uses mechanical vibrations similar to sound waves; Liquid penetrant inspection, which can locate surface-breaking defects in non-porous materials; Magnetic particle inspection, which can detect surface and slightly subsurface

discontinuities in ferromagnetic materials; and Eddy current testing, which uses electromagnetic induction to detect flaws in conductive materials.

PHY660 Irradiation Facilities and Data Acquisition Systems

وسائل التشعيع وأنظمة الحصول على البيانات

Radioactivity: What it is, how it occurs, characteristics, units of measure. Radiation Effects: Biological, materials, low and high doses. Shielding: Absorption, protection methods, shielding calculations. Administrative Controls: Record keeping, incident reporting, emergency procedures. Monitoring and Measurement: Instruments, calibration and operation, survey techniques, personnel and facility monitoring.

PHY661 Mathematical and Computational Methods in Radiation Physics

طرق رياضية وحسابية فى الفيزياء الأشعاعية

UNIT I VECTOR CALCULUS AND MATRICES

Scalar and vector fields – Gradient, Divergence, Curl and Laplacian – line, surface,volume integrals – Theorems of Gauss, Green and Stokes – Applications, Vector operators in curvilinear co-ordinates Eigen Value, problem, diagonalisation and similarity transformation.

UNIT II COMPLEX ANALYSIS

Analytic functions – Conformal mapping- Simple and Bilinear transformation- Applications - Cauchy's Integral Theorem and Integral formula – Taylor's and Laurent's series – Singularities – Zeros, Poles and Residues – Residue theorem- Contour integration with circular and semicircular contours.

UNIT III FOURIER AND LAPLACE TRANSFORMS

Fourier series – Harmonic analysis, Fourier transform- Properties – transforms of simple functions and derivatives- Convolution theorems – Laplace's transform – Properties – Transforms of simple functions and derivatives – periodic functions – Convolution theorem – Applications of Fourier Transform in Medical imaging.

UNIT IV PARTICAL DIFFERENTIAL EQUATIONS

Transverse vibration of string – Wave equation – One dimensional heat conduction – diffusion equation – two dimensional heat flow – Laplace's equation – method of separation of variables- Fourier series solution in Cartesian coordinate.

UNIT V PROBABILITY, STATISTICS AND ERROR

Laws of probability, conditional probability, collection, tabulation and graphical representation of data. measures of central tendency, mean, median, mode, dispersion, standard deviation, root mean square deviation, moments, skewness and kurtosis. Application to radiation detection – error propagation,. Binomial distribution, poisson distribution, gaussian distribution, exponential distribution, Bivariate distribution, Correlation

PHY662 Advanced Topics in Applied Radiation Physics

موضوعات متقدمة فى الفيزياء الأشعاعية التطبيقية

UNIT I REVIEW OF NONIONISING RADIATIONPHYSICS IN MEDICINE

Different sources of Non Ionising radiation-their physical; properties-first law of photochemistry-Law of reciprocity- - Electrical Impedance and Biological Impedance - Principle and theory of thermography - applications -

UNIT II TISSUE OPTICS

Various types of optical radiations - UV, visible and IR sources - Lasers: Theory and mechanism- Laser Surgical Systems-Measurement of fluence from optical sources - Optical

properties of tissues – theory and experimental techniques-interaction of laser radiation with tissues – photothermal -photochemical – photoablation – electromechanical effect

UNIT III MEDIPHOTONICS

Lasers in dermatology, oncology and cell biology - Application of ultrafast pulsed lasers in medicine and biology - Lasers in blood flow measurement -- Fiber optics in medicine - microscopy in medicine - birefringence - Fluorescence microscope - confocal microscope - Hazards of lasers and their safety measures.

UNIT IV MEDICAL ULTRASOUND

Production, properties and propagation of ultrasonic waves - Bioacoustics – Acoustical characteristics of human body- Ultrasonic Dosimetry - Destructive and nondestructive tests - Cavitation - Piezo electric receivers, thermoelectric probe – Lithotropy -High power ultrasound in theraphy

UNIT V RADIO FREQUENCY AND MICROWAVE

Production and properties - interaction mechanism of RF and mirocwaves with biological systems: Thermal and non-thermal effects on whole body, lens and cardiovascular ystems - tissue characterization and Hyperthermia and other applications-Biomagnetism - Effects – applications

PHY663 Recent Advanced Techniques in Radiotherapy

التقنيات الحديثة فى العلاج الأشعاعى

UNIT I TELEGAMMA MCHMINES

Co60and Cs 137as teletherapy sources - source containers - international source capsule - effect of penumbra- Types of collimators - beam directing devices – Different Source Shutter Systems-Quality Assurance of telegamma units.

UNIT II PARTICLE ACCELERATORS

Particle accelerators for medical applications – Resonant transformer – cascade generator - Van De Graff Generator – Pelletron – Cyclotron – Betatron – Synchrocyclotron - electron synchrotron-Protron synchrotron

UNIT III LINEAR ACCELERATORS

Components of modern linear accelerator-Standing and travelling wave guides, Magnetrons and Klystrons. Bending Magnet, Target, Flattening filter, Collimators Need for high quality portal imaging - Fluoroscopic, diode, crystal, - Diagnostic imaging on a linear accelerator - portal dose images, Portal Dosimetry. Telecobalt Vs Linacs.

UNIT IV RADIOTHERAPY SIMULATORS

Conventional simulators - CT simulators - cone beam CT simulators (CBCT) -comparison and quality assurance of simulators - different simulation techniques - Orthogonal, Semi-orthogonal, Isocentric, Variable angle and Stereo-Shift.

UNIT V ADVANCED RADIOTHERAPY EQUIPMENTS

Superficial X-ray therapy units - Gamma knife - cyber knife - Intra operative radiation therapy units- Tomotherapy -Neutron therapy - (BNCT)- proton therapy

PHY664 Neutrons Non-Destructive Techniques

التقنيات النيترونية غير التالفة

Sources of neutron – Nuclear reactors, Radioactive sources and accelerators -Characteristics of sources and their capabilities – Flux density, energy range and Applications - classification of neutrons – Thermal, slow and fast neutrons – Neutron radiography methods – Direct

exposure, transfer methods and real time methods -applications – Difference between neutron radiography and X-ray radiography and gamma radiography.

PHY665 Radiopharmaceuticals

الصيدلانيات المشعة

Introduction**,** Radionuclides in nuclear medicine, Radiopharmaceuticals in routine use, Basics of nuclear physics, Detection of radiation, radiobiological effects of radiation Radiopharmaceutical chemistry, Production of radionuclides, Radiopharmaceutical chemistry – technetium, Radiopharmaceutical chemistry – chelators, complexes and radioiodine, Radiopharmaceutical quality control – theory and practice, Design and formulation of , radiopharmaceuticals, PET Radiopharmaceuticals, Regulatory issues, Radiation safety– what do the regulations require, Pharmaceutical regulations and GMP, Radiopharmacy design and operation, Radiation safety – what do we do in practice, Transport of radioactive material, Radiopharmacy Safety Break out Session, Drug interaction Workshop, Clinical radiopharmacy, Blood cell labelling – theory and practice, Therapeutic radiopharmaceuticals, Radiopharmaceutical calculations, Development and licensing of radiopharmaceuticals

PHY666 Reactor Physics and Nuclear Plants

فيزياء المفاعلات والمحطات النووية

Reactor Fundamentals / Nomenclature / Nuclear Reactions / Nuclear Stability/Neutron Sources / Binding Energy / Fission Process / Chart of Nuclides/Radioactive Decay / Cross-Sections/Compound Nucleus / Resonances / Neutron Scattering/Neutron Slowing Down / Neutron Flux / Moderators / Energy Condensation/Power Reactors I (LWRs / Neutron Life Cycle)/Power Reactors II (CANDU / Advanced LWRs, Gas Reactors, …), Transport Equation, Criticality / Flux / Current / BCs, Kinetics Approximation, Delayed Neutrons / Photoneutrons / Inhour, Control Rods / Burnable Poisons, Reactor Control / Xenon / Samarium, Depletion / MA

PHY667 Data Processing in radiation

معلجة البيانات

Models and modelling, hypothesis testing and parameter estimation, type I and II uncertainties, Clinical trials and evidence-based medicine, Phase 0, I, II, III, and IV trial designs, meta-analysis, clinical endpoints, survival statistics and the Cox Proportional Hazards Model, Statistical modelling and exploratory data analysis, external and internal validity of models, bootstrap and Monte Carlo methods, goodness of fit, Dose-response models, normal tissue complication probability (NTCP) and tumor control probability (TCP) models, modelling combined modality therapy, patient-level risk factors, the linear-quadratic model and beyond, use of models in treatment planning, Artificial Intelligence and MCHMine Learning applications. Deep learning and Convolutional Neural Networks in image analysis. Big data analytics and Data Science, wide and tall data sets, dimensionality reduction, data mining, over-fitting, training and validation sets, sample splitting. Predictive assays, ROC curves and AUC, sensitivity, specificity, positive and negative predictive value

6– برنامج الفيزياء الحيوية الطبية (Medical Biophysics Program)

BPH601 Computational Biophysics

فيزياء حيوية حسابية

Computational Biophysics: is a multidisciplinary field, which correlate innovations in molecular biology, biotechnology, bioengineering, bioinformatics, biophysics, medical physics, and neurobiology with the intersection between biology, physics, computer science, and biostatistics. The objective of this course is to enable students to advance an understanding of protein structure and dynamics, set up and run molecular dynamics simulations, and search for small molecule inhibitors using state-of-the-art methods in computer-aided drug discovery. This course will stroll students through the basic techniques of bio-molecular simulation, including application of extremely parallel molecular dynamics simulations and associated analysis techniques to enable new discoveries within the vast quantity of digital data. Lectures on course concepts will be closely joined with hands-on tutorials that allow the practical application of computational methods and statistical data analysis in a project-based format. The course will include the basic principles of protein structure, molecular dynamics simulations, and set up (run) their own protein / bio-molecular system MD simulation on both personal computers as well as cluster architectures. Additionally, this course will perform the interpretation of basic (statistical) analysis techniques on the resulting MD trajectories.

BPH602 Modern Biophysics

فيزياء حيوية حديثة

Biomolecules-Molecular bonding and interactions- Protein folding - molecular recognition, enzyme catalysis - nanomCHMines- Biomolecules - Laws of thermodynamics-Molecular interactions and their role in forming of biological structures-Structure of biological membranes and their properties-Membrane transport- Nucleic acids and DNA structure, hydrocarbons, lipids, amino acids and protein structure -Bioelectric phenomena in membranes-Physical properties of muscles-Physical bases of NMR imaging and NMR spectroscopy-Influence of non-ionizing radiation on human organism- Analysis of emission and absorption spectra-Creation of images in optical systems-Mechanism of image generation in human eye.

BPH603 Molecular Spectroscopy

أطياف جزيئية

The molecular spectroscopy is basic to the study of Instrumental analysis. The electronic states in molecule and molecule structure can be studied by analysing the spectra such as UV-vis, IR, NMR, and ESR. The purpose of this subject is to understand what properties of molecule the spectra are based on. The basis of absorption and emission of radiation by molecular species, (the wave properties of the light, the quantum theory of light, quantum theory of matter, molecular energies and the Born Oppenheimer approximation, the types of molecular motion and spectroscopy associated with eCHM) , Rotational spectroscopy – (classical description of molecular rotation, quantum mechanics of molecular motion, rotational spectra, determination of the bond length from rotational constants, vibrational stretching and vibrational satellites, no-rigid rotor, centrifugal distortion, degeneracies and intensities, Stark effect, selection rules, rotational spectra of polyatomic molecules) ,Vibrational spectroscopy – (classical description of molecular vibrations, the classical harmonic oscillator, quantum mechanics of molecular vibration, vibrational selection rules, anharmonic vibrations and Morse oscillator, bond dissociation energies and Birge-Sponer plots, calculation of force constants from vibrational spectrum, isotopic shift, rotational structure in vibrational spectra of diatomic molecules, vibrational selection rules, vibration of polyatomic molecules, normal modes, characteristic group vibrational energies, hydrogen bonds in IR spectra) , Raman Spectroscopy – (description

of Raman scattering, Rayleigh scattering, Stokes and anti-Stokes scattering , polarizability of the molecules, Placzek theory, selection rules for rotational Raman spectra of diatomic molecules, rotational Raman spectra, vibrational Raman spectra, Raman spectra of polyatomic molecules), Electronic Spectroscopy – (electronic transition, energy of electronic transition, selection rules, the Franck-Condon principle, term symbols for describing atomic and molecular states, Russel Saunders spin-orbit coupling, selection rules of electronic transition, absorption intensity, probability of light absorption, an electronic spectrum, classification of electronic transition, d-d and CT transitions) , Emission Spectroscopy ,12. Photoelectron spectroscopy – (the photoelectric effect, UV photoelectron spectroscopy UPES, X-ray photoelectron spectroscopy XPES, electron binding energy, ESCA, Auger electron spectroscopy) will be covered.

BPH604 Bioenergetics

الطاقات الحيوية

Bioenergetics is a branch of biochemistry that studies the transformation of energy within living organisms, and between living organisms and their environment. The objective of this course is to give students information about energy supply and transformation in the human body, learn about the internal environment of the human body and how energy is generated in the body and the different pathways during different states- rest, work, recovery and learn about the acid-base balance and the function of kidneys to regulate and maintain this. This course is focused on basics of interatomic and intermolecular interactions in biopolymers. It is aimed on description of fundamental forces in biomolecules, influence of solvent and molecular modelling approCHM. The main objective of the course is to provide the students with the ability to describe and explain fundamental interactions in biomolecules and apply the obtained knowledge to practical problems. Learning outcomes include identification of existing biopolymers, evaluation of individual molecular interactions, identification of the dominant interaction. A comprehensive description of the basic theory and approximation of biopolymers will also be provided.

BPH605 Physics of Radiation Therapy

فيزياء العلاج الإشعاعى

This course is an introduction to the Physics of Radiation therapy. Radiation Therapy is the use of high-energy radiation to damage cancer cells' DNA and destroy their ability to divide and grow. It may be delivered using mCHMines called linear accelerators or via radioactive sources placed inside the patient on a temporary or permanent basis. Radiation therapy may be used to cure cancer, to relieve a cancer patient's pain or alleviate other symptoms. The basic principle for radiation therapy is focused on targeting the radiation dose to the tumor cells as precisely as possible to minimize side effects and avoid damaging normal cells. Topics will include: Radiation units, the main types of Radiation Therapy, and alternative radiotherapy equipment including Gamma Knife, Tomotherapy and MRI based systems. Principles and applications of BrCHMytherapy and Teletherapy, Stereotactic principles and treatment delivery including Cyberknife. Physical concepts of design, quality control, quality assurance, system commissioning and acceptance. Verification and treatment delivery including phantom and patient dosimetry and percent depth dose. Also, the major Radiation therapy techniques involving intensity modulated radiation therapy (IMRT), and image guided radiation therapy (IGRT) will be discussed throughout the course.

BPH606 Medical Biostatistics

الإحصاء الحيوى الطبى

This course is an introduction to statistical methods used in biological and medical research. Elementary probability theory, type of variables, basic concepts of statistical inference, confidence intervals, p-values, regression and correlation methods, and sample size estimation are covered. Statistical distributions including normal, Poisson, binomial, Chi-square and log-normal would be taught. Topics include paired and unpaired t-test, ANOVA, two-way ANOVA and multiple variable analysis and the corresponding non-parametric statistics would also be described. Other important statistical tests including logistic regression, Cox regression, confounding, adjustment, and effect modification would also be covered. Emphasis on applications to medical problems would be provided

BPH607 Cancer Biology

بيولوجيا السرطان

This course aims to provide a comprehensive overview of the biology and pathology of cancer. Educates students on the principles of cancer biology, including the various genetic and molecular changes normal cells undergo during transformation into malignant cancer cells, description of an oncogene and why it is important in cancer development, and studying the function of tumor suppressor genes. Explain the cell cycle, its regulation, and how cell dysfunction can lead to cancer. To this end, students are helped to gain an understanding of cellular and molecular mechanisms that go awry, thereby providing optimal conditions for cancer. We explore the role of mutations in cancer cells, and how they lead to the dysregulation of essential biological properties like programmed cell death, cell proliferation and differentiation. We also explore the challenges associated with diagnosing and treatment of cancers, as well as ways in which to prevent cancer.

BPH608 Advanced Anatomy

التشريح المتقدم

This course is an advanced exploration of human anatomy. Covers the structure and some functions at the cellular, tissue, organ, and system levels. Emphasizes the names, locations, and functions of body components. Involves problem-solving and analytical thinking. A thorough comprehension of anatomy is at the core of biological anthropology, functional anatomy, and comparative evolutionary research. Skeletal function and form, often subjects of analysis in these fields, cannot be fully interpreted and understood without the context of the soft tissues—from muscles and ligaments to blood vessels and organs—that surround and interact with the bones. There will therefore be an emphasis on understanding the 3-D relationships between structures, and how all body systems are interrelated. Embryology, histology, medical imaging, and clinical applications of anatomy will also be important components of the course. Upon completion of this course, students should:

1) Demonstrate knowledge and understanding of the anatomical features and arrangements for the organ systems under study.
2) Demonstrate knowledge and understanding of how the organ systems under study function individually and cooperatively to maintain local and global homeostasis in the human body.
3) Demonstrate the ability to apply knowledge gained to clinically-relevant situations.

BPH609 Pharmacology

علم الأدوية

Concepts of General and Clinical Pharmacology-Systemic Pharmacology-Drugs Affecting Autonomic Nervous System (ANS)- Drugs Affecting Peripheral Nervous System (PNS)-Drugs Affecting Cardiovascular System (CV)-Drugs Affecting Autacoids, Inflammation and Gout-Drugs Affecting Kidney Function-Drugs Affecting Respiratory System-Drugs Affecting Gastro-intestinal System-Drugs Acting on Blood-Drugs Affecting Central Nervous system-Drugs Affecting Endocrine System and its Diseases-Pharmacology of Chemotherapeutic Agents-immunopharmacology.

BPH610 Genetic Engineering

الهندسة الوراثية

This course is an introduction to Genetic engineering, sometimes called genetic modification, is the process of altering the DNA in an organism's genome. This may mean changing one base pair (A-T or C-G), deleting a whole region of DNA, or introducing an additional copy of a gene. It may also mean extracting DNA from another organism's genome and combining it with the DNA of that individual. Genetic engineering is used by scientists to enhance or modify the characteristics of an individual organism. Genetic engineering has a number of useful applications, including scientific research, agriculture and technology. Genetic engineering has advanced the understanding of many theoretical and practical aspects of gene function and organization. Through recombinant DNA techniques, bacteria have been created that are capable of synthesizing human insulin, human growth hormone, alpha interferon, a hepatitis B vaccine, and other medically useful substances. Plants may be genetically adjusted to enable them to fix nitrogen, and genetic diseases can possibly be corrected by replacing dysfunctional genes with normally functioning genes. The objective of the course is to familiarize the students with the basic concepts in genetic engineering; to acquaint the students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology; and to appraise them about applications genetic engineering. Learning outcomes include knowledge of tools and strategies used in genetic engineering, understanding of applications of recombinant DNA technology and genetic engineering. from academic and industrial perspective as well as deep knowledge of genetic engineering in problem solving and in practice.

BPH611 Programming

برمجة

The goal of this course is to provide you with some of the essential computing skills and knowledge you will need to be a successful computational biologist. The scripting language Python and/or R, which is widely used for bioinformatics and computational biology—will be studied. We will study how one makes a model and implements it in computer code. This course will cover algorithms by biopython set of freely available tools for solving various biological problems along with a handful of programming challenges using R helping you implement these algorithms in biology

BPH612 Physics of Medical Imaging

فيزياء التصوير الطبى

The Physics of Medical Imaging reviews the scientific basis and physical principles underpinning imaging in medicine. It covers the major imaging methods of x-radiology, nuclear medicine (SPECT and PET), ultrasound (US), and nuclear magnetic resonance (MRI), and considers promising new techniques. The focus will be directed toward a deep understanding of the underlying concepts as well as foundation of imaging instrumentation, quality control and quality assurance procedure. The basic of image formation, acquision, reconstruction, processing will be explained and described besides data analysis and interpretation. Factors that impact image quality, system performance and imaging pitfalls and artifacts would be reviewed and described as well. Applications of medical imaging in various human disorders would be an asset to this course.

BPH613 Nanobiotechnology

التكنولوجيا الحيوية النانونية

This course provides perspective for students and researchers who are interested in nanoscale physical and biological systems and their applications in medicine. It introduces concepts in nanomaterials and their use with bio components to synthesize and address larger systems. Applications include systems for visualization, biosensing, labeling, drug delivery, and cancer research. The technological impact of nanoscale systems, synthesis, and characterizations of nanoscale materials are discussed. Upon completion of this course, students will know (1) The fundamentals of nanotechnology; (2) DNA nanotechnology and design; (3) Peptide nanotechnology; (4) Protein nanotechnology; (5) Virus nanotechnology; (6) Bacteria nanotechnology; (7) Super-resolution imaging of biomolecular nanostructures

BPH614 Drug Discovery and Design

تصميم وإكتشاف العقاقير

The course provides computational methods in drug design, pharmacophores, binding interactions between drug and its targets, with emphasis placed on lead compounds, the role of combinatorial chemistry, drug actions at receptors, improvement of pharmacokinetic properties of drugs, computer-aided drug design and molecular modeling. In the computer course the students will get acquainted with methods used to correlate physicochemical properties with biological activity and the basics of computer-based methods of 3D-QSAR. Hands on practice on different software programs and bioinformatics and docking toolkits in molecular docking, protein structure prediction, folding, motif finding and other relevant topics of drug design and development.

BPH615 Biomechanics

الميكانيكا الحيوية

The overall purpose of this course is to introduce the fundamental principles of mechanics applied to the Description: study of biological systems. BIOEN 4250 is required for all undergraduates in the Bioengineering Program and is the starting point for coursework in biomechanics. Students should be familiar with the concepts covered in this course before enrolment in Biomechanics II, Biosolid Mechanics: Computational Biomechanics and Biofluid Mechanics. Course outcomes use both index and direct notation, understand transformation of

coordinate systems and how to solve problems in rigid body kinematics , apply finite deformation kinematics to analyse deformation and strain , understand the concept of stress , apply linear elasticity to analyse stresses and strains in materials under homogeneous deformation , derive and interpret the equations of motion for deformable bodies , interpret differences in the material behaviour of biological materials in terms of their constituents and organization, perform analysis of viscoelastic systems based on discrete element models

BPH616 Bioacoustics

الصوتيات الحيوية

Bioacoustics is a cross disciplinary science that combines biology and acoustics. Usually it refers to the investigation of sound production, dispersion and receptionin animals (including humans). This involves neurophysiological and anatom ical basis of sound production and detection, nd relation of acoustic signals to the medium they disperse through. The findings provide clues about the evolution of acoustic mechanisms, and from that, the evolution of animals that employ them. In underwater acoustics is also used to mean the effect of animals on sound propagated underwater, usually in reference to the use of sonar technology for biomass estimation. Methods in bioacoustics are becoming increasingly automated, with researchers deploying autonomous recorders that are capable of automatically collecting data. The automated analysis of sound has also been applied to tasks such as speech recognition. This is easily the most well-known application of audio analysis, and it is found on every smartphone today. Students in the field of bioacoustics are interested in anatomy and neurophysiology of organs involved in sound production and detection, including their shape, muscle action, and activity of neuronal networks involved. Of special interest is coding of signals with action potentials in the latter.

BPH617 Thermodynamics of Biological Processes

الديناميكا الحرارية فى العمليات البيولوجية

Thermodynamic aspects of biological processes cover heat generation and energy dissipation of live cell growth process, thermodynamic prediction of kinetic parameters (e.g. yield coefficients, growth rate, specific rates, affinity constants), metabolic heat production, Gibbs energy dissipation for aerobic, fermentative, and autotrophic cell growth, biocalorimetry and its applications. Upon completing the course, the student should be able to describe how the three laws of thermodynamics and entropy impact biological systems and can apply fundamental thermodynamics principles to set up and solve problems in physiological systems.

BPH620 Photobiology

التصوير الحيوى

An introduction to light interactions with biological systems. The class will examine the evolution of biological pigments and photoreceptor systems. Emphasis will be placed on how plants and animals detect changes in their environment based on light cues and how they respond at the physiological level. Examples of topics which will be explored are the evolution of vision, photosynthetic energy production, circadian rhythms, phototoxicity and bioluminescence.

BPH621 Bioinformatics

المعلوماتية الحيوية

Bioinformatics is a new multidisciplinary field that includes the development and implementation of computational methods and tools suitable to handle, decipher and interpret the plethora of bio-molecular data derived nowadays, acting as a bridge between bioinformation and biological knowledge extraction. It is recognized that bioinformatics is fuelling the rise of translational research and the success of molecular medicine. The aim of the course is to provide an introduction to key concepts and methods in bioinformatics. Emphasis will be put on efficient algorithms and techniques used in common applications for the analysis of genetic sequences. The focus will be on computational methods in Genomics and Proteomics. In Genomics, computational methods will include DNA sequencing and fragment assembly, identification of genes in DNA, gene regulation, expression, large data arrays, and methods to study genetic diversity. In Proteomics, computational methods will embrace similarity, homology and analogy, protein folding and protein structure. Topics covered: comparison and alignment of two or more sequences, indexing and searching of sequence databases, motif discovery, searching with sequence patterns, gene prediction as well as mapping and assembly of data from genome sequencing. Necessary basic knowledge of molecular biology will be communicated throughout.

BPH622 Artificial intelligence

الذكاء الإصطناعى

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviours on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. In deep learning, a convolutional neural network or CNN is a class of artificial neural networks or deep neural networks, most commonly applied to analyse visual imagery. Common applications include image analysis and processing (including biomedical imaging), face detection, object detection which has massive amounts of usage in many domains, emotion analysis, more complex usages include uses in self driving cars, etc. the course will cover an understanding neural networks, deep neural network architectures, introduction to tensor flow and Keras, training a deep neural network, gradient-based optimization, chaining derivatives and backpropagation, loss functions, optimizers, initializers, batch-normalization, dropouts, understanding image data, understanding the convolution layer, filters and feature maps and pooling layer. the conventional as well new neural network architectures would be discussed including LeNet-5, AlexNet, VGGNet, ResNet, XceptionNet, SENet,..etc. Applications of AI and deep learning in health care and medical imaging would be taught.

BPH623 Advanced Biomaterials

مواد حيوية متقدمة

The course would provide a general overview of biomaterials and its applications including bioactive materials and drug delivery systems. Interaction between human tissue and biomaterials. Focus areas include the principles and applications of biomaterials with specific physical, chemical, and mechanical properties which, for example, serve as substrates for tissue-engineered constructs, cell and drug delivery systems, or coatings of implantable devices. Contents would cover and overview of classification and use of biomaterials in biomedical applications, identification of the critical properties required for specific medical applications and select the optimal biomaterial for the job, temporary or permanent implants and biodegradable materials. Applied topics of biomaterials would also be discussed including manufacturing and characterization of biomaterial, methodology for manufacturing of

biomaterials (including 3D-printing), analysis of physical, chemical, and mechanical properties of biomaterials, tissue-material interactions, biocompatibility of biomaterials, bioactivity of biomaterials, explain methods to repair and regenerate injured or lost functional tissue with materials, autologous cells or stem cells. Emphasis will also be placed on biomaterials as a drug delivery system

7– برنامج فيزياء الفلك وعلوم الفضاء (Astrophysics and space science Program)

SPA601 Space Environment

بيئة فضائية

Nature of the space environment and how spacecraft interact with it, spacecraft environments such as Vacuum Environment, Neutral Environment, Plasma Environment, Radiation Environment, Micrometeoroid/Orbital Debris Environment. Destructive effects such as self-contamination, materials erosion by atomic oxygen, electrical discharges due to spacecraft charging, degradation of electrical circuits by radiation, and bombardment by micrometeorites.

SPA602 Advanced Space Plasma

بلازما الفضاء المتقدمة

The origin and effects of electron/ion/neutral collisions and plasma conductivity, the formation of the ionosphere, ionospheric currents, magnetospheric convection and dynamics, and solar wind-magnetosphere coupling.

SPA603 Fundamentals of Remote Sensing

أساسيات الإستشعار عن بعد

Definition and overview of remote sensing and remote sensing system, Electromagnetic radiation, terms and definitions, laws of radiation, electromagnetic spectrum, sources of electromagnetic radiation. Interactions between electromagnetic radiation and atmosphere, Remote sensing systems: active and passive systems, imaging and non-imaging systems, resolution—spatial, spectral and temporal. Orbits and platforms for Earth observation, Earth observation satellites (Land Remote Sensing Satellite (Landsat), Sensors used in Earth observation satellites and their Geometric and other characteristics.

SPA604 Meteorology and Climate Science

علم الأرصاد والمناخ

Introduction to meteorology and atmospheric dynamics, tropical and extra-tropical weather systems, Climatology and Components of the Earth's climate, Annual and semi-annual cycles, Climate variability, Oceanography, Role of oceans in weather and climate, Oceanographic parameters and circulation, Air-sea interactions.

SPA605 Geophysics

جيوفيزياء

Continental Drift, Sea floor spreading, Plate tectonics, interior structure of the earth, Types of seismic waves, earthquake Geographic distribution, seismic wave interaction with interfaces, Snell law, Fermat path, Magnetic susceptibility and permeability, polemagnetism and polar wander curves, gravity field, Geoelectric field.

SPA606 Space Geodesy

جوديسيا الفضاء

Coordinate systems: Earth-based, global and regional, Establishing coordinate systems from space-based observations, Global Positioning System (GPS): theory and implementation, Geographic information system (GIS): theory and implementation, Scientific applications of space Geodesy, continental drift, Earth-moon separation.

SPA607 Remote Sensing and GIS Applications

الإستشعار عن بعد وتطبيقات أنظمة المعلومات الجغرافية

Imaging spectrometry and its application, satellite sensors (laser; fluorescence spectroscopy) and their application. Role of meteorological satellites and onboard systems in assessing cyclones/typhoons, rainfall, atmospheric humidity profile. Greenhouse gases and their atmospheric chemistry, Global warming and climatic change, Watershed hydrology and integrated soil and conservation planning of watersheds, Geological disasters (landslides, earthquakes and volcanoes).

SPA608 Artificial Intelligence for Space Applications

الذكاء الإصطناعى لتطبيقات الفضاء

The course gives a review on the applications of artificial intelligence in the field of space science and identify open research questions and challenges. In particular, the using of AI in space weather forecast and prediction of several solar active parameters.

SPA609 Space Chemistry

كيمياء الفضاء

The course gives an introduction to space chemistry and chemical processes under extreme conditions (temperature, pressure, high or low density, bombardment by cosmic rays), and their impact on the early development of our solar system, as well as providing a deeper under-standing of processes in earthly regions where conditions approCHM those of extraterrestrial areas. The course includes topics of research methods used in space chemistry, chemical composition of celestial bodies and solar system, nuclear reactions and sources of stellar energy, evolution of stars and synthesis of elements, formation of organic compounds due to action of protons in solar and cosmic radiation, chemistry and cosmology-primary synthesis of organic compounds.

SPA610 Satellite Orbits and Sensors

قدرات الأقمار الصناعية والمستشعرات

Basic elements of orbital mechanics; in particular to understand orbital elements, and to compute orbits from given initial data. This will be done using a variety of analytical and numerical tools, compute examples for Geostationary and polar circular orbits, compute the ground traces of some circular orbits, observation of satellites, ground traces and tracking satellites, the basic construction of several scientific satellite sensors and data.

SPA611 Photogrammetry

المسح التصويرى

Fundamentals of aerial photogrammetry, Aerial cameras, Processing of black/white, color, black/white infrared, color infrared films, film density and characteristic curves. Aerial flight

planning, Basic Geometric characteristics of aerial photographs scale, ground coverage and resolution of aerial photos, tilt-and relief displacement. Stereo vision, stereo model and stereoscopes, Measurement of height from aerial photos, parallax and parallax measurement, Satellite sensors for stereo coverage, along track/across track stereo scanning. Principles of stereo photogrammetry, Principles of satellite photogrammetry, Principles of radar grammetry and synthetic aperture radar interferometry, Plotting instruments, Aerial triangulation, control and mapping. Principles of digital photogrammetry, cartography and map making.

SPA612 GNSS Remote Sensing

الإستشعار عن بعد للنظام العالمى للملاحة

The course provides an overview of the state of the art of Global Navigation Satellite System (GNSS) remote sensing technique. Also addressed are relevant challenging issues associated with GNSS remote sensing services and the performance enhancement of GNSS remote sensing to retrieve different meteorological parameters accurately and reliably. The course includes an introduction to GNSS, GNSS Atmospheric and Multipath Delays, Status of GNSS Remote Sensing, Atmospheric Sensing, Ocean, Sensing, Hydrology, Sensing and Mapping.

SPA613 Image Interpretation and Analysis

تحليل وتفسير الصور

Principles of visual interpretation of aerial photos and satellite imagery. Recognition elements and interpretation keys for visual interpretation. Techniques of visual interpretation, Basic interpretation equipment. Interpretation of aerial photos, multispectral imagery, thermal imagery, side-looking airborne radar imagery and synthetic aperture radar imagery. Principles of data transfer and assessment of interpretation accuracy. Introduction to digital image processing. Fundamentals of computers and image processing systems, image analysis and digital data format, image rectification and registration Image enhancement techniques, Contrast stretching, edge enhancements and filtering, Fourier space enhancements and spectral rationing.

SPA614 Space Mission Design and Operation

تصميم المهمات والعمليات الفضائية

Orbital dynamics and launch vehicles, Attitude measurement and control, Power generation and storage, Telemetry and command, data management, Mechanical design and testing, Thermal design and control, Payload design considerations

SPA615 Geoinformatics

المعلوماتية الأرضية

Vector data structures, Raster data structures, Data inputting, editing and topology in GIS, Integration of spatial and non-spatial data. Map projections and data transformations in GIS, Spatial data analysis (vector-based), Spatial data analysis (faster-based). Digital elevation model (DEM) and its applications, Remote sensing and GIS data integration, Errors and accuracy evaluation in GIS (data quality and sources of errors).

SPA616 Geological Remote Sensing

الإستشعار عن بعد الجيولوجى

Principles of remote sensing in Geology, Aerial photo/satellite image interpretation in lithological interpretation, Aerial photo/satellite image interpretation in structural analysis.

Geological interpretation of thermal remote sensing data, Geological interpretation of microwave remote sensing data, Hyperspectral remote sensing for lithological mapping and mineral exploration. Organization and design of spatial/non-spatial Geoscientific data under a GIS environment, Integration of Geoscientific data under a GIS environment Remote sensing and GIS in oil and mineral exploration. Remote sensing and GIS in mineral exploration and management, Principles of Geostatistics and applications in Geosciences.

8– برنامج الفيزياء النظرية (Theoretical Physics Program)

PHY668 Mathematical Physics III

فيزياء رياضية III

Calculus of variations – Partial differential equations – Integral Equations – Group Theory – Numerical Methods – Tensors and Differential Manifolds.

PHY669 Quantum Physics III

ميكانيكا الكم III

Angular momentum and the rotation group – Spin and identical particles – Isospin – Time independent and time dependent perturbation theory – Applications to atoms and molecules including Thomas-Fermi and Hartree-Fock atoms – Approximate methods – EPR paradox and Bell type theorems – Quantum Entanglement – Interaction of radiation with matter – Collision theory – Second quantization.

PHY670 Classical Mechanics (III)

ميكانيكا كلاسيكية

Lagrangian Formulation of Mechanics; Constraints and Configuration Manifolds; Symmetries and Conservation laws – Hamiltonian Formulation of Mechanics; Hamilton's Equations of Motion (Simplistic ApproCHM) – Canonical Transformations; Action-Angle Variables; Poisson brackets and Invariants; Integrable Systems – Canonical Perturbation Theory – Adiabatic Invariants; Rapidly Varying Perturbations – KAM theorem; Non-integrability and Chaos in Hamiltonian Systems – Introduction to Continuum Dynamics and Classical Fields (Sine-Gordon Equation; Klein-Gordon equation).

PHY671 Statistical Physics II

فيزياء إحصائية II

Interacting particles – Chemical equilibrium – Quantum statistical mechanics – Phase transitions – Transport Theory – Transport Coefficients – Ferromagnetism – Fluctuations – Renormalization group – Lattice systems – Dissipative dynamics.

PHY672 Physics of Particles and Fields

فيزياء الجسيمات والمجالات

Aspects of Classical Field Theory – Aspects of Quantum Field Theory – Particle Groups and Symmetries – Forces and Interactions – Feynman Diagrams – The Standard Model of Particle Physics – Higgs Mechanism – Path-integral Formalism.

PHY673 Classical Electrodynamics II

الكتروديناميكا كلاسيكية II

Maxwell's equations –Electromagnetic waves in Vacuum and Matter – Potential and Fields – Relativistic-Covariant formulation of electrodynamics.

PHY674 Computational Physics I

فيزياء حسابية I

Numerical methods for quadrature solution of integral and differential equations, and linear algebra. Finite difference methods, finite element techniques, solving a system of equations. Use of computation and computer graphics to simulate the behavior of complex physical systems. Monte Carlo statistical methods, and their application to a variety of physical problems.

PHY675 Density Functional Theory I

نظرية الكثافة الوظيفية I

Overview and elementary example – Functionals and how to minimize them – Wavefunction quantum mechanics: From one to many electrons – Modern density functional theory – The local density approximation – Spin density functional theory.

PHY676 Physics Beyond the Standard Model I

الفيزياء وراء النموذج القياسى

Standard Model: Brief reminder and Problems – Anomalies – Phenomenology of Physics Beyond the Standard Model – Aspects of Effective Field Theories

PHY677 Astrophysics and Cosmology I

الفيزياء الفلكية وعلم الكونيات I

This course focuses on developing the modern theory of structure formation in cold dark matter Universe. Part (1); The special and general theories of relativity. Part (2); The unperturbed state of the universe: Dynamics of expanding Universe – The FRW metric and Friedmann equations – The Thermal History of the Universe (Hot Big Bang model) – Decoupling and Thermodynamics of relic particles – Nucleosynthesis and Recombination – Introduction to Inflationary Theory.

PHY678 Relativity and Gravity I

النسبية والجاذبية I

The Special Theory: History and Model Building – The Elements of Relativistic Mechanics – Vector and Tensor Analysis in Special Relativity – Tensor Calculus, Integration and Symmetry – Perfect Fluids in Special Relativity – Curved Manifolds and Physics in Curved Space-time.

PHY679 Fluid Dynamics I

ديناميكا الموائع I

Why are fluids useful models? – Viscous flows – Navier-Stock's Equations – Vorticity flows – Turbulence, Chaos, and Stability – Diffusion, Conduction, and Transport Coefficients

PHY680 Computational Physics II

فيزياء حسابية II

This course is a sequel to "Computational Physics (1)". Topics covered include choice of programming language, design of programs, introduction to compiled language programming (C, FORTRAN or Python), introduction to interpreted language programming (Matlab, Maple or MATematica), properties of floating-point numbers, solution of large linear eigensystems, numerical differentiation and integration, partial differential equations, Monte Carlo strategy and methods in statistical and quantum physics, selected advanced topic, course projects.

PHY681 Density Functional Theory II

نظرية الكثافة الوظيفية II

Some exact conditions satisfied by LDA – Some exact conditions not satisfied by LDA – Exchange-correlation holes and the reliability of LDA – Generalized gradient approximations – Adiabatic connection formula, static correlation, and hybrids – Other topics.

PHY682 Physics Beyond the Standard Model II

الفيزياء وراء النموذج القياسى II

Standard Model: Brief reminder and Problems – Anomalies – Phenomenology of Physics Beyond the Standard Model – Aspects of Effective Field Theory – Aspects of Grand Unified Theories – Neutrinos and Dark Matter – Aspects of Supersymmetry.

PHY683 Astrophysics and Cosmology II

الفيزياء الفلكية وعلم الكونيات II

Part (1); The Perturbed State of the Universe: Relativistic Cosmological Perturbations – Perturbed Boltzmann equation – Inhomogeneities – Anisotropies – Initial Perturbations from Inflation – Newtonian Perturbation Theory – Cosmological Probes – Conclusions. Part (2); The standard model of cosmology. Part (3); The dark sector in cosmology: Experimental evidence – Particle Models of dark matter – Models of dark energy.

PHY684 Relativity and Gravity II

النسبية والجاذبية II

The Principles of General Relativity – Einstein Field Equations – The Schwarzschild Solution and Black Holes – Gravitational Waves – Relativistic Cosmology – Cosmological Models – Modified Gravity Models.

PHY685 Fluid Dynamics II

ديناميكا الموائع II

Sound Waves – Gravitational Waves – Relativistic Fluids – Superfluids – Einstein-Euler Equations – Numerical Relativistic Hydrodynamics – Modelling Dissipation.

برامج قسم الكيمياء

أولا : مرحلة الدبلوم

1- دبلوم الكيمياء التحليلية

Compulsory Courses

CHM501 Colored and spectral analysis

التحليل اللونى والطيفي

Theory of spectrophotometry and colorimetry, Classification of methods of color measurement, Photoelectric colorimeters, and spectrophotometers. The components of optical instruments, in terms of electronics and optical components, and the concept of signal to noise. Various molecular spectrometric methods are covered including UV-Vis spectrometry, basics of molecular fluorescence, molecular phosphorescence, chemi-, and bioluminescence. Basics of atomic spectrometric methods including methods of atomic absorption, atomic emission, plasma, and atomic fluorescence methods and their analytical applications. Introduction to infrared spectrometry; application of infrared spectrometry. Evaluation of analytical data. The need for quality assurance. An overview of advanced techniques in spectroscopic methods

CHM502 Chromatographic analysis

التحليل الكروماتوغرافي

General description of chromatography, the rate theory of chromatography, important relationships for chromatography – qualitative and quantitative analysis by chromatography.
Liquid liquid extraction - extraction of organic complexes - extraction of metal – organic complexes – extraction of ion association complexes.
Gas chromatography - principles instruments - stationary phase – applications – high performance liquid chromatography – scope of HPLC-column efficiency – instruments – mobile phase. Gas chromatography- mass spectrometry.
Partition, adsorption, ion exchange, size exclusion, supercritical fluid chromatography.
An overview of advanced techniques in chromatographic separation methods

CHM503 Radioanalytical chemistry

كيمياء تحليلية إشعاعية

Radioactive isotopes – radioactive decay products – decay process – radioactivity – instrumentation - measurement of alpha and beta radioactivity instrumentation – measurement of alpha and beta particles – measurements of gamma radiation – neutron activation methods – neutron sources - interactions of neutron with matter – theory of activation methods – classification of activation methods – isotopic dilution methods – principle – applications – radiometric methods principles and applications.

CHM504 Practical: Industrial and water analysis (I)

عملي: التحليل الصناعي وتحليل المياه (1)

-Determination of pH, turbidity, Alkalinity, Acidity, Total hardness, Residual and available Chlorine.

CHM505 Sensors in analysis

المجسات في التحليل

Types of sensors, types of membranes, sensor signal conditioning, calibration, and readout. Ionophores and selective ligands in electrode technology, selectivity methods. Applications of sensors, environmental applications, pharmaceutical applications, industrial applications, biological applications

CHM506 X-ray analysis

التحليل بالأشعة السينية

Fundamental principles, instrument components, X–ray fluorescence methods, X-ray absorption methods, X–ray diffraction methods. The electron microprobe.

CHM507 Electroanalytical methods of analysis

طرق التحليل الكهروكيميائية

Principles of electrolysis. electrodeposition, coulometric methods of analysis, voltammetry, polarography and conductometric methods. Potentiometric methods, overview of potentiometric methods. Indicator electrodes, ion-selective electrodes direct potentiometry. Potentiometric titrations, potentiometric methods involving enzymes. The electrochemical generation of chemiluminescence biosensors. Recent techniques.

CHM508 Practical: Industrial and water analysis (II)

عملي: التحليل الصناعي وتحليل المياه (2)

Determination of Sulfate and Phosphates, oil and grease, Iron and Fluoride, Suspended, settleable, Volatile and fixed solids.

Elective courses

CHM509 Analytical methods in some industrial sectors

الطرق التحليلية في بعض القطاعات الصناعية

An overview of the current separation methods in some sectors including iron and steel industry, textiles industry, paints industry, ceramics industry, cement industry, electroplating industry, petrochemicals industry, etc.

CHM510 Pollution control and management

التحكم في التلوث وإدارته

An overview of environmental pollution, types of pollutants, atmospheric pollution: sources, effects and control, Global warming, ozone layer depletion, water pollution: sources, effects and control, solid waste treatment technologies, monitoring and reporting

CHM511 Solar and nuclear energy

الطاقة الشمسية والنووية

Methods of converting solar energy into electricity, heat and solar fuels, different solar cell technologies, principle of a solar cell, fabrication of solar cells, Photovoltaic (PV) devices.

Introduction to nuclear science and nuclear energy, The operating principles of nuclear reactors, The various steps in the nuclear fuel cycle, Nuclear waste, Nuclear safety, The pros and cons of nuclear energy.

CHM512 Characterization techniques

تقنيات توصيف المواد

Fourier transform infrared, X-ray diffraction, scanning electron microscope, transmission electron microscope, energy-dispersive X-ray spectroscopy, X-ray photoelectron spectroscopy, Diffuse reflectance spectroscopy, X-ray fluorescence, ^{13}C NMR and ^{1}H NMR spectroscopy, surface area analysis, Thermal analysis.

CHM513 Solid-phase extraction (SPE)

الاستخراج باستخدام الطور الصلب

Introduction, Physical fundamentals of SPE, Selective materials for solid-phase extraction in environmental analysis (the recent advances in the development of new sorbent materials for solid-phase extraction for improving the removal interferences from the matrix in environmental analysis), Types of SPE using nanomaterials, Adsorption mechanism management on functionalized nanomaterials, Functionalized nanomaterials in dispersive SPE (demonstrate and highlight the recent advancements in the development of new functionalized nanomaterials for SPE applications), applications on chemistry of wastewater treatment.

CHM514 Instrumental analysis

التحليل بالاجهزة

Advanced techniques in Chromatographic separation methods (ultra-performance liquid chromatography- liquid chromatography coupled with tandem mass spectrometry, etc.)
Advanced techniques in spectroscopic methods (inductively coupled plasma–optical emission spectroscopy, surface-enhanced Raman spectroscopy, and laser-induced breakdown spectroscopy, Auger electron spectroscopy)

2- دبلوم الكيمياء التطبيقية
Compulsory Courses

CHM515 Industrial Organisation/ Chemical Technology/ Unit operations

إدارة صناعية و تكنولوجيا كيميائية وعمليات موحدة

Introduction to Industrial management, feasibility studies, Business plan, SWOT analysis, Gap analysis, Gap closure and Competitiveness. 2- Market research, Product and Process Innovation. Project management, Supply chain and supply management. Plant design principles. Conditions for location selection. Plant Layout principles. Flow sheets. Equipment sketch drawing. Reading layout drawings. Bottle necks. Planning and setting up of modern factories. Procurement principles and Good Manufacturing Practice. The UN regulation for the transportation of hazardous goods. UN classification of hazardous goods. UN labeling requirements.
Requirements for the manufacture of hazardous goods packaging. Quality in industry. Egypt's industry modernization. Organizational infrastructure of Industry in Egypt. Unit Operations definition and classification. Heat and energy balances.
Energy transfer. Mass transfer. Heat exchangers. Utilities in chemical factories: Steam boilers, cooling towers, water treatment etc. Applications of selected unit operations in the food

industry, chemical industry and pharmaceutical/cosmetics industries. For a selected number of Unit Operations study underlying physico-chemical principles, equipment features and their outline drawings, mechanisms of operation, applications for various industries and various materials. In addition, interrelation with other unit operations and most importantly alternative solutions.

CHM516 Solid waste management

- ادارة المخلفات الصلبة

Waste characterization. Collection and separation. Thermal conversion. Biological treatment. Land filling, waste stabilization. Recycling of solid waste. Paper recycling. Plastics and Glass recycling. Recent topics.

CHM517 Surface and colloid chemistry

- كيمياء السطوح والغرويات

colloidal properties: optical, electrical and kinetic properties, Physical and chemical adsorption. Classification and properties of interfaces: gas-solid, gas- liquid, liquid – liquid and solid - liquid interface. Adsorption isotherm. Electrical aspects of surface chemistry. General properties of colloidal systems and colloidal stability Adhesion, Contact angle and wetting, flotation, flocculation and detergency Association structure and micelle formation. Emulsion and foams. Rheology of emulsions. colloidal applications in industry: ink and paint manufacture. Recent topics.

CHM518 Analytical methods in chemical industries

- طرق التحاليل فى الصناعات الكيميائية

An overview of analytical methods in chemical industries. Instrumentation utilized in these approCHMes, including elemental analysis (CHN analyzer, karl fisher, kjeldahl method, XRF), thermal analysis, chemical separations (chromatography including IC, HPLC, GC, GC/MS), spectroscopy analysis: molecular spectroscopy (UV-vis, FTIR), molecular fluorescence and phosphorescence, atomic absorption spectrophotometry, atomic emission spectrophotometry. Scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS). Electroanalytical methods of analysis: electrodeposition, voltammetry, polarography, potentiometry. Radiochemical methods of analysis. Recent topics.

CHM519 Practical

- مقرر عملى

يتم تحديد المحتوى طبقا لتخصص الطالب

CHM520 Total quality management (TQM)

- ادارة الجودة

Brief Introduction to Industrial organization\management and linking it to quality management: -SWOT analysis, Gap analysis. Gap closure. Competitiveness. Market share. Market research. Product and Process Innovation. Technology transfer. Intellectual property. Patents. Trademarks. Positioning in international markets, Supply chain management, Physical distribution. Cash flow. Payback period. Return on investment. Breakeven point. Customer relations. Ethics in industrial management. Terminology such as: Total quality Management, Quality and Profitability. Quality Management, Quality Improvement, Accuracy, Sample, Specification, Reliability, Repeatability. Reproducibility, Six Sigma, Strategic Planning,

System Audit, Control, Corrective Action, Cost of Conformance, Cost of Quality, Customer Relationship Management. Quality Principles and Philosophies covers Deming's 14-point Management Philosophy and the principles set by others like Juran 10 point programme, Crosby 14 step [programme, Shingo, Ishikawa, Drucker 5 principles of management and Ohno seven forms of waste. In addition to the quality process model and the 8 QM Principles of ISO 9000:2000. Quality systems HACCP, JIT, Health Safety and Environment ISO systems. ISO 14000 environmental standard. Quality control circles. The application part on Egypt covers standardization bodies, certification bodies, accreditation bodies and metrology bodies, and cooperation with international bodies. Egypt Excellence Award. Quality for Egypt EXPORTS.

CHM521 Advanced techniques in electrochemistry

- **تقنيات متقدمة فى الكيمياء الكهربية**

Electrochemical Impedance Spectroscopy (EIS). Basics of Electrochemical Impedance Spectroscopy. Advantages of EIS Technique. Applications of EIS Determination of Rate of Oxide film Thickness. Applications of EIS for determination the inhibition efficiency of inhibitor. Corrosion Mechanism of metals under a single droplet of electrolyte. Determination of Atmospheric Corrosion rate of Steel and Alloys under a Cyclic Wet – Dry Condition. Application of AC impedance for determination of the water absorption by organic coatings. Evaluation of Anticorrosive Performance of the film by Impedance Method. Electrochemical Quartz Crystal Microbalance (EQCM): Introduction.
Application of EQCM in Electrochemistry. Scanning Kelvin Probe (SKP): Introduction. Application of Scanning kelvin Probe to Electrochemistry. Recent topics.

CHM522 Advanced Materials and Techniques

- **مواد وتكنولوجيات متقدمة**

An introduction of shape memory technology (SMT). Piezoelectric materials. Nanomaterials. Self-Healing materials. Self-Cleaning materials. Ultralight materials. Biomaterials. Advanced plastic materials. Energy harvesting and storing materials. Advanced semiconductor/conductor materials. Packaging manufacture. Smart packaging. Active packaging. intelligent package. Related environmental issues. Recent topics.

CHM523 Nano technology and applications

تكنولوجيا النانو وتطبيقاتها

Nano chemistry and new materials -preparation of nanoparticles (physical, chemical and green routes), Properties of nanomaterials (physical, chemical, optical and magnetic properties), Introduction to nanoparticles and nanocomposite, preparation, full characterization, application and benefits (medical, industrial, environmental, energy generation and storage, food processing & packaging drug delivery). Recent topics.

CHM524 Practical

- **مقرر عملى**

يتم تحديد المحتوى طبقا لتخصص الطالب

Elective courses

CHM525 Chemistry and technology of textiles and dyes

- **كيمياء وتكنولوجيا النسيج والصبغات**

Natural fibers (cotton fibers – natural silk – natural wool – mineral fibers – glass fiber). Manmade fibers (viscous – acetate – nitro cellulose – copper ammonium fibers). Synthetic fibers (polyamide – polyester – acrylic – polyolefin – mineral fibers). Light colour and dyestuffs – synthesis of dyestuffs – basic dyes – mordant dyes – Vat dyes – solubilized vat dyes – Sulphur dyes – fluorescent brightening agent – azoic colours. Recent topics.

CHM526 Chemistry and technology of building materials

- كيمياء وتكنولوجيا مواد البناء

Natural and artificial building materials. Gypsum and cements, Introduction to cements, types of cements. Portland cement, raw materials and manufacturing processes (dry and wet). Production, reactions in the kiln, chemical composition, clinker, mortars, concrete, hydration, setting. Properties of different cements, testing and specifications of cements, decay and durability of cements, uses of different cements. Ceramics, raw materials, clays (mineralogy, clay composition), Physical and chemical properties of clays, manufacturing process, advanced bio and nano ceramics. Recent topics.

CHM273 Chemistry and technology of paints

- كيمياء وتكنولوجيا البويات

Introduction. Raw materials of paint (e.g., pigment, resin, filler, solvent, additives), with emphasis on alkyld resins and water-based emulsions. Principle of paint formulation. Paint production (technique of paint preparations). Apparatus and routine lab testing. Surface preparation and paints application. Types of paints. General problem of paints. Recent topics.

CHM528 Chemistry and technology of printing inks

- كيمياء وتكنولوجيا احبار الطباعة

Printing ink raw materials. Printing systems. Printing ink manufacture and testing. Rheology of printing ink and pigment dispersion. Solvent based ink and water-based inks. Ink drying mechanisms. Ink in relation to paper. Health, safety and environmental aspects. Recent topics.

CHM529 Chemistry and technology of Ferrous and nonferrous materials

- كيمياء و تكنولوجيا الفلزات الحديدية وغير الحديدية

Raw materials [iron ores, copper ores, aluminum ores, lead ores, zinc ores, chromate ores titanium ores – manganese ores – silica ores, fluxing materials, fuel] Preparation of raw materials (washing – gravity separation – flotation – magnetic separation – magnetizing roasting – electrostatic separation).Production of pig iron (blast furnace – direct production process – new technique on pig iron production, raw melt methods) Production of steel different techniques (old and new techniques) – chemical reaction in any processes. Production of copper (reaction during the production. Production of aluminum (reaction during the production) Production of ferro – chrome, Ferro – silicon, ferro – titanium, ferro manganese – lead, sodium chromate, sodium titanate, titanium, chrome and manganese. The chemical reaction at eCHM process and the factor affecting them. Application of these materials. Recent topics.

CHM530 Chemistry and technology of petrochemicals

- كيمياء وتكنولوجيا البتروكيماويات

Introduction to petrochemicals raw materials. Gaseous raw materials (gases – refinery gases – synthetic gases (mixture of gases). Liquid raw materials (aromatic hydrocarbon – alicyclic

(saturated paraffins) – Solid hydrocarbons. Long chain alpha olefins. Processing of raw materials (nitration – oxidation – halogenation – sulphonation – sulfochlorination and sulpho-oxidation) Synthetic detergents (definition – advantage – composition – types – physical and chemical properties. Lubricating oils (definition of lubricating oils – types of lubricating oils) Natural lubricating oil (method of obtaining oils – physical and chemical properties – additives, e.g., Antioxidant – dispersant – viscosity index improper – extreme pressure additive). Synthetic oils (properties – preparation – field of application). Recent topics.

CHM531 Chemistry and technology of plastics

- كيمياء وتكنولوجيا البلاستك

High molecular mass compounds. Synthesis of polymer. Methods of polymerization Structure and properties of polymer. Solubility and properties of polymer processing (compression, blow, injection, molding, extrusion). Industrially important thermoplastic and thermosetting polymers. Mechanical properties of polymer. Analysis and testing of polymer. Degradation of polymer. Adhesion and heat-sealing Finishing operation of plastic. Recent topics.

CHM532 Chemistry and technology of paper and paperboard

- كيمياء وتكنولوجيا الورق والكرتون

Raw materials for paper and board manufacture. Pulping processes (mechanical pulping-semichemical pulping- chemical pulping). Pulp bleCHMing. Screening and cleaning of pulp. Non-fibrous additives to paper making stock. Preparation of stock for paper making. Paper manufacture (paper mCHMine). Surface treatment (sizing, pigment coating, calendaring). Paper testing. Environmental aspects of paper and paperboard industry. Recent topics.

CHM533 Chemistry and Technology of fertilizers

- كيمياء وتكنولوجيا الاسمدة

General Concepts, Classification of Fertilizer Grade. Short History of Fertilizer Development. Foundation for the Modern Fertilizer Industry. Phosphate Fertilizers, Nitrogen Fertilizers, Potash Fertilizers, Other Nutrients, Compound Fertilizers, Fluid Mixed Fertilizers. Production Technology of Ammonia. Primary Reforming, Secondary Reforming, Carbon Monoxide Conversion, Carbon Dioxide Removal, Methanation, Compression, Ammonia Synthesis, Thermodynamics and Kinetics, Ammonia Converter Design. Introduction, Properties of Urea, Urea Processes, Recycle Processes, Total-Recycle Processes, Stripping Process-Based Plants, Urea Finishing Processes, Granulation. Ammonium Nitrate. Introduction, Ammonium Nitrate Properties, Commercial Forms of Ammonium Nitrate, Process Chemistry, Production Technology, Neutralization, Concentration and Stabilizing Agents, Finishing Processes. Single Superphosphate (SSP). Fundamentals of SSP, The advantages of SSP, Suitability of Phosphate Rocks, Chemistry of SSP, Kotka superphosphate, Production Methods, Product Properties. Triple Superphosphate (TSP). Introduction, Fundamentals of TSP Production, Technology of TSP Production Powder or Granular TSP by the Den Process, Reaction, Denning, Storage/Curing, Granulation, Ex-Den Granulation, Direct Slurry Granulation. Recent topics.

CHM534 Chemistry of basic industries

- كيمياء الصناعات الاساسية

Introduction to the Chemical Industry. Sulfuric Acid and Its derivatives. Industrial Gases: nitrogen, oxygen, etc. Inorganic Nitrogen Compounds. Chemicals from Limestone: Soda Ash (Sodium Carbonate), Sodium Silicate, etc. (Silica Gel Sodium Chloride Derivatives and

Miscellaneous Inorganics: Sodium Chloride, Caustic Soda (Sodium Hydroxide, Caustic), Hydrochloric Acid (Muriatic Acid) and Miscellaneous Inorganic Chemicals - Basic Organic Chemicals. The Chemical Industry and Pollution. Recent topics.

ثانيا : مقررات تمهيدي الماجستير

1- برنامج الكيمياء اللا عضوية

Compulsory Courses

CHM601 Advanced Analytical chemistry

كيمياء تحليلية متقدمة

Statistics and computational tools in analytical chemistry, standardizing analytical methods, sampling, quality control and assurance. An introduction to modern analytical instrumentation and techniques in the areas of spectroscopy, chromatography, and electroanalysis. Instrumentation and experimental technique for high-resolution chromatography and coupling of chromatography with mass spectrometry and its applications in food, pharmaceutical and environmental analysis areas. Recent methods in radiochemical analysis

CHM602 Industrial Inorganic Chemistry and Energy (I)

الكيمياء الصناعية غير العضوية والطاقة (1)

- Hydrogen: Economic Importance, manufacture processes, application Hydrogen peroxide and sodium peroxide.
- Phosphorus and its compounds: Inorganic phosphorus compounds, Raw materials, phosphoric acid, Salts, Organic phosphorus compounds and their manufacture
- Sulfur and Sulfur compounds: Production from elemental sulfur deposits, from Hydrogen sulfide and dioxide and from pyrites. Applications, sulfuric acid production
- Halogens and Halogens compounds, Economic importance and applications, Fluorspar, Fluorapatite, organofluoro compounds, hydrochloric acid, manufacture of chlorine, oxygen compounds; perchlorates
- Chromium and its compounds
- Silicones, industrial silicone products, silicone oils, Rubbers, Resins.
- Inorganic fibers (silicon carbide fibers).

CHM603 Advanced materials for energy storage and conversion

المواد المتقدمة لتخزين الطاقة وتحويلها

1. Carbon Derivatives in Performance Improvement of Lithium-Ion Battery Electrodes Current Status and Trends in Spinel Cathode Materials for Lithium-Ion Battery.

2- Advanced Materials for Energy Storage Devices

I. Recent Advances in Usage of Cobalt Oxide Nanomaterials as Electrode Material for Supercapacitors
II. Recent Developments in Metal Ferrite Materials for Supercapacitor Applications
III. The Place of Biomass-Based Electrode Materials in Next-Generation Energy Conversion and Storage
IV. Synthesis and Electrochemical Properties of Graphene

3- Fuel Cells

I -Dual Performance of Fuel Cells as Efficient Energy Harvesting and Storage Systems

4- Solar Cell

I. Solar Cell Technology: Challenges and Progress

II. Earth-Abundant Materials for Solar Cell Applications
III. Stannate Materials for Solar Energy Applications
5. Recent Topics

CHM604 Chemical separation techniques

تقنيات الفصل الكيميائي

– General description of chromatography, the rate theory of chromatography, important relationships for chromatography – qualitative and quantitative analysis by chromatography
- Liquid - liquid extraction - extraction of organic complexes - extraction of metal – organic complexes – extraction of ion association complexes.
Gas chromatography - principles instruments - stationary phase – applications – high performance liquid chromatography – scope of HPLC-column efficiency – instruments – mobile phase. Gas chromatography- mass spectrometry
Partition, adsorption, ion exchange, size exclusion, supercritical fluid chromatography.

CHM605 Industrial Inorganic Chemistry and Energy (II)

الكيمياء الصناعية غير العضوية والطاقة (2)

- Nuclear fuel cycle nuclear reactor types (Light water, Boiling water, Pressurized water reactors) (Heavy water reactor- fast breeder reactors)
- Nuclear fuel production
- Production of uranium concentrate from ores and separation yellow cake
- ^{235}U EnriCHMent
- Disposal of waste from nuclear power stations.

CHM606 Advanced materials (nanomaterials, porous and functional materials)

المواد المتقدمة (المواد النانونية والمواد المسامية والمواد الوظيفية)

Fundamentals: Standard Definitions of Nanomaterials, Size-dependent properties of nanomaterials, Nanomaterials Fabrication Techniques: Physical, Chemical and Biological Fabrication Techniques, Nanomaterials Characterization Techniques.
Functional Nanoporous Materials: Properties and characterization of Nanoporous materials.
Types of functional Nanoporous Materials:

1. Nanoporous silica, carbon, metal oxide.
2. porous coordination polymer
3. metal organic framework (MOF)
4. covalent organic frameworks (COF)
5. Water sorption nanomaterials.
6. sensing nanomaterials
7. Recent Topics

Elective Courses (Inorganic pathway)

CHM607 Radioactive activation analysis

التحليل بالتنشيط الاشعاعى

- Introduction to basic nuclear chemistry

- Interaction of radiation with matter
- Interaction of neutrons with matter
- Production of neutrons
- Neutron activation analysis
- Applications in chemical trace element analysis
- Application of isotopes for medicine
- Gamma spectrometry

CHM608 Group theory application

تطبيق نظرية المجموعات

Chemical Application of group theory Sym. Point group, Application to chemical structure problems, Matrix representation of groups. The character table, Application to molecular structure, Infrared spectroscopy, Raman spectroscopy, Application to bonding σ , π - bonding

CHM609 Inorganic reaction mechanisms

ميكانيكية التفاعلات غير العضوية

Reaction mechanism of substitution reaction, the general mechanism of square planar substitution complexes Pt (II) and other d metal ions. Substitution of octahedral complexes, replacement of coordinated water solvolysis, electron transfer reactions, synthesis of coordination compounds using electron transfer reactions. molecular rearrangements and reactions of coordinated ligands

CHM610 Physical Inorganic Chemistry

كيمياء غير عضوية فيزيائية

- Complex formation and destruction
- Formation constants and stoichiometry
- Spectrophotometric studies: Identification and characterization of complex compounds (Vis - UV - IR electrometric)
- Solid complex characterization and synthesis methods.

Elective Courses (Analytical pathway)

CHM611 Instrumental analysis

التحليل بالاجهزة

Advanced techniques in Chromatographic separation methods (ultra-performance liquid chromatography- liquid chromatography coupled with tandem mass spectrometry, etc.)
Advanced techniques in spectroscopic methods (inductively coupled plasma–optical emission spectroscopy, surface-enhanced Raman spectroscopy, and laser-induced breakdown spectroscopy, Auger electron spectroscopy)

CHM612 Electroanalytical methods

طرق التحليل الكهروكيميائية

Review of the basics of electrochemistry, modern electroanalytical techniques (redox potentiometry, linear and cyclical sweep voltammetry, hydrodynamic voltammetry, rotating disc electrode methodology, etc.), descriptions of the double layer, chronoamperometry, chronocoulometry, chronopotentiometry, impedance spectroscopy, chemically modified

electrodes spectroelectrochemistry, electrochemical imaging methods, Sources of errors in instrumentation.

CHM613 X-ray analysis

طرق التحليل بالاشعة السينية

Fundamental principles, instrument components, X–ray fluorescence methods, X-ray absorption methods, X–ray diffraction methods. The electron microprobe.

CHM614 Pollution control and management

التحكم في التلوث وإدارته

An overview of environmental pollution, types of pollutants, atmospheric pollution: sources, effects and control, Global warming, ozone layer depletion, water pollution: sources, effects and control, solid waste treatment technologies, monitoring and reporting.

CHM615 Characterization techniques

تقنيات توصيف المواد

Fourier transform infrared, X-ray diffraction, scanning electron microscope, transmission electron microscope, energy-dispersive X-ray spectroscopy, X-ray photoelectron spectroscopy, Diffuse reflectance spectroscopy, X-ray fluorescence, ^{13}C NMR and ^{1}H NMR spectroscopy, surface area analysis, Thermal analysis.

CHM616 Solid-phase extraction (SPE)

الاستخراج باستخدام الطور الصلب

Introduction, Physical fundamentals of SPE, Selective materials for solid-phase extraction in environmental analysis (the recent advances in the development of new sorbent materials for solid-phase extraction for improving the removal interferences from the matrix in environmental analysis), Types of SPE using nanomaterials, Adsorption mechanism management on functionalized nanomaterials, Functionalized nanomaterials in dispersive SPE (demonstrate and highlight the recent advancements in the development of new functionalized nanomaterials for SPE applications), applications on chemistry of wastewater treatment.

Elective Courses (Physical pathway)

CHM617 Advanced Molecular Spectroscopy

التحليل الجزيئي الطيفي المتقدم

1. Raman Vibrational and rotational spectroscopy
2. Electronic Spectroscopy and Magnetic Resonance Spectroscopy
3. Molecular Electronic Spectroscopy
4. Fluorescence and Phosphorescence
5. Lasers and laser spectroscopy
6. Photoelectron and related Spectroscopy
7. Nuclear Magnetic Resonance Spectroscopy
8. Electron Spin Resonance Spectroscopy
9. The Franck–Condon Principle
10. Recent Topics

CHM618 Advanced Quantum Chemistry- Valence Bond ApproCHM

1. Molecular Orbital ApproCHM
2. The Variation Method
3. The Simple Huckel Method and Applications
4. The Extended Huckel Method
5. The SCF-LCAO-MO Method and Extensions
6. Computational Chemistry Methods
    a. Molecular Mechanics ^Force Field Methods
    b. Empirical and Semi-Empirical Methods •
7. Ab Initio Methods

CHM619 Advanced solid-state chemistry

كيمياء المواد الصلبة المتقدمة

1. Crystal classes and symmetries as a basis for space groups
2. The most important crystal structures for AB, AB2, AB3 and other more complex compounds
3. Crystal defects,
4. Relationship between crystal structure, defect structure, composition and properties -
5. Preparative methods such as sol-gel, vapor phase deposition, and chimie douce
6. Advanced Characterization Techniques including electron microscopy, diffraction (X-ray diffraction and neutron diffraction) and spectroscopic methods such as Solid-State NMR
7. Modules on Materials-related aspects such as industrial processing routes to the production of ceramics, cements and glasses.
8. Recent topics

CHM620 Advanced surface chemistry

كيمياء السطوح المتقدمة

Structure, thermodynamics, kinetics, and reactivity of molecules at liquid and solid interfaces, with applications to monolayers, wetting, film growth, catalysis, and atmospheric chemistry.

Brief Outline for the content

1. Introduction to solid and liquid interfaces
2. Interfacial thermodynamics of single and multi-component systems
3. The motions of surface molecules
4. Phases of insoluble monolayers at gas-liquid and gas-solid interfaces and film growth
5. The surface chemical bond
6. Kinetics and dynamics of collisions, adsorption, diffusion, and desorption at gas-solid and gas-liquid interfaces
7. Surface chemical reactions
8. Recent topics

CHM621 Advanced Catalysis

كيمياء الحفز المتقدم

This course is divided into three main chapters: **1. Homogeneous catalysis:** characterization of homogeneous catalysts, ligand effects, mechanistic aspects of the various catalytic reactions, kinetics of homogeneous catalysis and selective catalyzed organic reaction. **2. Heterogeneous catalysis:** types of adsorption isotherm, characterization of solid catalysts, classification of

heterogeneous catalysts, and photocatalysis and its applications in renewable energy and environmental remediation. **3. Catalysis and Green Chemistry:** catalysis as green process, green solvents, basics of organometallic chemistry and chemicals from biomass.

CHM622 Advanced chemistry of colloids

كيمياء الغرويات المتقدمة

The aim of the course is to provide advanced physical-chemical knowledge within the field of Colloid Chemistry, based on a molecular perspective, basic principles of intermolecular interactions and thermodynamics are linked to applications in biological systems and technical applications, including cell membranes, drug formulations, food applications.

Brief Outline for the content

1. Kinetic properties of colloids.
2. Kinetics of Aggregation.
3. Characterization Methods of Colloids: Optical Properties.
4. Colloid stability.
5. Applications of Colloid Chemistry in Science and Industry.

CHM623 Advanced physical chemistry of polymers

الكيمياء الفيزيائية المتقدمة للبوليمرات

This course aims at studying property/structure relations for polymers, the difference between the ideal and real behavior of polymer chains, properties of polymers when existing in the solutions, molten state, solid-state, elastomeric state, amorphous state, and crystalline state, as well as applying thermodynamics on polymer systems, characterization of polymers and their advanced applications.

Brief contents

1. Ideal Chain
2. Real Chain
3. States of order in polymers
4. Thermodynamics of Polymer Systems
5. Structure/Property Relationships
6. Advanced topics in Macromolecular Chemistry
7. Determination of properties of macromolecules

2- برنامج الكيمياء العضوية
Compulsory Courses

CHM624 Design, synthesis, and structure elucidation of a heterocyclic target system

تصميم وتخليق الأنظمة الحلقية الغير متجانسة وتحقيق التركيب الكيميائي

Disconnection rules: Carbon-carbon and carbon-heteroatom disconnection-Formation of a C-C bond- Formation of C-heteroatom bonds- Strategies for designing a synthetic scheme for target system: Application of disconnection approCHM and advanced reaction mechanisms-Nomenclature rules: Fused-, substituted, bridged-spiro-cage systems Application of disconnection-synthon synthetic equivalents approCHM in the solution of synthetic problems-Heterocyclic systems as pharmaceutical, as agrochemicals, in photographic techniques, and as dye precursors.

CHM625 Spectroscopy and molecular structure determination of organic compounds

التحليل الطيفي وتحديد التركيب الجزيئي للمركبات العضويه

Develop an advanced understanding of spectroscopic and chromatographic techniques for the determination and analysis of organic molecules-Ways of interpreting the spectral data- Study the theory and applications of advanced nuclear magnetic resonance (NMR)- Mass spectroscopy (MS), X-ray diffraction- Advanced chromatographic methods (HPLC, GC/MS and LC/MS interfacing techniques).

CHM626 Polymer science and technology

علم و تكنولوجيا البوليمرات

Introduction to the basic principles of polymer science - The chemical, physical, thermal, and morphological features of polymers- Mechanism of polymerization reactions (free-radical polymerization, cationic polymerization, anionic polymerization, condensation polymers)- Polymer terminology-Categories of organic polymers (natural, semi-synthetic and synthetic polymers)- Heterocyclo-polymers, inorganic polymers, synthetic biopolymers, medicinal polymers- Polymer additives (fillers, stabilizers, hardeners, plasticizers, anti-plasticizers, flame retardants, blowing agents, antistatic reagents, colorants...etc...)- Understanding of the link between polymer chemical structures, physical properties, processing methods and ultimate applications-Transition retardation and inhibition- Polymer degradation and polymer recycling.

CHM627 Natural products chemistry

كيمياء المنتجات الطبيعيه

The role of natural products in drug discovery and development- Primary and secondary metabolism- The building blocks of different categories of natural products, enzymes and catalysis- The acetate pathway, polyketides, fatty acids, and macrolides- Plant polyphenols and their applications-Shikimic acid pathway in biosynthesis of phenolic compounds-Physicochemical properties of tannins and chemical ecology-Hyphenated techniques in separation and structure determination of natural products.

CHM628 Physical-Organic chemistry and chemical reaction mechanisms

الكيمياء العضويه الفزيائيه وميكانيكيه التفاعلات

Understanding of organic compounds in terms of reactions and mechanism as well as design logical syntheses of organic compounds using retrosynthetic analysis- Specific topics include reaction kinetics and transition state theory, nucleophilic and electrophilic addition reactions, eliminations, intramolecular pyrolytic and oxidative eliminations reactions, nucleophilic and electrophilic substitution reactions, condensation reactions and pericyclic reactions.

CHM629 Bio-organic chemistry

الكيمياء العضويه الحيويه

Natural amino acids and peptides- Structures of peptides- Non-proteinogenic amino acids and their peptides- Peptide synthesis- Design of chiral peptide catalysts- Peptide antibiotics and their mechanism of actions- Enzymes and cofactors in organic reactions-Fermentation and synthesis of complex organic molecules- DNA and RNA chemistry- Preparation of selected organic compounds using synthetic biological methods-Recent topics.

Elective Courses

CHM630 Stereochemistry

الكيمياء الفراغيه

2-D representations (line drawings, Fischer projections, Haworth projections)-Optical, Geometrical, Conformational Isomerism- Stereochemical terminology for sugars and amino acids: glyceraldehyde: the D- and L- notation of monosaccharides, cyclic hemiacetals, anomerism and glycosides, molecular representation of monosaccharide, the conformation of the pyranoses, structure of α-amino acid- Stereochemistry of organic reactions: stereoselective reactions, stereospecific reactions, reactions Involving chiral carbon bond breaking, a reaction in which a second chiral carbon is generated, prochiral environments (enantiotopic, diastereotopic), SN2 (inversion), reactions which proceed with racemation, elimination mechanisms (E2, Hoffmann), additions to alkenes (syn, anti, Diels-Alder), additions to carbonyls (Cram's rule), chiral techniques and syntheses, optical resolution, use of catalytic enzymes- Real-world applications, including chiral drugs.

CHM631 Organic chemistry and Nanotechnology

الكيمياء العضويه وتقنيه النانو

The role of size on mechanical, optical, thermal and electrical properties of materials- Understanding of the fabrication of nanomaterials and nanodevices: top-down and bottom-up methods-Introducing various modern techniques using natural and synthetic organic compounds developed to produce Nanostructures and Nano-devices- Representing the chemistry and applications of nanocomposites based on natural and synthetic organic polymers- Discussing different Nanomaterials shapes, structures, patterns and their manufacturing- Describing of bio-nano-materials structures and processing, in addition to their clinical applications- Introducing the up-to-date used Nano-biomaterials based on natural and synthetic- organic polymers. Applications of nanomaterials as nano-pesticides, nano-fertilizers, nano-catalysts...etc -recent applications in nanotechnology for water and wastewater treatment and removal of toxic organic pollutants.

CHM632 Textile and dyes

كيمياء النسيج والصبغات

Fundamental principles of dyeing- Structure and properties of textile materials- Pre-treatment and preparation of textile materials prior to dyeing- An overview of dye fastness testing-Methods and mCHMinery for the dyeing process-The chemistry of reactive dyes and their application processes- Disperse dyes, natural dyes, direct dyes, metal-complex dyes, sulphur dyes, acid dyes, environmentally friendly dyes, and fluorescent dyes- Azoic dyeing- Future trends.

CHM633 Medicinal chemistry

الكيمياء الطبيه

Introduction to medicinal chemistry- Drug targets- Receptors and signal transduction-Enzymes as drug targets-Nucleic acids and protein synthesis as drug targets-Sources of lead compounds- Drug synthesis-Optimization of lead compounds-Computer-aided drug design-Combinatorial chemistry and high-throughput screening- Biotechnology and biopharmaceuticals-Biological aspects of drug development-Drug metabolism-Toxicity

testing- Preformulation studies-Solubility and drug development-Drug stability-Clinical research-Clinical research and its regulation-Design and management of clinical trials.

CHM634 Photochemistry and pericyclic chemistry

كيمياء ضوئية وحول حلقية

Organic photochemistry excited electronic states: Spin multiplicity, single and triplet states, sensitization and quenching- Photochemistry of the carbon- carbon double bond Geometrical isomerization, photochemical pericyclic reactions, photo addition to alkenes- Photoreactions of carbonyl compounds: carbon- carbon bond cleavage, cycloadditions- Photochemistry of aromatic compounds: photosubstitutions at the aromatic ring, the Photo-Fries rearrangement, photocycloadditions, photo-oxidations with oxygen- Pericyclic reactions: classification of pericyclic reactions: cycloadditions, electrolytic reactions, sigmatropic rearrangements- The theory of pericyclic reactions- Thermal cycloadditions: Diels- Alder reaction, related six-electron cycloadditions- Thermal (2+2) cycloadditions: Cycloaddition of cumulenes, (2+2) cycloreversions- 1,3-Dipolar cycloadditions: Electrolytic reactions, Chelotropic Reactions, Sigmatropic reactions, acid catalysis of the Diels-Alder reaction.

CHM635 Organometallic chemistry

كيمياء عضويه فلزيه

Structure and bonding in transition metals- Structure, properties, and bonding of ligands commonly encountered in organometallic chemistry- Metal Alkyls and Metal Hydrides- Metal Carbonyls, Cyanides, Nitrosyls- Phosphine Complexes and Substitution-Metal Olefin Complexes- Conjugated π -ligand Complexes -Physical methods used for the study of organometallic compounds- Chemical behavior of organometallic compounds (metal-centered reactions and ligand-modification reactions)- Applications of organometallic compounds in organic synthesis.

CHM636 Advanced environmental chemistry

كيمياء بيئيه متقدمه

Study the chemistry of air, water, and toxic organic compounds- Atmospheric Chemistry and Air Pollution- Climate Change and Energy- Water Chemistry and Water Pollution- Methods for pollutant identification and detecting- Eco-transformation reactions, distribution, effects of chemicals in the atmosphere, water and soil- Methods of pollution control- and minimization of wastes- Environmental interpretation of analytical data obtained in comparison to standards and reference points-Recent topics.

3- برنامج الكيمياء التطبيقية

Compulsory Courses

CHM637 Industrial Organization/ Chemical Technology/ Unit operations

إدارة صناعية و تكنولوجيا كيميائية وعمليات موحدة

Introduction to Industrial management, feasibility studies, Business plan, SWOT analysis, Gap analysis, Gap closure and Competitiveness. Market research, Product and Process Innovation. Project management, Supply chain and supply management. Plant design principles. Conditions for location selection. Plant Layout principles. Flow sheets. Equipment sketch drawing. Reading layout drawings. Bottle necks. Planning and setting up of modern factories. Procurement principles and Good Manufacturing Practice. The UN regulation for the transportation of

hazardous goods. UN classification of hazardous goods. UN labeling requirements. Requirements for the manufacture of hazardous goods packaging. Quality in industry. Egypt's industry modernization. Organizational infrastructure of Industry in Egypt.
Unit Operations definition and classification. Heat and energy balances. Energy transfer. Mass transfer. Heat exchangers. Utilities in chemical factories: Steam boilers, cooling towers, water treatment etc. Applications of selected unit operations in the food industry, chemical industry and pharmaceutical/cosmetics industries. For a selected number of Unit Operations study:, underlying physico-chemical principles, equipment features and their outline drawings, mechanisms of operation, applications for various industries and various materials. In addition, interrelation with other unit operations and most importantly alternative solutions.

CHM638 Surface and colloid chemistry

كيمياء السطوح والغرويات

Adsorption of molecules on surfaces and adsorption isotherms Surface forces: double layer forces, Van der Waals forces, and steric forces Colloidal systems and colloidal properties: optical electrical and kinetic properties**.** Stability of colloids Surface and interfacial tension and contact angle measurements. Surface active agents: surface activity, critical micelle concentration. Emulsions: liquid- liquid interface, stability (emulsifier, amphipathic particles), emulsion rheology. Bubbles and foams: gas – liquid interface, foam stability, frothing agents, foam breaking. The importance of colloidal phenomena to Science and Technology examples drawn from colloidal systems of significant commercial and technological importance, such as inks, paints, foods, polymer blends, papermaking and nanocomposites. Recent topics

CHM639 Advanced materials and technologies

مواد وتكنولوجيات متقدمة

An introduction of shape memory technology (SMT). Piezoelectric materials. Nanomaterials. Self-Healing materials. Self-Cleaning materials. Ultralight materials. Biomaterials. Advanced Plastic materials. Energy harvesting and storing materials. Advanced semiconductor/conductor materials. Packaging manufacture. Smart packaging. Active packaging. intelligent packaging. Related environmental issues. Recent topics

CHM640 Solid waste management

ادارة المخلفات الصلبة

Solid waste legislation and law- introduction to solid waste management (collection, separation and analysis). Management of solid wastes (Reutilization of solid waste and disposal). Implementation of reuse and recycling technologies in major commercial and industrial sectors such as paper, glass, plastics, metals, wood, tire, electronics, and construction/demolition wastes. Waste treatment and handling. Thermal conversion, biological treatment, and Land filling. Handling of hazardous waste (Radioactive waste and biomedical waste). Industrial waste management. Environmental impact of solid waste. Recent topics

CHM641 Total quality management (TQM)

ادارة الجودة

Brief Introduction to Industrial organization\management and linking it to quality management: SWOT analysis, Gap analysis. Gap closure. Competitiveness. Market share. Market research. Product and Process Innovation. Technology transfer. Intellectual property. Patents. Trademarks. Positioning in international markets, Supply chain management, Physical

distribution. Cash flow. Payback period. Return on investment. Breakeven point. customer relations. Ethics in industrial management.
-Terminology such as: Total quality Management, Quality and Profitability. Quality Management, Quality Improvement, Accuracy, Sample, Specification, Reliability, Repeatability. Reproducibility, Six Sigma, Strategic Planning, System Audit, Control, Corrective Action, Cost Of Conformance, Cost Of Quality, Customer Relationship Management,
- Quality Principles and Philosophies covers Deming's 14-point Management Philosophy and the principles set by others like Juran 10-point programme, Crosby 14 step [programme, Shingo, Ishikawa, Drucker 5 principles of management and Ohno seven forms of waste. In addition to the quality process model and the 8 QM Principles of ISO 9000:2000. Quality systems HACCP, JIT, Health Safety and Environment ISO systems. ISO 14000 environmental standard. Quality control circles
- The application part on Egypt covers standardization bodies, certification bodies, accreditation bodies and metrology bodies, and cooperation with international bodies. Egypt Excellence Award. Quality for Egypt EXPORTS.

CHM642 Advanced Analytical Chemistry

كيمياء تحليلية متقدمة

Statistics and computational tools in analytical chemistry. Standardizing analytical methods. Sampling, quality control and assurance. An introduction to modern analytical instrumentation and techniques in the areas of spectroscopy (FTIR, XRD, SEM, TEM, EDX, XPS, XRF). Surface area analysis. Thermal analysis. Chromatography and electroanalysis. Instrumentation and experimental technique for high-resolution chromatography and coupling of chromatography with mass spectrometry and its applications in food, pharmaceutical and environmental analysis areas.

Elective Courses

CHM643 Chemistry and technology of cement and concrete

صناعة و تكنولوجيا الاسمنت والخرسانة

Introduction to cement (Soroko). Cement burning. Cement hydration. Concrete aggregate. Resistance of concrete to natural destructive agents. Recent topics.

CHM644 Chemistry and technology of ceramics

صناعة وتكنولوجيا السيراميك

Raw materials of ceramics. Clays (mineralogy, clay composition). Physical and chemical properties of clays. Classification of clays (primary clays, e.g., kaolin and secondary clays, e.g., ball clay). Types of clays (stone ware clay, earthen ware clay, fire clay, ball clay bentonite). Characterization of clays. Advanced ceramics. Uses of advanced ceramics. Bio ceramics and their uses. Nano ceramics and their uses. Recent topics.

CHM645 Chemistry and technology of glass

صناعة وتكنولوجيا الزجاج

introduction to glass. Physical and chemical properties of glass. Raw materials for glass manufacture. Raw material processing. Chemical reactions involved in glass manufacture. Manufacture process, formation of batch material, melting and shaping. Annealing and

finishing. Common types of glass. Special types of glass, high silica glass, optical glass, fused silica glass, borosilicate glass, Pyrex, lead glass, photosensitive glass and rare earth glass. Recent topics.

CHM646 Chemistry and technology of fertilizers

صناعة وتكنولوجياالاسمدة

General Concepts, Classification of Fertilizer Grade. Short History of Fertilizer Development. Foundation for the Modern Fertilizer Industry. Phosphate Fertilizers, Nitrogen Fertilizers, Potash Fertilizers, Other Nutrients, Compound Fertilizers, Fluid Mixed Fertilizers. Production Technology of Ammonia. Primary Reforming, Secondary Reforming, Carbon Monoxide Conversion, Carbon Dioxide Removal, Methanation, Compression, Ammonia Synthesis, Thermodynamics and Kinetics, Ammonia Converter Design. Introduction, Properties of Urea, Urea Processes, Recycle Processes, Total-Recycle Processes, Stripping Process-Based Plants, Urea Finishing Processes, Granulation. Ammonium Nitrate. Introduction, Ammonium Nitrate Properties, Commercial Forms of Ammonium Nitrate, Process Chemistry, Production Technology, Neutralization, Concentration and Stabilizing Agents, Finishing Processes. Single Superphosphate (SSP). Fundamentals of SSP, The advantages of SSP, Suitability of Phosphate Rocks, Chemistry of SSP, Kotka superphosphate, Production Methods, Product Properties. Triple Superphosphate (TSP). Introduction, Fundamentals of TSP Production, Technology of TSP Production Powder or Granular TSP by the Den Process, Reaction, Denning, Storage/Curing, Granulation, Ex-Den Granulation, Direct Slurry Granulation. Recent topics.

CHM647 Chemistry and technology of paints

صناعة وتكنولوجيا البويات

Introduction. Paint composition (pigment, resin solvent and additives). Technology of formulation and manufacture of coatings. The physical chemistry of dispersion. Industrial paint making process. The rheology of paints. Types of coatings (Appliance, automotive, coil, can, marine, building coatings, etc.…). Technology of surface preparation, treatments and coating applications. Technology of industrial and specialty coatings. Characterization, analysis and evaluation of coatings. Recent topics.

CHM648 Chemistry and technology of petrochemicals

صناعة وتكنولوجيا البتروكيماويات

Introduction on origin of petroleum. Chemical properties of petroleum. Chemical valuation of crude oil. Method of refining petroleum technology. An introduction to petrochemicals. Petrochemical products. Polyolefins (polyethylene, polypropylene, polyisobutylene), vinyl polymers (polystyrene, poly vinyl chloride, polyvinyl acetate), diene polymers (polybutadiene, styrene butadiene, rubber, nitrile rubber, polyisoprene, neoprene). Synthetic detergents. Recent topics.

CHM649 Industrial environmental aspects

اعتبارات البيئة الصناعية

Steam treatments. ISO 14000. In and out water treatment in different industries as sugar cane, fertilizers, textile, …etc. Recent topics.

CHM650 Sustainable chemistry

الكيمياء المستدامة

Resources and product design and recycling. Energy conversion and storage. Sustainable chemistry and renewable energy. Green chemistry. Industrial catalysis. Recent topics.

CHM651 Chemistry and technology of textiles and dyes

صناعة وتكنولوجيا النسيج والصبغات

Introduction to types and classification of textiles. Structure and properties of textile materials. Manufacture of Yarn and Fabric-Pre-treatment and preparation of textile materials prior to dyeing. Nanotechnology in textiles.
Dye types and processes. Chemistry of dyeing. Theory of coloration of textiles and chemistry and theory of dyeing. Dyeing mechanisms. Nanotechnology in dyes. Dyeing mCHMineries, printing technology. Quality control testing . Sustainable and green chemistry in dyeing and textile industry. Recent topics.

CHM652 Chemistry and technology of paper and paperboard

صناعة وتكنولوجيا الورق والكرتون

Structure of wood and cellulosic fiber. Pulping of wood and non-wood raw materials. Stock preparation for paper making. Paper chemistry and wet end. Paper physics. Paper and paper board converting (surface sizing, paper coating, calendering and supercalendering). Corrugated board manufacturing. Carton board package manufacture and application. Tissue paper manufacture. Lamination. Paper testing. General requirements of printing paper. Chemicals recovery and environmental aspects of paper industry. Recent topics.

CHM653 Nano Technology and applications

تكنولوجيا النانو وتطبيقاتها

Classification and preparation of nanoparticles (physical, chemical and green routes). Nano chemistry and new Materials. Preparation of nanomaterials and characterization. Application and benefits (medical, industrial, environmental, energy generation and storage, food processing & packaging drug delivery). Recent topics.

CHM654 Chemistry of basic industries

كيمياء الصناعات الاساسية

Introduction to the Chemical Industry. Sulfuric Acid and its derivatives. Industrial gases: nitrogen, oxygen, etc. Inorganic nitrogen compounds. Chemicals from limestone: Soda Ash (Sodium Carbonate), Sodium Silicate, ...etc (Silica Gel, Sodium Chloride Derivatives and Miscellaneous Inorganics: Sodium Chloride). Caustic Soda (Sodium Hydroxide, Caustic), Hydrochloric Acid (Muriatic Acid) and Miscellaneous Inorganic Chemicals. Basic organic chemicals. Chemical Industry and Pollution. Recent topics.

CHM655 Industrial corrosion and surface protection

التآكل الصناعي وحماية السطح

Industrial Corrosion Problems: Atmospheric corrosion and high temperature oxidation. Corrosion in industrial cooling water system. Corrosion in boilers and condensate pipelines.

Corrosion due to acids. Corrosion during metal surface cleaning and descaling. Corrosion during storage and transportation of metallic articles. Corrosion in various industries.
Protection methods against corrosion: Change of metal, design improvement, change of environment, anodic protection, cathodic protection and protective coatings. Corrosion inhibitors: classification, mechanism, selection of corrosion inhibitors, inhibition efficiency and factors influencing inhibition efficiency, measurement of inhibition efficiency. Recent topics.

CHM656 Industrial polymers

البوليمرات الصناعية

Polymer Synthesis**:** Basic aspects of polymers. Classifications of polymers, thermoplastics, thermosets and elastomers. Advanced synthesis techniques and industrial polymerization processes (bulk, solution, suspension, emulsion, etc.)
Latex and Rubber**:** Type of latices: natural, synthetic, artificial and modified latices. Latex composition. Latex testing and applications. Rubber: types, testing, applications.
Polymer Analysis and Identification: Studies on thermal analysis (DSC & TGA) and spectroscopic analysis (FTIR & NMR). Polymeric surface modification methods (plasma processing, corona treatment and flame treatment); Grafting techniques and functionalization (polymerization reaction).
Polymer Technology: Selected topics in polymer technology (e.g., Engineering thermoplastics, engineering thermoset, and specialty polymers (conductive polymers, dendritic polymers). Membrane, biomedical engineering and drug delivery. Recent topics.

CHM657 Chemistry and technology of printing inks

صناعة وتكنولوجيا احبار الطباعة

The raw materials and principles of ink formulation. printing ink manufacture and unit operations in the ink industry. Colloidal nature and rheology of printing inks. The traditional printing processes. Ink testing, control and quality assurance. Drying mechanisms of inks. Digital printing (photocopy, ink jet and laser). Conductive ink. Health, safety, and environment. Recent topics.

4- برنامج الكيمياء الحيوية
Compulsory Courses

BCH601 Advanced metabolism and its disorders.

التمثيل الغذائي المتقدم واضطراباته.

Disorders of carbohydrate metabolism. Disorders of protein metabolism. Protein folding disorders (Alzheimer's, prions and amyloid). Disorders of lipids metabolism. Disorders of nucleic acids. Metabolic syndrome, diagnosis, and pathogenesis of the metabolic syndrome. The hormonal regulation of metabolism and the role of protein phosphorylation in this context, the regulation of metabolism in physiological and pathological situations (e.g. diabetes).

BCH602 Advanced molecular biology and its applications in genetic engineering.

البيولوجيا الجزيئية المتقدم وتطبيقاته في الهندسة الوراثية.

DNA Replication transcription, Post transcriptional processing, Recombination, Genetic Code, Translation in Pro- and Regulation of Transcription and Translation. Molecular biology techniques. Recombinant DNA methods, Applications of recombinant technology: Gene therapy, Human genome. DNA sequencing methods, strategies for genome sequencing; methods for analysis of gene expression at RNA and protein level, large scale expression analysis, such as Dot-blotting and micro array based techniques. RFLP, RFLP in DNA fingerprinting. PCR and types (Reverse transcriptase RT-PCR, Real time/quantitative PCR, inverse PCR, nested PCR, multiplex PCR, anchored PCR and asymmetric PCR), RAPD and AFLP techniques. Blotting techniques.

BCH603 Protein production and analysis.

إنتاج وتحليل البروتين.

Overview of protein structure. Protein isolation and characterization. Principles of X-ray diffraction theory and practice. Protein crystallization, data collection, solving and refinement of the model's protein structure, and validation. Protein receptors. Transport Proteins. Recombinant protein production and analysis Protein diseases. Binding proteins. Protein folding. Infectious proteins. Post-translational processing of protein. Protein modelling.

BCH604 Applied immunology.

علم المناعة التطبيقي.

The course handles the basis of immunology, covering cells and mechanisms of innate and adaptive immune responses (inflammation, anti-microbial and anti-viral defenses, T-cell activation, antibody production, etc.). The course also offers insights into the physiopathology of the immune responses (chronic inflammation, allergy, autoimmune disorders, transplantation and cancer) and the clinical (immunotherapy, cytokine therapy, etc.) and industrial (monoclonal antibodies, ELISA and immunodiagnostics, etc.) applications of immunological processes, immunotherapy, tumor immunology, transplantation immunology.

BCH605 Advanced cancer biology.

بيولوجيا الأورام المتقدم.

The course covers basic aspects of the main pathways inducing formation of a tumor. The main emphasis will be made on modes of carcinogenesis, tumor metabolism, the formation of oncogenes, the action of tumor suppressor genes and the induction of tumors by viruses. The course covers also aspects of tumor diagnostics and therapy.

BCH606 Advanced biochemical instrumental analysis.

تحاليل الكيمياء الحيوية المتقدمة.

Overview of biochemical calculations. pH metres and electrodes. Gradient centrifugation and ultracentrifugation. Immunochemical Techniques: Radioimmunoassay and enzyme-linked immunoassay, etc. Isotopic techniques, Electrophoresis, Chromatography: Ion exchange chromatography, gel filtration, Gas chromatography, hydrophobic interaction chromatography, affinity chromatography, etc. Absorption spectrophotometry (Principles, techniques, UV, Visible and Fluorescence, applications to macromolecular structures.

Elective Courses

BCH607 Bionano concepts and its application.

مفاهيم المواد الحيوية النانونية و تطبيقاتها.

Production of various types of nanostructured materials with usage and potential within biochemistry. Using biomaterials and biomolecules as bases for inorganic structures. Introduction to surface physics and biomaterials. Methods for derivatisation and characterisation of surfaces and other carrying structures. Theory and methods for studies of the interaction with surfaces and fibres of biomolecules. Applications within bioseparation, diagnostics, the drug delivery and bioimplants. Theory for how lipid/polymer nanoparticles can be utilised as model membranes and for formulation/administration of drugs. Molecular prints of biomolecules. Production and applications of inorganic replicas of biological materials. Enzyme reactors based on nanostructured materials.

BCH608 Advanced enzymology.

علم الإنزيمات المتقدم

This course covers the introduction, enzyme production by microbial fermentation, enzyme production by animal and plant cell cultures, extraction, separation and purification of enzymes, enzyme molecular modifications, immobilization of enzymes, cells and protoplasts, enzyme catalysis in non-aqueous phases, enzyme directed evolutions, enzyme reactors, and applications of enzymes.

BCH609 Advanced nutritional biochemistry.

الكيمياء الحيوية الغذائية المتقدمة.

Concept - Composition of food - macro and micro nutrients and their functions. Nutritional requirements of infants, children & youth. Nutritional demand in pregnancy, lactation and menopause. Nutrition for old people. Obesity, Risk factors of obesity, Metabolic syndrome, Diagnosis and pathogenesis of metabolic syndrome. Signs, symptoms and risk factors of metabolic syndrome, Treatment and management of metabolic syndrome. Diseases arising due to protein - calorie malnutrition and under nutrition (Kwashiorkar and Marasmus diseases). Vitamins (fat and water soluble) deficiency diseases - Mineral deficiency diseases - symptoms and dietary supplementation. Symptoms of diseases and modification of dietary pattern for patients suffering from fever (Typhoid and Malaria), Jaundice, hyper acidity (Ulcer), parenteral nutrition.

BCH610 Stem cells and regenerative medicine.

الخلايا الجذعية والطب التجديدي.

Stem cells – definition, classification and sources, clinical applications of stem cells; Mammalian Nuclear Transfer Technology; stem cell-based therapies and ethical considerations. Reprogramming of somatic cells to induced pluripotent stem cells, Application of iPS technology to regenerative medicine. Developmental hematopoiesis, Epigenetic regulation of stem cell fate, niche biology: regulation of

hematopoiesis by the nice. Mediated signalling mechanisms. Cryopreservation of cells (general), Cord blood banking and long-term storage of stem cells, FACS and its application in stem cell research. Neural stem cells and differentiation. Bone and cartilage biology. Embryonic stem cells, Cancer stem cells.

BCH611 Bioinformatics.

المعلوماتية الحيوية.

This course explores the theory and practice of biological database searching and analysis. In particular, students are introduced to integrated systems where a variety of data sources are connected through internet access. Information retrieval and interpretation are discussed, and many practical examples in a computer laboratory setting enable students to improve their data mining skills. Methods included in the course are searching the biomedical literature, sequence homology searching and multiple alignment, phylogeny, gene prediction, protein sequence motif analysis and secondary structure prediction, and several genome browsing methods. Introductory analysis using the R programming language is introduced. Computer access is required.

BCH612 Protein and antibody engineering.

هندسة البروتين والأجسام المضادة .

Basic principles of peptide, protein and antibody engineering, Recombinant antibody fragments and their properties: Fab, Fv, scFv, Diabody, Nanobody, Hybridomaviz. Display technologies for monoclonal antibody development, basic principles and scope of display technologies. Linkage of phenotype and genotype, Advantages and applications of display technologies and protein engineering, Role of display technologies in drug development. Applications of recombinant antibodies: Monoclonal viz. Recombinant antibodies in drug development, Scope and problems of antibody based drugs, Generation of chimeric and humanized monoclonal antibodies for clinical applications, Recombinant antibodies in current medical use: Application of monoclonal antibody based drugs in treatment of cancers and other diseases.

BCH613 Advanced clinical biochemistry.

الكيمياء الحيوية السريرية المتقدمة.

Automation in Clinical Biochemistry, quality Assurance & Management, Establishment and use of reference values, diagnostic performances of tests. Evaluation and clinical significance of liver functions tests, kidney functions tests, lipid profile, cardiac profile, mineral tests, Enzymes, Hormone tests, hemoglobins, Blood gases and pH. Strategy of cancer detection by biochemical means; cancer markers and cancer screening. Use and limitations of tumor products and enzymes in the diagnosis and monitoring of cancer enzymes. Hormone receptors and response to therapy, Primary neoplastic.

BCH614 Research methodology and biostatistics.

منهجية البحث والإحصاء الحيوي.

Synopsis and Scientific paper writing techniques: Synopsis and research grant and scholarship writing presentation of data. Overview of measures of central tendency, Chi square test. Scientific writing. Biostatistics: population and sample size, sampling

distribution. Research design. Study of some classical papers for experimental design and data presentation. Normal, Binomial and Poisson distributions. Tests of significance, student's t –test. Analysis of variance (ANOVA). One-way and two-way ANOVA. Regression analysis. Simple and multiple analysis regression. Overview of non-parametric tests, statistical packages; Graphical Instat, Graphpad and SPSS.

BCH615 Introduction to the state of the art of cell culture technologies.

مقدمة فى تقنيات زراعة الخلية.

This course will cover the basics of cell and tissue culture which will comprise requirements of a tissue culture laboratory: aseptic area, incubation and culture, preparation and sterilization, storage, defined media and supplements, development of media, serum-free media, disadvantages of serum, advantages and disadvantages of serum-free media, preparation of reagents and materials, sterilization of apparatus and liquids, initiation of a primary cell culture, isolation of the tissue, routine maintenance, subculture, cloning and selection, cryopreservation, cell banks, transporting cells, differentiation, expression of the in vivo phenotype, stem cell plasticity, cell interaction, systemic factors, cell–matrix interactions, polarity and cell shape differentiation and malignancy, contamination and culture of chosen cells.

قسم النبات والميكروبيولوجى

أولا : مقررات تمهيدى الماجستير

3- برنامج النبات

Compulsory Courses

BOT601 Experimental Design in Plant Sciences

تصميم التجارب في علوم النبات

This course deals with topics of general nature such as; Data collection, description, processing and presentation. Probability, variance, distribution in population. Study design. Hypothesis development and testing. Correlation and regression. Linear regression and multiple regression. Strategies for experimental design and analysis. Analysis of variance. Experimental design methods, completely randomized design, randomized complete block, split plot design. Study Factorial design, ANOVA test, and Pareto chart, Min Run level, Placket-Berman, Taguchi OA, Response Surface methodology, Central composite, Analysis, Application in research papers

BOT602 Advanced Stress Physiology in Plants

فسيولوجيا الإجهاد المتقدم في النباتات

Origin and occurrence of salted soils – Classification of salted soils - Plant Relations to salted soils - Crop responses to salt stress (Seed germination and plant growth) – Nutrient uptake by plants under stress conditions (flooding, salinity, and drought stress) – Fertilizer management and salinity tolerance - Interactive and antagonistic effects of salinity and fertility – Biofertilizers for salt tolerance - Salt tolerance mechanism - drought and salt tolerance in plants - Role of plant metabolites in abiotic stress tolerance with special reference to secondary compounds - Alleviation of seawater stress during germination and early growth of barley by using gibberellin, proline, and glycine betaine treatment - Application of nanotechnology in agriculture for salt stress tolerance.

BOT603 Bioindicators

كاشفات حيوية

Definition, Types of bioindicators and bio monitors, strategies and principles of bioindication and biomonitoring, Bioindicators for ecosystem management, indicating and predicting toxic materials in an ecosystem using a species, Phytoremediation and its types, use of a higher plant as a bioindicator, higher plants as an accumulative bioindicator, Agri-biodiversity indicators as a tool for policymaking, Examples for international biomonitoring programs.

BOT604 Advanced Molecular Genetics

الوراثة الجزيئية المتقدمة

This course covers the the major biological processes of plants in a molecular, genetics and genomics context. It provides a broad coverage of the current concepts and techniques of plant molecular genetics and genomics and their application to crop productivity and improvement based on the genetics principals. Special emphasis will be placed on recent publications in the research of these topics involving plant growth and development, abiotic/biotic stresses, metabolism, hormones, nutrient relations sed and epigenetics.

BOT605 Advanced Plant Enzymology

انزيمات النبات المتقدم

The course may deal with the following topics. Protein structure of enzymes - Mechanism of enzymes action- Enzymes assay & activity - Enzymes inhibition & regulation (Allosteric regulation- Reversible covalent modification- Proteolytic cleavage - Feedback regulation- Isozymes regulation) - Constitutive & Inductive enzymes - Biotechnology process of enzyme production - Immobilization of enzymes - Biosensor - Industrial application of enzymes - Roles and Types of antioxidant (Enzymatic & Nonenzymatic Antioxidants) - Current Topics in Enzymology

BOT606 Advanced Plant Taxonomy

تصنيف النبات المتقدم

The major goal of the course is to enGeoe students to understand plant identification through observation and descriptions of vegetative and reproductive morphology. The students should learn how to discover and classify plant diversity and describe and explain major features and evolutionary origins. The students will learn how to interpret and evaluate the analytical and experimental tools used to understand plant diversity. Students must have regular access to a computer and the Internet to access online materials in data bases and will be expected to download course material as well as upload assignments. Students need to have access to a device to photograph plants and upload photographs. The students must be able use computer aided classification of plants based on phenetics and phylogenetic approCHMes.

Elective courses

BOT607 Advanced Plant Growth Hormones

هرمونات نمو النبات المتقدم

Introduction – Identifications – Steroid and Peptide Hormones – Classification of the main Plant Growth Hormones: Auxin, Gibberellin, Cytokinin, Ethylene, Abscisic acid – Their precursors, synthesis, translocation, and physiological effects – Newly discovered growth substances, as Signaling Molecules During Abiotic Stress: Salicylic acid, Jasmonic acid, and Brassinosteroid - Polyamines: Identification, Classification, Distribution, Biosynthesis - Their role in osmotic stress tolerance – Effect of Arginine and Urea on Polyamines content and Growth of Bean Under Salinity Stress – Methods for Measuring Phytohormones.

BOT608 Assimilation of Mineral Nutrients in Plants

تمثيل التغذية المعدنية في النباتات

Introduction – Essential Elements: Macronutrients: N, P, K, Ca, Mg, S, and Micronutrients: B, Cl, Cu, Fe, Mn, Mo, Ni, Zn – Determination of Essentiality – Assimilation in Plants – Functions and Roles in Plants – Diagnosis in Plants – Symptoms of Deficiency and Excess – Forms in Soils – Fertilizers – Factors affecting uptake – Beneficial Elements: Al, Co, Se, Si, Na, V, - Growth Stimulation and Toxicity – Function

BOT609 Physiology of Herbal Medicine

فسيولوجيا طب الأعشاب

Introduction to herbal medicine - How to use herbal medicines - Advantages of herbal medicine- Drug discovery of natural compounds (Traditional processes - The modern processes) - Most popular herbal medicines (Species - part used - extraction and determination of chemical constituents) - Precautions for using herbal medicines (Safety - Side effects) - Phytochemistry and bioactive compounds of some herbal medicines used in cardiovascular medicine, having antidiabetic and anti-cancer activity-and their mechanism of action - Medicinal herbs in the future

BOT610 Tissue culture and Biotechnology

زراعة الأنسجة وعلم التقنية الحيوية

Basic principles in plant growth and development pertaining to in vitro culture. Methodology and application in meristem culture, organ culture, somatic embryogenesis, haploid and endosperm culture, embryo culture and cell suspension cultures. Application of tissue culture in growth and development, stress physiology, metabolic engineering, plant breeding, plant pathology, plant-microbe interaction, production of secondary metabolites and germplasm preservation. Methods of gene transfer and gene editing in crop improvement and plant productivity.

BOT611 Applications of Nanotechnology in Plants

تطبيقات تقنية النانو في النبات

Introduction to nanotechnology - Tools & techniques - ApproCHMes used - Nanoparticle synthesis - Characterization and properties of nanomaterials - Origin - Advantages & Disadvantages of nanoparticles - Applications of nanotechnology in different fields of agriculture - Role of nano fertilizers in improvement of nutrients use efficiency - Seed management and crop improvement - Nanoparticle mediated gene delivery - Soil remediation - Management of insect-pests using nanotechnology

BOT612 Molecular Biology Tools

أدوات البيولوجيا الجزيئية

Molecular biology is the study the molecular basis of biological activity. Most used methods are protein methods and nucleic acid methods to explore cells characteristics, parts, and chemical processes, and pays special attention to how molecules control a cell's activities and growth. The techniques include DNA cloning, cut and paste DNA, bacterial transformation, transfection, chromosome integration, cellular screening, cellular culture, extraction of DNA, DNA polymerases and DNA nucleases, DNA sequencing, DNA synthesis, molecular hybridization, rewriting DNA: mutations, random mutagenesis, point mutation, chromosome mutation. Most important techniques are Polymerase Chain Reaction (PCR), Expression cloning, Gel electrophoresis, Macromolecule blotting and probing, Arrays (DNA array and protein array).

BOT613 Climate Change and Plants

التغيرات المناخية والنبات

Introduction to causes of climate change, how will global climate change affect the performance, survival, and distribution of plants? plant function in relation to global climate change and enable you to answer this question at scales ranging from cellular function to community processes. The course will have a broad content ranging from topics as fundamental as how: plants take up carbon from the atmosphere through photosynthesis and

how this uptake of carbon is linked to the use of water; changing environmental factors such as temperatures affect plant function; the biotic environment is crucial in determining how plants acquire nutrients and their responses to changes in the global climate; and, climate change is leading to increased mortality of plants – often described as 'dieback' – in ecosystems across the globe. Climate change and plant invasion. Effect of climate change on diversity and distribution of plant species. Past and future predictions of plant species distribution: methods and tools. Mitigation of climate change.

BOT614 Advanced Topics in Plant Ecology

موضوعات متقدمة في البيئة النباتية

The course explores the major concepts, principles, research, and methods of plant ecology, with emphasis on the classic and contemporary literature. The focus is on ecological data for field studies, main field measurements in plant ecology, spatial distribution patterns of plants, sampling and experimental design in plant ecology and species diversity measures.

BOT615 Plant Functional Ecology

بيئة نباتية وظيفية

Through this course the students will learn more about the following points: Concept of functional ecology, Different plasticity of the whole plant and leaf traits under different environmental conditions such as light, water and nutrient availability, Functional ecology of root system, Ecology of branch autonomy, plant-plant interactions, study cases.

BOT616 Biodiversity and Conservation of Plants

التنوع الحيوي وصون النباتات

This course gives students an understanding of biodiversity and conservation biology as scientific disciplines. the history and subject matter of conservation biology, including a discussion of the scientific approCHM to understanding the world, what biodiversity is, where it's found and how it arises, values of biodiversity including economic, ethical and ecological perspectives, important principles in designing conservation and restoration projects and understand population biology processes and patterns (especially for small and endangered populations), the status of biodiversity and the impacts of current threats such as habitat destruction, introduction of exotic species, spread of disease and overexploitation,. Case studies and readings are major parts of the course.

BOT617 Phylogeny and Plant Biosystematics

علم الوراثة والتصنيف الحيوي للنبات

The course will explore the origin and diversification of land plants while emphasizing the integration of taxonomy (identification, nomenclature, classification of flowering plants) into other processes of biosystematics such as speciation, reproductive biology, adaptation, convergence, bioGeography, morphology, chromosomes, and molecules. ApproCHMes and techniques of plant phylogeny will be described particularly methods based on molecular polymorphism. By the end of the course students should be adept at taking raw molecular data and generating phylogenies based on parsimony, Bayesian, and likelihood methods in a range of software packages. The course includes other topics based on the research plan of the students, case studies and assignments.

BOT618 Phytoremediation

المعالجة النباتية

This course is introducing the definition of phytoremediation technology, advantages and disadvantages, mechanisms of phytoremediation, metals sequestration mechanisms, Iron plaque techniques, advanced trends in phytoremediation, case studies and readings from different sources on recent topics on phytoremediation.

BOT621 Plant Families

العائلات النباتية

Angiosperm biodiversity based on understanding of the floral and vegetative structures of angiosperms and the identification of plants to family level is a major part of this course. Students are encouraged to explore the classification of plant families in different systems of classification. In addition, the course may include readings from different sources. The students shous be able to write a biodiversity essay, either covering a group of plants, or describing a Geographical area. The students should be able to distinguish families of flowering plants and use keys and manuals.

BOT622 Sources of Taxonomic Information

مصادر المعلومات التصنيفية

Floral and vegetative traits, microscopic and submicroscopic features, hairs and trichomes, pollen features. The role of chromosomes in plant systematics and evolution. Chemosystematics and molecular systematics. Development of plant classification systems with emphasis on phenetic and cladistics approCHMes. Tools and resources for data analysis and phylogeny reconstruction

BOT623 Phylogeny and Molecular Evolution

علم الوراثة والتطور الجزيئى

The major topics include history of molecular approCHMes to plant phylogenetic classifications. ApproCHMes and techniques of plant phylogeny. Methods based on proteins polymorphism. Methods based on molecular polymorphism. DNA sequencing and non-PCR based techniques. PCR based techniques. Methods of data analysis and phylogeny reconstruction. The course may include other topics based on the research plant of the students and case studies and assignments.

BOT624 Recent Topics in Plant Genetic Diversity

موضوعات حديثة في التنوع الوراثي النباتي

The course is based on readings of recent topics in plant biodiversity that may include variation and evolution in plants, genotypic and phenotypic patterns, genetic diversity, adaptation, breeding systems, hybridization, apomixis. Readings may be extended to evolutionary data in population genetics and systematics, literature, variation analysis, breeding techniques, data presentation, molecular evolution, and other topics**.**

BOT626 Environmnetal Genetics

الوراثة البيئية

The course may deal both environmental/ecological effects on population genetics within populations (e.g., adaptation, selection) and environmental/ecological effects on gene flow and

genetic isolation between populations, conservation genetics, The first half of the course may be a review of traditional general genetics, a review of ecological processes of microevolution, and an overview of relevant concepts in population genetics. The second half of the course will examine environmental influences on genetic properties within populations, conservation genetics, and landscape genetics and environmental influences on gene flow between populations)

BOT627 Plant Breeding and Genetics

تربية النبات والوراثة

Principals and methods of plant breeding. Breeding approCHMes and CHMievements. Breeding for nutritional quality traits. Breeding for improved protein content and quality in cereals and legumes, sources of quality traits. Breeding for improved oil content and quality. Breeding for improved secondary metabolites. Breeding for abiotic and biotic stress tolerance.

BOT628 Advanced Plant Cytogenetics

الوراثة الخلوية النباتية المتقدمة

The correct handling of plant chromosomes, methods in plant cytogenetics, cell division, reproduction methods, chromosome nomenclature, karyotype analysis, chromosomal aberrations, genome analysis, transgenic crops, and cytogenetics in plant breeding. A brief introduction on the historical aspect of cytogenetics and flows directly into handling of plant chromosomes by classical and modern cytological techniques, classical Mendelian Genetics, brief description of cell division, and chromosome identification by karyotype analysis. The comprehension of cytogenetics is incomplete without information on the role of aneuploidy in associating a gene on a particular chromosome, and these methodologies as a primary topic. Covering classical to modern cytogenetics, and the crucial role of cytogenetics in improving crops.

BOT629 Genomics and Epigenomics

علم الجينوم وعلم الوراثة

The major topics include the genetic structure of plant genomes such as genome size, gene content, extent of repetitive sequences and polyploidy/duplication events, mitochondrial and chloroplast genomes, genetic maps and quantitative traits, genome evolution and whole genome sequencing. The major topics of epigenomics focus on changes that provides important clues to mechanisms and function of gene regulation across many genes in a cell or plant such as DNA methylation sequences, transposons variation, and the micro RNAs and their role in gene regulation, stress response, and population-level phenotypic diversity and evolution. The course may include other topics based on the research plant of the students and case studies and assignments.

BOT630 Genetic Engineering and Gene Editing

الهندسة الوراثية وتحرير الجينات

The topics should focus on pursuing knowledge about the theoretical as well as the practical aspects of both biology and technology of recent advances in DNA recombination centered on gene technology application. In particular, the recent methods of gene transfer to improve resistance of plants to biotic and abiotic stresses. The topics should be extended to gene editing and the biosafety of genetic engineering and genetic modifications for improving plant

productivity. The course may include other topics based on the research plant of the students and case studies and assignments.

BOT634 Advanced Taxonomy of Algae **التصنيف المتقدم للطحالب**

This course should review the taxonomy of algae and explore the fundamental principles of algae systematics with reference to structural differentiation of algal cells, tissues and forms. In addition, the course shall deal with the different types of life cycles and bases of algal classification, general characteristics and classification of major algal groups. Students must have regular access to a computer and the Internet to access online materials in data bases and will be expected to download course material as well as upload assignments. Students need to have access to a device to photograph plants and upload photographs. The students must be able use computer aided classification of plants based on phenetics and phylogenetic approCHMes

BOT635 Ecology and Physiology of Algae

بيئة وفسيولوجيا الطحالب

This course deals with describing the various habitats of algae such as marine water, fresh water and soils and the morphological and structural adaptations of different algae to their environments. This course may include recent approCHMes and principles of the physiological processes in algae with reference to growth and growth regulators, nutrition, photosynthesis, enzymes and metabolism. The fundamental principles of algal cell wall structure and function, pigments, proteins and carbohydrates, fatty acids and saponifiable lipids and their metabolism in algae will be addressed as well as vitamins and extracellular products. Special attentions may be given to methods of isolation and cultivation and maintenance of algae in culture collections.

BOT636 Biotechnology of Algae

التكنولوجيا الحيوية للطحالب

The content of this course to explore the uses and economic importance of algae with reference to its utilization in different economic applications such food production, agriculture, industry, wastewater treatment and medicine and other application. The course comprises readings, seminars, and discussions as major parts of the course.

برنامج الميكروبيولوجي

Compulsory Courses

MIC601 Plant microbe interaction

تفاعل الميكروبات مع النبات

Importance of microbiology in sustainable agriculture. Life of microbes in the rhizosphere, on aerial plant parts, and inside the plant. The disease concept, Parasitism and disease development Parasitism and pathogenicity. Host range of pathogen, different Stages of the development of disease, The disease cycle. How pathogen attack plants Mechanical forces exerted by pathogen on host tissues, chemical weapons of pathogens (enzymes in plant disease, microbial toxins in plant disease, growth regulators in plant disease, polysaccharides, suppressors of plant defense responses). Effect of pathogens on plant physiological functions: Effect of pathogen on: photosynthesis, translocation of water and nutrients in the host plant.

Effect of pathogen on host plant respiration, permeability of cell membranes and on transcription and translation. How plants defend themselves against pathogens: Pre-existing structural and chemical defenses. Induced structural and biochemical defenses.

MIC602 Microbial Genetics and Biotechnology.

وراثة ميكروبية و تكنولوجيا حيوية

Heritable information flow in microorganisms, Chromosome organization in prokaryotic and eukaryotic cells, Genetic basis for variation in microbial population, Mechanisms for gene transmission between microbial cells, Bacteriophage life cycle, Mechanisms for regulation of gene expression, Basic concepts of extrCHMromosomal genetic elements, Basic concepts of Epigenomic characterization of microorganisms, Genetic selection and screening of different genotypes, The current biotechnological application in the field of microbial genomics.

MIC603 Experimental Design for Biology

تصميم التجارب لعلم البيولوجى

This course deals with topics of general nature suchas; experimental principles and basic statistics such as completely randomized design (CRD) and randomized complete block (RCB). Also hypothesis development and testing, data summary and normal distribution and strategies for experimental design and analysis and research objectives. Simulations, interactions and source of variance Analysis of variance (ANOVA). Linear regression and multiple regression. Assumptions, data transformation, missing values, split plot designs. Comparing regression lines, analysis of covariance. Reading, discussions and seminars are parts of this course. Study Factorial design, ANOVA test, and Pareto chart, Min Run level, Placket-Berman, Taguchi OA, Response Surface methodology, Central composite, Analysis, Application in research papers.

MIC604 Fermentations Chemistry **كيمياء التخمرات**

Fermentation technology – Mode of fermenter operation – Types of fermentation processes – preparation of media for bioprocesses – Preparation of cultures for fermentation processes – Microbial Biotechnology: Examples, Primary metabolites: Organic acids, Amino acids, Ethanol production, Secondary metabolites: Antibiotics.

MIC605 Advanced Yeasts **خمائر متقدمة**

Classification of yeasts (yeast identification: past, present, and future methods). Molecular identification of yeast. Technology of yeasts production (Bakers yeasts-culture methods-treatment of molasses and yeast behavior in drought). Advances in genetic modification of industrial yeasts and information on recent developments in wine and beer. Biosynthesis of vitamins by yeast (nutritional yeast).

MIC606 Microbiology of Extreme Environments

ميكروبيولوجيا البيئات المتطرفة

Adaptation of microbial life to environmental extremes. Extreme environments as models for microbial ecology research. Microbial community composition of different extreme environments. High temperature adaptation in thermophiles. low temperature adaptation in psychrophiles. High salt adaptation in halophiles. Acid adaptation in acidophiles.
Metal adaptation in acidophiles. Osmophiles, Oligotrophs and Alkalophiles.

Elective Courses

MIC607 Advanced Plant Virology

علم الفيروسات المتقدم

Virus Infection of Plants: Plant viruses face special problems initiating an infection, Transmission of Plant Viruses (Seeds, Vegetative propagation/ grafting, Vectors: Bacteria, Fungi, Nematodes, Arthropods: Insects- aphids, leafhoppers, planthoppers, beetles, thrips, etc. ArCHMnids-mites), Multipartite Plant Viruses, Pathogenesis of Plant Virus Infections (necrosis, hypoplasia, hyperplasia), Emergent Plant Viruses. An advanced consideration of the molecular aspects of viruses. replication cycle; interactions with the host cell; mechanisms of pathogenicity; vaccines. The course consists of lectures with additional literature reading and brief seminars by students. Students will be required to write an advanced research paper as part of the course evaluation.

MIC608 Microbial Communication in Foods

تواصل الميكروبات في الطعام

The language: Signals from bacteria, N-acyl-L-Homoserine Lactones, Autoinducing peptides. The Phenotypes: Virulence, Biofilm Formation, Bacteriocin synthesis. The behaviour in foods: Sourdough, Yoghurt, other foods. The probiotic message. The new perspective: antimicrobial therapy, selection of starters, food quality, novel biogenic compounds.

MIC609 Microbial biotransformation

تحويلات حيوية ميكروبية

Microorganisms and Biotransformation-Properties of biotransformation and fields of application -Design of biotransformation process – Improvement of biotransformation process – Product isolation. Early steroids biotechnological applications e.g., 11-ydroxylation reactions, ascorbic acid production, and new semi-synthetic antibiotics. Present and future interest in Transformation of other compounds, raw material, agro-waste and wastewater and microbial remediation.

MIC610 Radiation Biology **علم البيولوجيا الاشعاعية**

Introduction: the significance of radiobiology and radiotherapy for cancer treatment. Irradiation-induced damage and the DNA the DNA damage response. Cell death after irradiation: how, when, and why cells die. Quantifying cells kill and cell survival. Dose-response relationships in radiotherapy. The oxygen effect and fractionated radiotherapy.

MIC611 Nano-Biotechnology and Applications

تكنولوجيا النانو الحيوية و تطبيقاتها

Introduction to nanotechnology. Method of synthesis of nanoparticles. Biological synthesis of nanoparticles. Characterization of nanoparticles. Metal nanoparticles. Liposome and nano-emulsion. Nanocomposite. Magnetic nanoparticles. Application of nanoparticles I (Medical, agricultural). Application of nanoparticles II (Antimicrobial mode of action).

MIC612 Microbial Antibiotic

مضادات حيوية ميكروبية

Antibiotic Discovery - Spectrum & Action of Antimicrobial Activity Drugs - Commonly Used Antimicrobial Drugs - Tests to Guide Chemotherapy - Resistance to Antimicrobial Drugs and Mechanisms -The Future of Chemotherapeutic Agents

MIC613 Separation Techniques and Instrumental Analysis

طرق فصل و تحليل بالأجهزة

Laboratory measurements, Data handling, Sample collection and storage, Reference ranges Spectrophotometry, Atomic absorption, Bioluminescence, Chemiluminescence and nephelometry. Immunoassay: basic principles, components, separations and assay labels, Enzyme linked immunosorbent assay (ELISA) and its biochemical application applications, Radioimmunoassay: principles of analytical biochemistry – assay validation, quality assurance. Introduction to separation electrophoretic techniques, sample preparation, GC, High performance liquid chromatography (HPLC), thin layer chromatography and analysis of protein electrophoretic techniques. Principles and basic techniques of blood taking and automated analysis of blood. Introduction to mass spectrometry applications in biology. Introduction to enzyme assays and isozyme studies. Automated analytical techniques, ion-specific electrodes, capillary electrophoresis, and it's biomolecular applications. Introduction to biosensors and its biochemical application.

قسم علم الحيوان والحشرات

1- مقررات برنامج الفسيولوجى
Compulsory Courses

ZOO601 Neurophysiology

فسيولوجيا الجهاز العصبى

Membrane potential action potential type of channels. The nervous system and it's components. Structure of neuron and it's function brain areas and their function. Neuroglia cells, the synapses (types and structures). The second messengers, the neurotransmitters (types, synthesis and structures). The different receptors of neurotransmitters and mode of action.

ZOO602 Endocrinology

علم الغدد الصماء

This course describes the study of endocrine hormones and of the organs involved in endocrine hormone release, this science also deals with the biosynthesis, chemistry and storage of hormones, the factors and mechanisms controlling hormonal secretion, the cellular mechanisms of hormone action, and the pathophysiology of endocrine system dysfunction.

ZOO603 Hematology

علم الدم

Introduces hematopoiesis, the origin and maturation of the various types of blood cell lines with emphasis on the red and white blood cells. Includes study and analysis of hemoglobin, hematocrit, erythrocytic sedimentation rate and blood cell counts. Emphasizes cell identification, cell differentiation and blood cell morphology. Presents anemia and their classifications based on red blood cell morphology and etiology. Introduces human hematological disorders associated with white cell abnormalities. Emphasizes cell identification, cell differentiation and cell morphology evaluation procedures. Allows for practice of hematology analytical skills and correlation of laboratory findings with patient symptoms and clinical history. Presents principles of automated instrumentation and application of flow cytometry to clinical hematology. Blood grouping and transfusion.

ZOO604 Drugs Affecting Nervous System

الأدوية المؤثرة على الجهاز العصبي

This course will explore the different classes of drugs and mechanism of action, Routes of drug administration, absorption, distribution, and excretion. Neurotransmission in CNS. Anxiolytic and hypnotic drugs. CNS stimulants-Antidepressant drugs (types - mechanism of action - adverse effects).

ZOO605 Enzymology

علم الأنزيمات

This course will cover the meaning of enzymology, basic properties of enzymes, classification and nomenclature of enzymes, enzymes kinetics, inhibition, effect of temperature and pH on enzymatic reactions, basics of catalysis, mechanisms of enzymatic reactions, regulatory enzymes, regulation of enzymatic action, enzymes in organized systems, databases for enzymes, and use of enzymes in clinical diagnostics.

ZOO606 Toxicology

علم السموم

Studying the general basis of toxicology and the possible mechanism behind it. It also explains the various type of toxicities encountered in biological systems and the toxic agents involved. Dose-response relationships, absorption, distribution and excretion of toxicants. Biotransformation of toxicants, toxic response and toxic testing of various body organs. Chemical carcinogenesis and genotoxic agents. Oxidative stress mechanism of necrotic and apoptotic cells. Toxic agents (pesticides, metals, radiation, solvents and vapors, animal toxins, plant toxins). Environmental toxicology: food additives, contaminants. Pollutants-applications of toxicology.

Elective Courses

ZOO607 Physiology of Respiration and Excretion

فسيولوجيا التنفس والأخراج

This course will provide: a foundational understanding of the basic functions of the pulmonary system; and integration of individual facts in order to understand how organ systems work independently and interdependently in the body. One example of this integration is in the understanding of emphysema. Other examples covered in this course include high altitude physiology and pulmonary adaptations to exercise. This course will also provide a foundational understanding of the basic functions of the kidney; the mechanisms by which filtration of fluid occurs at the glomerulus; some current ideas on the causes of progression of chronic kidney disease; molecular aspects of structural and functional regulation of renal sodium excretion; advances in the molecular understanding of the kidney and acid base balance; the complex renal adaptations that occur in renal hemodynamics and sensing and control of sodium balance during normal pregnancy and integration of individual facts in order to understand how organ systems work independently and interdependently in the body. One example of this integration is in the understanding of the aging kidney.

ZOO608 Ecology

علم البيئة

Introduction: what is ecology and what is its relationship to other aspects of the biological science. The ecosystem concept: examples of different types of ecosystems, major concepts of an ecosystem, Geochemical cycle. Energy flow in the ecosystem: review of the 1st and 2nd laws of thermodynamics and their relevance to ecological system.

ZOO609 Cardiovascular and Muscular Physiology

فسيولوجيا القلب والأوعية الدموية والعضلات

This course will provide a foundational understanding of the basic functions of the muscle and the human cardiovascular system; and integration of individual facts in order to understand how organ systems work independently and interdependently in the body. One example of this integration is in the understanding of hypertension and heart failure. Other examples covered in this course are in the integrated responses to exercise as well as patho-physiologic responses to aging.

ZOO610 Environmental Pollution

تلوث بيئى

Different types of pollution, atmospheric, aquatic and soil with examples. Effect of pollution on plant habitat, ecosystems, plant ecology, physiology and genetics. Ecological and human health effects of selected environmental pollution problems; particularly those related to chemical contaminants and physical changes to water, air and soil.

ZOO611 Immunology

علم المناعة

Molecular immunology studies, the immune system and processes of the immune system at the molecular level. Here, then, molecular immunologists are concerned with such processes as signaling and activation of immune cells as well as the structure and functioning of such molecules as receptors and mediators among others. Through this field of study, it has not only become possible to determine how the immune system works at the molecular level, but also manipulate various aspects of the system for immunotherapy purposes.

ZOO612 Cell Signaling

الإشارات الخلوية

This course will introduce knowledge of the signaling mechanisms that exist in human cells. These mechanisms are the source of many new drug targets and understanding their biology is critical for the development of new therapeutics and an advanced understanding of current treatment options. Topics to be discussed include G-protein coupled receptors, NF-κB, receptor tyrosine kinases, TGF-β, mTORC, apoptosis and ion channels, among others.

ZOO613 Free Radicals

الشوارد الحرة

Oxidative stress is an underlying factor in a number of common human diseases, including cancer, cardiovascular disease, and diabetes mellitus. Dietary antioxidants and specialized enzymes represent a backbone of the antioxidant defense system in human tissues. This course is designed to provide basic information about molecular mechanisms that are targeted by these species, and about the association between damage caused by these species and etiology of human diseases. A significant part of the course is devoted to nutritional antioxidants and their roles in the prevention and treatment of these diseases.

ZOO614 Ethology

علم السلوك

Ethological course concerns with the study of function, mechanisms, and evolution of behavior. The study aims to explore the role of nervous system, hormones, biological clock, and learning as different mechanisms of behavior. Genetic basis of behavior is taken also into consideration. Topics to be studied are: The role of limbic system different structures in emotions and behavior. Hypothalamus and feeding behavior, sleep-wake cycle, thermoregulation, sexual behavior, and stress response. Learning and memory. The role of hormones in feeding and sexual behavior. The role of biological clock in hibernation and migrating behavior.

ZOO615 General Histopathology

أنسجة مرضية عام

Studying cell injury & repair, cell adaptation, acute & chronic inflammation, cellular growth disturbance, hyperplasia, hypertrophy, atrophy, dysplasia, metaplasia, Cellular Apoptosis & Necrosis.

ZOO616 Molecular Biology

بيولوجيا جزيئية

DNA structure and gene expression. DNA isolation from different types of cells. Restriction enzymes. Agarose gel electrophoresis. Polymerase chain reaction technique and its application, amplifying DNA, analyzing structure, expression of genes and genomes and advanced molecular techniques and medical applications.

I: Core Cytology& Histology Courses (2 credit hours for eCHM course)

ZOO617 General Histology

علم الانسجة عام

Studying the systemic histology for cardiovascular system, nervous system, urinary system and glandular system.

ZOO618 General Histopathology

علم الأنسجة المرضية عام

This course will cover the study of cell injury & repair, cell adaptation, acute & chronic inflammation, cellular growth disturbance, hyperplasia, hypertrophy, atrophy, dysplasia, metaplasia, Cellular Apoptosis & Necrosis.

ZOO619 Immunohistochemistry

كيمياء أنسجة مناعية

Introduction to the principles & methodology of immunohistochemistry from tissue fixation till staining techniques. Study the antigen & antibodies types, studying labeled antibodies & fluorescent microscope as a diagnostic tool.

ZOO620 Stem Cells and Tissue Culture

الخلايا الجزعية وزراعة الأنسجة

Basic of tissue culture techniques & theories, stem cell culturing technique & applications.

ZOO621 Histochemistry

كيمياء الأنسجة

Introduction to histochemistry, enzyme histochemistry from fixation till staining methods, studying the enzyme detection as a diagnostic tool.

ZOO622 Cell Ultra Structure

التركيب الدقيق للخلية

Studying the structure description & function of the cellular organelles.

II: Elective Cytology& Histology Courses (2 credit hours for eCHM course)

ZOO623 Special Histopathology

علم أمراض الأنسجة خاص

Studying the histopathological changes at the level of organs, studying the gross & microscopic changes.

ZOO624 Neurohistology

علم الأنسجة العصبية

Embryonic development of nervous tissue. Structure and function of the meninges. Ultrastructure of spinal cord, synapses, blood brain barrier, nerve fibers and ganglia…. etc. Histology of different parts of the nervous system. Histopathology of nervous tissue in different neurodegenerative diseases.

ZOO625 General Cytopathology

علم أمراض الخلية عام

Studying the pathological changes at the level of the cell organelles & the general features of benign & malignant cells.

ZOO626 Histology of Immune System

علم الأنسجة للجهاز المناعى

Histology and function of lymph nodes, lymphatic vessels, thymus, spleen, tonsil and bone marrow. Autoimmune diseases, immunodeficiency, hypersensitivity.

ZOO627 Electron Microscope

الميكروسكوب الألكترونى

Tissue preparation from fixation till staining, basics and theory of EM, types of EM, advantages and disadvantages, updating of imaging system of EM & applications of EM.

ZOO628 Hematology

علم دراسات الدم

Introduces hematopoiesis, the origin and maturation of the various types of blood cell lines with emphasis on the red and white blood cells. Includes study and analysis of hemoglobin, hematocrit, erythrocytic sedimentation rate and blood cell counts. Emphasizes cell identification, cell differentiation and blood cell morphology. Presents anemia and their classifications based on red blood cell morphology and etiology. Introduces human hematological disorders associated with white cell abnormalities. Emphasizes cell identification, cell differentiation and cell morphology evaluation procedures. Allows for practice of hematology analytical skills and correlation of laboratory findings with patient symptoms and clinical history. Presents principles of automated instrumentation and application of flow cytometry to clinical hematology. Blood grouping and transfusion.

I: Core Genetics & Molecular Cell Biology Courses (2 credit hours for eCHM course)

ZOO629 Molecular Cell Biology

بيولوجيا الخلية الجزيئية

Cell cycle progression, cell cycle control system and the major events, cytokinesis. Control of cell division and cell growth, Mitogen stimulate cell division, DNA damage blocks cell division, cytoskeletal polymers and motors, cytoskeleton proteins, programmed cell death and apoptosis.

ZOO630 Advanced Genetics

وراثة متقدم

Molecular basis of genetics, Chromosome structure & function, Regulation of gene function, Sex determination & differentiation, Karyotype phenotype relationship, Pedigree analysis and applications, Linkage, recombination and eukaryotic gene mapping.

ZOO631 Human Genetics

الوراثة البشرية

An Introduction to the course, The Central Dogma and Genetic Variation, Mendelian Inheritance of Disease, Identifying Mendelian Disease Genes,Genetic variation, Pattern of inheritance, Human population Genetics, Human genome, Epigenetics, Genomics & proteomics.

ZOO632 Cancer Biology

بيولوجيا الأورام

An Overview to Carcinogenesis (chemical-radiation-viral). Oncogenesis. properties of malignant cells. Metastasis and angiogenesis. Apoptosis. Tumor markers. Cancer etiology (endogenesis and exogenesis factors). Spreading of cancer. Inhibition of carcinogen action. Cancer theories.

ZOO633 Cytogenetics

الوراثة الخلوية

Chromosomes in metaphase, Visible functional structures of chromosomes, Chromosome organization, Functional elements of chromosomes, Banding pattern, Karyotyping, Preparation of chromosomes for analysis, Chromosomal aberration, Whole chromosome and structural aneuploidy, Diagnostic techniques for chromosomal disorders.

II: Elective Genetics& Molecular Cell Biology Courses (2 credit hours for eCHM course)

ZOO634 Radiobiology

بيولوجيا أشعاعية

Atomic structure. Isotopes (ionizing and non-ionizing types of radiations). Radiation dosimetry: radio activity and radiation dose units. Radiation measurement. Environmental radioactivity. Biological effects of ionizing radiations. Radiosensitivity and radioresistance. Radiation protection. Sealed and open radiation sources. Open radio-isotopes techniques: isotopes dilution principle. Neuron activation. Radioseparation techniques. Autoradiography, radio-labeling. Design of radioisotope. laboratory facilities and precautions.

ZOO635 Tissue Culture

زراعة الأنسجة

Studying the principles of cell and tissue culture techniques in biology and medicine and the requirements of a tissue culture system, laboratory. Equipments, culture control of infection,

evaluation of growth potentials and maintenance. Methods of examination of cells and tissues, types of microscopies. Applications of tissue culture: general and medical requirements of a tissue culture system. Equipments of a tissue culture laboratory. Control of infection in tissue culture: sterilization & septic techniques. Tissue culture media: natural and synthetic. Common types of tissue culture, common primary explanation techniques. Evaluation of growth potentials in tissue culture: growth morphology. maintenance of culture: feeding and transfer. Tissue desegregation and cell cloning. Organ culture and fate of cultures. Preservation of cultures.

ZOO636 Genetic Engineering

الهندسة الوراثية

An overview of gene control, Restriction enzymes, cloning vectors and cloning, construction of genomic, chromosome and cDNA libraries, identifying specific cloned sequences in cDNA and genomic libraries, DNA sequence analysis, applications of genetic engineering, hazards and problems of recombinant DNA technology and the possible techniques to minimize biohazards.

ZOO637 Drugs

علم الأدوية

Introduction. The pharmacokinetics of drugs (routes of administration-absorption, distribution and elimination). The pharmacodynamics of drugs (the action of drugs). Drug receptors. Interaction psychostimulauts (types and mode of action). General anesthetics (types and action). Anxiolytics, sedatives and hypnotics (types and action). The analgesic, narcotic and non-narcotic (mode of action). Central nervous system depressants (types and mode of action). Antidepressant drugs (types and mode of action).

ZOO638 Population Genetics

وراثة العشائر

Allele frequencies, Hardy-Weinberg equilibrium, and linkage equilibrium; Hardy-Weinberg equilibrium for multiple alleles and loci, genetic drift : Identity by descent, diffusion, the coalescent, Effective population size, Mutation: Types of mutations, mutation and drift, neutral theory, Selection: Defining and measuring fitness, single locus models, Mutation selection balance, frequency dependent selection, gametic selection, Selection and drift, selection on two or more loci, estimating selection, Inbreeding: Calculation of inbreeding coefficients, mating system evolution, Population Subdivision and Migration: Wahlund effect, F statistics, genetic distance, Models of population structure, migration and drift, and interdemic selection.

ZOO639 Developmental Genetics

وراثة التكوين

Principles of developmental genetics, transcription factors & enhancers, cell signals & differentiation, post-transcriptional regulation & microRNAs, chromatin & epigenome, cell-cell signaling through direct interactions, stem cells, reprogramming & generation, asymmetric cell division & cell fates.

I: Core Comparative Anatomy & Embryology Courses (2 credit hours for eCHM course)

ZOO640 Comparative Anatomy

التشريح المقارن

General classification of vertebrates, Introduction to vertebrate anatomy, the relation of vertebrate anatomy and phylogeny, comparative anatomical study of different body systems among vertebrate classes as digestive, circulatory, reproductive and nervous systems.

ZOO641 Embryology

علم الأجنة

Development of the face, palate, oral cavity, visceral arches and pharynx. Development of digestive tube (esophagus, stomCHM and intestine) and the associated glands (liver and pancreas). Development of coelom and mesenteries (the intraembryonic coelom, the pericardial cavity, the pleural cavities, the diaphragm, the peritoneal cavity) as well as their abnormalities. Development of the respiratory system and its abnormalities. Development of nervous system.

ZCAE642 Histology

علم الأنسجة

General revision on different types of animal tissues, glandular histology, digestive system, Nervous system, reproductive system, urinary system.

ZOO643 Developmental Biology

بيولوجيا التطور

It is an essential course for students of biology and medical sciences. Application of advanced knowledge and techniques from other disciplines such as molecular biology, Genetics and Cell biology has created a new trend of investigation of the different stages of development. This trend known as Analytical Embryology, Modern Embryology or preferably Developmental Biology. Developmental biology is an exciting discipline. It mainly concerns with biology of developmental or analysis of events of developmental on a molecular and genetical level. It is one of the advanced courses for students of higher classes. Students, however, can't go through study of developmental biology without being, first, familiar with descriptive or classic embryology.

ZOO644 Experimental Animal

حيوان تجريبي

This course is essential for biological post graduate students. Classification of all animal kingdoms. It concerns with studying the experimental animals in details. Also, doses of drugs to the animal according to Paget table. Some difference between species is also concerned. Differences between animal systems from the dissection point of view. Ethical treatment for experimental animals.

ZOO645 Cranial Nerves

الأعصاب المخية

Classification of the cranial nerves. Description of the nerves and their branches in Anamniota and Amnoita. Analysis of the fibers carried by these nerves and their branches.

II: Elective Comparative Anatomy & Embryology Courses (2 credit hours for eCHM course)

ZOO646 Advanced Taxonomy

علم التقسيم المتقدم

Urinogenital system: pronephros, mesonephros, metanephros, urinary bladder, testis, male genital ducts, ovary, female genital ducts. Head segmentation of vertebrates. Nervous system: neuron, neuroglia cells, spinal cord, spinal nerves, brain, cranial nerves.

ZOO647 Biodiversity

التنوع البيولوجي

Biodiversity refers to the variety of living things and the ecosystems that they form. Biodiversity increases when new species evolve (speciation) and decrease when species become extinct. Every species alive today may play an important role the earth's ecosystem. The loss of single plant species can cause the extinction of many animals and insects that depends upon it. The loss of species may be due to direct actions as hunting or indirect actions such as habitat loss. Species biodiversity. Genetic biodiversity. Indices of diversity. Diversity on environmental gradients. Determinants of diversity.

ZOO648 Evolutionary Morphology

تطور الشكل الظاهري

The effect of physical and climatic factors on vertebrate evolution. Origin of chordates. Evolution of Agnatha-Evolution Gnathostomata. Development of jaws. Types of jaw suspension. Evolution of Chondrichthyes. Evolution of Osteichytes. Evolution of Amphibian-Evolution of Reptilian. Evolution of Aves. Evolution of Mammalians.

ZOO649 Skeletal System

الجهاز الهيكلي

Evolutionary classification of Chordata. An introduction to the anatomy of chordates, with special reference to the study of the skeletal system in various groups. A detailed study of developmental of the skull of the snake. Eryxcolubrinus in several successive stages from early stages of the development of the chondrocranial till the fully formed chondrocranial followed by the formation of the osteocranium. The region of Bagrusbayad (The study of the structure and function of the muscular system).

ZOO650 Neurophysiology

فسيولوجيا الجهاز العصبي

Membrane potential action potential type of channels. The nervous system and it's components. Structure of neuron and it's function brain areas and their function. Neuroglia cells, the synapses (types and structures). The second messengers, the neurotransmitters (types, synthesis and structures). The different receptors of neurotransmitters and mode of action.

I: Core Invertebrates & Parasitology Courses (2 credit hours for eCHM course)

ZOO651 Advanced Biology of Protozoa and Myxozoa

بيولوجيا متقدمة للأوليات والميكسوزوا

Cell biology of free living and pathogenic protozoa and their interaction with host cells. Selected topics on human and animal pathogenic flagellates, amoebae, ciliates and apicomplexan parasites. Cnidarian origins of the Myxozoa, classification and phylogenetics of Myxozoa, approCHMes for characterizing Myxozoan species, annelid-myxosporean interactions, transmission of myxozoans to vertebrate hosts, immune responses to Myxozoa.

ZOO652 Biology of Free-Living Protozoa

يولوجيا الأوليات حرة المعيشة

Taxonomy of free-living protozoa; the flagellates, sarcodines, ciliates. How protozoans obtain energy, modes of feeding for Protozoa with or without cytostomes, digestive processes, symbiotic relationships in Protozoa, factors influencing feeding, physiological functioning of Protozoa, asexual life-cycle, factors influencing growth and division, sexual reproduction, isogamous reproduction, anisogamous reproduction, physiological functions, structure of locomotory organelles, interactions of bacterivorous protozoa with their food source, role of protozoa in nutrient recycling, predators of protozoa.

ZOO653 Immunoparasitology

علم الطفيليات المناعي

Protective immunity in some infections is due to a combination of humoral and cellular immunity; in this circumstance parasites are coated with antibody which makes them susceptible to direct cytotoxicity by macrophages, eosinophils, and neutrophils. Antibody alone is protective against some other infections. Nonspecific and genetic factors are clearly important but are still undefined participants in the host response.

ZOO654 Biology of Helminthology

بيولوجيا الديدان

Free living and pathogenic helminths and their interaction with their hosts. Platyhelminthes, Nematoda and Acanthocephala general characters. Neodermata definition**.** Morphology, taxonomy, biological life cycles and physiology of Helminthes. The diseases that they cause in man and animals. The most effective methods of diagnosing, preventing and treating helminthiases.

ZOO655 Molecular Parasitology

البيولوجيا الجزيئية للطفيليات

This course endeavors to explicate the various applications of assorted molecular based aspects in the field of parasitology including understanding the molecular mechanisms of pathogenesis of parasites, possible tools for combating parasitic infections in man and his livestock. The course also looks at successes, emerging knowledge, and challenges in the field of vaccine and drug development with special emphasis on neglected tropical diseases. It highlights need to understand parasite adaptations for survival within the host and correlates of immune protection in order to translate them to effective drugs and vaccines against parasitic infection, disease control and prevention.

ZOO656 Biology of Higher Invertebrates

بيولوجيا اللافقاريات العليا

Study the feeding, reproductive, respiratory, circulatory, locomotory mechanisms of higher invertebrate Phyla. Knowing the general character of eCHM Phylum and the main differences found between them.

II: Elective Invertebrates & Parasitology Courses (2 credit hours for eCHM course)

ZOO657 Ultrastructure of Protozoology

التركيب الدقيق للأوليات

General ultrastructure characteristics of parasitic flagellates, amoebae, ciliates, apicomplexan parasites, and microspora. Host cell entry by the parasites. Ultrastructure of host-parasite relationships, host cell changes, Ultrastructure of feeding mechanisms, growth and multiplication.

ZOO658 Biology of Minor Phyla

بيولوجيا الشعب الصغيرة

Study the feeding, reproductive, respiratory, circulatory, locomotory mechanisms of Minor Phyla. Knowing the general character of eCHM Phylum and the main differences found between eCHM.

ZOO659 Medical Entomology for Disease Control

علم الحشرات الطبية لمكافحة الأمراض

The discipline of medical entomology is focused upon insects and arthropods that impact human health. Medical entomology also includes scientific research on the behavior, ecology, and epidemiology of arthropod disease vectors, and involves a tremendous outreCHM to the public, including local and state officials and other stake holders in the interest of public safety.

ZOO660 Experimental Design in Zoology

التصميم التجريبي في علم الحيوان

Groping and sampling experimental animals. Sampling units, random sampling techniques, use of random numbers for sampling experimental animals. Methods of summarizing data. Suitable biostatistics for the experiment. Methods of experimental design.

ZOO661 Ultrastructure of Helminthology

التركيب الدقيق للديدان

Study the ultrastructure characteristics of helminthes; external structures as the tegument, microtriches, suckers and internal ones as vitellaria, reproductive, digestive and excretory structures.

ZOO662 Molecular Studies of Invertebrates

دراسات جزيئية اللافقاريات

DNA extraction methods from different species will be discussed. Differentiation between several species will be studied through polymerase chain reactions (PCR).

ZOO663 Immunodiagnosis

مناعة تشخيصية

Modern immunology relies heavily on the use of antibodies as highly specific laboratory reagents. The diagnosis of infectious diseases, the successful outcome of transfusions and transplantations, and the availability of biochemical and hematologic assays with extraordinary specificity and sensitivity capabilities all attest to the value of antibody detection. Immunologic methods are used in the treatment and prevention of infectious diseases and in the large number of immune -mediated diseases.

ZOO664 Ecoparasitology

علم الطفيليات البيئي

Types of parasites and hosts. The host as an environment for the parasite. A study of specific examples of the interactions of the various stages of parasites with their living environments (hosts), as well as the external environment. The zooGeography of parasites. Parasites as ecological control agents of hosts. A study of specific examples of parasites of terrestrial and aquatic animal hosts.

I: Core Immunology Courses (2 credit hours for eCHM course)

ZOO665 Immunochemistry

كيمياء المناعة

It is the study of the chemistry of the immune system. This involves the study of the properties, functions, interactions and production of the chemical components (antibodies/immunoglobulins, toxin, epitopes of proteins like CD4, antitoxins, cytokines/chemokines, antigens) of the immune system. It also includes immune responses and determination of immune materials/products by immunochemical assays.

ZOO666 Applied Immunology

مناعة تطبيقية

Applied immunology provides services to support the development of biological therapeutics such as monoclonal antibodies, vaccines and diagnostics. Applied immunology is a sub-discipline of immunology.

ZOO667 Advanced Molecular Biology

البيولوجيا الجزيئية

DNA structure and gene expression. DNA isolation from different cells. Restriction enzymes. Agarose gel electrophoresis. Polymerase chain reaction, amplifying DNA, analyzing structure, expression of genes and genomes and advanced molecular techniques.

ZOO668 Molecular Immunology

مناعة جزيئية

Molecular immunology studies the immune system and processes of the immune system at the molecular level. Here, then, molecular immunologists are concerned with such processes as signaling and activation of immune cells as well as the structure and functioning of such molecules as receptors and mediators among others. Through this field of study, it has not only become possible to determine how the immune system works at the molecular level, but also manipulate various aspects of the system for immunotherapy purposes.

ZOO669 Diagnostic Immunology

مناعة تشخيصية

Modern immunology relies heavily on the use of antibodies as highly specific laboratory reagents. The diagnosis of infectious diseases, the successful outcome of transfusions and transplantations, and the availability of biochemical and hematologic assays with extraordinary specificity and sensitivity capabilities all attest to the value of antibody detection. Immunologic methods are used in the treatment and prevention of infectious diseases and in the large number of immune -mediated diseases.

ZOO670 Immunoparasitology

مناعة طفيليات

Protective immunity in some infections is due to a combination of humoral and cellular immunity; in this circumstance parasites are coated with antibody which makes them susceptible to direct cytotoxicity by macrophages, eosinophils, and neutrophils. Antibody alone is protective against some other infections. Nonspecific and genetic factors are clearly important but are still undefined participants in the host response.

II: Elective Immunology Courses (2 credit hours for eCHM course)

ZOO671 Medical Microbiology

علم الكائنات الدقيقة الطبية

Medical microbiology studies of microorganisms, or microbes, a diverse group of generally minute simple life-forms that include bacteria, algae, fungi, protozoa, and viruses. The field is concerned with the structure, function, and classification of such organisms and with ways of both exploiting and controlling their activities.

ZOO672 Pathology

علم الامراض

As a field of general inquiry and research, pathology addresses components of disease: cause, mechanisms of development (pathogenesis), structural alterations of cells (morphologic changes), and the consequences of changes (clinical manifestations). In common medical practice, general pathology is mostly concerned with analyzing known clinical abnormalities that are markers or precursors for both infectious and non-infectious disease, and is conducted by experts in one of two major specialties, anatomical pathology and clinical pathology.

ZOO673 Chronobiology

علم الإيقاع البيولوجى

Biological rhythms are the natural cycle of change in our body's chemicals or functions. It's like an internal master "clock" that coordinates the other clocks in your body. The "clock" is located in the brain, right above the nerves where the eyes cross. It's made up of thousands of nerve cells that help sync your body's functions and activities.

ZOO674 Biostatistics Analysis

إحصاء حيوية

Statistics is the discipline that concerns the collection, organization, analysis, interpretation, and presentation of data. In applying statistics to a scientific, industrial, or social problem, it is conventional to begin with a statistical population or a statistical model to be studied.

ZOO675 The Relationship between the Nervous System and the Immune System

العلاقة بين الجهاز العصبي والجهاز المناعى

The immune system may interfere with brain function. The central nervous system may also influence the activity of the immune system. The central nervous system is functionally protected by the blood-brain barrier.

ZOO676 Medical Parasitology

علم الطفيليات الطبية

Parasitology is the study of parasites, their hosts, and the relationship between them. As a biological discipline, the scope of parasitology is not determined by the organism or environment in question but by their way of life. This means it forms a synthesis of other disciplines, and draws on techniques from fields such as cell biology, bioinformatics, biochemistry, immunology, genetics, evolution and ecology.

ZOO677 Comparative Immunology

مناعة مقارنة

Comparative immunology investigates the major differences of the immune system between different organisms, generally organisms that are not closely related, in order to gain an appreciation for the variety of immune mechanisms that exist and to draw conclusions on the evolution of immunity.

ZOO678 Toxicology

علم السموم

Toxicology is a scientific discipline, overlapping with biology, chemistry, pharmacology, and medicine, that involves the study of the adverse effects of chemical substances on living organisms and the practice of diagnosing and treating exposures to toxins and toxicants. The relationship between dose and its effects on the exposed organism is of high significance in toxicology. Factors that influence chemical toxicity include the dosage, duration of exposure (whether it is acute or chronic), route of exposure, species, age, sex, and environment. Toxicologists are experts on poisons and poisoning.

I: Core Entomology Courses (2 credit hours for eCHM course)

ZOO678 Insect Diversity and Taxonomy

تنوع الحشرات وتصنيفها

Principles and practices of insect classification and identification with emphasis on adult insects.

ZOO679 Insect Physiology and Molecular Biology

فسيولوجيا الحشرات والبيولوجيه الجزئيه

Overview of insect physiology and modern molecular techniques to study physiological process.

ZOO680 Insect Ecology

علم بيئة الحشرات

To develop an understanding of important ecological concepts through study of dynamic relationships among insects and their environment. To become familiar with the literature of insect ecology, and interpretation and critique of ecological research.

ZOO681 Morphology of Insects

مورفولوجيا الحشرات

Origin, evolution, and functional significance of external insect structure. Structure and function of major internal systems.

ZOO682 Advanced Applied Entomology

علم الحشرات التطبيقي المتقدم

Topics will include the integration of tactics, integration of disciplines and specific case histories in insect management, or use of insects to manage weeds

ZOO683 Insects Affecting Human and Animal Health

الحشرات المؤثره علي صحة الحيوان والانسان

Discussion of arthropod parasites and disease vectors. Topics include an overview of disease transmission and public health, epidemiology, vector biology, important arthropod groups and their control.

II: Elective Entomology Courses (2 credit hours for eCHM course)

ZOO684 Honey Bee Biology and Beekeeping, and human life

تربية النحل وحياة الانسان

To acquaint the student with social insects in general and honey bees in particular, to promote an interest in beekeeping as a hobby, occupation, and/or science, to give the students the basic knowledge of how to keep honey bees, and to increase awareness of the contribution that pollinating insects make to agriculture, natural ecosystems, and human life.

ZOO685 Insect Behavior and Chemical Ecology

سلوك الحشرات والبيئه الكيميائيه

Insect Behavior and Chemical Ecology. Basic concepts in insect senses and patterns of behavioral responses to various environmental stimuli. Previous knowledge of basic entomology is helpful, but not required.

ZOO686 Conceptual Methods in Ecology and Evolution

الاساليب المفاهيميه في علم البيئه والتطور

This course provides students with hands-on experience in a diverse array of conceptual research techniques used by ecologists and evolutionary biologists.

ZOO687 Insect-Plant Relationships

العلاقات بين الحشرات والنباتات

This course examines the natural history, ecology, and evolution of insect/plant relationships. Topics include mechanisms and theory of plant defense, behavioral and physiological

adaptations of herbivorous insects, pollination biology, multitrophic-level interactions, causes of insect outbreaks, and applications to managed ecosystems.

ZOO688 Phylogenetic Systematics

منهجي النشوء والتطور

Theory and methods of phylogenetic analysis and cladistics will be explained. Applications of phylogenetic analysis, such as historical bioGeography, biological classification, and testing of ecological hypotheses will be explored.

ZOO689 Special Problems in Entomology and Acarology

مشاكل خاصه في علم الحشرات والقوارض

Investigations of chosen insect problems, including original work. Discussion and assignment of current insect subjects.

ZOO690 Scientific Publishing: Process and Ethics

النشر العلمي :العمليه والاخلاق

An introduction to scientific publishing, including types of scientific journals, choosing where to publish, the structure of scientific papers, the peer review process, data management and archiving, post-publication promotion of research, metrics of scientific impact such as impact factors and altmetrics, and publication ethics.

ZOO691 Insect Pests of Household, Man and Animals

الافات الحشريه المنزليه للانسان والحيوان

Identification, biology and control of different insect pests like ants, termites, cockroCHMes, silver-fish, cricket, powder-post beetle, carpet beetle, cloth-moths, psocids, lice, bed-bugs, fleas, mosquitoes, house flies, wasps, sand flies, stable flies, flesh flies, blow flies, tsetse flies, black flies and midges.

ZOO692 Insect Physiology

فسيولوجيا الحشرات

Introduction; embryonic and post-embryonic development, physiology of integument, digestive, trCHMeal, circulatory, excretory, reproductive, muscular and nervous systems; sense organs and perception; sound and light production, thermoregulation; production and function of hormones and pheromones.

ZOO693 Integrated Pest Management

المكافحه المتكامله للافات

Introduction; history, concept and principles of Integrated Pest Management (IPM); organic farming, economics of pest management, different methods of insect pest scouting and forecasting; losses caused by insect pests to different crops; methods of pest management: cultural, physical, mechanical, legislative, chemical, biological, microbial, biotechnological and genetic control measures, feeding deterrents, insect growth regulators (IGRs) and pheromones.

ZOO694 Insect Classification and Biodiversity

تصنيف الحشرات والتنوع البيولوجي

Introduction; schemes of classification; types and components of biodiversity, history of insects, phylogenetic affinities of different orders; insect adaptation in various Geographical regions; speciation and biodiversity; classification of insect orders up to family level with particular reference to insect fauna of Egypt.

ZOO695 Agricultural Pests and Their Management

الافات الزراعيه والتعامل معها

Introduction; concepts of IPM technology, identification, distribution, host plants, biology, damage and management of mites and insect pests of field crops, vegetables and orchards; brief introduction to important vertebrate pests.

ZOO696 Stored Product Pests and Their Management

افات المنتجات المخزنة والتعامل معها

Introduction; identification, biology and management of different stored product pests; principles and types of storages; factors affecting grain and other products in storages; stored product losses and their prevention.

ZOO697 Beneficial Insects

الحشرات النافعه

Introduction; insects of medicinal, food and aesthetic value; insect pollinators and environmental indicators; scavengers, entomophagous (predators and parasitoids) and weed-feeding insects; beneficial insect industries.

ZOO698 Plant Resistance to Insect Pests

مقاومة النبات للافات الحشريه

Introduction; concepts of resistant and transgenic crops to insect pests; mechanism and factors of resistance; ecological, physiological, asynchrony, induced genetic antixenosis, antibiosis and tolerance; genetic basis of resistance; effect of environment on resistance; biotypes and resistance; measurement of resistance. Effect of transgenic crops on nontarget organism.

ZOO699 Insecticides and Their Application

المبيدات الحشريه وتطبيقها

Introduction; nomenclature, classification on the basis of mode of entry, chemical nature (natural and synthetic insecticides), mode of action, toxicity and insecticides formulations; compatibility, physico-chemical properties, residues of insecticides; insecticide resistance and its management, hazards and safety measures; functioning of various types of hand and power operated equipments for insecticide application. Types of nozzles. Information about insecticide legislation.

ZOO6100 Range and Forest Entomology

نطاق وحشرات الغابات

Importance of range and forest entomology in range land and forest ecosystems; insect pests of range and forest trees, lawn insects, their identification, distribution, host plants, biology, nature of damage, estimation of losses and management; competition and complementary role of insects with range livestock.

ZOO6101 Biological Control of Insect Pests

المكافحة البيولوجيه للافات الحشريه

Introduction, concept, history and scope; ecological basis of biological control; natural enemies: predators, parasitoids and insect pathogens (mode of action, application, epizootics); advantages and disadvantages, characteristics of bio-control agents; procedure of biological control: introduction; enhancement of bio control agents (introduction, conservation, mass culture, augmentation, release, monitoring and importation); rearing techniques of bio-control agents and their host insects; role of biological control in IPM. Commercialization of biocontrol agents, Quality management in biological control agent rearing, establishment of biological control system.

I: Core Animal Ecology Courses (2 credit hours for eCHM course)

ZOO6102 Ecosystem

الانظمة البيئية

Concept of ecosystem. Characters of ecosystem. Ecosystem theory. Ecosystem energetic. Ecosystem as an information system. BioGeochemical cycles. Environmental health and environmental engineering.

ZOO6103 Desert, Marine, and Fresh Water Ecology

بيئة صحراوية وبحرية ومياة عذبة

Desert Ecology: Desert ecosystem. The best use of desert animal strategy. Study of the structure and function of plant and animal colonies and their relationship to environmental factors that regulate growth and survival.
Fresh Water and Marine Ecology: The general characters to environment of different zones in seas, oceans and fresh water, and the organisms inhibiting eCHM zone. Distribution of salinity and temperature in different environments.

ZOO6104 Fish Biology and Fisheries

بيولوجيا الاسماك والمصايد

Skin structure and its derivatives. Different types of reproduction. Size and age at first sexual maturity. Fishes' classification and nomenclature. Dynamic study of fish families and evaluation of the stock.
Fish biology: General characters and classification of fishes, comparison of diverse groups of fishes. Body shapes and movement in fishes, different fin modifications. Skin structure and modifications of scales in fishes. Modification of digestive system and feeding in fishes. Respiratory system and circulatory systems in fishes. Reproductive system, sexual dimorphism reproduction in fishes. Fertilization, parental care, embryonic development and relationship between larvae and marine environment. Fish migration.

ZOO6105 Aquaculture

الاستزراع المائي السمكي

An introduction to economic fishes. Methods of open fish culture and fish farms. Marine aquaculture. Aquaculture in cages. Aquaculture of variable types. Economy of aquaculture. The culture of fish, aquatic invertebrates and other organisms is a major and growing source of food in the world. This course examines techniques used in Canadian and worldwide

aquaculture, their biological basis, current research to improve production and environmental issues related to aquaculture practices. Excursions to aquaculture facilities are planned.

ZOO6106 Water Pollution and Treatments

التلوث المائي ومعاجته

Detail study of the water environment and water resources with special emphasis on wastewater source identification, sampling, analysis and performing treatability tests. Course work will concentrate upon the methods for process identification and transformation of pollutant during industrial processes, methods for pollution control and minimization at sources as well as waste handling, treatment and disposal. Also, an introduction to the environmental interpretation of data obtained in comparison to standard points.

ZOO6107 Air Pollution and Treatments

التلوث الهوائي ومعالجته

Definitions and concepts, common air pollution issues, system approCHM to atmospheric pollution. Atmospheric physics: structure of the atmosphere, horizontal and vertical transport of pollution. Pollutants: Air pollution sources and emissions, atmospheric motion and pollutant transport, categorization of pollutant, air pollution impact on health and environment, major pollutant sources and budgets, air quality standards. Indoor and urban air pollution and control. Regional and global issues: global warming, stratospheric ozone depletion, acid rain, long-range transport, hazardous air pollution, urban smog. Air pollution management and regulation.

II: Elective Animal Ecology Courses (2 credit hours for eCHM course)

ZOO6108 Egyptian Environment and Natural Reserves

البيئة المصرية والمحميات الطبيعية

Introduction to Egypt environment. Natural biodiversity. Threats that face natural environment and Extinction rate. Rules of establishment and protection of natural reserves. Natural reserves in Arabic Republic of Egypt.

ZOO6109 Fish Taxonomy

تصنيف الأسماك

An introduction in taxonomy and basic idioms. Basics of Binomial Nomenclature, international code of zoological nomenclature. Taxonomic keys and its types. Taxonomic systems and its types. Taxonomic characteristics and classification of fishes. The different methods and techniques of fish classification. Identify the several types of fishes through taxonomic characteristics.

ZOO6110 Fish Feeding and Physiology

فسيولوجيا وتغذيه الاسماك

Fish physiology**:** Metabolism in fish. Blood and circulation. Respiration, excretion and osmotic regulation for different forms of fishes. Sensation and sensory organs. Nervous and endocrine coordination.
Fish metabolism: Different pattern of feeding and modification of digestive system. Protein requirement for fishes. Sources of plant and animal protein. Feeding efficiency criteria. Ration formation and energy calculation. Effect of feeding rates on growth performance.

ZOO6111 Chemistry of Pesticides and Heavy Metals

كيمياء المبيدات والمعادن الثقيله

The course introduces students to chemical, physical and toxicological properties of organic and in organic toxicants in aquatic and terrestrial environments , the course introduces students to the kinds of toxic substances, chemical nature of toxicants, toxicity- influencing factors, exposure to toxic substances, dose response relationships, xenobiotic and endogenous substances, kinetic and non - kinetic toxicology, phases of toxicity, metabolic reactions of xenobiotic compounds, phase I and phase II reactions, biochemical mechanisms of toxicity, interference with enzyme action, biochemistry of mutagenesis, biochemistry of carcinogenesis and toxic natural products.

ZOO6112 Freshwater Invertebrate Ecology

علم البيئه اللافقاريه للمياه العذبه

The ecosystem perspective, including the roles of aquatic invertebrates in ecosystem processes, overview of aquatic insect ecology, Ecological roles of invertebrate functional groups, and how they change along the continuum, how invertebrates influence ecosystem processes and functions such as decomposition, primary production, and nutrient cycling, and how those with amphibious life cycles can link aquatic and terrestrial habitats through energy and nutrient subsidies.

ZOO6113 Methods for Evaluating Environmental Impacts

طرق تقييم التأثيرات البيئية

This analytical course introduces the student to the fundamentals of ecological and laboratory evaluation and measurement of pollutants. The student is to acquire the basic skills for chemical separation of a mixture of pollutants and how to plan and prepare for simultaneous multi-component system analysis. Introduction to the methods and principles of environmental assessment of the impacts of activities and pollutants (predicting, dispersion and ecological distribution of pollutants during discharge and after emission) with the introduction of the basics of project formulation, relationships between organisms and their environment and in managing human, air and soil resources. A course which will familiarize students with a wide range of laboratory and held methods directly applicable to the study of environmental problems.

ZOO6114 Fauna Egyptian and Geographical Distribution

الحيوانات المصريه والتوزيع الجغرافي

Introduction. Bony Fish fauna of Egypt. Cartilaginous Fish fauna of Egypt. Amphibian fauna of Egypt. Reptilian fauna of Egypt (Squamata). Reptilian fauna of Egypt (Lacertilia). Mammals (Rodents of Egypt). Mammals (Bats of Egypt). Aves in Egypt.

ZOO6115 Behavioral Ecology

علم البيئة السلوكية

Theory and practice in biology study of animal behavior: ethology and behavioral ecology. The observation and description of behavior along with the development, function, and evolution of behavior in an ecological context are examined as important elements in the analysis of behavior, particularly social behavior. Topics include a sensory control system,

foraging behavior, communication, home range, territorial behavior, aggression and dominance, sexual behavior, mate choice, mating system, play and social organization.

قسم الجيولوجيا

أولا: الدبلومات

1- دبلومة الجيولوجيا التطبيقية

GEO501 Mineral Exploration

أستكشاف المعادن

Introduction, Exploration techniques e.g., drilling, Geophysical etc.;. Mechanical and chemical weathering, Weathering and regolith, Exploration in various regolith environments, Chemical dispersion: primary and secondary, Sampling and sampling theory in mineral exploration and detection techniques, Stream sediment Geochemistry, Soil surveys, BioGeochemical Surveys, other sampling media, Statistical data analysis and other calculations, Exploration of specific mineral deposits (e.g. Orogenic gold, Low-high sulfidation epithermal Au-Ag mineralization, etc.).

GEO502 Applied Structural Geology

الجيولوجيا التركيبية التطبيقية

Descriptive analysis, kinematic analysis, dynamic analysis, fault seal analysis, fractures and veins, Geophysical investigation, Interpretation of Geophysical data, boreholes and well logs, remote sensing, GIS, DEM and virtual globs, Geodesy and GPS data, modelling, mineral exploration, shear zones control mineralization.

GEO503 Applications of Remote Sensing in Geology

تطبيقات الأستشعار عن بعد فى الجيولوجيا

History and Scope of Remote Sensing, Electromagnetic Radiation, Digital Imagery, Image Interpretation, Types of Sensors (Land, Active, Thermal), Image Resolution, Preprocessing, Image Classification, Hyperspectral Remote Sensing, Geographic Information Systems, Projects in Geological applications of remote sensing.

GEO504 Ore Deposits of Egypt

رواسب الخامات فى مصر

Introduction, Classification of Ore Deposits, Magmatic ore deposits, Magmatic-hydrothermal mineralizations, Hydrothermal mineral deposits in orogenic environments, Hydrothermal mineral deposits in volcano-sedimentary environments, sedimentary mineral deposits, ore deposits in the Arabian-Nubian Shield.

GEO505 Applied Mining Geology

جيولوجيا التعدين التطبيقية

Introduction, Mining methods (open pit mines, underground mines, unconventional mining), Mine mapping, Drilling techniques and drill holes logging (drilling methods, diamond core drilling, reverse circulation percussion drilling, etc.), Sampling of mine workings (sampling rock faces in the underground mines, sampling the broken ore, trenching and winzing), Data preparation, Geological constraints of mineralization, Exploratory data analysis, Resource estimation methods, Applied mining Geostatistics.

GEO506 Environmental Geology **جيولوجيا البيئة**

Basic understanding of major Geological processes occurring in the near surface and surface of the Earth, (streams & flooding, coastal zone and Mass movement, climate change and desert), Comprehension of how environmental Geological processes impact humans and society, Appreciation on how anthropogenic activities are modified natural environmental processes.

GEO507 Petroleum Provinces of Egypt **الأقاليم البترولية فى مصر**

Petroleum provinces in Egypt, Petroleum systems of Egypt, Source rocks; Hydrocarbon generation areas, Hydrocarbon bearing rocks, Types of petroleum traps, Distribution of oil and gas fields, Type of crude oils, Prospective areas, Oil and gas production and reserves, Main oil and gas producing fields in Egypt, North African petroleum Basin, Arabian Gulf petroleum province, Giant oil fields in the world, Petroleum potentiality of Egypt, Middle East, North Africa.

GEO508 HydroGeology of Egypt

هيدروجيولوجية مصر

Types of aquifers, Description and distribution of aquifers in Egypt, Groundwater potentiality in Egypt, Aquifers problems, Aquifer management, Seawater intrusion in costal aquifers and desalination.

GEO509 Rock Mechanics

ميكانيكا الصخور

Introduction, Stress and infinitesimal strain, Rock mass structure and characterization, Rock strength and deformability, Methods of stress analysis, Excavation design in massive elastic rock, Excavation design in stratified rock, Excavation design in blocky rock, Energy, mine stability, mine seismicity and rock bursts, Rock support and reinforcement, Monitoring rock mass performance.

GEO510 Sedimentary Basin Analysis **تحليل أحواض ترسيب**

The foundations of sedimentary basins, (basins in their plate tectonic environment, the physical state of lithosphere), The mechanics of sedimentary basin formation, The sedimentary basin-fill (the sediment routing system, basin stratigraphy, etc.), Application to petroleum play.

GEO511 Using Geochemical Data **إستخدام البيانات الجيوكيميائية**

Introduction, analyzing Geochemical data (averages, correlation, regression, etc.), using major element data (rock classification, variation diagrams), Using trace element data (controls on trace element distribution, rare earth elements, normalized multi-element diagrams, Bivariate trace element plots), Using Geochemical data to discriminate between tectonic environments, Using radiogenic isotope data (Geochronology, petrogenesis), using stable isotope data.

GEO512 Well Logging **تسجيل آبار**

Introduction (terminology, basic log types, coring, wellsite mud logging, etc.), Log interpretation, Saturation/Height analysis, Advanced log interpretation techniques (shaly sandstone analysis, carbonates, NMR logging, etc.).

GEO513 Ore Microscopy **مجهرية الخامات**

Preparation of samples for ore microscopy (polished sections, polished thin-sections), Properties of ore minerals in reflected light (observations in polarized light, observations between crossed nicols and observations in convergent light, microindentation hardness), Textures and structures of the ore minerals (introduction, descriptive classification of ore textures, genetic classification of ore textures), Ore minerals paragenesis and zoning.

GEO514 Mineral Processing Technology **تكنولوجيا تركيز الخامات**

Introduction, Crushers (primary & secondary crushing, primary crushers: jaw crushers and gyratory crushers, secondary crushers: cone crushers, crushing rolls, impact crushers), Grinding mills (mechanisms of breakage, motion of the charge in the tumbling mill, Tumbling mills: rod mills, ball mills, autogenous mills), Gravity concentration (principles of gravity concentration, types of gravity separators), Dense Medium Separation (DMS) (principles of DMS, the dense medium: liquids & suspensions, separating vessels: gravitational & centrifugal), Froth flotation (principles of froth flotation: collectors, frothers & regulators, flotation mCHMines, flotation plant practice), Magnetic and high-tension separation.

GEO515 Applied Mineralogy **علم المعادن التطبيقى**

Minerals and their chemical classification, Physical properties, Special mineral properties and related structures (Luminescence, phosphorescence, fluorescence, absorption), Precious and Semiprecious stones (Identification of gemstone, gem testing, gem enhancement and its classifications, uses of gemstones, etc.), Environmental mineralogy (Mineralogical effects causing pollution and related hazards, Health hazards from natural minerals, etc.), Concept of Geomedicine and medicinal mineralogy (Geomedicine related to various elements and minerals, Various types of diseases caused by different elements and minerals).

GEO516 Statistics and Data Analysis in Geology

الأحصاء وتحليل البيانات فى الجيولوجيا

Introduction, Elementary Statistics, Matrix algebra, Analysis of sequences of data, Spatial analysis, analysis of multivariate data, Statistics and data analysis in Geochemical prospecting.

2- دبلومة الجيوفيزياء التطبيقية

GPH501 Seismic Methods (refraction and reflection)

الطرق السيزمية

Basic principles of seismic refraction. Straight Raypaths in Layered Media-Planar interfaces. Straight Raypaths in Layered media – Irregular interfaces. The theory of curved Raypaths.

Seismic Refraction data corrections. Transmission of diving waves through inhomogeneous gradient medium. Geometry of reflected ray paths (single horizontal reflectors, Multiple horizontal reflectors, Dipping reflector, Ray paths of multiple reflections). Multichannel profiling . The reflection seismogram. Presentation of reflection survey data. Survey design parameters. Basic Data Processing. Migration.

GPH502 Gravity Method

التثاقلية الأرضية

Fundamental Principles (Newton's law Gravitational acceleration, Earth's mass & density, Gravitational potential, Rock densities and Normal spheroid & Geode). Gravity measurements and data reduction. Isostasy and crustal thickness. Analysis and interpretation of gravity data. Gravity anomalies and Geological structures.

GPH503 Geomagnetic Method

المغناطيسية الارضية

Fundamental Principles (Magnetic fields, Intesnsity of magnetization , Magnetic susceptibility & permeability, Dipole field, Diamagnetism , paramagnetism, ferromagnetism, common magnetic series). The earth's magnetic field. Magnetization of rocks. Magnetic surveying & interpretation techniques. Introduction of magnetic data. Magnetic mapping of Geological structures.

GPH504 Electric Method

الكهربية الارضية

Fundamental Principles of Geoelectric. Methods of Geo-electricity. Earth resistivity methods. Applications and interpretation of resistivity data. SP, IP and magnetotelluric methods.

GPH505 Earthquake Seismology

علم الزلازل

Elastic wave theory. Mechanism of Earthquakes . Instrumentation of earthquakes . Earthquakes and Plate Tectonics. Locating an earthquakes, types of Magnitudes, Seismic moment, fault plane solution

GPH506 Petrophysics

البتروفيزياء

Concepts and problems common in petroleum engineering that will appeal to a wide range of disciplines. Rock properties and their interactions with fluids, including gases, liquid hydrocarbons, and aqueous solutions. A basic understanding of the physical properties of permeable Geologic rocks and the interactions of the various fluids with their interstitial surfaces.

GPH507 Petroleum exploration (Geophysical Perspective)

الاستكشاف الجيوفيزيقي عن البترول

Seismic reflection method for hydrocarbon exploration, field layout, data processing, and interpretation. Static and weathering correction. Basic migration tools.

GPH508 Geophysical exploration for minerals and groundwater
الاستكشاف الجيوفيزيقي عن المعادن والمياه الجوفية

Magnetic method, source of magnetic field, basic reduction filters: reduce to the pole, diurnal variation. Curie point, basic filters such as vertical gradient, total horizontal gradient and tilt angle. Radiometric method: field observations and interpretation.

GPH509 Electromagnetic Method **الطريقة الكهرومغناطيسية**

Electromagnetic theory. Combination of EM fields. EM equipment. EM field systems for ground surveys and interpretation. Time Domain Electromagnetic technique, Frequency Domain Electromagnetic technique. Field layout problems. UXO detection using Electromagnetic method.

GEO512 Well logging **قياسات آبار**

Importance of well logging in prospecting for water, Hydrocarbons, minerals and ore deposits. Applications of SP logs, GR logs and NGS logs, Identification of unconformity surface, Determination of igneous rocks & organic content. Instruments used for well logging. Basic problems for well logging.

GPH510 Computer science in Geophysics **تطبيقات الحاسب في الجيوفيزياء**

Basics of digital data analysis, Geostatistical approCHMes. Probability theory. Types of errors in data and how to handle them. Gridding and contouring of Geophysical data, Introduction to programming in Python.

GPH511 Engineering Geophysics **الجيوفيزياء الهندسية**

Application of Geophysical methods to engineering purposes and problems, Geophysical assessment for soil and rock properties, Study of site conditions and soil – structures relationships, application of measurements and characteristics of strong ground motion, Advanced application of Geophysical methods to engineering purposes and problems, Geophysical assessment for soil and rock properties

GPH512 Reservoir Geophysics **جيوفيزياء الخزانات**

Introduction & Rock Physics Basis, Application of Seismic in Development and Production Fields, Application of Seismic Attributes in Development and Production Fields, Application of AVO & Geostatistical Modeling in Development and Production Fields ,Application of Post Stack AI Inversion in Development and Production Fields, List of Software Exercises (all using Petrel software)

GPH513 Application of Geophysics in Mining **تطبيقات جيوفيزياء المناجم**

Introduction about mineral resource potentials in Egypt and in the world. Application of different Geophysical methods for mineral exploration, near surface mineral mapping.

GPH514 Marine Geophysics **الجيوفيزياء البحرية**

This course discusses the application of Geophysical methods to map the potential of marine resources by analysing the characteristics of marine Geophysical data, surveys design for

offshore exploration and research purposes, how Geophysical measurements can be taken at sea.

GPH515 Geothermal exploration **استكشاف المكامن الحرارية**

Introduction, importance of Geothermal energy exploration, different Geophysical methods and their roles in Geothermal explorations, and ground temperature mapping.

GPH516 Global environment **البيئة العالمية**

The course includes the study of solid-earth systems, atmospheric, oceanic and selective topics of environmental Geophysics. The course handle critical issues such as climate change, Geophysical hazards, and environment protection.

GPH517 Space Geophysics **جيوفيزياء الفضاء**

This course offers study in solar storms, Explores the sun, observations from space and from Earth; Earth's space environment, radiation belts and hazards, plasma storms and auroras, planetary systems and resources, and project highlighting space and its exploration, Geophysical fluid dynamics (turbulence, rotating systems, stability, hydromagnetic), planetology (orbital dynamics, planetary interiors, surfaces and atmospheres, solar-system origin), space physics (magnetosphere, radiation belts, solar wind, magnetic fields, cosmic rays), and applied Geophysics. Other comparable areas of study are also possible.

مقررات برنامج الصخور و الجيوكيمياء و رواسب الخامات

GEO601 Igneous Petrology **صخور نارية**

Earth structure and petrotectonic assemblages, structures of igneous rocks (extrusive and intrusive structures), textures of igneous rocks, chemistry and mineralogy of igneous rocks, classification of igneous rocks (textural, mineralogical and multiple criteria classifications), petrogenesis, movement and modification of magmas, basalts and ultramafic volcanic rocks, rhyolite and pyroclastic rocks, andesites and related rocks, ultramafic-mafic complex and related rocks, granodiorites and related rocks, granites, aplites and pegmatitic rocks, alkaline igneous rocks and carbonatites.

GEO602 Geochemistry **جيوكيمياء**

Crystal chemistry, crystal structure, Geochemical classification of elements, Geochemical differentiation of elements, Distribution of elements in igneous rocks, distribution of elements in sedimentary rocks, Geochemical cycles of elements, isotope Geochemistry, analytical methods in Geochemistry.

GEO603 Ore Deposits **رواسب خامات**

Introduction, Deposits related to mafic igneous rocks, with possible Egyptian examples, Deposits related to oceanic crust with Egyptian examples, Deposits related to intermediate to felsic intrusions with possible Egyptian examples, Deposits related to submarine volcanism with Egyptian examples, Metallogenic provinces, epochs, and plate tectonics.

GEO604 Metamorphic Petrology **صخور متحولة**

Metamorphism and metamorphic rocks, texture and structure of metamorphic rocks, metamorphic conditions, metamorphic facies, metamorphic phase diagrams, relation between metamorphism and plate tectonics, contact metamorphism, regional metamorphism under low to medium P-T conditions, high P-T metamorphism, eclogites, dynamic metamorphism.

GEO605 Mineralogy **علم المعادن**

Optical properties of minerals, Rock-forming minerals, Structure of silicate minerals, Silicates mineral groups and their application in petrogenesis (silica minerals, mica group, feldspar group, amphibole group, pyroxene group, olivine group, serpentine minerals, clay minerals etc.), Non-silicate mineral groups (carbonates, phosphates, sulphates, etc.), Mineral chemistry and mineral structural formula calculation.

GEO606 Ore Mineralogy **معادن خامات**

Preparation of polished sections, optical properties of ore minerals, textures and structures of ore minerals, wall-rock alterations, fluid inclusions, ore mineral paragenesis and zoning, ore-forming processes, examples of most necessary ore mineral deposits.

GEO607 Application of GIS and remote sensing in Environmental Geology
أستشعار عن بعد وتطبيقات نظم المعلومات الجغرافية في الجيولوجيا البيئية

This course introduces the concepts and components of a Geographic information system (GIS) and remote sensing. It also teCHMes the essential skills of operating a functional GIS through the use of ArcGIS software package. the operational processes of spatial data acquisition, editing and QA/QC, metadata development, Geodatabase design, spatial query and display, spatial analysis and modeling, preliminary GIS application development, mapping and dynamic visualization, and GIS implementation basics, electromagnetic radiation and physics of remote sensing, optical remote sensing, thermal remote sensing, hyperspectral remote sensing, microwave radiometry, Digital Image Processing Production of Thematic maps, Integration between Remote Sensing and Geographic Information Systems, Remote Sensing Applications on Geology, Remote Sensing Applications on Mineral Resources.

GEO608 Exploration of Mineral Deposits **أستكشاف الرواسب المعدنية**

Introduction, Exploration Geochemistry fundamentals; the use of litho-Geochemistry in mineral exploration; Exploration techniques e.g., drilling, Geophysical etc.;. Mechanical and chemical weathering; Weathering and regolith; Exploration in various regolith environments; Chemical dispersion: primary and secondary, Sampling & sampling theory in mineral exploration and detection techniques; Stream sediment Geochemistry; Soil surveys; BioGeochemical Surveys; other sampling media, Statistical data analysis and other calculations, VHMS ore deposit models and exploration, PCD, Breccias in porphyry and epithermal environments, Low-high sulfidation epithermal Au-Ag exploration, Orogenic gold ore deposit models and exploration.

GEO609 Isotope Geology **جيولوجيا النظائر**

Introduction (atomic structure, isotopes, isotones, isobars, radioactive and stable isotopes), Mass spectrometry and techniques in isotopes measurement, Rb-Sr dating method, U-Th-Pb dating method, Oxygen and hydrogen isotopes, Carbon isotopes, Sulfur isotopes.

GEO610 Industrial Minerals معادن صناعية

Introduction to industrial mineralogy, importance of industrial minerals, environmental hazards and safety, ceramic material and ceramic industry, structural and building materials, manufacturing materials, metallurgical and refractory materials, chemical and fertilizer materials, abrasive minerals.

GEO612 Geochemical Techniques تقنيات جيوكيميائية

Geochemical sample preparation, X-ray fluorescence (XRF), Instrumental Neutron Activation Analysis (INAA), Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Inductively Coupled Plasma Mass Spectrometry (ICP-MS): LA-ICP-MS, ID-MS, TIMS, etc., Electron Probe Micro-Analysis (EPMA), Ion Probe, X-ray elemental mapping, Scanning Electron Microscopy (SEM), Wavelength-Dispersive X-ray Spectroscopy (WDS), Energy-Dispersive X-ray Spectroscopy (EDS).

GEO613 Mining Geology جيولوجيا التعدين

Introduction, Geochemical and Geophysical Exploration Methods, Mineral Exploration Drilling, Mining Methods: Mining Terminology, Surface mining methods: Open pit mining, Strip mining, Dredging, etc., Subsurface mining methods: Room and Pillar, Cut and Fill, Block Caving, Solution Mining, etc., Estimates of Grades and Tonnage.

GEO614 Ore Dressing تركيز خامات

Introduction (minerals & ores, mineral processing methods, flow sheet, efficiency of mineral processing operations: liberation & concentration), Ore handling (removal of harmful materials, ore transportation, ore storage, feeding), Comminution (principles of comminution), Crushers (primary and secondary crushing, primary and secondary crushers), Grinding mills, Industrial screening and classification of ores, Gravity concentration, Dense Medium Separation (DMS), Froth flotation, Magnetic and high-tension separation, Ore sorting and tailings disposal.

GEO615 Sedimentary Petrology صخور رسوبية

Fundamental classifications, grain size, particle morphology, technology of grain size analysis, statistical parameters, mineral composition of sedimentary rocks, petrology of sandstone, petrology of mudstone, discrimination and nomenclature of terrigenous sediments, petrology of carbonate rocks, diagenesis.

مقررات برنامج البترول والمياه

GEO617 Petroleum Geology

جيولوجيا البترول

Introduction and definitions, Occurrence of petroleum, Origin of petroleum (generation of hydrocarbon types, source rocks), Reservoir rocks- classification, Reservoir rocks- Petrophysical properties, Primary migration of hydrocarbons, Secondary migration of hydrocarbons (textures and mineralogical classification), Petroleum traps, Classification of crude oils, Geological model for exploration, Evaluation of petroleum prospects, Petroleum potentiality of Egypt, Middle East, North Africa

GEO618 Sandstone reservoir

خزان الحجر الرملي

Introduction and definitions, Classification of reservoir rocks, Fragmental (clastic) reservoir rocks, Petrophysical characteristics of Sandstone reservoir, Pore spaces and types in sandstone reservoir, Basic porosity types, Porosity modifying processes, Porosity enhancement, Permeability, Secondary migration in reservoir rocks, Sandstone reservoir fluids, Sandstone reservoir rocks in Egypt.

GEO619 Advanced HydroGeology **هيدروجيولوجيا متقدمة**

Water & Climate, Water-Budget Analysis, Theories and Basic Terminology, Physical hydroGeology, Sources of Information on HydroGeology, Geology of HydroGeology, hydroGeological map, Aquifer systems, Groundwater Flow.

GEO620 Petroleum Traps **مصائد البترول**

Introduction and definitions, Occurrence of petroleum, classification of exploration traps, Structural traps (Chemical and multiple classification), Stratigraphic traps, Combined traps, Petroleum system, predicting reservoir system quality and performance, evaluating top and fault seal, Predicting the occurrence of oil and gas traps

GEO621 Sedimentary Environments

البيئات الترسيبية

Environments defined, environments of erosion, equilibrium, and deposition, environments classified, sedimentary facies, sedimentary models, subsurface environment (subsurface temperatures and pressures), subsurface fluids (non-hydrocarbon gases, petroleum fluids, subsurface waters), fluid flow in sedimentary basins.

GEO622 HydroGeochemistry **هيدروجيوكيمياء**

Basic Chemical and Physicochemical Principles, Ionic Constituents of groundwater, Major Ions, Chemical Units and Balance, Groundwater Sampling and Analysis, Composite Quality Indicators, Water Quality Graphical Representations, multivariate analyses and principal components, Environmental Isotopes,

GEO607 Application of GIS and remote sensing in Environmental Geology

أستشعار عن بعد وتطبيقات نظم المعلومات الجغرافية في الجيولوجيا البيئية

This is course introduces the concepts and components of a Geographic information system (GIS) and remote sensing. It also teCHMes the essential skills of operating a functional GIS through the use of ArcGIS software package. the operational processes of spatial data acquisition, editing and QA/QC, metadata development, Geodatabase design, spatial query and display, spatial analysis and modeling, preliminary GIS application development, mapping and dynamic visualization, and GIS implementation basics, electromagnetic radiation and physics of remote sensing, optical remote sensing, thermal remote sensing, hyperspectral remote sensing, microwave radiometry, Digital Image Processing Production of Thematic maps, Integration between Remote Sensing and Geographic Information Systems, Remote Sensing Applications on Geology, Remote Sensing Applications on Mineral Resources.

GEO623 Sequence Stratigraphy

التتابع الطبقي

Concepts and principles of sequence stratigraphy and its importance; Concise Review of sequence stratigraphic tools; the evolution of sequence stratigraphy; depositional sequences and systems tracts (transgressive and regressive cycles); low and high accommodation system tracts; low stand and high stand system tracts; sequence boundaries; types of stratigraphic sequences; depositional sequence, genetic stratigraphic sequence, transgressive-regressive sequences, parasequences; sequence stratigraphy of outcrops, cores and of wireline logs; subdivision of depositional sequences and systems tracts; sequence stratigraphy and depositional environments; breaking of depositional sequences; facies patterns in depositional sequences. Applications of Sequence stratigraphy in fluvial systems - coastal plain to shoreline-shelf systems –deltaic systems- Estuarine systems - deep-marine systems and carbonate systems; causes of sea level fluctuations; principles of seismic stratigraphic interpretation, interpreting shallow to deep carbonate and clastic depositional tracts. Some examples of applying sequence stratigraphic tools to surface and subsurface Egyptian successions.

GEO624 Petroleum Geochemistry

جيوكيمياء البترول

Aspects of petroleum organic Geochemistry, Origin of petroleum (generation of hydrocarbon types, source rocks), Source rocks, Organic carbon; organic matter, Kerogen assessment - From kerogen to petroleum, Geochemistry of reservoir waters, Chemical composition of gaseous hydrocarbons and condensates, Biomarkers and Geochemical Fossils, Geochemical aspects of petroleum migration, Pyrolysis techniques, Petroleum alteration, Geochemical exploration, Geochemical evaluation of petroleum prospects, Geochemical characteristics of Egyptian crude oils and gas; Source rocks in the sedimentary succession of Egyptian petroleum provinces.

GEO625 Applied Sedimentology

علم الراسب التطبيقي

Fundamental classification- grain size – particle morphology, Technique of grain size analysis, Mineral composition of sedimentary rocks, Petrology of sandstone, Statistical parameters, Petrology of mudstone, Discrimination and nomenclature of terrigenous sediments, Petrology of carbonate rocks, Diagenesis.

GEO626 Groundwater Modeling Techniques **تقنيات نمذجة المياه الجوفية**

General theory of Mathematical modeling of hydrological systems, finite elements and finite difference methods, integration of basic processes in hydrological models (evaporation, runoff, soil water dynamics, groundwater flow) in Mathematical models. Model calibration, parameter optimization, validation of groundwater models and its uncertainty, application of Modflow modeling package, case studies.

GEO627 Groundwater quality and contaminant hydroGeology

جودة المياه الجوفية والملوثات

Quality assurance, Water Quality Standards, Physicochemical Processes in Groundwater Flow, Collecting Groundwater Samples, Field Measurements, Laboratory Analyses, Interpreting lab results and graphical representations, Hydrochemical Behavior of Contaminants, Sources of Contamination, Groundwater Quality Variation Assessment Indices.

GEO628 Methods of groundwater Exploration **طرق استكشاف المياه الجوفية**

Surface Geological methods, subsurface Geological methods, surface Geophysical methods, subsurface Geophysical methods, drilling and installation of wells and piezometers.

GEO629 HydroGeophysics **هيدروجيوفيزياء**

This course examines Geophysical methods that are currently being developed in field of groundwater exploration. Studying the relationships between Geophysical and hydrological properties of aquitard. Hence focus on both; the conceptual basis of near-surface Geophysics and recently developed hardware and software technologies, including those that integrate Geophysical data with other types of information.

GEO630 Well-logging

Introduction: Definitions and fundamentals of formation evaluation, Logging techniques and measurements, Well site practice, Environmental corrections, Log digitizing, Lithology determination, Water saturations determination, Other approCHMes (shaly problems), Net pay determination, Advanced mud logging, Measurements while drilling (MWD, LWD), Log correlation using sequence stratigraphy, Magnetic resonance imaging logs, Array induction logs, Borehole images, Advanced sonic logs, Cased hole logs.

GEO631 Structural Geology

Introduction: Definitions, Description and classification of Geologic structure, Types of Fractures, Types of faults, Types of folds, Types of foliations, and lineation, Formation of Geologic structures, Stress Forces, Strain Forces, Shear zones Areas, Mechanism of faulting, Mechanism of folding, Gravity controlled structures, Geotectonic, Continental drift, plate tectonics.

GEO632 Seismic Stratigraphy

علم الطبقات السيزمية

Basic concepts, definitions and objectives of seismic stratigraphy, Stratigraphic patterns in seismic data, Seismic attribute analysis, Seismic sequence analysis – interpretation of depositional environment and lithology, eustatic sea level changes, Seismic Facies analysis-seismic reflection characteristics, simple and complex reflection configuration, Seismic reflection character analysis- amplitude and continuity.

GEO633 Petroleum Provinces

أقاليم البترول

Petroleum provinces in Egypt, Petroleum systems of Egypt, Source rocks; Hydrocarbon generation areas, Hydrocarbon bearing rocks, Types of petroleum traps, Distribution of oil and gas fields, Type of crude oils, Prospective areas, Oil and gas production and reserves, Main oil and gas producing fields in Egypt, North African petroleum Basin, Arabian Gulf petroleum province, Giant oil fields in the world, Petroleum potentiality of Egypt, Middle East, North Africa

GEO634 Isotope hydroGeology

هيدروجيولوجيا النظائر

Environmental isotopes in hydroGeology- isotopes standers and measurement-Isotopes ratio mass spectrometry-Radioisotopes-modern groundwaters age dating- Old groundwaters age dating. Data sampling-water rock interaction-groundwater quality.

GEO635 Watershed analysis and management **تحليل وإدارة الأحواض المائية**

Water & Climate, Landforms & Water, Watersheds, Migration of water through a catCHMent, Water Balance, Morphometric analyses for watershed, Watersheds Hazards and Catastrophes, Watershed Management Planning.

GEO636 Environmental HydroGeology **هيدروجيولوجيا بيئية**

Hydrologic Cycles- Watershed Hydrology- Environmental Impacts and HydroGeological Systems- Waste Disposal Sites-Environmental Impacts on Water Resource - Waste Management -Ground-Water Protection- Ground-water Quality Models- Case Studies

GEO637 Geospatial data analysis **تحليل البيانات الجغرافية المكانية**

Spatial data models, Principles of Electro-Magnetic radiation, Data acquisition, Analyzing reflected and emitted radiation, Atmospheric image correction, Geospatial data management and retrieval, Spatial reference systems, Image reprojection and resampling, Visualisation principles and map creation, Image visualisation and colour composites.

مقررات برنامج الجيولوجيا البيئية

GEO638 Environmental Geology **الجيولوجيا البيئية**

Basic understanding of major Geological processes occurring in the near surface and surface of the Earth, (streams & flooding, coastal zone and Mass movement, climate change and desert) - Comprehension of how environmental Geological processes impact humans and society - Appreciation on how anthropogenic activities are modified natural environmental processes

GEO639 Environmental sustainability **الاستدامة البيئية**

Learn about the economic, social, and environmental aspects of sustainability and some frameworks for defining and measuring progress toward a sustainable society. Explore the major impacts that humans have on the environment. Environmental Law, Sustainable Consumption, Understanding Voluntary Simplicity as a Form of Sustainable Consumption, Exploration natural resources.

GEO607 Application of GIS and remote sensing in Environmental Geology

أستشعار عن بعد وتطبيقات نظم المعلومات الجغرافية في الجيولوجيا البيئية

This course introduces the concepts and components of a Geographic information system (GIS) and remote sensing. It also teCHMes the essential skills of operating a functional GIS through the use of ArcGIS software package. the operational processes of spatial data acquisition, editing and QA/QC, metadata development, Geodatabase design, spatial query and display, spatial analysis and modeling, preliminary GIS application development, mapping and dynamic visualization, and GIS implementation basics,

electromagnetic radiation and physics of remote sensing, optical remote sensing, thermal remote sensing, hyperspectral remote sensing, microwave radiometry, Digital Image Processing Production of Thematic maps, Integration between Remote Sensing and Geographic Information Systems, Remote Sensing Applications on Geology, Remote Sensing Applications on Mineral Resources.

GEO640 Engineering Geology **الجيولوجيا الهندسية**

This course provides an introduction to Geological structure, strength of Geologic material, ground investigation, ground water, slope stability, Reservoirs and Dams, Excavations, Ground treatment and support. Classification of physical properties of rocks, effect of internal and external factors on the properties of rocks, mechanical properties of rocks (density properties, characteristics of loosened rock, stress and strain, clastic properties, strength, plastic and theological properties, hydrodynamics and gas-dynamics of rocks), technological indices of rocks, Geophysical techniques applied to selected problems in environmental Geology.

GEO641 Water resources **موارد المياه**

H Hydrologic cycle, Climate and water availability, Water balances, Precipitation, Hyetograph and Hydrograph Analysis, Groundwater, Reservoir, Flood Management, Hydrologic Analysis and Design, Drought Management and Water Harvesting, hydroelectric power and water resources planning and development

GEO642 Spectral Geology **الجيولوجيا الطيفية**

Spectral Geology definition, Spectral data and what can they be used for, interaction of matter with electromagnetic radiation of different wavelength ranges, Pre-processing of image data and assessment of data quality, measurement and analysis of portions of the electromagnetic spectrum to identify spectrally distinct and physically significant features of different rock types and surface materials, mineralogy and their alteration signatures, Mineral mapping in rock samples.

GEO643 Soil and rock mechanics **ميكانيكا التربة والصخور**

The basics of rock and soil mechanics, their relationship with other disciplines especially civil engineering, terminology, Classification of physical properties of rocks and soil, effect of internal factors and external factors on the properties of rocks and soil, mechanical properties of rocks, technological of rocks.

GEO644 Exploration of Mineral Deposits **استكشاف الترسبات المعدنية**

Introduction, Exploration Geochemistry fundamentals; the use of litho-Geochemistry in mineral exploration; Exploration techniques e.g., drilling, Geophysical etc.;. Mechanical and chemical weathering; Weathering and regolith; Exploration in various regolith environments; Chemical dispersion: primary and secondary, Sampling & sampling theory in mineral exploration and detection techniques; Stream sediment Geochemistry; Soil surveys; BioGeochemical Surveys; other sampling media, Statistical data analysis and other calculations, VHMS ore deposit models and exploration, PCD, Breccias in porphyry and epithermal environments, Low-high sulfidation epithermal Au-Ag exploration, Orogenic gold ore deposit models and exploration.

GEO609 Isotope Geology **جيولوجيا النظائر**

Introduction (atomic structure, isotopes, isotones, isobars, radioactive and stable isotopes), Mass spectrometry and techniques in isotopes measurement, Rb-Sr dating method, U-Th- Pb dating method, Oxygen and hydrogen isotopes, Carbon isotopes, Sulfur isotopes.

GEO645 Energy resources **مصادر الطاقة**

Fossil fuels and their characteristics, Solar energy, Bio energy, Wind energy, Nuclear energy, World energy resources, Energy consumption pattern of different countries, Environment, development and Society-comparative approCHMes to natural resource management, Indigenous system of natural resource management (land, water, forest, air etc), Environmental ethics, Urbanization and Sustainability, Environmentally responsible consumption.

GEO646 Physical and chemical properties of soil **الخصائص الفيزيائية والكيميائية للتربة**

Types of soil and soil description, properties of soils, Origin of Soil and Grain Size, Classification of Soil.

GEO647 Environmental management **إدارة بيئية**

Rocks and minerals and their exploitation, Energy and the environment, Agriculture and the environment, Water and its management, Oceans and fisheries, Managing natural hazards, The atmosphere and human activities, Human population, Natural ecosystems and human activities, Environmental Law

GEO648 Advanced Environmental Geophysics **الجيوفيزياء البيئية المتقدمة**

Introduction to some of current environmental challenges and their Geophysical characteristics, Importance of Environmental Geophysics, Shallow seismic refraction and its role in environmental studies, Electrical method and their role in environmental studies, electromagnetic method and their role in environmental studies, Gravity and magnetic methods and their roles in environmental studies, and Ground penetration radar method and their role in environmental studies. Different case studies.

GEO649 Natural Hazards &Disaster risk reduction **الحد من المخاطر الطبيعية والكوارث**

fundamental introduction to natural hazards ((earthquakes, volcanoes, mass movements, subsidence, floods, coasts), environmental hazards (water, soil and air pollution), waste management (solid, liquid and radioactive), land use planning and engineering Geology), and the disaster risk concept, quantitative analysis of risk, uses risk information for decision making in different disaster management phases,

مقررات برنامج الطبقات و الحفريات

GEO650 Lithostratigraphy **علم الطبقات الصخرية**

Concepts and basis of lithostratigraphy; sedimentology; principles of stratigraphy; stratigraphy and Geologic time; Geochronology; time-stratigraphic units; unconformities and the different criteria for recognizing them; primary structures (physical or organic) in sedimentary rocks and its usage as way-up indicators; chronostratigraphy; time-stratigraphic units; stratigraphic nomenclature; procedures for establishing rock units. Application of lithostratigraphy

(paleoenvironments and Geological maps); lithostratigraphic correlation; presentation of outcrop data, subsurface procedures; Radiometric stratigraphy - Facies stratigraphy; Quantitative stratigraphy; sedimentary environments; (non-marine environments, transitional environments, and marine environments); tracing environments in space and time; lateral and vertical relationships among lithosomes; significance of ichnofossils in applied stratigraphy; the main concepts and applications of sequence stratigraphic analysis.

GEO651 Macropaleontology **علم الحفريات الكبيرة**

The domain of paleontology; nature of fossils (fossilization, types of preservation, kinds and names of animals, adoption to environment, development, fossil-bearing rocks).The fossils record and notes of evolution - Rates of evolution ,adaptive radiation sand extinction ,competition. The diversification of invertebrate life; invertebrate paleontology; Corals (characteristics, classification, and Geologic distribution); BrCHMiopods (morphology, classification, evolution, and stratigraphic distribution); Pelecypods (classification, evolution, functional morphology, and stratigraphic distribution); Gastropods (classification, shell structure, and morphology); Cephalopods (characteristics, classification, evolution, uses as index fossils); Echinoderms (classification, morphology, different classes, life habits); Trilobites (classification, morphology, stratigraphic use as Cambrian index fossils). Hemichordata (classification, morphology, stratigraphic use as Ordovician and Silurian index fossils).

GEO652 The Phanerozoic Eon of Egypt **دهر الحياة الظاهرة فى مصر**

The scope of Phanerozoic Eon of Egypt, Geomorphologicfeatures and Geologic provinces of Egypt (the Nile River and its delta, the Eastern Desert, the Western Desert, the Sinai Peninsula), the main structural units in Egypt, the general stratigraphy and general tectonic framework of the Paleozoic Era in Egypt, the subsurface sequences in the north of the Western Desert. The economic importance of the rocks of the Paleozoic Era. The Permo- Triassic. Mass extinction at the end of Paleozoic Era. The stratigraphy and tectonics of the Mesozoic Era in Egypt, the Triassic and Jurassic period in North Sinai, the Jurassic subsurface formations in the north of the Western Desert, the paleoGeography and facies analysis and sedimentary environments through the Mesozoic Era.; the surface exposures and the sedimentary facies of the Cretaceous period in Egypt, the subsurface sequences of the Cretaceous period, the paleoGeography of Egypt during the Cretaceous, the economic importance of the of the Mesozoic Era strata . Mass extinction at the end of Cretaceous period. The contact between the periods of middle and modern life, Maastrichtian / Paleocene, stratigraphy of the Cenozoic era in Egypt, Paleocene and Eocene outcrops in Egypt, economic aspects of the Eocene rocks in Egypt, the paleoGeography of the Tertiary epochs in Egypt, occurrences of the Miocene and Pliocene periods in northern Egypt. The evaluation of Egypt throughout the Phanerozoic Eon. An overview of the Quaternary and Recent sediments.

GEO653 Biostratigraphy **علم الطبقات الحيوية**

Concepts and development of classical biostratigraphy; time in Geology (dating of rocks by fossils); integration of biostratigraphy into modern Geochronology; biostratigraphic nomenclature; biostratigraphy and chronostratigraphy; parameters contributing in

biostratigraphy; fossils and stratigraphy; classification of organisms; evolutionary trends; patterns of evolution; bioGeographic provinces; depositional environments; Geographical distribution; abundance and size; preservation potential; rate of speciation; mobility of organisms; ontogeny and phylogeny; taxa used in biostratigraphy; biostratigraphic correlation; biological classification of organisms; marine microfossils; extinction and its reasons; different types of biozones (assemblage zones, range zones, interval zones, Acme-zones); biostratigraphy in relation to other stratigraphic techniques; application of biostratigraphy; Paleozoic life (life development of trilobites, brCHMiopods, molluscs, graptolites, paleoGeography, records in sedimentary rocks and flooding the continental margins); Mesozoic life (evolution of reptiles); Cenozoic life (paleoGeography and human development).

GEO654 Micropaleontology **علم الحفريات الدقيقة**

Scope of micropaleontological studies; evolution and biodiversity; techniques of micro-organisms studies; studying of some important microfaunas and microfloras; Microfossils, stable isotopes & ocean-atmosphere history - Microfossils in stratigraphy - Microfossils as ecological pollution indicators. Inorganic-walled microfossils such as: Foraminiferida (living animal, life history, morphological characteristics; taxonomy, Geological distribution; paleoecological parameters controlling the distribution of foraminifera; larger forminiferida (fusulinids, orbitoidids, discocylinids, miogypsinids); nummulitids (skeletal structure, physiological features, classification, Geological distribution and stratigraphic importance); ostracods, calcareous nanno-planktons and radiolarians (hard parts, growth stages, physiological features, mode of life, taxonomy,paleoecology, Geological distribution and importance); silicoflagellates and diatoms.

GEO655 Environmental stratigraphy and facies modelling **الطبقات البيئية والسحنات**

The scope and fundamental of modern environmental stratigraphy; the evolution and importance of stratigraphy; sedimentary environments; chronostratigraphy; sedimentology; application of lithostratigraphy (environments and Geological maps); sediments and environments; Whalter's law; sediments and organisms; organisms contributing sediments (algal mats, stromatolites, coral reefs); mass extinction in the Phanerozoic time; stratigraphic procedures; facies models (fluvial facies, deltaic facies, clastic tidal facies, carbonate tidal facies and coral reefs facies); facies units and its conventional stratigraphic units; facies boundaries; vertical and lateral relations among facies. Relations between different units and facies associations.

GEO656 Historical Geology **الجيولوجياالتاريخية**

The evolution and dynamic of Earth; development of atmosphere and biosphere; Pre-Cambrian Earth and life history; the Hadean Eon; concepts and principles of Geologic time; Geologic Time Scale; organic evolution; absolute time and radioactivity; radiometric dating; absolute and relative dating; correlation, unconformities; coastal and marine environments, the Proterozoic Eon; the Paleozoic life history (life in coal swamps); the age of trilobites and fishes; glaciations; orogeny; paleoGeography of Paleozoic, Gondwana land; mass extinction; Paleozoic periods in Egypt; the Mesozoic life history; breakup of Pangea; black shales and chalk Seas; the age of Dinosaurs; flora in Mesozoic; Mesozoic periods in Egypt; the Cenozoic

life history; scattering of Africa; The paleoGeography of Cenozoic; the cenozoic life history; Cenozoic periods in Egypt; ice age (Pleistocene); the Age of mammals and primitive human evolution.

GEO657 Paleoecology and microfacies **البيئات القديمة والسحنات الدقيقة**

The concept of paleoecology, fundamental ecologic principles, paleoecology and environmental stratigraphy; environmental analysis of terrestrial, marine and shallow marine environments (organic composition, types of microorganisms), sediments and environments; physical primary structures; organic influences on sediments; biogenic structures; depositional systems and the stratigraphic record; ecologic factors in marine environments (temperature, salinity, oxygen, etc.); chemical and biological factors; microfacies studies; sedimentary facies (types of facies, facies models, interpretation of facies, controlling factors, etc.); classification of carbonate rocks; biological criteria; different types of organisms affecting by different factors; the concept of foraminiferal paleoecology, mollusks, echinoderms, etc.; modern methods of paleoecology, application of paleoecology in stratigraphy and paleontology; different types of microfacies and its applications.

GEO658 Palynology **علم الاحافير النباتية**

The concept of palynology; the natural history of palynomorphs; microscopic methods and sporomorph morphology; distinguishing criteria for pollen grains and spores; palynological laboratory techniques; some factors affecting practical applications of paleopalynology; differential sorting of palynomorphs into sediments; sedimentation of spores/pollen and other palynomorphs; marginal palynology; thermal maturation of palynomorphs (carbonization); palynostratigraphy; palynofacies, palynodebris, discordant palynomorphs; production, dispersal, sedimentation and taphonomy of spores/pollen grains; wall microstructure of organic-walled organisms; factors affecting the nature of pollen in marine environment; palynofacies analysis and its stratigraphic application; palynomorphs in Paleozoic time; palynomorphs in Mesozoic time, dinoflagellate cysts (wall structure, morphology, paleoecology, Geologic distribution); the importance of palynology in petroleum exploration.

GEO659 Sedimentary basin analysis **تحليل الاحواض الرسوبية**

Introduction; The various types of basin formation in various types of Geotectonic setting; Introducing a Geologic method by which the formation and evolution history of a sedimentary basin is revealed, subsidence history and consequences for reservoir and source rock development and the petroleum system. Analyzing the sediment fill and subsidence; aspects of the sediment, namely its composition, primary structures, and internal architecture; mechanisms of sedimentary basin formation by stretching, strike-slip, flexure and compression, effects of mantle dynamics, basin infill mechanisms and depositional systems, basin stratigraphy, subsidence and thermal history, changes of reservoir and petrophysical parameters during burial and tectonic processes, and application to the petroleum system. Developing models to explain broad basin formation mechanisms; examples include intracratonic, rift, passive margin, strike-slip, forearc, backarc-marginal sea, fold and thrust belt, and foreland basins.

GEO660 Vertebrate Paleontology **علم الحفريات الفقارية**

Overview of the fossil vertebrates, Geological time scale, the Geological and biological principles and theories involved in the study of vertebrae paleontology for acquiring knowledge about the vertebrate groups most common in Egypt, e.g. fish, crocodylomorphs, dinosaurs, and mammals. Fossil preservation; vertebrate skeletal anatomy; Patterns of vertebrate evolution. Microevolutionary Processes. Migration patterns and plate tectonics. Survey of Vertebrate Evolution ((Late Paleozoic marine reptiles); Dinosaur anatomy; Taxonomic classification of dinosaurs; Extinction factors. Evolutionary trends in Labrynthodont Vertebrae and Skulls; PaleoGeography, Climate and Cenozoic Mammal Evolution; the dietary features of vertebrae animals from the Mesozoic and early Cenozoic Era. Application of scientific principles to the study of Mesozoic vertebrate marine reptiles, dinosaurs and early to mid-Cenozoic mammals utilizing Geological and biological approCHMes and theories. Explorations of the fossil evidence for the evolution and diversification of vertebrates during the Geologic history of earth.Museum exhibits for the vertebrate fossils.

GEO661 Sequence stratigraphy **تتابعات الطبقات**

Concepts and principles of sequence stratigraphy and its importance; Concise Review of sequence stratigraphic tools; the evolution of sequence stratigraphy; depositional sequences and systems tracts (transgressive and regressive cycles); low and high accommodation system tracts; low stand and high stand system tracts; sequence boundaries; types of stratigraphic sequences; depositional sequence, genetic stratigraphic sequence, transgressive-regressive sequences, parasequences; sequence stratigraphy of outcrops, cores and of wireline logs; subdivision of depositional sequences and systems tracts; sequence stratigraphy and depositional environments; breaking of depositional sequences; facies patterns in depositional sequences. Applications of Sequence stratigraphy in fluvial systems - coastal plain to shoreline-shelf systems –deltaic systems- Estuarine systems - deep-marine systems and carbonate systems; causes of sea level fluctuations; principles of seismic stratigraphic interpretation, interpreting shallow to deep carbonate and clastic depositional tracts. Some examples of applying sequence stratigraphic tools to surface and subsurface Egyptian successions.

GEO662 Biostatistics applications in paleontology **تطبيقات الإحصاء الحيوي في علم الحفريات**

Introduction; visualization and data analysis in modern paleontology, Analysis of thousands of fossils with respect to evolution and environment, and more focused studies of taxonomy and ecology; quantitative biostratigraphy as an analysis of large amounts of data on fossil occurrences with the aim of ordering the fossils in time, which is important for improving the Geological timescale and correlating sedimentary strata across localities.

GEO663 Marine Paleobiology **علم الأحياء القديمة البحرية**

Objective of Paleobiology; definition of the goals of conservation paleobiology, and highlights how it can be used to identify and understand marine ecosystem crises. Providing case studies demonstrating the applications of conservation paleobiology in modern communities; encouraging interdisciplinary dialogue and collaboration to maintain a productive marine

biosphere; applied research highlighting how conservation paleobiology can be used to understand ecosystem response to perturbation in near and deep time; developing novel applications of paleontological approCHMes to neontological data; presenting a range of ecosystem response and recovery through environmental crises, from high-resolution impacts on organism interactions to the broadest scale of responses of the entire marine biosphere to global change.

مقررات برنامج الصخور الرسوبية والترسيب

GEO664 Sedimentary Rocks

الصخور الرسوبية

Fundamental classifications, grain size, particle morphology, technology of grain size analysis, statistical parameters, mineral composition of sedimentary rocks, petrology of sandstone, petrology of mudstone, discrimination and nomenclature of terrigenous sediments, petrology of carbonate rocks, diagenesis.

GEO665 Geochemistry of Sedimentary Rocks **جيوكيمياء الصخور الرسوبية**

Origin of sedimentary rocks, provenance analysis based on elemental, mineralogic, and isotopic composition of siliciclastic rocks, chemical composition and mineralogy of marine sediments, terrestrial chemical sediments, Geochemistry of organic-rich rocks, Geochemistry of carbonates and siliceous rocks, evaporites: paleoclimate and evolution of ocean chemistry, stable isotope Geochemistry and sedimentary record.

GEO666 Sedimentary Basin Analysis (1)

أحواض الترسيب 1

Rock composition texture sedimentary structure, facies and sequence, depositional sedimentary environment (glacial, fan, eolian, fluvial, deltaic, shallow siliciclastic sea, shallow water carbonate deep sea clastic, deep water evaporitic environment).

GEO667 Applied Sedimentology

(علم الترسيب التطبيقى)

Sedimentology and the earth sciences, sedimentary cycle, physical properties of particles, porosity and permeability, sedimentary structures, depositional systems, allochthonous sediments (mudrocks, sandstones, and rudaceousrocks), autochthonous sediments (carbonates, coal, sedimentary iron ores, evaporites, cherts), applied sedimentology (petroleum and sedimentary Ores).

GEO668 Clay Mineralogy

علم المعادن الطينية

Introduction to the chemistry and mineralogy of clays, Geology of clays, particle Size, surface area and morphology of clays, clay analysis chemistry and mineralogy of kaolinite, illite and smectite minerals, chemistry and mineralogy of chlorite and mixed layer minerals, clay mineralogy and shale instability.

GEO669 Sedimentary Basin Analysis (2)

أحواض الترسيب 2

Sedimentary basins, classification, marine sedimentary environments, basin analysis, evaluation of basin petroleum potential.

GEO670 Heavy Minerals

المعادن الثقيلة

Introduction of heavy minerals, chemistry and nomenclature of heavy minerals, heavy mineral concentration and distribution, heavy minerals as provenance tracers (anorogenic provenances, magmatic arcs, axial belts and obductedophiolites, mixed orogenic provenances), heavy minerals analysis.

GEO671 Stratigraphy **علم الطبقات**

Concepts and basis of stratigraphy; principles of stratigraphy; stratigraphy and Geologic time; sedimentary environments; Geochronology; time-stratigraphic units; unconformities ; primary structures (physical or organic) in sedimentary rocks; chronostratigraphy; time-stratigraphic units; absolute time in the stratigraphic record; stratigraphic nomenclature; application of lithostratigraphy; lithostratigraphic correlation; presentation of outcrop data; facies stratigraphy; Quantitative stratigraphy; tracing environments in space and time; lateral and vertical relationships among lithosomes; time in Geology (dating of rocks by fossils; biostratigraphic nomenclature; biostratigraphy and chrono-stratigraphy; taxa used in biostratigraphy; biostratigraphic correlation; biological classification of organisms; marine microfossils; extinction and its reasons; different types of biozones; applications of sequence stratigraphic analysis.

GEO672 Evaporites

المتبخرات

Genesis of evaporites, processescontrolled genetic units in evaporite,brines and brines evolution, lacustrine evaporites,groundwater-generated evaporites, sabkhas, deep water evaporites, composition of evaporites (evaporitic carbonates, halides, and sulfates), trace elements and isotopic consideration.

GEO673 Facies Analysis

تحليل السحنات

Introduction of facies (lithofacies and biofacies), grain size and texture, facies associations and models (fluvial environments, deltaic environments, lacustrine environments, eolian environments, clastic shorelines, arid shorelines and evaporites, clastic continental shelve, carbonate environments).

مقررات برنامج الجيولوجيا التركيبية والتكتونية

GEO631 Structural Geology **(الجيولوجيا التركيبية)**

Faults (Fault terminology, fault anatomy, displacement distribution, identifying faultsin an oil field setting, the birth and growth of faults, growth of fault populations,faults, communication and sealing properties), kinematics and paleostress in the brittle regime, deformation at the microscale, folds and folding, shear zones and mylonites, contractional regimes, extensional,

transtensional and transpressional regimes, structures of igneous intrusions, gravity controlled structures, balancing and restoration

GEO675 Remote Sensing **(الاستشعار عن بعد)**

Concepts of remote sensing aerial photography, (elements, air photo interpretation (instrumentation and procedures), principles of landform identification and evaluation, applications of aerial photographs in Geology), earth resources satellites multispectral scanners, digital image processing, applications of remote sensing and Geographic information systems in Geology.

GEO677 Analysis of Geological structures **(تحليل التراكيب الجيولوجية)**

Structural analysis (structural data sets, field data, remote sensing and Geodesy, DEM, GIS and Google Earth, seismic data, experimental data, numerical modelling, other data sources, organizing the data, structural analysis, concluding remarks), Rheology, methods for constructing profiles and block diagram of folds

GEO678 Geotectonics **(الجيولوجيا التكتونية)**

Major earth structures, plate tectonic theory, mountain building and orogenies, present day tectonics, stable and unstable tectonic zones, Geological structures and plate tectonics

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GEO680 Petroleum Geology **(جيولوجيا البترول)**

Introduction and definitions, Occurrence of petroleum, Origin of petroleum (generation of hydrocarbon types, source rocks), Reservoir rocks- classification, Reservoir rocks- Petrophysical properties, Primary migration of hydrocarbons, Secondary migration of hydrocarbons (textures and mineralogical classification), Petroleum traps, Classification of crude oils, Geological model for exploration, Evaluation of petroleum prospects, Petroleum potentiality of Egypt, Middle East, North Africa.

GEO681 Applied Geophysics **(الجيوفيزياء التطبيقية)**

Advanced application of different Geophysical techniques to delineate the Geometry of structural basins and their depths and the crustal thickness.

GEO682 Advanced Stratigraphy **(الطبقات البيئية المتقدمة)**

The scope and fundamental of modern environmental stratigraphy; the evolution and importance of stratigraphy; sedimentary environments; chronostratigraphy, sedimentology; application of lithostratigraphy (environments and Geological maps); sediments and environments; Whalter's law; sediments and organisms; organisms contributing sediments (algal mats, stromatolites, coral reefs); mass extinction in the Phanerozoic time; stratigraphic procedures; facies models (fluvial facies, deltaic facies, clastic tidal facies, carbonate tidal facies and coral reefs facies); facies units and its conventional stratigraphic units; facies boundaries; vertical and lateral relations among facies. Relations between different units and facies associations.

GEO683 Field Geology **(جيولوجيا الحقل)**

The importance of fieldwork, mode of occurrence of rock units, **outcrop Structures, e**quipment, Landsat Images and GIS, preparing maps and basic Mapping, notebooks and data recording, primary outcrop structures, secondary or late Stage outcrop structures, outcrop contact relationships.

GEO684 Structures of Igneous intrusions **(تراكيب المتداخلات النارية)**

Structures found within igneous bodies, structural classification of intrusive igneous bodies, methods of emplacement of igneous intrusions, dilational of cone-sheet and radial dykes, mode of emplacement of large intrusions.

GEO685 Microtectonics **(علم التكتونيات الدقيقة)**

Framework of Microtectonic Studies, Flow and Deformation, Deformation Mechanisms, Deformation of polymineralic rocks, Flow Laws and Deformation Mechanism, Shear Zone, fault rocks, mylonites, sense of shear.

GEO602 Geochemistry **جيوكيمياء**

Crystal chemistry, crystal structure, Geochemical classification of elements, Geochemical differentiation of elements, Distribution of elements in igneous rocks, distribution of elements in sedimentary rocks, Geochemical cycles of elements, isotope Geochemistry, analytical methods in Geochemistry.

GEO686 Earthquake Seismology **علم الزلازل**

Elastic wave theory. Mechanism of Earthquakes . Instrumentation of earthquakes . Earthquakes and Plate Tectonics. Measurement of acceleratiuon and application of synthetic accelergrams , paleoseismicity

GEO687 Sedimentary basins **(أحواض الترسيب)**

Cclassification of sedimentary basins, clastic and marine sedimentary environments, basin analysis, evaluation of basin petroleum potential.

GEO688 Metamorphic Petrology **(علم الصخور المتحولة)**

Metamorphism and metamorphic rocks, texture and structure of metamorphic rocks, metamorphic conditions, metamorphic facies, metamorphic phase diagrams, relation between metamorphism and plate tectonics, contact metamorphism, regional metamorphism under low to medium P-T conditions, high P-T metamorphism, eclogites, dynamic metamorphism.

GEO689 Geology of Arabian–Nubian Shield **(جيولوجيا الدرع العربى النوبى)**

An Introduction, historic overview, the ANS Within the Northern East African Orogen, the Mozambique Ocean, the Eastern Margin of the EAO (NW India to Oman), the Western Margin of the EAO (the Eastern Saharan Metacraton).

مقررات برنامج الجيوفيزياء

GEO686 Earthquake Seismology علم الزلازل

Elastic wave theory. Mechanism of Earthquakes . Instrumentation of earthquakes . Earthquakes and Plate Tectonics. Measurement of acceleratiuon and application of synthetic accelergrams , paleoseismicity

GPH601 Advanced Potential techniques تطبيقات متقدمة في طرق الجهد

Potential fields method descriptions. Nature of data obtained from satellite sensors. Data analysis. Advanced modeling techniques using Python libraries.

GPH602 Advanced Well Logging تسجيلات آبار متقدم

General characteristics of well logging. Influence of the drilling fluid on measured data. Principles of log interpretation. Spontaneous potential, conventional electric logs, focused logs, borehole wall contact devices, sonic logs, radioactive measurements, preparation of a logging program. The course is intended to provide an insight into borehole environment, measurement techniques and methods of well log interpretation. Practical exercises in the most important interpretation methods of well logging measurements. Objectives (expected results of study and acquired competences) Basic principles of logging instruments and methods of interpretation.

GPH603 Mathematical method in Geophysics تطبيقات الرياضيات في الجيوفيزياء

Mathematical knowledge related to Geophysical data. Forward and Inverse methods. Optimization of estimated models. Linear and non-linear problems. Linearization of non-linear problem. Simulation of Geophysical fields.

GPH604 Advanced seismic Method الطرق السيزمية المتقدمة

Seismic reflection and refraction method description. Modern techniques for data processing. Modern inversion techniques. Problems and artifact. Recent advances in seismic attributes and seismic imaging

GPH605 Electric and Electromagnetic Methods الطرق الكهربية والكهرومغناطيسية

Laws for electric and electromagnetic fields. Rock properties pertinent to electric and electromagnetic methods. Field survey and modeling

GPH606 Geophysical exploration of Hydrocarbon الاستكشاف الجيوفيزيقي في البترول

Geophysical methods used for hydrocarbon exploration, this include; gravity, magnetic, seismic reflection and electromagnetic. Description of field survey design, data processing and interpretation. 2D and 3D presentation of the results. Confirmation of the models with well log interpretation.

GPH607 Modeling of Groundwater Aquifers نمذجة مستودعات المياه الجوفية

Basics of numerical methods with particular reference to groundwater modelling. Analysis of different approches: finite differences, finite elements. Approximations, Taylor series, conditioning, stability, consistency, boundary conditions, iterative methods. Basics of hydroGeological concepts useful for the definition and the solution of problems by using

numerical methods. Examples of numerical solutions, eq. diffusion, advection, dispersion, heat flow. Application of finite element (e.g., FEFLOW) and finite difference (e.g., MODFLOW with GMS and GV interfaces) numerical codes for the solution of: groundwater flow in saturated and unsaturated conditions, steady and transient. - contaminant transport - coastal saline aquifers - well design

GPH608 Advanced mineral exploration (Geophysical Perspective) الاستكشاف المتقدم عن المعادن

Gravity and magnetic methods are extremely useful in both mineral and oil exploration. The nature of mining environment. Gold mines characteristics and their relation to potential field methods. Radioactive method for mining exploration.

GEO631 Structural Geology (الجيولوجيا التركيبية)

Faults (Fault terminology, fault anatomy, displacement distribution, identifying faultsin an oil field setting, the birth and growth of faults, growth of fault populations,faults, communication and sealing properties), kinematics and paleostress in the brittle regime, deformation at the microscale, folds and folding, shear zones and mylonites, contractional regimes, extensional, transtensional and transpressional regimes, structures of igneous intrusions, gravity controlled structures, balancing and restoration

GPH609 Basin Analysis تحليل الخزانات

Definition and scope - Classification of basins - Basin subsidence and basin fill - Case studies of some sedimentary basins - Data of the subsurface Geology (outcrop Geological data - Seismic data visualization and interpretation - Well log data interpretation and correlations) - Introduction to 3D Geological Modelling- Structural modeling (Fault modelling and framework. - Fractured reservoir modeling) - Stratigraphic Modelling - Sedimentological modeling (Layering and zonation modeling - Facies modeling) - Geometrical modelling - Petrophysical modeling - Volume calculation - Reservoir Engineering - Well design

GPH610 Subsurface Geology الجيولوجيا تحت السطحية

Role and aspects of subsurface Geology ; Source of subsurface data ; Drilling methods and operation ; Presentation of subsurface data; Subsurface map – reading and interpretation; Subsurface correlation ; Unconformities; pinching out; subsurface structures; Criteria of subsurface structures; Geology history and evolution of structures; Subsurface Geological prospecting ; Sedimentary basins; Subsurface Geology of Egypt

GPH611 Advanced Petrophysics البتروفيزياء المتقدمة

Geology, Porosity, Absolute Permeability, Heterogeneity, and Geostatistics Concepts and problems common in petroleum engineering that will appeal to a wide range of disciplines. Rock properties and their interactions with fluids, including gases, liquid hydrocarbons, and aqueous solutions. A basic understanding of the physical properties of permeable Geologic rocks and the interactions of the various fluids with their interstitial surfaces, with special focus on the transport properties of rocks for single phase and multiphase flow. Core topics and includes full-color CT and NMR images, graphs, and figures to illustrate practical application of the material. Formation Evaluation . Avdvanced Formation Evaluation.

GPH612 Environmental Geophysics **الجيوفيزياء البيئية**

This course examines surface and borehole Geophysical methods that are currently being developed in industry, government labs and academia for examining the upper 200 m of the Earth's surface.

GPH613 Engineering Geophysics **الجيوفيزياء الهندسية**

Advanced application of Geophysical methods to engineering purposes and problems, Geophysical assessment for soil and rock properties, engineering applications in Geophysics, Study of site conditions and soil – structures relationships, application of measurements and ccharacteristics of strong ground motion, Advanced application of Geophysical methods to engineering purposes and problems, Geophysical assessment for soil and rock properties, engineering applications in Geophysics

GPH614 Machine learning in Geophysics **تطبيقات التعلم الآلي في الجيوفيزياء**

Course comprises of artificial intelligence which allows software applications to provide accurate results such as predicting outcomes despite not being specifically programmed for it; with the help of historical Geophysical data. Computer science, artificial intelligence, data science related to Geophysical data, deep learning & statistics. Application of clustering schemes to jointly emphasize results from multi-techniques.

GEO659 Sedimentary basin analysis **تحليل الاحواض الرسوبية**

Introduction; The various types of basin formation in various types of Geotectonic setting; Introducing a Geologic method by which the formation and evolution history of a sedimentary basin is revealed, subsidence history and consequences for reservoir and source rock development and the petroleum system. Analyzing the sediment fill and subsidence; aspects of the sediment, namely its composition, primary structures, and internal architecture; mechanisms of sedimentary basin formation by stretching, strike-slip, flexure and compression, effects of mantle dynamics, basin infill mechanisms and depositional systems, basin stratigraphy, subsidence and thermal history, changes of reservoir and petrophysical parameters during burial and tectonic processes, and application to the petroleum system. Developing models to explain broad basin formation mechanisms; examples include intracratonic, rift, passive margin, strike-slip, forearc, backarc-marginal sea, fold and thrust belt, and foreland basins.