Helwan University
Faculty of Science

جامعة حلوان
HELWAN UNIVERSITY

كلية العلوم - جامعة حلوان بنظام الساعات المعتمدة

اللائحة الأكاديمية

كلية العلوم - جامعة حلوان

لدرجة البكالوريوس في العلوم

بنظام الساعات المعتمدة

Undergraduate Academic Rules and Regulation

For Bachelor of Science Degree

(Credit Hours System)

2021

جمهورية مصر العربية

وزارة التعليم العالي

الوزير

قرار وزاري
رقم (٢٠٨٧) بتاريخ ٢٧/ ٦ /٢٠٢١
بشأن إصدار اللائحة الداخلية لكلية العلوم
جامعة حلوان (مرحلة البكالوريوس)
بنظام الساعات المعتمدة

وزير التعليم العالي والبحث العلمي ورئيس المجلس الأعلى للجامعات

** بعد الاطلاع على القانون رقم (٤٩) لسنة ١٩٧٢ في شأن تنظيم الجامعات والقوانين المعدلة له.
** وعلى قرار رئيس الجمهورية رقم (٨٠٩) لسنة ١٩٧٥ بإصدار اللائحة التنفيذية لقانون تنظيم الجامعات والقرارات المعدلة له.
** وعلى القرار الوزارى رقم (٨٤٥) بتاريخ ٢٠٠٢/٦/٩ بشأن إصدار اللائحة الداخلية لكلية العلوم جامعة حلوان (مرحلة البكالوريوس) بنظام الساعات المعتمدة والقرارات المعدلة له .
** وعلى موافقة مجلس جامعة حلوان بجلستيه بتاريخ ١/٢٦ ، ٢٠٢١/٤/٢٨ .
** وعلى موافقة لجنة قطاع العلوم الأساسية بجلستيها بتاريخ ٢/٢٧ ، ٢٠٢١/٣/٢٥ ، وموافقة ا.د/ رئيس لجنة قطاع العلوم الأساسية بموجب التفويض من لجنة القطاع بجلستها بتاريخ ٢٠٢١/٣/٢٥ .
** وعلى موافقة المجلس الأعلى للجامعات بجلسته بتاريخ ٢٠٢١/٦/١٩ .

قرر

(المادة الأولى)

يعمل باللائحة الداخلية المرفقة والخاصة بكلية العلوم جامعة حلوان (مرحلة البكالوريوس) بنظام الساعات المعتمدة ويلغى كل نص يخالف أحكامها .

(المادة الثانية)

على جميع الجهات المختصة تنفيذ هذا القرار.

وزير التعليم العالي والبحث العلمي
ورئيس المجلس الأعلى للجامعات

(أ.د/ خالد عبد الغفار)

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كلية العلوم

اللائحة الأكاديمية
كلية العلـــــوم - جـــامعة حلوان

Undergraduate Academic Rules and Regulations
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لدرجة البكالوريوس فى العلوم
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مقدمـــــــــة

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 البحتة والتطبيقية وإنتاج وإستثمار المعرفة.

رسالة الكلية

كلية العلوم جامعة حلوان مؤسسة تعليمية حكومية، تعمل على إعداد خريج متميز قادرعلى المنافسة في سوق العمل، وكذلك إنتاج وإستثمار بحوث علمية مبتكرة في مجالات العلوم الأساسية البحتة والتطبيقية من خلال برامج أكاديمية متخصصة ومتطورة ذات منظومة ذكية في مجال التعليم والتعلم والبحث العلمي، تساهم بشكل فاعل في خدمة المجتمع وتنمية البيئة محلياً وإقليمياً.

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: تعظيم الدور الانتاجى والخدمى بما يسهم في النهوض بالمجتمع و تنمية البيئة.

الغاية الخامسة: تعزيز الثقة لدى الأطراف المستفيدة من أجل الإرتقاء بالمكانة المجتمعية للكلية.

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أولا: الأحكام العامـــــــــــــــة

مادة (1): نظام الدراسة

نظام الدراسة بالكلية هو نظام الساعات المعتمدة، وتمنح جامعة حلوان بناءاً على طلب مجلس كلية العلوم درجة البكالوريوس فى العلوم Bachelor's Degree in Science (B.Sc.) فى أحد التخصصات المبينة فى المادة 9 من هذه اللائحة، بعد دراسة واجتياز الطالب بنجاح لعدد 138 ساعة معتمدة (136 ساعة معتمدة بالاضافة على عدد 2 ساعة معتمدة لمقرر حقوق الانسان غير محسوبة فى المجموع التراكمى) من المقررات الدراسية والأنشطة العلمية فى أحد البرامج التى تضمها اللائحة. ويمكن تعديل البرامج التى تتضمنها لائحة الكلية بعد خمسة سنوات على الأقل من بدء سريانها. ويجوز أن تضم لائحة الكلية برامج علمية جديدة بناءا على إقتراح مجلس الكلية أو أحد الأقسام العلمية، كما يجوز تقديم برامج جديدة داخل الكلية بمشاركة بعض الأقسام أو بالتعاون مع كلية أو اكثر من كليات الجامعة أو جامعة أخرى أو مركز بحثى.

مادة (2): لغة التدريس وأسلوبه:

أ- لغة التدريس والأمتحان هي اللغة الأنجليزية.

ب- تنتهج الكلية اساليب تدريس حديثة ومتنوعة تعمل علي اكساب الطلاب المعرفة والفهم والمهارات العملية والذهنية بما يتفق ومعايير الجودة.

مادة (3): معيار الساعة المعتمدة

أ- بالنسبة للمحاضرات النظرية :

تحتسب ساعة معتمدة واحدة لكل محاضرة مدتها ساعة نظرية واحدة أسبوعيا لمدة فصل دراسي كامل.

ب- بالنسبة للتطبيقات العملية والتمارين:

تحتسب ساعة معتمدة واحدة لكل فترة تطبيقات عملية او تدريبات او تمارين مدتها من 2 الى 3 ساعات أسبوعيا خلال الفصل الدراسي الواحد، وما يزيد عن ذلك يحتسب 2 ساعة معتمدة، ويسقط من حساب الساعات المعتمدة فترة التطبيقات العملية او التدريبات او التمارين التي مدتها ساعة واحدة.

ج- بالنسبة للتدريب والرحلات:

تحتسب ساعة معتمدة واحدة لأى فترة تدريبية مدتها ثلاث ساعات أسبوعياً لمدة فصل دراسى واحد أو ما يعادلها من تدريب صيفى أو رحلات علمية أو دراسة حقلية أو أنشطة أخرى.

مادة (4): مدة ومستويات الدراسة

مدة الدراسة لنيل درجة البكالوريوس في العلوم أربع سنوات جامعية أو متى استكمل الطالب عدد الساعات المعتمدة المطلوبة للتخرج (**138 ساعة**) بنجاح، وتقسم هذه المدة إلى أربعة مستويات دراسية، ويشمل المستوى الواحد فصلين دراسيين يفصل بينهما عطلة نصف العام وتحدد مستويات الدارسة بعدد الساعات التى اجتازها الطالب بنجاح.

وتحدد مستويات الدارسة بعدد الساعات التى اجتازها الطالب بنجاح كما يلى:-

(أ) المستوى الأول (Freshman) من صفر حتى 30 ساعة.

(ب) المستوى الثانى (Sophomore) من 31 ساعة حتى 64 ساعة.

(ت) المستوى الثالث (Junior) من 65 ساعة حتى 100 ساعة.

(ث) المستوى الرابع (Senior) من 101 ساعة وحتى 136 ساعة.

مادة (5): العام الدراسي والفصل الدراسي

يتكون العام الدراسي من فصلين دراسيين إلزاميين هما الفصل الأول (فصل الخريف)، والفصل الثاني (فصل الربيع) مدة كل منهما سبعة عشر أسبوعاً، ومن فصل ثالث اختيارى مكثف خلال فترة الصيف (فصل صيفى) لمدة ثمانية أسابيع.

مادة (6): الفصل الدراسى

يتكون الفصل الدراسى العادى من سبعة عشر أسبوعاً موزعة على النحو التالى:

(أ) فترة التسجيل مدتها أسبوع واحد ويجوز التسجيل المبكر الكترونيا قبل بدء الفصل الدراسى لطلاب المستويات الثانى والثالث والرابع.

(ب) فترة الدراسة أربعة عشر أسبوعاً منها أسبوع للإمتحانات النصفية.

(ت) فترة الإمتحانات النهائية يحددها مجلس الكلية والجامعة.

مادة (7) : الفصل الصيفى

(أ) هو فصل دراسى مكثف إختيارى مدته ثمانية أسابيع خلال الأجازة الصيفية يسجل فيه الطلاب المقررات الدراسية المؤجلة ومقررات الرسوب وكذلك المقررات اللازمة للتخرج أو دراسة مقررات تحسين التقدير بحد أقصى تسعة ساعات معتمدة، وتكون المقررات المطروحة متاحة طبقاً لضوابط يحددها مجلس الكلية.

(ب) ويسمح للطلاب المعرضين للفصل، وكذلك الطلاب المحتمل تخرجهم بزيادة الحد الأقصى إلى (١٢) ساعة معتمدة.

(ت) تكون الدراسة مكثفة لمدة 8 أسابيع ويليها أسبوعا للامتحانات حيث يبدأ الطلاب التسجيل المبكر الكترونيا قبل بدء الفصل الدراسى لطلاب

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المستويات الثانى والثالث والرابع ويتم الانتهاء من التسجيل فى الاسبوع الاول من الفصل الدراسى.

(ث) قواعد عامة:

1- الالتحاق بالفصل الدراسى الصيفى إختيارى وليس إجبارى.
2- سداد الرسوم الدراسية شرط أساسى لتأكيد تسجيل مقررات الفصل الدراسى الصيفى
3- غير مسموح بتغيير المسار للطالب المسجل فى الفصل الدراسى الصيفى.
4- لن يسمح بالانسحاب أو بالإسترداد بعد إنتهاء الفترة المحددة للتسجيل فى الفصل الدراسى الصيفى حتى لو كان الطالب مسددا للرسوم (بحد اقصى اسبوعين).
5- الالتزام بحضور المحاضرات والدروس العملية بنسبة 75 % شرط أساسى لدخول الامتحان.

مادة (8): الأقسام العلمية:

تضم كلية العلوم الاقسام العلمية التالية:

1- قسم الرياضيات
2- قسم الفيزياء
3- قسم الكيمياء
4- قسم النبات والميكروبيولوجى
5- قسم علم الحيوان والحشرات
6- قسم الجيولوجيا

ويجوز أن تنشأ بالكلية أقسام علمية بناءً على إقتراح مجلس الكلية وموافقة مجلس الجامعة ووفقاً لقانون تنظيم الجامعات .

مادة (9): البرامج الدراسية:

تطرح كلية العلوم البرامج العلمية الدراسية المذكورة فى هذه المادة (18 برنامجا علميا دراسيا) بالإضافة إلى برنامج نوعى واحد تضمها اللائحة كالاتى:

- برنامج الرياضيات
- برنامج الرياضيات وعلوم الحاسب
- برنامج الاحصاء وعلوم الحاسب
- برنامج الفيزياء
- برنامج الفيزياء الحيوية الطبية
- برنامج علوم الفضاء
- برنامج الكيمياء
- برنامج الكيمياء الحيوية
- برنامج الكيمياء التطبيقية
- برنامج النبات
- برنامج الميكروبيولوجى
- برنامج الميكروبيولوجى والكيمياء الحيوية
- برنامج النبات والكيمياء
- برنامج علم الحيوان
- برنامج علم الحيوان والكيمياء
- برنامج الجيولوجيا
- برنامج الجيوفيزياء
- برنامج الجيولوجيا و الكيمياء
- برنامج التكنولوجيا الحيوية الجزيئية (برنامج نوعى بمصروفات)

البرنامج النوعى له لائحة داخلية مستقلة تنظم العمل به ويلغى العمل بالبرامج الأخرى الموجودة باللائحة السابقة والتى لم تذكر فى هذه اللائحة اعتبارا من تاريخ صدورها.

ويجوز أن تنشأ بالكلية برامج أكاديمية أخرى وفقا لأحكام قانون تنظيم الجامعات وبتوصية من مجالس الاقسام المختصة وبموافقة مجلس الكلية ومجلس الجامعة.

مادة (10): القبـول وتخصصات المستوى الأول

تقبل كلية العلوم الطلاب الحاصلين على الثانوية العامة القسم العلمى تخصص (رياضيات وعلوم) أو مايعادلها وفقاً لشروط القبول التى يحددها المجلس الأعلى للجامعات، ويجوز لمجلس الكلية أيضا قبول طلاب وافدين بشروط القيد والتحويل المطبقة على الطلاب المصريين وقد يضيف شروط أخرى يقترحها مجلس الكلية ويوافق عليها مجلس الجامعة، ويوزع طلاب المستوى الأول الحاصلين على الثانوية العامة أو ما يعادلها على ثلاث شعب هى:

- شعبة العلوم الطبيعية وتقبل الحاصلين على الثانوية العامة رياضيات أو علوم.
- شعبة العلوم البيولوجية وتقبل الحاصلين على الثانوية العامة علوم.
- شعبة العلوم الجيولوجية وتقبل الحاصلين على الثانوية العامة رياضيات أو علوم.
- فى حال ضم الرياضيات والعلوم فى شهادة الثانوية العامة يتم توزيع طلاب المستوى الأول حسب تنسيق داخلى يعتمد على درجات الطلاب فى مواد الرياضيات والعلوم.
- ويتضمن الجدول التالى (1) توزيع مقررات العلوم الاساسية للمستوى الاول على الشعب الثلاث.
- ويجوز فتح برامج أخرى بالمستوى الأول فى الكلية أو أقسام لم يرد اسمها فى قائمة الأقسام والبرامج المذكورة فى المادة 8، 9 من هذه اللائحة بعد موافقة مجلس الكلية ومجلس الجامعة.

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جدول (1): توزيع مقررات العلوم الأساسية للمستوى الأول على الشعب الثلاث.

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

مادة (11): التخصصات والبرامج الدرسية

(أ) يختار الطالب البرنامج الذى يرغب دراسته بعد إجتيازه المستوى الأول فى اطار الشعبة التى التحق بها، طبقا لخطة دراسية، وطبقا لنظام تنسيق داخلي يعتمده مجلس الكلية علي ان يأخذ في الاعتبار ما يلي:

1. الشروط والأعداد التي يقرها مجلس الكلية بعد أخذ رأي الأقسام العلمية المختصة.
2. رغبة الطالب.
3. التقدير العام.
4. تقدير مادة، أو مواد، التخصص.
5. القدرة الايستعابية للقسم العلمى.

(ب) يجوز لمجلس الكلية قبول طلاب من الحاصلين على درجة البكالوريوس من إحدى كليات العلوم أو من الكليات العملية الأخرى من المصريين والوافدين

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للدراسة بالكلية وذلك بعد أخذ رأى مجالس الأقسام المختصة وبشرط ألا تقل مدة الدراسة بالكلية عن أربعة فصول دراسية إلزامية كاملة على الأقل وبشروط قبول يقترحها مجلس الكلية ويوافق عليها مجلس الجامعة. الجدول الاتى (جدول (2)) يوضح البرامج الدراسية ومسارات التخصص:

جدول (2): البرامج الدراسية ومسارات التخصص.

الثانوية العامة	المستوى الأول	البرامج الدراسية	نوع البرنامج
علمى رياضيات + علمى علوم	مجموعة العلوم الطبيعية	الرياضيات	منفرد
		الرياضيات وعلوم الحاسب	مزدوج
		الاحصاء وعلوم الحاسب	مزدوج
		الفيزياء	منفرد
		الفيزياء الحيوية الطبية	منفرد
		علوم الفضاء	منفرد
		الكيمياء	منفرد
		الكيمياء التطبيقية	منفرد
	مجموعة علوم الأرض	الجيولوجيا	منفرد
		الجيوفيزياء	منفرد
		الجيولوجيا والكيمياء	مزدوج
علمى علوم	مجموعة العلوم البيولوجية	الكيمياء الحيوية	منفرد
		النبات	منفرد
		النبات والكيمياء	مزدوج
		الميكروبيولوجى	منفرد
		الميكروبيولوجى والكيمياء الحيوية	مزدوج
		علم الحيوان	منفرد
		علم الحيوان والكيمياء	مزدوج
		التكنولوجيا الحيوية الجزيئية	برنامج نوعى

مادة (12): متطلبات التخرج

متطلبات التخرج لنيل درجة البكالوريوس فى العلوم هى إجتياز الطالب بنجاح **136** ساعة معتمدة، بالإضافة إلى مقرر حقوق الإنسان.

جدول (3): توزيع الساعات المعتمدة ولمتطلبات التخرج لنيل درجة البكالوريوس وعدد الساعات الاجبارية والاختيارية

م	المتطلب	عدد الساعات			النسبة المئوية	تعريف بالمتطلب
		إجبارى	إختيارى	مجموع		
1	**متطلبات الجامعة**	*2+4	4	*2+8	**5,88**	فى المستوى الأول غالبا
2	**متطلبات الكلية**	**28**	--	**28**	**20,59**	فى المستوى الأول غالبا
3	**متطلبات التخصص المنفرد**	**60**	**30**	**90**	**66,18**	يبدأ الطالب دراستها اعتبارا من المستوى الثانى
4	**متطلبات التخصص الرئيسى**	**46**	**20**	**66**	**48,53**	يبدأ الطالب دراستها اعتبارا من المستوى الثانى
5	**متطلبات التخصص الفرعى**	**16**	**8**	**24**	**17,65**	يبدأ الطالب دراستها اعتبارا من المستوى الثانى
6	**متطلبات التخصص المزدوج**	**60**	**30**	**90**	**66,18**	يبدأ الطالب دراستها اعتبارا من المستوى الثانى
7	**الإختيار الحر**	-	**6**	**6**	**4,41**	يبدأ الطالب دراستها اعتبارا من المستوى الثانى
8	**تدريب ميدانى**	**2**	--	**2**	**1,47**	تدريبات تطبيقية 6 أسابيع بعد المستوى الثالث
9	**مشروع تخرج**	**2**	--	**2**	**1,47**	مشروع بحثى أو مقال

عدد الساعات الكلى فى كل مستوى				
المستوى الاول	المستوى الثانى	المستوى الثالث	المستوى الرابع	المجموع
36	**34-32**	**34-32**	**36-32**	***2+136**

* ساعات معتمدة غير مضافة لعدد الساعات المعتمدة الكلى ولاتحسب ضمن المعدل التراكمى لمتوسط النقاط.

(أ) **متطلبات الجامعة:** مقررات ثقافية وعلمية وتشمل على مقررات إجبارية عامة وإختيارية مطروحة من قبل الجامعة والكلية بواقع **8** ساعات معتمدة، ويجوز لمجلس الكلية طرح مقررات أخرى بعد موافقة مجلس الجامعة.

- متطلبات الجامعة الاجبارية وتشمل على أربعة ساعات لمقررات عامة إجبارية:

2 ساعة معتمدة فى دراسة اللغة الانجليزية

2 ساعة معتمدة فى دراسة تكنولوجيا المعلومات

- متطلبات الجامعة الاختيارية وتشمل على أربعة ساعات مقررات إختيارية:

يختار الطالب عدد مقررين من مقررات الجامعة الاختيارية الملحقة بجدول (7).

- 2 ساعة أسبوعية لمقرر حقوق الانسان ويكون التقييم فيها راسب/ناجح ولاتحسب ضمن المجموع التراكمى.

(ب) **متطلبات الكلية :** مقررات علوم أساسية مساعدة أو مساندة لفهم التخصص: **28** ساعة إجبارية تشارك فى تقديمها كل أقسام الكلية.

(ت) **متطلبات القسم:**

1- **متطلبات التخصص المنفرد: 90** ساعة معتمدة، توزع بين 60 ساعة معتمدة مقررات إجبارية (لا غنى عنها لاستيفاء مواصفات الخريج) و30 ساعة معتمدة مقررات اختيارية من قائمة المقررات النظرية والعملية والتطبيقية.

2- **متطلبات التخصص المزدوج : 90** ساعة معتمدة، توزع بين 60 ساعة مقررات إجبارية (لا غنى عنها لاستيفاء مواصفات الخريج) و30 ساعة معتمدة مقررات اختيارية من قائمة المقررات النظرية والعملية والتطبيقية وتقسم مناصفة بين فرعى التخصص المزدوج.

3- **متطلبات التخصص الرئيسى: 66** ساعة معتمدة، منها 46 ساعة معتمدة اجبارية و20 ساعة معتمدة اختيارية.

4- **متطلبات التخصص الفرعى :24** ساعة معتمدة، توزع بين 16 ساعة معتمدة مقررات إجبارية و 8 ساعات معتمدة مقررات اختيارية من قائمة المقررات النظرية والعملية والتطبيقية.

5- **مقررات اختيارية حرة: 6** ساعات معتمدة، يختارها الطالب من خارج مقررات التخصص بالتشاور مع المرشد الأكاديمي.

6- **مشروع التخرج:** يقوم طلاب المستوى الرابع بجميع البرامج بالكلية بإعداد و كتابة مقال مرجعى أوتنفيذ مشروع تخرج بحثى فى التخصص المنفرد أو فى أحد فرعى التخصص المزدوج أو موضوع مشترك بينهما باشراف أحد أعضاء هيئة التدريس. ويعتبر مقررا دراسيا تحتسب له عدد **2** ساعة معتمدة وممتدة على مدى الفصلين الدراسين للمستوى الرابع، علي ان يتقدم الطلاب خلال عشرون يوما من نهاية امتحانات الفصل الثانى بتقريرا علميا ممنهجا عن المشروع مدعما بالمراجع العلمية التي استعان بها الطالب، مع القاء عرضا علميا يناقش فيه الطالب من خلال لجنة يشكلها القسم من اعضائه على ان يكون من بينهم المشرف علي المشروع أو المقال، ويجوز ان يشارك في اللجنة أعضاء من التخصصات المختلفة بالكلية أو من خارج الكلية يحددهم مجلس القسم المختص.

7- **تدريبات تطبيقية وميدانية** لمدة أربع أسابيع داخل مؤسسات إنتاجية أو أحد المراكزالبحثية أو الأقسام العلمية بالجامعة التى يدرس بها الطالب أو جامعة أخرى فى الاجازة الصيفية بين المستوى الثالث والرابع، وتحسب **2** ساعة معتمدة فى المستوى الرابع الفصل الدراسى الاول ويحدد مجلس الكلية مشرفى التدريب

بناء على مقترحات مجالس الأقسام المختصة، على ان تطبق القواعد المعمول بها في الجامعة على المشرفين. علي ان يتقدم الطلاب فى بداية الفصل الاول من المستوى الرابع بتقريرا علميا ممنهجا عن الفترة التدريبية، مع القاء عرضا علميا يناقش فيه الطالب من خلال لجنة يشكلها القسم من اعضائه على ان يكون من بينهم المشرف علي التدريب، ويجوز ان يشارك في اللجنة أعضاء من التخصصات المختلفة بالكلية أو من خارج الكلية يحددهم مجلس القسم المختص.

8- الرحلات العلمية

(أ) قسم الرياضيات:

يقوم طلبة المستوى الرابع بقسم الرياضيات برحلات علمية تحت اشراف اعضاء هيئة التدريس بالقسم، وتحدد مدة الرحلة وتاريخ القيام بها بمعرفة مجلس القسم المختص وموافقة مجلس الكلية، على ان تشمل الرحلة زيارة ميدانية للشركات والمصانع والبنوك والبورصة والمراكز البحثية والهيئات العلمية المتخصصة.

(ب) قسم الفيزياء:

يقوم طلاب المستوى الرابع بقسم الفيزياء برحلات علمية تحت اشراف اعضاء هيئة التدريس بالقسم، وتحدد مدة الرحلة وتاريخ القيام بها بمعرفة مجلس القسم المختص وموافقة مجلس الكلية، على ان تشمل الرحلة زيارة ميدانية لمحطات توليد الطاقة ومحطات رصد الاقمار الصناعية والشركات والمصانع والمراكز البحثية والهيئات العلمية والمعامل المتخصصة.

(ت) قسم الكيمياء:

يقوم طلاب برنامجى الكيمياء والكيمياء التطبيقية ابتداء من المستوي الثاني برحلات اليوم الواحد لزيارة المصانع والشركات المرتبطة بالتخصص، ويحدد تاريخ القيام بالرحلة بمعرفة مجلس القسم العلمي المختص.

ث-قسم النبات والميكروبيولوجى:

يقوم طلاب المستوى الرابع برحلات علمية تحت اشراف اعضاء هيئة التدريس بالقسم، وتحدد مدة الرحلة وتاريخ القيام بها بمعرفة مجلس القسم المختص وموافقة مجلس الكلية، على ان تشمل الرحلة احد اماكن النباتات الطبيعية بالوديان والمناطق الساحلية المختلفة بناء على تنوع الكساء الخضرى بهذه المناطق ووفرتة.

ج-قسم علم الحيوان والحشرات:

يقوم طلاب المستوى الرابع بالقسم برحلة علمية تحت اشراف أعضاء هيئة التدريس بالقسم لدراسة التنوع الحيوانى فى البيئات المختلفة فى مصر وتحدد مدة وتاريخ القيام بالرحلة بمعرفة مجلس القسم المختص وموافقة مجلس الكلية.

ح- قسم الجيولوجيا:

- يقوم طلاب المستوى الاول بعدة زيارات علمية للمراكز البحثية والهيئات والشركات الجيولوجية والجيوفيزيقية والمتاحف الجيولوجية والمحميات الجيولوجية الطبيعية والمناطق الجيولوجية المختلفة لمدة يوم واحد.
- يقوم طلاب المستوى الثاني برحلة علمية حقلية تحت اشراف هيئة التدريس للمناطق الجيولوجية المختلفة بكل فصل دراسى لمدة يحددها مجلس القسم المختص ويقرها مجلس الكلية.
- يقوم طلاب المستوى الثالث والرابع برحلة علمية حقلية تحت اشراف اعضاء هيئة التدريس لمدة يحددها مجلس القسم المختص ويقرها مجلس الكلية.

9- يجوز للاقسام العلمية طرح مقررات تدريبية لطلاب الشعب العلمية المختلفة يري القسم أنها تعطي ميزة تنافسية لطلابه في سوق العمل بعد موافقة مجلس الكلية وموافقة مجلس الجامعة.

مادة (13): أكواد وأرقام المقررات الدراسية

ترقم المقررات المطروحة فى جدول البرامج الدراسية من أربعة أرقام دلالاتها كما يلى:

(أ) يمثل الرقم الأول من اليسار المستوى الدراسى الذى يقدم فيه المقرر وهو 1 للمستوى الأول و2 للمستوى الثانى و3 للمستوى الثالث و4 للمستوى الرابع

(ب) يمثل الرقم الثانى من اليسار الفصل الدراسى الذى يقدم فيه المقرر وهو 1 للفصل الأول و2 للفصل الثانى

(ت) يمثل الرقمين الثالث والرابع إلى اليسار تسلسل المقرر فى المستوى الدراسى والتخصص

(ث) تسبق الأرقام رموز من ثلاث حروف أبجدية تشير إلى تخصص المقرر فى البرنامج المنفرد واربع حروف أبجدية تشير إلى تخصص المقرر فى البرنامج المزدوج

(ج) يتم طرح المقررات ذات الأرقام الفردية فى الفصل الدراسى الأول فى الخريف وطرح المقررات ذات الأرقام الزوجية فى الفصل الدراسى الثانى فى الربيع ويجوز للجنة شئون الطلاب طرح المقرر فى أكثر من فصل بناءً على اقتراح الأقسام المختصة.

(ح) تمثل مقررات الجامعة الاختيارية بالحروف الابجدية Uni ثم من اليسار المستوى الدراسى ثم يليه الفصل الدراسى ثم nn والتى تمثل تسلسل المقرر فى المستوى والفصل الدراسى بعد اخر رقم فى المقررات الاجبارية للجامعة.

(خ) تمثل مقررات القسم الاختيارية بالحروف الابجدية التى تمثل تخصص المقرر ثم من اليسار المستوى الدراسى ثم يليه الفصل الدراسى ثم nn والتى

Helwan University

تمثل تسلسل المقرر فى المستوى والفصل الدراسى بعد اخر رقم فى المقررات الاجبارية.

(د) تمثل المقررات الاختيار الحر بالحروف الابجدية Fre ثم من اليسار المستوى الدراسى ثم يليه الفصل الدراسى ثم nn والتى تمثل تسلسل المقرر فى المستوى والفصل الدراسى.

(ذ) يمثل مقرر التدريب الميدانى بالحروف الأبجدية الدالة على تخصص البرنامج يليها رقم 40 ثم حروف PT.

(ر) يمثل مقرر البحث والمقال بالحروف الأبجدية الدالة على تخصص البرنامج يليها رقم 40 ثم حروف RP.

(ز) يشترط للتسجيل فى مقرر له متطلب أو متطلبات سابقة إستيفاء شروط النجاح فى هذه المقررات السابقة، والمتطلب السابق هو مقرر يجب على الطالب إجتيازه بنجاح قبل التسجيل فى المقرر الاعلى. ويطرح المتطلب فى مستوى دراسى أقل من المستوى الدراسى للمقرر المطلوب التسجيل فيه . ويجوز فى المستوى الرابع فقط ولآتمام متطلبات التخرج السماح للطالب بالتسجيل فى مقرر ما ومتطلبه الذى سبق الرسوب فيه معاً وذلك بموافقة المشرف الأكاديمى ووكيل الكلية لشئون التعليم والطلاب.

(س) الجدول الاتى رقم (4) يبين رموز الأقسام والتخصصات والبرامج :

جدول (4): رموز الاقسام والتخصصات والبرامج.

الرمز	البرنامج/التخصص	القسم	الشعبة
Uni	University requirements	متطلبات الجامعة	الجامعة
Mat	Mathematics	الرياضيات	العلوم الطبيعية
Sta	Statistics		
MaCo	Mathematics & Computer Science		
StCo	Statistics&Computer Science		
Com	Computer Science		
Phy	Physics	الفيزياء	
BPh	Medical Biophysics		
Spa	Space Sciences		
Chm	Chemistry	الكيمياء	
Ach	Applied Chemistry		
BCh	Biochemistry		
Bot	Botany	النبات والميكروبيولوجى	العلوم البيولوجية
Mic	Microbiology		
BoCh	Botany & Chemistry		
MiBc	Microbiology& Biochemistry		
Zoo	Zoology	علم الحيوان	
ZoCh	Zoology& Chemistry		
Geo	Geology	الجيولوجيا	العلوم الجيولوجية
GPh	Gophysics		
GeCh	Geology & Chemistry		
PT	Practical Trianing		التدريب الميدانى
RP	Research Project		مشروع التخرج
Fre	Free Elective courses		إختيار حر

مادة (14): الإرشاد الأكاديمى والسجل الأكاديمى

(أ) يخصص لكل طالب مرشد أكاديمى من بين أعضاء هيئة التدريس لتوجيه الطالب دراسياً ومساعدته على إختيار المقررات الدراسية وعدد الساعات التى يسجل بها وفقاً لقدراته وإستعداده.

(ب) يكون لكل طالب سجل بيانات لدى المرشد الأكاديمى يسجل فيه المقررات التى درسها الطالب يسمى السجل الأكاديمى وهو بيان يوضح المقررات الدراسية التى درسها فى كل فصل دراسى ورموزها وأرقامها والدرجات والنقاط والتقديرات التى حصل عليها ورموز التقديرات والمعدل الفصلى والتراكمى والتقديرات الفصلية ورموزها والتقدير العام حتى تخرج الطالب من الكلية.

(ت) لا تقبل بطاقات التسجيل أو الإضافة أو الإنسحاب إلا باعتماد المرشد الأكاديمى، وعلى الطالب الرجوع إليه لإستشارته في أموره الدراسية وتقديم النصح له لحل المشكلات التي قد تعترضه. ويعتبر رأى المرشد الاكاديمى استشارى.

مادة (15) : التسجيل وتحديد المستوى الدراسى

(أ) يتم توزيع طلاب المستوى الأول على الشعب التى تضمها اللائحة فى مادة 10 طبقا لرغباتهم وفق شروط يضعها مجلس الكلية قبل بداية الدراسة (مادة 11).

(ب) يتم تسجيل الطلاب الكترونيا قبل بداية الفصل الدراسى ويتم الإنتهاء من تسجيل المقررات فى الأسبوع الأول من الدراسة، ويجوز فى حالة وجود أعذار قهرية أن يتم التسجيل حتى نهاية الأسبوع الرابع (الحذف والإضافة)، وفى جميع الأحوال يراعى عند تسجيل الطالب لمقرر ما، ضرورة دراسته للمتطلب السابق (مقرر أساسى لفهم محتوى المقرر، محدد بجداول البرامج الدراسية) إن وجد.

(ت) ينقل الطالب إلى المستوى الثانى إذا إجتاز 30 ساعة معتمدة ويسجل فى المستوى الثالث إذا إجتاز 64 ساعة معتمدة ويسجل فى المستوى الرابع إذا إجتاز 100 ساعة معتمدة.

(ث) يجوز قبول طلاب من الحاصلين على درجة بكالوريوس العلوم ويرغبون فى دراسة تخصص آخر، او قبول طلاب من كليات اخرى من جامعات مصرية خاضعة لقانون تنظيم الجامعات او جامعة الأزهر او من جامعات معترف بها من المجلس الاعلى للجامعات أو خريجى الكليات العسكرية (الحربية- الجوية- البحرية- الفنية)، بشرط ألا تقل مدة الدراسة بالكلية عن سنتين أكاديميتين أو أربعة فصول دراسية عادية وذلك بعد عمل المقاصة اللازمة للمقررات، ويجوز وضع شروط أخرى يحددها مجلس الكلية، وتحدد الرسوم بناءً على قرارات المجلس الأعلى للجامعات.

مادة (16): العبء الدراسى

يسمح لكل طالب بالتسجيل فى ساعات تتراوح بين 12 و18 ساعة معتمدة لكل فصل دراسى أساسى ويستثنى من ذلك الحالات الآتية:-

(أ) يجوز للطالب المتفوق الحاصل على تقدير ممتاز (A 3.667) على الأقل بعد المستوى الأول - أن يسجل 20 ساعة معتمدة فى الفصل الدراسى الواحد وبحد أقصى 4 مرات طوال فترة الدراسة.

(ب) يجوز لمجلس الكلية زيادة الحد الأقصى للعبء الدراسى إلى 22 ساعة معتمدة لمرة واحدة للطالب الذى إجتاز 100 ساعة معتمدة بغرض إتمام متطلبات التخرج اللازمة له مع مراعاه الحصول على التقدير الوارد فى الفقرة (أ) من هذه المادة.

(ت) لا يسمح للطالب الذى لا يحقق معدل تراكمى 2 (60% من الحد الأقصى لمجموع درجات المقررات التى درسها) بالتسجيل فى أكثر من **12** ساعة معتمدة فى الفصل الدراسى الواحد ويراقب أكاديميا (مادة 25 ب) حتى يتجاوز هذا المعدل.

(ث) يجوز لمجلس الكلية أن يعفى الطالب المحول من كلية مناظرة من بعض المقررات إذا ثبت أنه قد درس ونجح فى مقررات تعادلها فى الكلية المحول منها، كما يجوز للطالب المسجل بالكلية دراسة مقررات مناظرة فى كلية من كليات العلوم الأخرى بجمهورية مصر العربية أو فى الخارج لظروف يقبلها مجلس الكلية بعد أخذ رأي مجلس القسم المختص وبشرط الحصول على موافقة مسبقة على دراستها بعد تقديم المحتوى العلمى لها و بحيث لاتزيد عن 36 ساعة معتمدة فى مجملها وتحتسب نتيجتها ضمن الساعات المطلوبة للتخرج وفى حساب المعدل التراكمى لمتوسط النقاط للطالب.

مادة (17): الحذف والإضافة والإنسحاب

(أ) يجوز للطالب بتوصية من المرشد الأكاديمى أن يحذف أو يضيف مقررا أو أكثر حتى نهاية الأسبوع الرابع من الدراسة (الأسبوع الثانى من الفصل الصيفى) وذلك بما لا يخل بالعبء الدراسى المنصوص عليه فى المادة 16، وبما لا يزيد عن 6 ساعات معتمدة فى الفصل الدراسى الواحد (3 ساعات فى الفصل الصيفى).

(ب) يجوز أن ينسحب الطالب من دراسة أى مقرر حتى نهاية الأسبوع الثامن من بدء التسجيل للفصل الدراسى ، ويسجل هذا المقرر فى سجل الطالب الأكاديمى بتقدير "منسحب W" بشرط أن لا يكون الطالب قد تجاوز نسبة الغياب المقررة قبل الانسحاب، وتعرض حالات الإنسحاب الإضطرارية بعد هذا الميعاد على

لجنة شئون التعليم والطلاب بالكلية للنظر فيها وإقرارها من مجلس الكلية، على ألا يخل الانسحاب بالعبء الدراسى للطالب وفقاً للمادة 16.

مادة (18): تغيير مسار الدراسة أو تعديل البرنامج الدراسى

(أ) يجوز للطالب تغيير أو تعديل برنامجه الدراسى خلال المستوى الأول والثانى، بعد موافقة المرشد الأكاديمى ولجنة شئون التعليم والطلاب ومجلس الكلية بشرط توافر أماكن شاغرة وشروط القبول فى برنامج التخصص الذي يرغب في التحويل إليه

(ب) يدرس الطالب مقررات التخصص الجديد ولا تحتسب مقررات البرنامج المحول منه ضمن متطلبات التخرج لمسار الطالب الجديد ما لم تكن ضمن مقررات البرنامج المحول اليه.

(ت) تشطب من سجل الطالب جميع المقررات التي اجتازها الطالب ما لم تكن من متطلبات البرنامج المحول إليه، ولا يتم احتسابها في المعدل التراكمي لمتوسط النقاط، ويجوز لمجلس الكلية فرض رسوم إضافية عن هذا التحويل.

مادة (19): المواظبة

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

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

الطالب على لجنة شئون التعليم والطلاب ومجلس الكلية لحرمانه من استكمال دراسة المقرر أو قبول عذره واعتباره غائب بعذر.

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

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

مادة (20): التأجيل وتكرار الرسوب

(أ) إذا قام الطالب بالتسجيل فى مقرر من المقررات وقام بالحضور و أداء جميع اعمال والاختبارات الفصلية و العملية ولكنه لم يتمكن من دخول الامتحان التحريرى النهائى لعذر مقبول تقبله لجنة شئون الطلاب ومجلس الكلية، يعطى للطالب فى هذه الحالة تقدير غير مكتمل (غ م Incomplete, Inc,) و هو تقدير مؤقت لحين دخول الطالب الامتحان النهائي فى فترة لا تتجاوز أسبوع او أسبوعين من بداية الفصل الدراسى التالى، و يعدل تقدير غير مكتمل الى التقدير النهائي الذى يحصل عليه الطالب، وفى حالة عدم دخول الامتحان النهائي فى الموعد المقرر يستبدل تقدير غير مكتمل بتقدير راسب (ر F).

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

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

(ث) فى حالة المقررات التى تستلزم فترة زمنية أطول من فصل دراسى واحد والتى تنطبق على مشروع التخرج أو المقال البحثى يسجل الطالب فى الفصل الاول من المستوى الدراسى على النظام ممتد أو مستمر، وتؤجل تقديراتها للفصل الدراسى التالى وعند إجتياز المقرر ترفع نتيجته فى نهاية الفصل ويعطى للطالب التقدير المستحق.

مادة (21): التقويـم والدرجات

(أ) زمن الامتحان النظرى هو ساعة واحدة لكل ساعة تدريسية معتمدة.

(ب) يتم تقييم إمتحان كل مقرر من (100) مائة درجة، بحيث يتم تقييم مجموع درجات الطالب فى المقررات النظرية والعملية بناءا على النسب الواردة فى جدول (5) التالى:-

جدول (5): نسب تقييم الطالب فى المقررات النظرية والعملية.

نوع الامتحان	المقرر نظرى وعملى	المقرر نظرى فقط	المقرر عملى فقط
إمتحان نظرى نهائى	60%	60%	-
إمتحان عملى نهائى	20%	-	60%
إمتحان شفوى نهائى	5%	10%	-
إمتحان فصلى نظرى (منتصف الفصل)	10%	20%	-
إختبارات دورية وأعمال فصلية (تمارين وواجبات وتطبيقات ،،، الخ)	5%	10%	40%
مجموع درجات الإمتحانات	**100%**	**100%**	**100%**

(ت) بالنسبة للمقال المرجعى أو مشروع التخرج بالمستوى الأخير والمخصص له ساعتان معتمدتان توزع درجاته بواقع 60% على جودة المقال أو تقرير المشروع، و20% للمناقشة الشفهية و20% للمتابعة الدورية من أحد أعضاء هيئة التدريس.

(ث) بالنسبة للتدريب الميدانى يخصص له ساعتان معتمدتان توزع درجاته بواقع 40% على جودة تقرير الطالب، و20% لتقرير مشرف الطالب الاكاديمى، و20% لتقرير مشرف الطالب فى موقع التدريب و20% للمناقشة.

(ج) يعقد الأمتحان النهائى لكل مقرر فى نهاية الفصل الدراسي بموجب جدول تعده إدارة شئون الطلاب ويقره مجلس الكلية ويعلن على الطلاب.

(ح) بناء على متطلبات ومواصفات المقرر يكون الأختبار نظريا او عمليا تطبيقيا او شفويا او كل ذلك، وتتم الإمتحانات الشفهية والتحريرية بواسطة لجنة لاتقل عن أثنين من أعضاء هيئة التدريس من بينهم القائم على تدريس المقرر ويقوم القسم بتشكيل لجان الامتحانات ويعتمدها مجلس الكلية، اما الامتحانات العملية

(خ) أو التطبيقية او الشفوية فتشكل لجان الامتحان من ثلاث اعضاء هيئة تدريس لإجراء الامتحانات.

(د) يعتبر الطالب الغائب في الامتحان العملى النهائي أو الإمتحان التحريرى النهائى بدون عذر يقبله مجلس الكلية غائباً في المقرر، ويعتبر الطالب الذى يحصل على درجة أقل من 40% من درجة الإمتحان النظرى النهائى راسباً فى المقرر.

مادة (22): الدلالات الرقمية والرمزية للدرجات والتقديرات

(أ) تقدر الدرجات التى يحصل عليها الطالب فى كل مقرر دراسى على النحو الموضح فى جدول (6) التالى:-

جدول (6): تقدر الدرجات التى يحصل عليها الطالب فى كل مقرر دراسى.

التقدير Grade		رمز التقدير		المكافئ الرقمى بالنقاط من 4	الدرجة المئوية
Excellent	ممتاز	A^+	أ+	4,000	100 >- 90
Excellent	ممتاز	A	أ	3,667	90 >- 85
Very Good	جيد جدا	B^+	ب+	3,333	85 >- 80
Very Good	جيد جدا	B	ب	3,000	80 >- 75
Good	جيد	C^+	جـ+	2,667	75 >- 70
Good	جيد	C	جـ	2,333	70 >- 65
Pass	مقبول	D	ل	2,000	65 >- 60
Fail	راسب	F	ر	0,000	60 >- 0
Postponed	مؤجل	P	م ج	0.000	60 >- 0
Incomplete	غير مكتمل	Inc	غ م	0,000	60 >- 0
Denial	محروم	DN	م	0,000	60 >- 0
Withdrawn	منسحب	W	م ن	0,000	60 >- 0
Audit-Pass	ناجح حضور	AuP	ن ح	------	100 >- 60
Audit-Fail	راسب حضور	AuF	ر ح	------	60 >- 0

مادة (23): المعدل الفصل والمعدل التراكمى

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

$$\text{المعدل الفصلـــي} = \frac{\text{مجموع حاصل ضرب نقاط كل مقرر فصلى x عدد ساعاته المعتمدة}}{\text{حاصل جمع الساعات المعتمدة لهذة المقررات فى الفصل}}$$

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

$$\text{المعدل التراكمى لمتوسط النقاط} = \frac{\text{مجموع حاصل ضرب نقاط كل مقرر تم دراسته x عدد ساعاته المعتمدة}}{\text{حاصل جمع الساعات المعتمدة لهذة المقررات التى تم دراستها}}$$

مادة (24): مرتبة الشرف

تمنح مرتبة الشرف للطالب الذى ينهى دراسته بالكلية فى غضون المدة الإعتيادية للتخرج والتى لاتزيد عن 8 فصول دراسية أساسية بتقدير ممتاز إذا حقق معدل تراكمى من النقاط قدره **3,666** أو أكثر وبشرط ألا يقل معدله التراكمى فى أى فصل دراسى عن **3,0** وألا يكون قد رسب فى أى مقرر دراسى خلال دراسته فى الكليـــة أو فى الكلية المحول منها اذا كان قد قضى مدة دراسة لا تزيد عن عامين فى كلية أخرى.

مادة (25) : الإنذار والمراقبة الأكاديمية

(أ) إذا حصل الطالب على معدل تراكمى أقل من 2 (60% من الحد الأقصى لمجموع درجات المقررات التى درسها) ينذر إنذار أول من شئون الطلاب بعد إعتماده من وكيل الكلية لشئون التعليم والطلاب.

(ب) إذا تكرر تدنى المعدل التراكمى للطالب عن 2 لفصل دراسى ثان، ينذر إنذار ثان ويعتبر الطالب مراقب أكاديميا ولا يسمح له بالتسجيل إلا فى الحد الأدنى للساعات وهو 12 ساعة معتمدة (مادة 16 ت).

(ت) الطالب الذى لا يحقق معدل تراكمى **2** أو أكثر عند إتمامه متطلبات التخرج يجب عليه إعادة التسجيل فى عدد من المقررات الدراسية بحد أقصى 12 ساعة معتمدة فى الفصل الدراسى ويحصل على كامل الدرجة فى هذه المقررات حتى يحقق المعدل المطلوب للتخرج، ويحسب له التقدير الأعلى للمقررات التى سبق له النجاح فيها وتضاف نتيجة هذه المقررات فى سجله الأكاديمى.

(ج) الطالب الموضوع تحت الملاحظة الأكاديمية يجب أن يرفع معدله التراكمي إلى 2.00 فأكثر وذلك في مدة أقصاها أربعة فصول دراسية متتالية ، ويرسل إليه إنذار ثان لتذكيره إذا أكمل فصلين دراسيين دون الوصول إلى المعدل المطلوب، كما يُخطر ولي أمره بذلك ، وإذا لم يحقق الطالب تقدير تراكمي 2.00 على الأقل بعد أربعة فصول دراسية متتالية أو منفصلة يتم فصله نهائياً.

مادة (26) الإنقطاع عن الدراسة وإلغاء القيد والفصل

(أ) يجوز للطالب أن يطلب تأجيل دراسته لمدة لاتزيد عن أربعة فصول دراسية، منفصلة أو متصلة، خلال مدة دراسته بالكلية على أن تقدم طلبات التأجيل فى

(ب) موعد أقصاه نهاية الأسبوع الخامس من الفصل الدراسى ويكون التأجيل نافذاً بعد أخذ رأى المرشد الأكاديمى ولجنة شئون التعليم والطلاب وموافقة مجلس الكلية ومجلس الجامعة.

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

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

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- يفصل طالب المستوى الأول إذا لم يجتز30 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال أربعة فصول دراسية رئيسية.
- يفصل طالب المستوى الثانى إذا لم يجتز 64 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال ثمانية فصول دراسية رئيسية، مع اعطاء الطالب فرصة إمتحان من الخارج بعد فصل دراسى تاسع بمصروفات يحددها مجلس الكلية ولمرة واحدة.
- يفصل طالب المستوى الثالث إذا لم يجتز 100 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال عشرة فصول دراسية، مع اعطاء الطالب فرصة إمتحان من الخارج بعد فصل دراسى حادى عشر بمصروفات يحددها مجلس الكلية ولمرة واحدة.
- يفصل طالب المستوى الرابع إذا لم يجتز 120 ساعة معتمدة من المقررات التى سجل فيها وأدى فيها الإمتحان خلال خمس سنوات دراسية، وإذا إجتاز الطالب 100 ساعة معتمدة على الأقل يكون له حق الإستمرار فى الدراسة حتى التخرج بمصروفات يحددها مجلس الكلية.

مادة (27) : نظام الإستماع والطالب الزائر

(أ) يجوز لمجلس الكلية بعد أخذ رأى مجالس الأقسام العلمية المختصة أن يقبل طلاب من كليات الجامعة أوالجامعات الأخرى كمستمعين لبعض المقررات بالكلية وفقاً لقواعد يحددها مجلس الكلية ويوافق عليها مجلس الجامعة، ولايكون له أعمال فصلية ولاأمتحانات دورية ولانهائية وتمنح الكلية شهادة تفيد حضور هذه المقررات كمستمع.

(ب) كما يجوز قبول طلاب زائرين من كليات أخرى لمدة عام لدراسة مقررات دراسية بحد أقصى 36 ساعة معتمدة، ويكون له نسبة حضور وأعمال فصلية

وأمتحانات دورية وامتحان نهائى مثل الطالب المسجل بالكلية ويأخذ إفادة من الكلية بالمقررات التى درسها وتقديراتها.

(ت) كما يجوز زيارة طلاب الكلية جامعة أخرى لدراسة مقررات يتضمنها برنامجهم الدراسى بحد أقصى 36 ساعة معتمدة، وتسجل المواد التى درسها فى سجله الدراسى بالتقديرات والدرجات والنقاط التى حصل عليها الطالب.

مادة (28): تطبيق أحكام قانون تنظيم الجامعات

(أ) تطبق هذه اللائحة إعتباراً من العام الجامعى التالى لتاريخ صدورها على الطلاب المستجدين بالمستوى الأول بالكلية، أما الطلاب الباقون للإعادة بالمستوى الأول والطلاب المنقولون للمستويات الأعلى فتنطبق عليهم أحكام اللائحة الداخلية التى إلتحقوا فى ظلها وذلك حتى تخرجهم.

(ب) تطبق أحكام قانون تنظيم الجامعات ولائحته التنفيذية فيما لم يرد فيه نص فى هذه اللائحة.

(ت) يلغى التحاق الطلاب المستجدين بالفرقة الاولى بالبرامج الأخرى الموجودة باللائحة السابقة للكلية والتى لا تضمها هذه اللائحة وذلك اعتبارا من تاريخ قرار صدورها.

مادة (29): تطبيق المعدلات المرجعية للجودة والإعتماد

تلتزم الكلية بضرورة توافق المضمون العلمى لبرامجها مع معايير الجودة فى التعليم الجامعى كما حددتها الهيئة القومية لضمان جودة التعليم والإعتماد، وخاصة عدد أعضاء هيئة التدريس على رأس العمل فعلا بالكلية أو بالجامعة وملائمة التخصص العلمي لهم مع التدريس للمقررات التي سوف يشاركون في تدريسها بناءا على المقررات الدراسية المرفقة بلائحة الدراسة ومحتواها العلمى، وكذلك توفر

الإمكانيات المعملية الكافية لاكتساب الطلاب مهارات ومعارف كافية تتفق مع حصولهم على درجة البكالوريوس فى العلوم.

مادة (30): توصيف البرامج والمقررات الدراسية

يقوم كل قسم من أقسام الكلية بإعداد توصيف كامل لمحتويات البرنامج والمقررات التي يقوم بتدريسها فى ضوء مقترحات البرامج والمقررات التى وضعتها لجان علمية متخصصة وأقرتها لجنة قطاع العلوم الأساسية ووافق عليها المجلس الأعلى للجامعات، وبعد إعتمادها من لجنة القطاع تصبح محتويات المقررات ملزمة لأعضاء هيئة التدريس القائمين على التدريس بما لا يقل عن نسبة 80% من المحتوى الدراسى للمقررات، ويجوز لمجلس الكلية، بناءً على إقتراح مجالس الأقسام المختصة، تعديل المحتوى العلمي لأى مقرر من المقررات الدراسية بعد أخذ رأى لجنة قطاع العلوم الأساسية.

جامعة حلوان
Helwan University

ثانيا:جداول البرامج الدراسية
Programs Tables

جامعة حلوان
Helwan University

مجموعة العلوم الطبيعية
Physical Sciences Group

جامعة حلوان
Helwan University

First Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni1101	English Language for Science	----	Univ. Comp.	2	-	-	2
Uni11nn	See Uni. Elect. Courses Table	----	Univ. Elect.	2	-	-	2
Com1101	Introduction to Computer Science			2	1	-	2
Mat1101	General Mathematics I (Calculus I)	----	Fac. Comp.	2	-	1	2
Mat1103	General Mathematics II (Introduction to Algebra)			2	-	1	2
Phy1101	General Physics I			2	-	1	2
Phy1103	Practical Physics I			-	3	-	1
Chm1101	General Chemistry I			2	-	1	2
Chm1103	Practical Chemistry I			-	3	-	1
Zoo1103	Principals of Zoolgy			1	3	-	2
Total				**15**	**10**	**4**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni1202	Information Technology		Univ. Comp	2	-	-	2
Uni12nn	See Uni. Elect. Courses Table		Univ. Elect.	2	-	-	2
Com1202	Introduction to Programming	---	Fac. Comp.	2	1	-	2
Mat1202	General Mathematics III (Calculus II)			2	-	1	2
Mat1204	General Mathematics IV (Mechanics I)			2	-	1	2
Phy1202	General Physics II			2	-	1	2
Phy1204	Practical Physics II			-	3	-	1
Chm1202	General Chemistry II			2	-	1	2
Chm1204	Practical Chemistry II			-	3	-	1
Bot1103	Introduction to Botany			1	3	-	2
Total				**15**	**10**	**4**	**18**

برامج قسم الرياضيات
Mathematics Department Programs

جامعة حلوان
Helwan University

برنامج الرياضيات – تخصص منفرد
Mathematics Program (Mat)
Single Major

جامعة حلوان
Helwan University

Second Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	2	-	-	2
Mat2105	Analytic Geometry		Dept. Comp.	2	-	1	2
Mat2107	Calculus III	Mat1202		2	-	2	3
Mat2109	Linear Algebra I			2	-	1	2
Mat2111	Mechanics II	Mat1202		2	-	2	3
Mat21nn	See Program Elect. Courses Table		Dept. Elect.	2	-	1	2
Total				**14**	**-**	**7**	**16**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Course	-	Free Elect.	2	-	-	2
Mat2206	Abstract Algebra	Mat1103	Dept. Comp.	2	-	2	3
Mat2208	Ordinary Differential Equations	Mat1202		2	-	1	2
Mat2210	Mechanics III	Mat2111		2	-	2	3
Mat2212	Vector Calculus	Mat2107		2	-	1	2
Mat22nn	See Program Elect. Courses Table		Dept. Elect.	4	-	-	4
Total				**14**	**-**	**6**	**16**

Third Level

First Semester							
Course code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Mat3113	Mathematical Packages I	Mat2108	Dept. Comp.	3	-	-	3
Mat3115	Mechanics IV	Mat2210		2	-	2	3
Mat3117	Operations Research I	Mat2109		2	-	1	2
Mat3119	Real Analysis	Mat1202		2	-	1	2
Mat31nn	See Program Elect. Courses Table		Dept .Elect.	6	-	3	6
Total				**18**	**-**	**7**	**18**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat3214	Analytical Mechanics	Mat2210	Dept. Comp.	3	-	-	3
Mat3216	Numerical Analysis I	Mat1202		3	-	-	3
Mat3218	Partial Differential Equations	Mat2208		2	-	-	2
Mat3220	Topology I	Mat3119		2	-	-	2
Mat32nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**16**	**-**	**-**	**16**

Hwan University

Fourth Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat40PT	Practical Training	-	Dept. Comp.	-	-	-	2
Mat40RP	Research Project (Continued)	-		1	-	1	1
Mat4121	Complex Functions	Mat3119		2	-	-	2
Mat4123	Fluid Mechanics I	Mat3216		3	-	-	3
Mat4125	Measure Theory	Mat3119		3	-	-	3
Mat4127	Special Functions	Mat2208		2		-	2
Mat41nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**17**	**-**	**1**	**19**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat40RP	Research Project		Dept. Comp.	1	-	1	1
Mat4222	Differential Geometry	Mat2212		2	-	-	2
Mat4224	Functional Analysis	Mat3119		3	-	-	3
Mat4226	Integral Equations	Mat3218		2	-	-	2
Mat4228	Quantum Mechanics	Mat4121		3	-	-	3
Mat42nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**17**	**-**	**1**	**17**

برنامج الرياضيات وعلوم الحاسب
تخصص مزدوج
Mathematics and Computer Science Program
Double Major

Helwan University

Second Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	2	-	-	2
Mat2105	Analytic Geometry	Mat1202	Dept. Comp.	2	-	1	2
Mat2109	Linear Algebra I	Mat1202		2	-	1	2
Com2103	Database System	Com1202		2	2	-	3
Com2105	Data Structures	Com1202		2	1	-	2
Mat21nn	See Program Elect. Courses Table		Dept. Elect.	2	-	2	3
Total				**14**	**3**	**4**	**16**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Course		Free Elect.	2	-	-	2
Mat2206	Abstract Algebra	Mat1103	Dept. Comp.	2	-	2	3
Mat2208	Ordinary Differential Equations	Mat1202		2		1	2
Com2204	Computer Language	Com1101		2	-	1	2
Com2206	Algorithms Analysis and Design	Com2105		2	2	-	3
Com22nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Total				**12**	**4**	**4**	**16**

Third Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course	-	Free Elect.	2	-	-	2
Mat3113	Mathematical Packages I	Mat2107	Dept. Comp.	3	-	-	3
Mat3119	Real Analysis	Mat2107		2	-	1	2
Com3107	Artificial Intelligence	Com2105		2	2	-	3
Com3109	Operating Systems	Com2105		1	2	-	2
Mat21nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Com21nn	See Program Elect. Courses Table			2	2	-	3
Total				**14**	**8**	**1**	**18**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat3216	Numerical Analysis I	Mat1202	Dept. Comp.	3	-	-	3
Mat3218	Partial Differential Equations	Mat2208		2	-	-	2
Com3208	Computer Graphics	Mat1204		1	2	-	2
Com3210	Introduction to Networks and Communications	Mat1204		2	2	-	3
Mat32nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Com32nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Total				**12**	**8**	**1**	**16**

Fourth Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
MaCo40PT	Practical Training		Dept. Comp.	-	-	-	2
MaCo40RP	Research Project (Continued)			1	-	1	1
Mat4125	Measure Theory	Mat3113		3		-	3
Mat4127	Special Functions	Mat2208		2		-	2
Com4111	Modeling and Simulation	Com2204		2	2	-	3
Com4113	Theory of Computation	Mat1204		1	-	2	2
Mat41nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Com41nn	See Program Elect. Courses Table			2	2	-	3
Total				**14**	**4**	**3**	**19**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat4222	Functional Analysis	Mat3119	Dept. Comp.	3	-	-	3
Mat4274	Numerical Analysis II	Mat3117		2	-	-	2
Com4212	Fundamentals of Information Security	Com2206		2	2	-	3
Com4214	System Analysis and Design	Com2103		1	2	-	2
MaCo40RP	Research Project			1	-	1	1
Mat42nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Com42nn	See Program Elect. courses Table			2	2	-	3
Total				**14**	**7**	**1**	**17**

برنامج الإحصاء وعلوم الحاسب
تخصص مزدوج
Statistics and Computer Science Program
Double Major

Helwan University

Second Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	2	-	-	2
Sta2101	Probability Theory	MAT1202	Dept. Comp.	2	-	2	3
Sta2103	Statistical Methods			2	1	-	2
Com2103	Database System	Com1202		2	2	-	3
Com2105	Data Structures	Com1202		2	1	-	2
Com21nn	See Program Elect. Courses Table		Dept. Elect.	2	-	2	3
Total				**14**	**4**	**4**	**17**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free. Course		Free Elect.	2	-	-	2
Sta2202	Mathematical Statistics	Sta2101	Dept. Comp.	2	-	2	3
Sta2204	StochSpaic Processes	Sta2101		2	-	1	2
Com2204	Computer Language	Com1101		2	-	1	2
Com2206	Algorithms Analysis and Design	Com2105		2	2	-	3
Sta22nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Total				**12**	**4**	**4**	**15**

Third Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Sta3105	Statistical Inference	Sta2202	Dept. Comp.	3	-	-	3
Sta3107	Time Series Analysis	Sta2204		2	-	-	2
Com3107	Artificial Intelligence	Com2105		2	2	-	3
Com3109	Operating Systems	Com2105		1	2	-	2
Sta21nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Com21nn	See Program Elect. Courses Table			2	2	-	3
Total				**15**	**6**	**-**	**18**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Sta3206	Order Statistics	Sta3105	Dept. Comp.	3	-	-	3
Sta3208	Regression Analysis	Sta3105		2	-	1	2
Com3208	Computer Graphics	Mat1204		1	2	-	2
Com3210	Introduction to Networks and Communications	Mat1204		2	2	-	3
Sta32nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Com32nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Total				**13**	**6**	**3**	**16**

Fourth Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
StCo40PT	Practical Training		Dept. Comp.	-	-	-	2
Sta4109	Nonparametric Statistics	Sta3105		2	-	-	2
Sta4111	Statistical Packages	Sta3105		3	-	-	3
Com4111	Modeling and Simulation	Com2204		2	2	-	3
Com4113	Theory of Computation	Mat1204		1	-	2	2
StCo40RP	Research project (Continued)			1	-	1	1
Sta41nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Com41nn	See Program Elect. Courses Table			2	2	-	3
Total				**14**	**4**	**3**	**19**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Sta4210	Experimental Design	Sta3105	Dept. Comp.	3	-	-	3
Sta4212	Reliability Theory	Sta3206		2	-	-	2
StCo40RP	Research Project			1	-	1	1
Com4212	Fundamentals of Information Security	Com2206		2	2	-	3
Com4214	System Analysis and Design	Com2103		1	2	-	2
Sta42nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Com42nn	See Program Elect. Courses Table			2	2	-	3
Total				**14**	**6**	**1**	**17**

برامج قسم الفيزياء
Physics Department Programs

جامعة حلوان
Helwan University

برنامج الفيزياء – تخصص منفرد
Physics Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	2	-	-	2
Mat2208	Ordinary Differential Equations	Mat1202	Dept. Comp	2	-	1	2
Phy2101	Physical Optics	Phy1101 Phy1202		2	-	-	2
Phy2103	Thermodynamics			2	-	1	2
Phy2105	Electromagnetic Field Theory I			2	-	1	2
Phy2107	Physical Electronics I			2	-	-	2
Phy2109	Practical Physics III	Phy1103 Phy1204		-	4	-	2
Phy21nn	See Program Elect. courses Table		Dept. Elect.	2	-	-	2
Total				**16**	**4**	**3**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Course		Free Elect.	2	-	-	2
Mat3218	Partial Differential Equations	Mat2208	Dept. Comp.	2	-	-	2
Phy2202	Modern Physics	Phy2101		2	-	-	2
Phy2204	Mathematical Physics I	Mat2208		2	-	-	2
Phy2206	Practical Physics IV	Phy2109		-	4	-	2
Phy22nn	See Program Elect. Courses Table		Dept. Elect.	4	-	-	4
Total				**12**	**4**	**-**	**14**

Third Level

First Semester							
Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Mat4127	Special Functions	Mat2208	Dept. Comp.	2	-	-	2
Phy3101	Solid State Physics I	Phy2202		2	-	-	2
Phy3103	Nuclear Physics I			2	-	-	2
Phy3105	Quantum Physics I			2	-	1	2
Phy3107	Practical Physics V	Phy2206		-	4	-	2
Phy31nn	See Program Elect. Courses Table		Dept.Elect	6	-	-	6
Total				**16**	**4**	**1**	**18**

Second Semester							
Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat4121	Complex Functions	Mat1202	Dept.Comp.	2	-	-	2
Phy3202	Physical Electronics II	Phy2107		2	-	-	2
Phy3204	Atomic and Molecular Spectroscopy	Phy3105		2	-	1	2
Phy3206	Computational Physics	Mat1202		2	-	1	2
Phy3208	Practical Physics VI	Phy3107		-	4	-	2
Phy32nn	See Program Elect. Courses Table		Dept.Elect.	6	-	-	6
Total				**14**	**4**	**2**	**16**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Phy4101	Quantum Physics II	Phy3105	Dept.Comp.	2	-	1	2
Phy4103	Mathematical Physics II	Phy2204		2	-	1	2
Phy4105	Solid State Physics II	Phy3101		2	-	-	2
Phy4107	Nuclear Physics II	Phy3103		2	-	-	2
Phy4109	Practical Physics VII	Phy3208		-	3	-	1
Phy40RP	Research Project (Continued)			1	1	-	1
Phy40PT	Practical Training			-	4	-	2
Phy41nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**15**	**8**	**2**	**18**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Phy4202	Statistical Physics	Phy4101	Dept.Comp.	2	-	1	2
Phy4204	Modern Optics & Laser Physics	Phy2101 Phy2105		2	-	1	2
Phy4206	Low Temperature Physics	Phy2103		2	-	-	2
Phy4208	Nanophysics and Nanotechnology	Phy4105		2	-	1	2
Phy4210	Elementary Particles Physics	Phy4101		2	-	-	2
Phy4212	Practical Physics VIII	Phy4109		-	3	-	1
Phy40RP	Research Project			1	1	-	1
Phy42nn	See Program Elect. Courses Table		Dept.Elect.	6	-	-	6
Total				**17**	**4**	**3**	**18**

برنامج الفيزياءالحيوية الطبية – تخصص منفرد
Medical Biophysics Program – Single Major

جامعة حلوان
Helwan University

Second Level

First Semester

Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	2	-	-	2
Mat2208	Ordinary Differential Equations	Mat1202	Dept. Comp.	2	-	1	2
Phy2103	Thermodynamics	Phy1101 Phy1202		2	-	1	2
BPh2101	Biophysics			2	-	1	2
Phy2109	Practical Physics III	Phy1103 Phy1204		-	3	-	1
Chm2107	Organic Chemistry	Chm1202		2	-	1	2
Zoo2107	Introduction to Physiology	Zoo1103		2	3	-	3
Phy21nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**16**	**6**	**4**	**18**

Second Semester

Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Course		Free Elect.	2	-	-	2
Phy2202	Modern Physics	Phy2101	Dept. Comp.	2	-	-	2
BPh2202	Electricity in Biological Systems	Phy1202		2	-	-	2
Phy2208	Radiation Physics			2	1	-	2
BPh2204	Practical Biomedical Physics I	Phy2109		-	4	-	2
Phy22nn	See Program Elect. Courses Table	---	Dept. Elect.	4	-	-	4
Total				**12**	**5**	**-**	**14**

Third Level

First Semester

Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Phy3101	Solid State Physics I	Phy2202	Dept. Comp.	2	-	-	2
BCh3218	Introduction to Molecular Biology			2	-	-	2
BPh3101	Radiobiology and Radiation Protection	Phy2208		2	-	-	2
BPh3103	Membrane Biophysics	BPh2101		2	-	-	2
BPh3105	Practical Biomedical Physics II	BPh2204		-	4	-	2
Phy31nn	See Program Elect. Courses Table	----	Dept. Elect.	6	-	-	6
Total				**16**	**4**	**-**	**18**

Second Semester

Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat3103	Numerical Methods	Mat1202	Dept. Comp.	2			2
Phy3105	Quantum Physics I	Phy2202		2	-	1	2
BPh3202	Biomolecular Spectroscopy and Spectrometry	Phy2202		2	-	-	2
BPh3204	Physics of Radiotherapy I	BPh3101		2	-	-	2
BPh3206	Practical Biomedical Physics III	BPh3105		-	4	-	2
Phy32nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**14**	**4**	**1**	**16**

Fourth Level

First Semester

Course code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
BPh4101	Atomic and Molecular Biophysic	Phy3105	Dept. Comp.	2	-	1	2
BPh4103	Modern Biophysics	BPh2101		2	-	-	2
BPh4105	Biomaterials			2	-	-	2
BPh4107	Practical Biomedical Physics IV	BPh3206		-	4	-	2
BPh40RP	Research Project (Continued)			1	1	-	1
BPh40PT	Practical Training			-	4	-	2
Zoo2204	Immunology I			1	2		2
Phy41nn	See Program Elect. Courses Table	----	Dept. Elect.	6	-	-	6
Total				**14**	**11**	**1**	**19**

Second Semester

Course code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Phy4214	Neutrons and Reactors Physics	Phy3105	Dept. Comp.	2	-	-	2
BPh4202	Pharmacology			2	-	-	2
BPh4204	Physics of Laser and Medical Applications	Phy2101		2	-	-	2
BPh4206	Practical Biomedical Physics V	BPh4107		-	3	-	1
BPh40RP	Research Project			1	1	-	1
BPh4208	Human Anatomy			2	1	-	2
Zoo4216	Cancer Biology			1	-		1
Phy42nn	See Program Elect Courses Table	----	Dept. Elect.	6	-	-	6
Total				**16**	**5**	**-**	**17**

برنامج علوم الفضاء – تخصص منفرد
Space Sciences Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Fre21nn	Free Course		Free Elect.	2	-	-	2
Mat2208	Ordinary Differential Equations	Mat1202	Dept. Comp.	2	-	1	2
Phy2101	Physical Optics	Phy1101 Phy1202		2	-	1	2
Phy2103	Thermodynamics			2	-	1	2
Phy2105	Electromagnetic Field Theory I			2	-	1	2
Spa2101	Astaronomy and Atsrophysics I	Phy1101		2	-	1	2
Phy2109	Practical Physics III	Phy1103 Phy1204		-	4	-	2
Phy21nn	See Program Elect. courses Table		Dept. Elect.	2	1	-	2
Total				**16**	**5**	**5**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni22nn	See Uni. Elect. Courses Table		Free Elect.	2	-	-	2
Phy2202	Modern Physics	Phy2101	Dept. Comp	2	-	1	2
Phy2204	Mathematical Physics I	Mat2208		2	-	1	2
Spa2202	Space Weather I	Spa2101		2	-	1	2
Phy2206	Practical Physics IV	Phy2109		-	4	-	2
Phy22nn	See Dept. Elect Courses Table		Dept. Elect.	4	-	-	4
Total				**12**	**4**	**3**	**14**

Third Level

First Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Spa3101	Radio Astronomy I	Spa2101	Dept. Comp.	2	-	-	2
Phy3101	Solid State Physics I	Phy2202		2	-	-	2
Phy3103	Nuclear Physics I			2	-	-	2
Phy3105	Quantum Physics I			2	-	1	2
Phy3107	Practical Physics V	Phy2206		-	3	-	1
Phy31nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**16**	**3**	**1**	**17**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Phy3203	Atomic and Molecular Spectroscopy	Phy3105	Dept. Comp	2	-	-	2
Phy2107	Physical Electronics I	Phy1101 Phy1202		2	1		2
Spa3201	Principales of Geographic Information System (GIS)			2	-	1	2
Spa3203	The Space Missions Analysis and Design Process	Spa2202		1	-	1	1
Spa3205	Space Plasma Physics I			2		1	2
Spa3207	Practical Space Science I	Phy3107		-	4	-	2
Phy32nn	See Dept. Elect Courses Table		Dept. Elect.	6	-	-	6
Total				**15**	**4**	**3**	**17**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mat3159	Space Dynamics		Dept. Comp	2	-	1	2
Spa4101	Earth's Atmosphere	Spa2101		2	-	1	2
Spa4103	Ionospheric Physics			2	-	-	2
Spa4105	Solar Physics			1	-	-	1
Spa4107	Space Environment			1	-	-	1
Spa4109	Practical Space Science II	Spa3207		-	3	-	1
Spa40RP	Research Project (Continued)			1	1	-	1
Spa40PT	Practical Training			-	4	-	2
Phy41nn	See Dept. Elect Courses Table		Dept.Elect	6	-	-	6
Total				**15**	**8**	**2**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Spa4202	Global Navigation Satellite Systems		Dept. Comp.	2	-	-	2
Phy4204	Modern Physics &Laser Physics	Phy2101 Phy2105		2	-	-	2
Spa4204	High Energy Astrophysics	Phy3103		2	-	-	2
Spa4206	Meteorological Remote Sensing			2	-	-	2
Spa4208	Geomagnetism			1	-	-	1
Spa4210	Image Processing and Analysis			1	-	1	1
Spa4212	Practical Sparo Physics III	Spa4109		-	3	-	1
Spa40RP	Research Project			1	1	-	1
Phy42nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**17**	**4**	**1**	**18**

برامج قسم الكيمياء
Chemistry Department Programs

جامعة حلوان
Helwan University

برنامج الكيمياء – تخصص منفرد
Chemistry Program - Single Major

Helwan University

Second Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Courses	---	Free Elect.	4	-	-	4
Chm2101	Principles of Classical Methods of Analysis	Chm1202	Dept. Comp.	2	-	1	2
Chm2103	Practical Analytical Chemistry I	*Chm2101		-	3	-	1
Chm2105	Chemical Thermodynamics	Chm1202		2	-	1	2
Chm2107	Organic Chemistry I			2	-	-	2
Chm2109	Practical Organic Chemistry I	*Chm2107		-	3	-	1
Chm21nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**14**	**6**	**2**	**16**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm2202	Spectrophotometric Methods of analysis I	Chm 2111	Dept. Comp.	1	-	-	1
Chm2204	Representative Elements Chemistry	Chm 1202		2	-	-	2
Chm2206	Electrochemistry I	Chm 2105		2	-	-	2
Chm2208	Phase Equilibria			1	-	-	1
Chm2210	Soild State	Chm1202		1	-	-	1
Chm2212	Organic Chemistry II	Chm 2107		2	-	-	2
Chm2214	Organic Chemistry III			2	-	-	2
Chm2216	Practical Organic Chemistry II	*Chm 2212 *Chm 2214 Chm 2107		-	3	-	1
Chm22nn	See Program Elect. Courses Table		Dept. Elect.	4	-	-	4
Total				**15**	**3**	**-**	**16**

Third Level

First Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	See Uni. Elect. Courses Table	-	Free Elect.	2	-	-	2
Chm3101	Spectrophotometric Methods of Analysis II	Chm2111	Dept. Comp.	1	-	-	1
Chm3103	Transition Elements Chemistry I	Chm2204		2	-	-	2
Chm3105	Chemical Kinetics	Chm2105		1	-	-	1
Chm3107	Catalysis			1	-		1
Chm3109	Practical Physical Chemistry I	Chm2206 Chm2208		-	3	-	1
Chm3111	Stereochemistry	Chm2107		2	-	-	2
Chm3113	Physical Organic Chemistry	Chm2212		1	-	-	1
Chm31nn	See Program Elect Courses Table		Dept. Elect.	6	-	-	6
Total				**16**	**3**	**-**	**17**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm3202	Transition Elements Chemistry II	Chm 3103	Dept.Comp.	2	-	-	2
Chm3204	Practical of Chemical Analysis I	Chm 2101 Chm 3103		-	3	-	1
Chm3206	Quantum Chemistry	Chm 2105		2	-	-	2
Chm3208	Practical Physical Chemistry II	Chm 3105 Chm 3107		-	3	-	1
Chm3210	Heterocyclic Chemistry	Chm1101 Chm1201		2	-	-	2
Chm3212	Polymer Chemistry			2	-	-	2
Chm3214	Practical Organic Chemistry III	*Chm 3210 *Chm 3212 Chm 2212		-	3	-	1
Chm32nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**14**	**9**		**17**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4101	Inner Transition Metals Chemistry	Chm 3202	Dept.Comp.	2	-	-	2
Chm4103	Colloidal and Surface Chemistry	Chm 2105		2	-	-	2
Chm4105	Molecular Spectroscopy	Chm 3206		1	-	-	1
Chm4107	Organic Spectroscopy	Chm 2107 Chm 3210		2	-	1	2
Chm4109	Chemistry of Natural Products	Chm 3210		2	-	-	2
Chm4111	Practical Organic Chemistry IV	*Chm 4107 *Chm 4109 Chm 2212		-	3	-	1
Chm40RP	Research Project (Continued)			1	1	-	1
Chm40PT	Practical Training			-	4	-	2
Chm41nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**16**	**8**	**1**	**19**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4202	Chromatographic Separations I	Chm3101	Dept. Comp.	2	-	-	2
Chm4204	Nuclear Chemistry and Group Theory	Chm4101		2	-	-	2
Chm4206	Practical of Chemical Analysis II	*Chm4202 *Chm4204		-	3	-	1
Chm4208	Corrosion	Chm2206		1	-	-	1
Chm4210	Physical Polymer	Chm3105		1	-	-	1
Chm4212	Practical Physical Chemistry III	Chm4103 Chm4208		-	3	-	1
Chm4214	Photochemistry	Chm3113		1	-	-	1
Chm4216	Petroleum Chemistry	Chm2212		1	-	-	1
Chm40RP	Research Project			1	1	-	1
Chm42nn	See Program Elect. Courses Table	-	Dept. Elect.	6	-	-	6
Total				**15**	**7**	**-**	**17**

برنامج الكيمياء التطبيقية – تخصص منفرد
Applied Chemistry Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester

Course Code	Course Title	Prerequisite *Corequisites	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	4	-	-	4
Chm2101	Principles of Classical Methods of Analysis	Chm1202	Dept. Comp	2	-	1	2
Chm2103	Practical Analytical Chemistry I	*Chm2101			3		1
Chm2105	Chemical Thermodynamics	Chm1202		2	-	1	2
Chm2107	Organic Chemistry I	Chm1202		2	-	-	2
Chm21nn	See Program Elect Courses Table		Dept. Elect.	2	-	-	2
Total				**14**	**3**	**2**	**15**

Second Semester

Course Code	Course Title	Prerequisite *Corequisites	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm2202	Spectrophotometric Methods of Analysis I	Chm2111	Dept. Comp.	1	-	-	1
Chm2204	Representative Elements Chemistry	Chm1202		2	-	-	2
Chm2218	Electrochemistry II	Chm2105		2	-	-	2
Chm2212	Organic Chemistry II	Chm2107		2	-	-	2
Chm2220	Practical Organic Chemistry	*Chm2212		-	3	-	1
ACh2202	Chemistry and Technology of Textile and Dye	Chm2107 *Chm2212		2	-	-	2
ACh2204	Chemistry and Technology of Petroleum and Fuel	Chm2197 *Chm2212		2	-	-	2
ACh2206	Practical Applied Chemistry I	*ACh2202 *ACh2204		-	3	-	1
Chm22nn	See Program Elect Courses Table		Dept. Elect.	4	-	-	4
Total				**15**	**6**	**-**	**17**

Third Level

First Semester

Course code	Course Title	Prerequisite *Corequisites	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course	-	Free Elect.	2	-	-	2
Chm3101	Spectrophotometric Methods of Analysis II	Chm2202	Dept. Comp.	1	-	-	1
Chm3105	Chemical Kinetics	Chm2105		1	-	-	1
Chm4103	Colloidal and Surface Chemistry	*Chm3105		2	-	-	2
ACh3101	Chemistry and Technology of Paper and Board	*Chm4103		2	3	-	3
ACh3103	Chemistry of Silicate and Binder	Chm2204		2	-	-	2
ACh31nn	See Program Elect. Courses Table		Dept. Elect	6	-	-	6
Total				**16**	**3**	**-**	**17**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm2208	Phase Equilibria	Chm 2105	Dept. Comp.	1	-	-	1
Chm3216	Practical Physical Chemistry V	Chm2218 Chm3105 Chm4103		-	3	-	1
Chm3218	Organic Stereochemistry	Chm2107 Chm2212		1	-	-	1
ACh3202	Chemistry and Technology of Polymer and PlSpaic	Chm2107 Chm2212		2	3	-	3
ACh3204	Chemistry and Technology of Cement and Concrete	ACh3103		2	3	-	3
ACh3206	Quality Management			2	-	-	2
ACh32nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**14**	**9**	**-**	**17**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm3103	Transition Elements Chemistry I	Chm2204	Dept. Comp.	2	-	-	2
Chm3107	Catalysis	Chm2105		1	-	-	1
Chm4107	Organic Spectroscopy	Chm2107 Chm2212		2	-	1	2
ACh4101	Chemistry and Technology of Paints	Chm4103		2	3	-	3
ACh4103	Chemistry and Technology of Packaging Materials	Ach3101 Ach3202		2	-	1	2
ACh40RP	Research Project (Continued)			1	1	-	1
ACh40PT	Practical Training			-	4	-	2
ACh41nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**16**	**8**	**2**	**19**

Second Semester

Course code	Course Title	Prerequisite *Corequisites	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4218	Chromatographic Separations II	Chm2202 Chm3101	Dept. Comp.	1	-	-	1
Chm4220	Practical of Chemical Analysis IV	*Chm4218			3	-	1
Chm4222	Basics Chemistry of Heterocycles	Chm2107 Chm2212		1	-	-	1
ACh4202	Chemistry and Technology of Printing Inks	Chm4103		2	-	-	2
ACh4204	Solid WSpae Management	Ach4103		2	-	-	2
ACh4206	Unit Operation	Chm2105		2	-	1	2
ACh4208	Practical Applied Chemistry II	*ACh4202 *ACh4204		-	3	-	1
ACh40RP	Research Project			1	1	-	1
ACh42nn	See Program Elect. Courses Table	-	Dept. Elect.	6	-	-	6
Total				**15**	**7**	**1**	**17**

مجموعة العلوم البيولوجية
Biological Sciences Group

جامعة حلوان
Helwan University

First Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni1101	English Language for Science	----	Univ. Comp.	2	-	-	2
Uni11nn	See Uni. Elect. Courses Table		Univ. Elect.	2	-	-	2
Bot1101	General Botany I			2	3	-	3
Zoo1101	General Zoology I		Fac. Comp.	2	2	-	3
Chm1101	General Chemistry I			2	-	1	2
Chm1103	Practical Chemistry I			-	3	-	1
Phy1105	Physics for Biology I			1	2	-	2
Mat1101	General Mathematics I (Calculus I)			2	-	1	2
Sta1208	Introduction to Statistics			1	-	1	1
Total				**14**	**10**	**3**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni1202	Information Technology		Univ. Comp.	2	-	-	2
Uni12nn	See Uni. Elect. Courses Table		Univ. Elect.	2	-	-	2
Bot1202	General Botany II		Fac. Comp.	2	3	-	3
Zoo1202	General Zoology II			2	2	-	3
Chm1202	General Chemistry II			2	-	1	2
Chm1204	Practical Chemistry II			-	2	-	1
Phy1206	Physics for Biology II			1	2	-	2
Com1101	IntrIoducion to Computer Science			2	1	-	2
Com1103	Practical Computer Science			-	3	-	1
Total				**13**	**13**	**1**	**18**

برنامج الكيمياء الحيوية – تخصص منفرد
Biochemistry Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	---	Univ. Comp.	2	-	-	2*
Chm2101	Principles of Classical Methods of Analysis	Chm1202	Dept. Comp.	2	-	1	2
Chm2103	Practical Analytical Chemistry I	*Chm2101		-	3	-	1
Chm2105	Chemical Thermodynamics	Chm1202		2	-	1	2
Chm3105	Chemical Kinetics	*Chm2105		1	-	-	1
Chm2107	Organic Chemistry I	Chm1202		2	-	-	2
Chm2109	Practical Organic Chemistry I			-	3	-	1
BCh2101	Protein Chemistry and Metabolism			2	2	-	3
BCh2103	Vitamins and Minerals			2	1	-	2
BCh21nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Total				**15**	**10**	**2**	**19**

Second Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Course	-	Free Elect.	4	-	-	4
Chm2212	Organic Chemistry II	Chm2107	Dept. Comp.	2	-	-	2
BCh2202	Enzymology	BCh2101 BCh2103		2	1	-	2
BCh2204	Carbohydrates Chemistry and Metabolism	*BCh2202 BCh2103		2	2	-	3
BCh2206	Lipids Chemistry and Metabolism	*BCh2202 BCh2103		2	1	-	2
BCh22nn	See Program Elect. Courses Table		Dept. Elect.	2	2	-	3
Total				**14**	**7**	**-**	**16**

Third Level

First Semester							
Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course	-	Free Elect.	2	-	-	2
BCh3101	Nucleic acids Chemistry and Metabolism	BCh2101 BCh2202	Dept. Comp.	2	3	-	3
BCh3103	Immunochemistry I	BCh2101 BCh3105		2	1	-	2
BCh3105	Cell Biology I	BCh2101 BCh2206		2	1	-	2
Mic2101	General Microbiology and Biodiversity	Bot1101 Bot1202		2	2	-	3
BCh31nn	See Program Elect. Courses Table		Dept. Elect.	4	4	-	6
Total				**14**	**11**	**-**	**18**

Second Semester							
Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
BCh3202	Instrumental Biochemistry	Chm2103 BCh2101	Dept. Comp.	2	1	-	2
BCh3204	Body Fluids	BCh2101 BCh2202		2	2	-	3
BCh3206	Molecular Physiology	BCh3105		2	1	-	2
BCh3208	Molecular Biology	BCh3101		2	2	-	3
BCh32nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**14**	**6**	**-**	**16**

Fourth Level

First Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
BCh4101	Biochemistry of Cancer	BCh3105	Dept. Comp.	2	2	-	3
Chem4107	Organic Spectroscopy	Chm2107 Chm2212		2	1	-	2
BCh4103	Hormones	BCh2101 BCh2204 BCh3206		2	2	-	3
BCh4105	Drug Design	BCh2101 BCh2202 BCh2204 BCh2206 BCh3101		2	1	-	2
BCh40RP	Research Project (Continued)			1	1	-	1
BCh40PT	Practical Training			-	4	-	2
BCh41nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**15**	**11**	**-**	**19**

Second Semester							
Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
BCh4202	Biotechnology	BCh2202 BCh3101 BCh3208		2	2	-	3
BCh4204	Bio-nanotechnology and Applications	*BCh4202	Dept. Comp.	2	-	-	2
BCh 4206	Clinical Biochemistry	BCh2101 BCh2103 BCh2204 BCh2206		2	2	-	3
BTC4202	Pharmaceutical Industry	BCh3202 BTC4101		2	-	-	2
BCh40RP	Research Project			1	1	-	1
BCh42nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**15**	**5**	**-**	**17**

برامج قسم النبات والميكروبيولوجى
Botany and Microbiology Department Programs

جامعة حلوان
Helwan University

برنامج النبات – تخصص منفرد
Botany Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	-----	Univ. Comp.	2	-	-	2*
Fre21nn	Free Courses	---	Free Elect.	2	-	-	2
Bot2101	Advanced Plant Anatomy	Bot 1202	Dept. Comp	2	2	-	3
Bot2103	Principles of Genetics	Bot 1202		2	2	-	3
Bot2105	Algae	Bot1201		2	2	-	3
Bot2107	Economic Botany and Crop Plants	Bot1201		2	-	-	2
Bot21nn	See Program Elect. Courses Table		Dept. Elect.	2		-	2
Total				**13**	**6**	**-**	**17**

Second Semester							
Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Courses	---	Free Elect.	2	-	-	2
Chm2107	Organic Chemistry I	Chm1202	Dept. Comp	2	-	-	2
Bot2202	Plant Ecology	Bot1202		2	2	-	3
Bot2204	General Plant Taxonomy	Bot1202		2	2	-	3
Bot2206	Plant Water Relations	Bot 1101		1	2	-	2
Bot22nn	See Program Elect. Courses Table		Dept. Elect.	4	-	-	4
Total				**13**	**6**	**-**	**16**

Third Level

First Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Courses	---	Free Elect.	2	-	-	2
BCh3109	Biochemistry I	Chm2104	Dept. Comp	2	2	-	3
Bot3101	Plant Molecular Biology	Bot2103		2	2	-	3
Bot3103	Plant Growth and Development	Bot2206		2	2	-	3
Bot3105	Plant Tissue Culture	Bot2201		1	2	-	2
Bot31nn	See Program Elect. Courses Table		Dept. Elect.	4		-	4
Total				**14**	**8**	**-**	**17**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Bot3202	Plant Biosystematics and Evolution	Bot2204	Dept. Comp.	2	2	-	3
Bot3204	Environmental Pollution	Bot2103		2	2	-	3
Bot3206	Plant Enzymology	Bot3103		1	2	-	2
Bot3208	Plant Cytogenetics	Bot3206		1	1	-	1
Mic3202	Plant Pathology	Bot1101		1	2	-	2
Bot31nn	See Program Elect. Courses Table		Dept. Elect.	6		-	6
Total				**12**	**8**	**-**	**17**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4109	Chemistry of Natural Products	Chm3210	Dept. Comp.	2	-	-	2
Bot4101	Plant Metabolism	Bot3206		1	2	-	2
Bot4103	Plant Biotechnology	Bot3105		1	2	-	2
Bot4105	Desert and Wetland Ecology	Bot2202		1	2	-	2
Bot40PT	Practical Training	Bot3202		-	4	-	2
Bot40RP	Research Project (Continued)	--		1	1	-	1
Bot41nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**12**	**11**	**-**	**17**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm2202	Spectrophotometric Methods of Analysis I	Chm2111	Dept. Comp	1	-	-	1
Bot4202	Ecology and Physiology of Algae	Bot2105		2	2	-	3
Bot4204	Plant Breeding and Crop Improvement	Bot 2103		2	1	-	2
Bot4206	Flora of Egypt	Bot 2202		1	2	-	2
Bot4208	Conservation and Restoration Ecology	Bot 2202		2	-	-	2
Bot40RP	Research Project	--	Dept. Elect.	1	1	-	1
Bot42nn	See Program Elect. Courses Table			6	-	-	6
Total				**15**	**6**	**-**	**17**

برنامج النبات والكيمياء – مزدوج

Botany and Chemistry Program - Double Major

Helwan University

Second Level

First Semester

Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights	-----	Univ. Comp.	2	-	-	2*
Fre21nn	Free courses	---	Free Elect.	2	-	-	2
Chm2101	Principles of classical Methods of Analysis	Chm1202	Dept. Comp.	2	-	1	2
Chm2103	Practical Analytical Chemistry I	Chm2101		-	3	-	1
Chm2107	Organic Chemistry I	Chm1202		2	-	-	2
Chm2109	Practical of Organic Chemistry I	*Chm2107		-	3	-	1
Bot2101	Advanced Plant Anatomy	Bot1201		2	2	-	3
Bot2103	Principles of Genetics	Bot1101		2	2	-	3
Bot21nn	See Program Elect. Courses Table		Dept. Elect.	2	1	-	2
Total				**14**	**11**	**1**	**18**

Second Semester

Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm2202	Spectrophotometricmethods of Analysis I	Chm2111	Dept. Comp.	1	-	-	1
Chm2212	Organic Chemistry II	Chm2107		2	-	-	2
Chm2216	Practical Organic Chemistry II	*Chm2212		-	3	-	1
Bot2202	Plant Ecology	Bot1102		2	2	-	3
Bot2204	General Plant Taxonomy	Bot1102		2	2	-	3
Bot22nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Chm22nn	See Program Elect. Courses Table		Dept. Elect.	4	-	-	4
Total				**9**	**7**	**-**	**16**

Third Level

First Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Courses	---	Free Elect.	2	-	-	2
Bch3109	Biochemistry I	Chm2104	Dept. Comp.	2	2	-	3
Chm2105	Chemical Thermodynamics	Chm1202		2	-	1	2
Bot3101	Plant Molecular Biology	Bot2103		2	2	-	3
Bot2206	Plant Water Relations	Bot1101		1	2	-	2
Bot31nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Chm31nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**12**	**5**	**1**	**16**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4236	Separation methods	Chm2202	Dept. Comp.	2	-	-	2
BCh3214	Biochemistry II	BCh3109		2	2	-	3
Chm2204	Representative Elements Chemistry	Chm1202		2	-	-	2
Bot3103	Plant Growth and Development	Bot2206		2	1	-	2
Bot2105	Algae	Bot1201		2	2	-	3
Bot3216	Genetic Engineering	Bot2103		2	-	1	2
Bot32nn	See Program Elect. Courses Table		Dept. Elect	2	-	-	2
Chm32nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**12**	**8**		**18**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4109	Chemistry of Natural Products	Chm3210	Dept. Comp.	2	-	-	2
Chm4107	Organic Spectroscopy	Chm2202		2	-	-	2
Chm3105	Chemical Kinetics			1	-	-	1
Bot4101	Plant Metabolism	Bot3206		2	2	-	3
Bot4115	Medicinal and Aromatic Plants	Bot22046		2	2	-	3
BoCh40PT	Practical Training			-	4	-	2
BoCh40RP	Research Project (Contiued)			1	1	-	1
Bot41nn	See Program Elect. Courses Table		Dept. Elect	2	-	-	2
Chm41nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**14**	**9**	**-**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre42nn	Free Courses	---	Free Elect.	2	-	-	2
Chm4202	Chromatographic Separations I	Chm 2202	Dept. Comp	2	-	-	2
BCh4204	Bionanotechnology and Applications			2	-	-	2
Bot4103	Plant Biotechnology	Bot3105		2	2	-	3
Bot4206	Flora of Egypt	Bot2202		1	2	-	2
BoCh40RP	Research Project			1	1	-	1
Bot42nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Chm42	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**14**	**5**	**-**	**16**

برنامج الميكروبيولوجى – تخصص منفرد
Microbiology Program - Single Major

Helwan University

Second Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Mic2101	General Microbiology and Biodiversity	Bot1101 Bot1202	Dept. Comp.	2	2	-	3
Mic2103	Molecular Microbiology			1	2	-	2
Mic2105	Virology			1	2	-	2
Mic2107	Cell Biology & Genetics			1	2	-	2
Bot3103	Plant Growth and Development			1	-	-	1
Chm2113	Practical Analytical Chemistry II	*Chm2111		-	3	-	1
Chm2107	Organic Chemistry I	Chm1202		2	-	-	2
Mic21nn	See Program Elect. Courses Table		Dept. elect.	3	-	-	3
Total				**9**	**13**	**-**	**18**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mic2202	Mycology	Mic2101	Dept. Comp.	2	2	-	3
Mic2204	Bacteriology			2	2	-	3
Mic2206	Microbial Control			1	2	-	2
Mic2208	Soil Microbiology			1	2	-	2
BCh3109	Biochemistry I	Chm1202		2	2	-	3
Mic22nn	See Program Elect. Courses Table		Dept. Elec.	3	-	-	3
Total				**11**	**10**	**-**	**16**

Third Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	4			4
Mic3101	Microbial Physiology	Mic2101	Dept. Comp.	2	3	-	3
Mic3103	Applied Microbiology	Mic2204		1	2	-	2
Mic3105	Host Parasite Relationship	Mic2204 Mic2202		1	-	-	1
Chm2202	Spectrophotometric Methods of Analysis I	Chm1202		1	-	-	1
Mic31nn	See Program Elect. Courses Table		Dept. Elect.	6			6
Total				**15**	**5**	**-**	**17**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre32nn	Free Course		Free Elect.	2	-	-	2
Mic3202	Plant PathologyI	Mic2202 Mic2204 Mic3105	Dept. Comp.	1	2	-	2
Mic3204	Microbial Genetics	Mic2101		1	2	-	2
Mic3206	Microbial Enzymes	Mic3111		1	2	-	2
BCh3214	Biochemistry II	BCh3109		2	2	-	3
Chm2212	Organic Chemistry II	Chm2107		2	-	-	2
Mic32nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**15**	**8**	**-**	**19**

Fourth Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mic4101	Medical Microbiology	Mic2105 Mic2202 Mic2204	Dept. Comp.	2	2	-	3
Mic4103	Industrial Microbiology	Mic3101 Chm32nn		1	2	-	2
Mic4105	Biotechnology and Tissue culture	Mic2103 Mic2107 Bot21nn		1	2	-	2
Mic40PT	Practical Training			2	-	-	2
Mic40RP	Research Project (Continued)			1	1	-	1
Mic41nn	See Program Elect. courses Table		Dept. Elect.	6		-	6
Total				**13**	**7**	**-**	**16**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mic4202	Plant Pathology II	Mic2204 Mic3105	Dept. Comp.	1	2	-	2
Mic4204	Microbial Ecology	Mic2202 Mic2204 Mic2206 Mic3220		1	2	-	2
Mic4206	Principals of Immunology	Mic2101		1	1		1
Mic4208	Bioinformatics, Proteomic and Genomics	Mic3204 Mat1204 Mat1103		1	2		2
Chm4202	Chromatographic Separations I	Chm2202		2	-	-	2
Mic40RP	Research Project			1	1	-	1
Mic42nn	See Program Elect. Courses Table		Dept. Elect.	6		-	6
Total				**13**	**8**	**-**	**16**

برنامج الميكروبيولوجى والكيمياء الحيوية – تخصص مزدوج
Microbiology & Biochemistry Program - Double Major

جامعة حلوان
Helwan University

Second Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Mic2101	General Microbiology & Biodiversity	Ch1202	Dept. Comp.	2	2	-	3
Mic2103	Molecular Microbiology			1	2	-	2
BCh2101	Protein Chemistry and Metabolism			2	2	-	3
BCh2103	Vitamins and minerals			2	-	-	2
Mic21nn Chm21nn	See Mic and/or Chm Program Elect. Courses Table in equal share as 50 % each		Dept. elect.	4	-	-	4
Total				**13**	**6**	**-**	**16**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre21nn	Free Course		Free Elect.	2			2
Mic2202	Mycology	Mic2101	Dept. Comp.	1	2	-	2
Mic2204	Bacteriology			2	2	-	3
Mic2206	Microbial Control			1	2	-	2
BCh2202	Enzymology	BCh2101 BCh2103		2	-	-	2
BCh2204	Carbohydrates chemistry and metabolism	BCh2202 BCh2103		2	2	-	3
BCh2206	Lipids chemistry and metabolism	*BCh2202 BCh2103		2	1	-	2
Mic22nn Chm22nn	See Mic and/or Chm program Elect. courses Tablein equal share as 50 % each		Dept. Elec.	2		-	2
Total				**13**	**8**	**-**	**18**

Third Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2			2
Mic3101	Microbial Physiology	Mic2101	Dept. Comp.	2	3	-	3
Mic3103	Applied Microbiology			1	2	-	2
BCh3101	Nucleic Acid Chemistry and Metabolism	BCh2101 BCh2202		2	3	-	3
Mic2105	Virology	Bot1101 Bot1202		1	2		2
Mic31nn Chm31nn	See Mic and/or Chm Program Elect. courses Tablein equal share as 50 % each		Dept. Elect.	6			6
Total				**14**	**10**	**-**	**18**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre32nn	Free Course		Free Elect.	2	-	-	2
Mic3202	Plant Pathology	Mic2202 Mic2204	Dept. Comp.	1	2	-	2
Mic3204	Microbial Genetics			1	2	-	2
BCh3204	Body Fluids I	BCh2101 BCh2202		2	2	-	3
Mic32nn Chm32nn	See Mic and/or Chm Program Elect. courses Tablein equal share as 50 % each		Dept. Elect.	6	-	-	6
Total				**14**	**6**	**-**	**15**

Fourth Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mic4101	Medical Microbiology	Mic2202 Mic2204 Mic2105	Dept. Comp.	2	2	-	3
Mic4103	Industrial Microbiology	Mic3201 Chm32nn		1	2	-	2
BCh4103	Hormones	BCh2204 BCh2101		2	2	-	3
MiBc40PT	Practical Training			2	-	-	2
MiBc40RP	Research Project (Continued)			1	1	-	1
Mic41nn Chm41nn	See Mic and/or Chm Program Elect. courses Tablein equal share as 50 % each		Dept. Elect.	6	-	-	6
Total				**14**	**7**	**-**	**17**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Mic4109	Microbial Toxins	Mic2101	Dept. Comp.	1	-	-	1
BCh4202	Nanotechnology and Applications	-		1	2	-	2
BCh4204	Clinical Biochemistry	BCh2101 BCh2103 BCh2204 BCh2206		2	2	-	3
Mic4105	Biotechnology and Tissue Culture	Mic2103 Bot21nn		1	2	-	2
BCh4101	Biochemistry of Cancer	BCh3105		2	2	-	3
MiBc40RP	Research Project			1	1	-	1
Mic42nn Chm42nn	See Mic and/or Chm program Elect. courses Table in equal share as 50 % each		Dept. Elect.	6	-	-	6
Total				**14**	**9**	**-**	**18**

Helwan University

برامج قسم علم الحيوان والحشرات
Zoology and Entomology Department Programs

جامعة حلوان
Helwan University

برنامج علم الحيوان– تخصص منفرد
Zoology Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Fre21nn	Free Course	---	Free Elect.	2	-	-	2
Chm2101	Principles of Classical Methods of Analysis	Chm1202	Dept. Comp.	2	-	1	2
Chm2107	Organic Chemistry I	Chm1202		2	-	-	2
Zoo2101	Invertebrates	Zoo1202		2	3	-	3
Zoo2103	Physiology I	Zoo1101		2	3	-	3
Zoo2105	Entomology	Zoo1202		2	2	-	3
Zoo21nn	See Program Elect. Courses Table		Dept. Elec.	2	-	-	2
Total				**16**	**8**	**1**	**19**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre22nn	Free Course		.Free Elect	2	-	-	2
Zoo2202	Chordata	Zoo1202	Dept. Comp.	2	3	-	3
Zoo2204	Immunology I	-		1	2	-	2
Zoo2206	Genetics	Zoo1101		1	2	-	2
Zoo22nn	See Program Elect. Courses Table		Dept. Elec.	4	-	-	4
Total				**10**	**7**	**-**	**13**

Third Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Zoo3101	Parasitology	Zoo1202	Dept. Comp.	2	2	-	3
Zoo3103	Insect Taxonomy	Zoo2105		1	2	-	2
Zoo3105	Histology	Zoo1101		2	3	-	3
Zoo3107	Ecology	Zoo1101		2	3	-	3
Zoo31nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Chm31nn	See Chm. Program Elect. Courses Table		Chm. Dept. Elect.	2	-	-	2
Total				**14**	**10**	**-**	**18**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Zoo3202	Physiology II	Zoo2103	Dept. Comp.	2	3	-	3
Zoo3204	Embryology	Zoo1101		1	2	-	2
Zoo3206	Immunology II	Zoo2204		1	1	-	1
Zoo3208	Marine Biology	Zoo1101		1	2	-	2
Zoo3210	Microtechniques	Zoo1101		-	3	-	1
Zoo00nn	See Dept. Elect. Courses Table		Dept. Elect.	5	-	-	5
Chm32nn	See Chm. Program Elect. Courses Table		Chm. Dept. Elect.	2	-	-	2
Total				**12**	**11**	**-**	**16**

Fourth Level

First Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4115	Medicinal natural products	Chm2107	Dept. Comp	2	-	-	2
Zoo4101	Physiology III	Zoo3202		2	3	-	3
Zoo4103	Molecular Biology	Zoo2206		-	2	-	1
Zoo4105	Immunology III	Zoo3206		1	2	-	2
Zoo4107	Cell Biology	Zoo1101		1	2	-	2
Zoo00nn	See Dept. Elect. Courses Table		Dept. Elect.	6	-	-	6
Zoo40PT	Practical Training			-	4	-	2
Zoo40RP	Research Project (Continued)			1	1	-	1
Total				**13**	**14**	**-**	**19**

Second Semester							
Course Code	Course Title	Prerequisites	Course Case	Hours			
				Lecture	Practical	Tutorial	Credit
Zoo4202	Histology and Histochemistry	Zoo3105	Dept. Comp.	2	3	-	3
Zoo4204	Comparative Anatomy	Zoo2202		2	3	-	3
Zoo4206	Experimental Embryology	Zoo3204		1	2	-	2
Zoo4208	Physiology IV	Zoo3202		1	-	-	1
Zoo4210	Animal Behavior	Zoo1101		1	-	-	1
Zoo40RP	Research Project			1	1	-	1
Zoo42nn	See Program Elect. Courses Table		Dept. Elect.	6	-	-	6
Total				**14**	**9**	**-**	**17**

برنامج علم الحيوان والكيمياء – تخصص مزدوج
Zoology and Chemistry Program – Double Major

جامعة حلوان
Helwan University

Second level

First Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2
Fre21nn	Free Course		Univ. Free Elect.	2	-	-	2
Chm 2101	Principles of Classical Methods of Analysis	Chm1202	Chm. Dept. Comp.	2	-	1	2
Chm 2103	Practical Analytical Chemistry (I)	-		-	3	-	1
Chm 2107	Organic Chemistry (I)	Chm1202		2			2
Chm 2109	Practical of Organic Chemistry (I)	-		-	3	-	1
Zoo2101	Invertebrates	Zoo1202	Dept. Comp.	2	3	-	3
Zoo2103	Physiology I	Zoo1101		2	3	-	3
ZoCh2101	General Entomology	Zoo1202		1	2	-	2
Zoo21nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Total				**15**	**14**	**1**	**20**

Second Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre00nn	Free Course		Univ. Free Elect.	-	-	-	4
Chm2202	Spectrophotometric Methods of analysis I	Chm 2111		1	-	-	1
Zoo2202	Chordata	Zoo1202	Dept. Comp.	2	3	-	3
Zoo2206	Genetics	Zoo1101		1	1	-	1
ZoCh2202	Introduction to Immunology	Zoo1101		1	1	-	1
Zoo22nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Chm22nn	See Dept. Elect. Courses Table		Chm. Dept. Elect.	2	-	-	2
Total				**9**	**5**	**-**	**14**

Third level

First Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni31nn	See Uni. Elect. Courses Table		Univ. Free Elect.	-	-	-	2
BCh3109	Biochemistry I		Chm . Dept. Comp.	2	2	-	3
Chm2105	Chemical Thermodynamics	Chm1202		2	-	1	2
Zoo3107	Ecology	Zoo1101	Dept. Comp	2	2	-	3
ZoCh3101	Medical Parasitology	Zoo1202		1	1	-	1
ZoCh3103	Histology and Microtechniques	Zoo1101		2	2	-	3
Zoo31nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Chm31nn	See Dept. Elect. courses Table		Chm. Dept. Elect.	2	-	-	2
Total				**13**	**7**	**-**	**18**

Second Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
BCh3214	Biochemistry II	BCh3109	Chm. Dept. Comp	2	2	-	3
Chm2204	Representative Elements Chemistry	Chm1202		2	-	-	2
Zoo3202	Physiology II	Zoo2103	Dept. Comp.	1	2	-	2
ZoCh3202	Immunology II	ZoCh2202		-	3	-	1
Zoo32nn	See Program Elect. Courses Table		Dept. Elect.	4	-	-	4
Chm32nn	See Dept. Elect. Courses Table		Chm. Dept. Elect.	4	-	-	4
Total				**13**	**7**	**-**	**16**

Fourth level

First Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm 3105	Chemical Kinetics	Chm2105	Chm. Dept. Comp.	1	-	-	1
Chm 4107	Organic Spectroscopy	Chm2107		2	1	-	2
Chm 4109	Chemistry of Natural Products	Chm 2107		2	2	-	3
Zoo4103	Molecular Biology	Zoo3206	Dept. Comp.	-	3	-	1
ZoCh4101	Physiology III	Zoo3202		2	1	-	2
ZoCh4103	Cell Biology	Zoo1101		1	1	-	1
Zoo41nn	See Program Elect. Courses Table		Dept. Elect.	2	-	-	2
Chm41nn	See Program Elect. Courses Table		Chm. Dept. Elect.	3	-	-	3
ZoCh40PT	Practical Training			-	4	-	2
ZoCh40RP	Research Project (Contined)			1	1	-	1
Total				**14**	**13**	**-**	**18**

Second Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4202	Chromatographic Separations I	Chm 2202	Chm. Dept. Comp.	2	-	-	2
Chm2212	Organic Chemistry II	Chm 2107		2			2
BCh4204	Bionanotechnology and Applications	BCh3214		2	-	-	2
ZoCh4202	Histology and Histochemistry	ZoCh3103	Dept. Comp.	2	1	-	2
ZoCh4204	Comparative Anatomy	Zoo2202		1	1	-	1
ZoCh4206	Embryology	Zoo3204		1	1	-	1
Zoo42nn	See Program Elect. Courses Table		Dept. Elect.	3	-	-	3
Chm42nn	See Program Elect. Courses Table		Chm. Dept. Elect.	4	-	-	4
ZoCh40RP	Research Project			1	1	-	1
Total				**18**	**4**	**-**	**18**

مجموعة العلوم الجيولوجية
Geological Sciences Group

جامعة حلوان
Helwan University

First Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni1101	English Language for Science	----	Univ. Comp.	2	-	-	2
Uni11nn	See Uni. Elect. Courses Table		Univ. Elect.	2	-	-	2
Geo1101	General Geology I			1	2	-	2
Mat1101	General Mathematics I (Calculus I)		Fac. Comp.	2	-	1	2
Sta1208	Introduction to Statistics			1	-	1	1
Phy1101	General Physics I			2	-	1	2
Phy1103	Practical Physics I			-	3	-	1
Chm1101	General Chemistry I			2	-	1	2
Chm1103	Practical General Chemistry I			-	3	-	1
Zoo1103	Introduction of Zoolgy			1	3	-	2
Total				**13**	**11**	**4**	**17**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni1202	Information Technology		Univ. Comp.	2	-	-	2
Uni00nn	See Uni. Elect. Courses Table		Univ. Elect.	2	-	-	2
GPh1202	General Geophysics		Fac. Comp.	2		-	2
Geo1202	General Geology II			1	2	-	2
Com1101	Introduction to Computer Science			2	1	-	2
Com1103	Practical Computer Science			-	3	-	1
Phy1202	General Physics II			2	-	1	2
Phy1204	Practical Physics II			-	3	-	1
Chm1202	General Chemistry II			2	-	1	2
Chm1204	Practical General Chemistry II			-	3	-	1
Bot1103	Introduction to Botany			1	3		2
Total				**14**	**13**	**-**	**19**

برامج قسم الجيولوجيا
Geology Department Programs

جامعة حلوان
Helwan University

برنامج الجيولوجيا – تخصص منفرد
Geology Program - Single Major

Helwan University

Second Level

First Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Fre21nn	Free Course		Free Elect.	2	-	-	2
Geo2101	Mineral Optics	Geo1202	Dept. Comp.	2	2	-	3
Geo2103	Macropaleontology	Geo1101		2	2	-	3
Geo2105	Crystallography	Geo1202		1	2	-	2
Geo2107	Principles of Historical Geology	Geo1101		1	2	-	2
Geo21nn	See Program Elect Courses Table	-	Dept. Elect.	2	4	-	4
Total				**12**	**12**	**-**	**18**

Second Semester							
Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni22nn	See Uni. Elect. Courses Table		Free Elect.	2	-	-	2
Geo2202	Micropaleontology	Geo2103	Dept. Comp.	2	2	-	3
Geo2204	Descriptive Mineralogy	Geo2101		1	2	-	2
Geo2206	Stratigraphy	Geo2107		2	2	-	3
Geo2208	Computer in Geosciences	-		1	2	-	2
Geo22nn	See Program Elect Courses Table		Dept. Elect.	1	2	-	2
Total				**11**	**10**	**-**	**14**

Third Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Geo3101	Igneous Petrology	Geo2204	Dept. Comp.	2	2	-	3
Geo3103	Sedimentary Petrology	Geo2206		2	2	-	3
Geo3105	Structural Geology	Geo1101		2	2	-	3
Geo31nn	See Program Elect. Courses Table	-	Dept. Elect.	3	6	-	6
Total				**11**	**12**	-	**17**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Geo3202	Metamorphic Petrology	Geo3103	Dept. Comp.	2	2	-	3
Geo3204	Geochemistry	Geo3101		2	2	-	3
Geo3206	Remote Sensing in Geology	-----		1	2	-	2
Geo3208	Applied Geophysics	GPh1202		2	2	-	3
Geo32nn	See Program Elect. Courses Table	-	Dept. Elect.	3	6	-	6
Total				**10**	**14**	-	**17**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Geo4101	Geology of Egypt	Geo2206	Dept. Comp.	2	2	-	3
Geo4103	Field Geology	Geo3105		1	2	-	2
Geo4105	Subsurface Geology			1	2	-	2
Geo4107	Hydrogeology	Geo3103		2	2	-	3
Geo40PT	Practical Training			-	4	-	2
Geo 40RP	Research Project (Continued)			1	1	-	1
Geo41nn	See Program Elect Courses Table	-	Dept. Elect.	3	6	-	6
Total				**10**	**19**	**-**	**19**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Geo4202	Petroleum Geology	Geo3103	Dept. Comp.	2	2	-	3
Geo4204	Economic Geology	Geo3204		2	2	-	3
Geo4206	Ore Microscopy	Geo2101		2	2		3
Geo4208	Field Trips	-		-	2	-	1
Geo40RP	Research Project			1	1	-	1
Geo42nn	See Program Elect. Courses Table	-	Dept. Elect.	3	6	-	6
Total				**10**	**15**	**-**	**17**

برنامج الجيوفيزياء – تخصص منفرد
Geophysics Program - Single Major

جامعة حلوان
Helwan University

Second Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Fre21nn	Free Course		Free Elect.	2	-	-	2
Phy2103	Thermodynamics	Phy1202	Dept. Comp.	2	-	1	2
GPh2101	Petrology	Geo1202		2	2	-	3
GPh2103	Magnetic Methods	GPh1202		1	2	-	2
GPh2105	Geoelectric Methods			2	2	-	3
GPh21nn/Mat2109	See Program Elect Courses Table	Mat1101	Dept. Elect.	2	-	1	2
GPh21nn/Mat2109	See Program Elect Courses Table			2	-	1	2
Total				**15**	**6**	**3**	**18**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni22nn	See Uni. Elect. Courses Table		Free Elect.	2	-	-	2
GPh2202	Principles of Lithostratigraphy	Geo1101	Dept. Comp	1	2		2
GPh2204	Principles of Structural Geology			1	2		2
GPh2206	Seismic Methods	GPh1202		2	2		3
GPh2208	Gravity Methods			2	2		3
Phynnnn	See Program Elect Courses Table	Phy1202	Dept. Elect.	2	-	1	2
Total				**10**	**8**	**1**	**14**

Third Level

First Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Fre31nn	Free Course		Free Elect.	2	-	-	2
Geo4101	Geology of Egypt	GPh2202	Dept. Comp.	2	2	-	3
GPh3101	Seismology I			1	2	-	2
GPh3103	Radiometric Geophysics			1	2	-	2
GPh3105	Geophysical Data Analysis	GPh2208		2	2		3
GPh31nn	See Program Elect. Courses Table		Dept. Elect.	6			6
Total				**14**	**8**	**-**	**18**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
GPh3202	Electromagnetic Methods		Dept. Comp.	2	2	-	3
GPh3204	Seismology II	GPh3101		1	2	-	2
GPh3206	Geothermal Methods	Phy2103		1	2	-	2
GPh3208	Petroleum and Subsurface Geology	GPh2204		2	2	-	3
GPh32nn	See Program Elect. Courses Table		Dept. Elect.	6		-	6
Total				**12**	**8**	**-**	**16**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
GPh40PT	Practical Training		Dept. Comp.	-	-	-	2
GPh4101	Petrophysics	GPh2101		2	2	-	3
GPh4103	Engineering Geophysics	GPh2206		1	2	-	2
GPh4105	Mathematical Geophysics	Mat1101		2	2	-	3
GPh4107	Paleomagnetism	GPh2103		1	2	-	2
GPh40RP	Research project (Continued)			1	1	-	1
GPh41nn	See Program Elect Courses Table	-	Dept. Elect.	6		-	6
Total				**13**	**9**	**-**	**19**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
GPh4202	Well Logging	GPh4101	Dept. Comp.	2	2	-	3
GPh4204	Principles of Hydrogeology	Geo4101		1	2	-	2
GPh4206	Environmental Geophysics	GPh4103		2	2	-	3
GPh4208	Field Trips	-		-	-	4	2
GPh40RP	Research Project			1	1	-	1
GPh42nn	See Program Elect. Courses Table	-	Dept. Elect.	6		-	6
Total				**12**	**7**	**4**	**17**

برنامج الجيولوجيا والكيمياء – تخصص مزدوج
Geology-Chemistry Program - Double Major

جامعة حلوان
Helwan University

Second Level

First Semester

Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni2101	Human Rights		Univ. Comp.	2	-	-	2*
Uni21nn	See Uni. Elect. Courses Table		Free Elect.	2	-	-	2
Chm2111	Introduction to Classical Methods of Analysis	Chm1202	Dept. Comp.	1	-	1	1
Chm2113	Practical Analytical Chemistry II	*Chm2111		-	3	-	1
Chm2105	Chemical Thermodynamics	Chm1202		2	-	1	2
Chm2107	Organic Chemistry I	Chm1202		2	-	-	2
Chm2109	Practical Organic Chemistry I	*Chm2107		-	3	-	1
GeCh2101	Paleontology	Geo1101		2	2	-	3
Geo2105	Crystallography	Geo1202		1	2	-	2
Total				**12**	**10**	**2**	**16**

Second Semester

Course Code	Course	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni22nn	See Uni. Elect. Courses Table		Free Elect.	2	-	-	2
Chm2204	Representative Elements Chemistry	Chm1202	Dept. Comp.	2	-	-	2
Chm2208	Phase Equilibria	Chm 2105		1	-	-	1
GeCh2202	Mineralogy	Geo2105		2	2	-	3
GeCh2204	Principles of Stratigraphy	GeCh2101		1	2	-	2
Chm22nn	See Program Elect Courses Table		Dept. Elect.	3		-	3
GeCh22nn	See Program Elect Courses Table			2	2	-	3
Total				**13**	**6**	**-**	**16**

Third Level

First Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Uni31nn	See Uni. Elect. Courses Table		Free Elect.	2	-	-	2
Chm3103	Transition Elements Chemistry I	Chm2204	Dept. Comp.	2	-	-	2
Chm3105	Chemical Kinetics	Chm2105		1	-	-	1
Chm3115	Practical Physical Chemistry IV	*Chm3105		-	3	-	1
GeCh3101	Principles of Igneous Petrology	GeCh2202		1	2	-	2
GeCh3103	Principles of Sedimentary Petrology	GeCh2204		1	2	-	2
GPh2204	Principles of Structural Geology	Geo1101		1	2	-	2
Chm31nn	See Program Elect. Courses Table	-	Dept. Elect.	2	4	-	4
Total				**10**	**13**	**-**	**16**

Second Semester

Course code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm2202	Spectrophotometric methods of analysis I	Chm 2111	Dept. Comp.	1	-	-	1
Chm2212	Organic Chemistry II	Chm 2107		2	-	-	2
Chm2216	Practical organic Chemistry II	*Chm 2212		-	3	-	1
Chm2218	Electrochemistry II	Chm 2105		2	-	-	2
GeCh3202	Principles of Metamorphic Petrology	GeCh3103		1	2	-	2
GeCh3204	Principles of Geochemistry	GeCh3101		1	2	-	2
Chm32nn	See Program Elect. Courses Table		Dept. Elect.	1	2	-	2
Geo32nn/ GeCh32nn	See Program Elect. Courses Table	-		3	6	-	6
Total				**11**	**15**	**-**	**18**

Fourth Level

First Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4113	Inner Transition Metals and nuclear Chemistry	-	Dept. Comp.	1	-	-	1
Chm4103	Colloidal and Surface Chemistry	Chm3103		2	-	-	2
Chm4107	Organic Spectroscopy	Chm2105		2	-	1	2
Geo4101	Geology of Egypt	Chm2107 Chm2212		2	2	-	3
GeCh4101	Principles of Applied Geophysics	GeCh2204		1	2	-	2
GeCh40PT	Practical Training	GPh1202		-	4	-	2
GeCh40RP	Research project (Continued)			1	1	-	1
Chm41nn	See Program Elect Courses Table	-	Dept. Elect.	2	4	-	4
Geo41nn/ GeCh41nn	See Program Elect Courses Table	-		1	2	-	2
Total				**12**	**15**	**1**	**19**

Second Semester

Course Code	Course Title	Prerequisite	Subject Case	Hours			
				Lecture	Practical	Tutorial	Credit
Chm4218	Chromatographic Separations II	Chm2202	Dept. Comp.	1	-	-	1
Chm4224	Practical of Chemical Analysis III	*Chm4218		-	3	-	1
Chm3212	Polymer Chemistry	Chm1101 Chm1201		2	-	-	2
Chm4216	Petroleum Chemistry	Chm2212		1	-	-	1
GeCh4202	Principles of Petroleum Geology	GPh2204		1	2	-	2
GPh4204	Principles of Hydrogeology	GeCh3103		1	2	-	2
Geo4208	Field Trips			-	2		1
GeCh40RP	Research Project			1	1	-	1
Chm42nn	See Program Elect. Courses Table	-	Dept. Elect.	1	2	-	2
Geo42nn/ GeCh42nn	See Program Elect. Courses Table	-		2	4	-	4
Total				**10**	**16**	**-**	**17**

ثالثا: جداول المقررات الإختيارية
Elective Courses Tables

Helwan University

متطلبات الجامعة الاختيارية
University Elective courses
Uni00nn

جدول (7): متطلبات الجامعة الاختيارية

كود المقرر	اسم المقرر	عدد الساعات المعتمدة
Uni0001	أسس علم الحاسبات	2
Uni0002	تاريخ مصر القديم	2
Uni0003	تاريخ مصر الحديث	2
Uni0004	علم النفس والاجتماع	2
Uni0005	الثقافة البيئية	2
Uni0006	تاريخ وفلسفة العلوم	2
Uni0007	الفلسفة والتفكير النقدى	2
Uni0008	أخلاقيات مزاولة المهنة	2
Uni0009	مهارات التواصل	2
Uni0010	الابتكار وريادة الأعمال	2
Uni0011	الأمان المعملى	2
Uni0012	الصحة واللياقة	2
Uni0013	كتابة ونشر البحوث العلمية	2
Uni0014	التنوع الحيوى والتنمية المستدامة	2
Uni0015	الصحة واللياقة	2
Uni0016	التغيرات المناخية	2
Uni0017	العلوم السياسية والعلاقات الدولية	2

جدول المقررات الإختيارية لبرنامج الرياضيات
Elective Courses Table for Mathematics Program

جامعة حلوان
Helwan University

جدول (8): المقررات الاختيارية لبرنامج الرياضيات

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Mat2151	History and Philosophy of Mathematics		2		1	2
Mat2153	Logic and Set Theory	----	2	-	1	2
Second Semester						
Mat2252	Discrete Mathematics	Mat1103	2	-	1	2
Mat2254	Linear Algebra (II)	Mat2109	2		1	2
Mat2256	Solid Geometry	Mat2105	2		1	2
Third Level						
First Semester						
Mat3155	Mathematical Biology	Mat2208	2	-	1	2
Mat3157	Electrostatic	Mat2210	2		1	2
Mat3159	Space Dynamics		2	-	1	2
Mat3161	Classical Thermodynamics	Mat2210	2		-	2
Mat3163	ElSpaicity Theory	Mat2208	2	-	1	2
Second Semester						
Mat3258	Electrodynamic	Mat3113	2		1	2
Mat3260	Graph Theory	Mat3113	2		1	2
Mat3262	Insurance Mathematics	Mat2208	2		1	2
Mat3264	Number Theory	Mat2208	2	-	1	2
Mat3266	Ring Theory	Mat2206	2	-	1	2
Fourth Level						
First Semester						
Mat4165	General Relativity	Mat3214	2	-	1	2
Mat4167	Integral Transforms	Mat3218	2	-	1	2

Helwan University

Mat4169	Mathematics for Science	Mat2208	2	-	1	2
Mat4171	Mathematical Modeling	Mat2208	2	-	1	2
Mat4173	Mathematical Packages II	Mat3113	2	1	-	2
Mat4175	Optimal Control Theory	Mat2208	2		1	2
Second Semester						
Mat4268	Fluid Mechanics II	Mat4121	2	-	1	2
Mat4270	Field Theory	Mat2212	2	-	1	2
Mat4272	Financial Mathematics	Mat2208	2	-	1	2
Mat4274	Numerical Analysis II	Mat3216	2	-	1	2
Mat4276	Operation Research II	Mat3117				
Mat4278	Topology II	Mat3220	2	-	1	2
Mat4078	Selected Topics in Mathematics		2	-	1	2

جامعة حلوان
Helwan University

جدول المقررات الإختيارية لبرنامج الرياضيات وعلوم الحاسب

Elective Courses Table for Mathematics and Computer Science Program

Helwan University

جدول (9): المقررات الاختيارية لبرنامج الرياضيات وعلوم الحاسب

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
Mathematics Elective courses						
Mat2107	Calculus III	Mat1202	2		2	3
Mat2111	Mechanics II	Mat1202	2		2	3
Computer Science Elective courses						
Com2252	Introduction to Data Science	Com1202	2	-	2	3
Com2254	Image Processing	Mat1204	2		2	3
Third Level						
Mathematics Elective courses						
Mat3155	Mathematical Biology	Mat2208	2	-	1	2
Mat3157	Electrostatic	Mat2107	2	-	1	2
Mat2254	Linear Algebra II	Mat2109	2		1	2
Mat3220	Topology I	Mat2212	2	-	1	2
Mat3260	Graph Theory	Mat3113	2	-	1	2
Mat3262	Insurance Mathematics	Mat2208	2	-	1	2
Mat3266	Number Theory	Mat2208	2		1	2
Computer Science Elective courses						
Com3151	Machine Learning	Com2252	2	2		3
Com3153	Computer Vision	Com2254	2	2		3
Com3256	Data Mining	Com2252	2	2		3
Com3258	Natural Language Processing	Com3151	2	2		3
Fourth Level						
Mathematics Elective courses						
Mat3117	Operations Research I	Mat2109	2	-	1	2
Mat4121	Complex Functions	Mat3119	2		1	2
Mat4171	Mathematical Modeling	Mat2208	2	-	1	2

Mat4173	Mathematical Packages II	Mat3113	2	1	-	2
Mat4272	Financial Mathematics	Mat2208	2		1	2
Mat4274	Numerical Analysis II	Mat3216	2	-	1	2
Mat4276	Operation Research II	Mat3117	2	-	1	2
Mat4080	Selected Topics in Mathematics		2	-	1	2
Computer Science Elective courses						
Com4155	Big Data Analytics	Com2252	2	2	-	3
Com4157	Introduction to Bioinformatics	Com2206	2	2	-	3
Com4262	Data Visualization	Com2252	2	2	-	3
Com4264	Introduction to Robotics	Com3258	2	2	-	3
Com4060	Selected Topics in Computer Science		2	2	-	3

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جدول المقررات الإختيارية لبرنامج الإحصاء وعلوم الحاسب

Elective Courses Table for Statistics and Computer Science Program

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جدول (10): المقررات الاختيارية لبرنامج الإحصاء وعلوم الحاسب

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
Statistics Elective courses						
Sta2252	Demography		2		2	3
Sta2254	Distribution Theory		2		2	3
Computer Science Elective courses						
Com2252	Introduction to Data Science	Com1202	2	2		3
Com2254	Image Processing	Mat1204	2	2		3
Third Level						
Statistics Elective courses						
Sta3151	Statistical Computing	Sta2202	2			2
Sta3153	Sampling Theory	Sta 2101	2			2
Sta3256	Biostatistics		2			2
Sta3258	Queuing Theory	Sta2204	2			2
Mat3103	Numerical Methods	Mat1202	2		-	2
Mat3119	Real Analysis	Mat2107	2	-		2
Computer Science Elective courses						
Com3151	Machine Learning	Com2252	2	2		3
Com3153	Computer Vision	Com2254	2	2		3
Com3256	Data Mining	Com2252	2	2		3
Com3258	Natural Language Processing	Com3151	2	2		3
Fourth Level						
Statistics Elective courses						
Sta4155	Bayesian Statistics	Sta3105	2		2	3
Sta4157	Econometrics	Sta3105	2		2	3
Sta4159	Statistical Methods in Finance	Stat3105	2		2	3

Sta4262	Simulation	Sta3105	2	2		3
Sta4264	Introduction to Bootstrap	Sta3105	2		2	3
Sta4266	Survival Analysis	Sta3105	2		2	3
Sta4060	Selected Topics in Statistics		2		2	3
Computer Science Elective courses						
Com4155	Big Data Analytics	Com2252	2	2	-	3
Com4157	Introduction to Bioinformatics	Com2206	2	2	-	3
Com4262	Data Visualization	Com2252	2	2	-	3
Com4264	Introduction to Robotics	Com3258	2	2	-	3
Com4060	Selected Topics in Computer Science		2	2	-	3

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جدول المقررات الإختيارية لبرنامج الفيزياء
Elective Courses Table for Physics Program

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جدول (11): المقررات الاختيارية لبرنامج الفيزياء

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Spa2101	Astronomy and Astrophysics I		2	-	1	2
Phy2111	Classical Mechanics I		2		1	2
Phy2113	Alternating Current and Electric Circuit		2	1		2
Second Semester						
BPh2101	Biophysics		2	1		2
Phy2208	Radiation Physics		2	1		2
Phy2210	Crystallography and Diffraction		2		1	2
Phy2212	Introduction to Nanoscience		2	1		2
Third Level						
First Semester						
Phy3109	Physics of Energy		2	1		2
Phy3111	Special Relativity		2		1	2
Phy3113	Fluid Mechanics		2		1	2
Phy3115	Special Topics in Physics I		2	1		2
Phy3117	Renewable Energy and Sustainability		2	1		2
Phy3119	Electrodynamics		2		1	2
Second Semester						
Phy3210	Cosmic Rays		2	1		2
Phy3212	Electromagnetic Field Theory II	Phy2105	2		1	2
Phy3214	Simulation and Modeling		2		1	2
Phy3216	Special Topics in Physics II		2	1		2
Phy3218	Classical Mechanics II	Phy2111	2		1	2
Phy3220	General Relativity	Phy3111	2		1	2
Fourth Level						
First Semester						

Phy4111	Semiconductor Technology		2	1		2
Phy4113	Principles of Group Theory		2		1	2
Phy4115	Physics of Non-Crystalline Solids		2	1		2
Phy4117	Magnetism and Magnetic Properties of Solids		2	1		2
Phy4119	Photonics		2	1		2
Second Semester						
Phy4214	Non-linear Optics		2	1		2
Phy4216	Neutrons and Reactors Physics		2	1		2
Phy4218	Physics of Smart and Functional Materials		2	1		2
Phy4220	Plasma Physics					
Phy4222	Optical Communication		2	1		2

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جدول المقررات الإختيارية لبرنامج الفيزياءالحيوية الطبية

Elective Courses Table for Medical Biophysics Program

Helwan University

جدول (12): المقررات الاختيارية لبرنامج الفيزياء الحيوية الطبية

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Phy2101	Physical Optics	Phy1102	2	1		2
Phy2208	Crystallography and Diffraction		2	1		2
Second Semester						
BPh2103	BioMechanics	Phy1101	2	1		2
Mic2101	Microbiology		2	1		2
Phy2212	Introduction to Nanoscience		2	1		2
Phy2107	Physical Electronic I	Phy1101	2	1		2
Third Level						
First Semester						
Sta3256	Biostatistics		2		-	2
BPh3107	Electronic Simulation of Biological Systems		2	1		2
BPh3109	Mathematical Biophysics		2		1	2
BPh3111	Environmental Biophysics		2	1		2
BPh3113	Bioeffects of Electromagnetic Energy		2		1	2
BPh3115	Biomathematics	Mat2208	2		1	2
Second Semester						
BPh3208	Nuclear Magnetic Resonance		2	1		2
Chm3228	Medicinal Organic Chemistry	Chm 2212 Chm 3210	2			2
BCh3214	Biochemistry II	BCh 3109	2	2		3
BPh3210	Computational BioPhysics		2		1	2
BCh4202	Biotechnology	BCh3208	2	1		2
Zoo3202	Physiology II	Zoo2103	2	1		2
Fourth Level						
First Semester						

BPh4109	Physics of Radiotherapy (II)		2	1		2
BPh4111	Biomagnatism		2	1		2
BPh4113	Bioenergetics		2	1		2
BPh4115	Signal Analysis and Medical Applications		2	1		2
BPh4117	Advanced Physical Techniques in Medicine		2	1		2
BPh4119	Cell Communication & Signaling Biophysics		2	1		2
Second Semester						
Phy4206	Low Temperature Physics		2	1		2
Phy4208	Nanophysics and Nanotechnology		2	1		2
Zoo4101	Physiology III (Neurobiology)	Zoo3202	2	1		2
Spa4210	Image Processing and Analysis		2	1		2
BPh4210	Physics of Diagnostic radiology		2	1		2
BPh4212	Physics of Nuclear Medicen		2	1		2

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جدول المقررات الإختيارية لبرنامج علوم الفضاء
Elective Courses Table for Space Sciences

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جدول (13): المقررات الاختيارية لبرنامج علوم الفضاء

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Spa2103	Star Physics	Spa2101	2	1		2
Phy2111	Classical Mechanics I		2		1	2
Phy2115	Spectroscopy		2		1	2
Second Semester						
Spa2204	Astronomy and Astrophysics II	Spa2101	2	1		2
Spa2206	Satellites	Spa2101	2	1		2
Spa2208	Cosmology	Spa2204	2		1	2
Mat3218	Partial Differential Equations		2		-	2
Third Level						
First Semester						
Spa3103	Stellar Evolution		2	1		2
Phy3210	Cosmic Rays		2	1		2
Spa3105	Celestial Mechanics	Phy2204	2		1	2
Phy2208	Radiation Physics		2		1	2
Phy3214	Simulation and Modeling		2		1	2
Second Semester						
Spa3209	Space Weather II		2	1		2
Spa3211	Radio Sparonomy II		2	1		2
Phy3117	Renewable Energy and Sustainability		2	1		2
Phy3212	Electromagnetic Field Theory II		2		1	2
Phy3111	Special Relativity		2		1	2
Fourth Level						
First Semester						
Phy4103	Mathematical Physics II		2		1	2
Spa4111	Planetary Physics		2	1		2
Spa4113	Space Plasma Physics II		2	1		2

Spa4115	Materials for space		2	1		2
Spa4117	Geoinformatics		2	1		2
Second Semester						
Phy4210	Elementary Particles Physics		2	1		2
Phy4206	Low Temperature Physics		2	1		2
Phy4202	Statistical Physics		2	1		2
Spa4214	Ionosphere & Magnetosphere		2	1		2
Phy4222	Optical Communication		2	1		2

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جدول المقررات الإختيارية لبرنامج الكيمياء
Elective Courses Table for Chemistry Program

Helwan University

جدول (14): المقررات الاختيارية لبرنامج الكيمياء

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
Physical Chemistry Elective Courses						
Chm2115	Nanoscience and Nanotechnology	Chm1202	2			2
Chm2222	Thermodynamic of Solution	Chm2105	1			1
Inorganic & Analytical Chemistry Courses						
Chm2117	Safety in Lab and Sampling	Chm 1202	2			2
Chm2224	Inorganic Chemical Industries	Chm 1202	2			2
Organic Chemistry Elective Courses						
Chm2226	Green Chemistry	Chm1202 Chm2107	2			2
Third level						
Physical Chemistry Elective Courses						
Chm3117	Chemistry of Cement	Chm2208	2			2
Chm3119	Chemistry of Ceramics	Chm2208	2			2
Chm3220	Physical Separation and Characterization Techniques	Chm2105	2			2
Chm3222	Metallurgy	Chm2208	2			2
Inorganic & Analytical Chemistry Elective Courses						
Chm 3121	Inorganic Reaction Mechanism	Chm 2204	2			2
Chm 3123	Micro Analysis	Chm 2101	2			2
Chm 3224	Bio-inorganic Complexes	Chm 3103	1			1
Chm 3226	Environmental Material Analysis	Chm 3101	2			2
Organic Chemistry Elective Courses						
Chm3125	Streoelective Synthesis	Chm 3111 Chm 2212	2			2
Chm3228	Medicinal Organic Chemistry	Chm 2212 Chm 3210	2			2
Chm3230	Bioorganic Chemistry.	Chm2212	2			2
Biochemistry Elective Courses						

BCh3109	Biochemistry I	Chm 1202	2	2		3
BCh3214	Biochemistry II	BCh 3109	2	2		3
BCh3204	Body Fluids	BCh 3109 BCh 3214	3			3
Fourth Level						
Physical Chemistry Elective Courses						
Chm4117	Comutational Modeling	Chm3206	2			2
Chm4228	Statistical Thermodynamics	Chm3206	1			1
Chm4230	Advanced Physical Chemistry of Polymer	Chm4210	2			2
Chm4232	Water Treatment	Chm2105 Chm4103	2			2
Chm4234	Nanomaterials for Energy Conversion and Storge	Chm2206	2			2
Inorganic & Analytical Chemistry Elective Courses						
Chm4119	Organometallic Chemistry I	Chm3202	2			2
Chm4121	Electroanalytical Methods of Analysis	Chm2202 Chm2206	2			2
Chm4236	Separation Methods	Chm3101	2			2
Organic Chemistry Elective Elective Courses						
Chm4123	Industerial Organic Chemistry	Chm3212	2			2
Chm4125	Organometallic Chemistry II	Chm2212	2			2
Chm4238	Petrochemicals	Chm4216	2			2
Chm4240	Chemistry of Dyes	Chm3210 Chm2212	2			2
Chm4242	Organic Design: The Disconnection Approach	Chm3210 Chm2212	2			2
Chm4244	Chemistry of Pesticides	Chm3210 Chm2212	2			2
Biochemistry Elective Elective Courses						
BCh4103	Hormones	BCh3109 BCh3214	2			2

- Physical Chemistry Elective Courses (at leSpa 8 Cr. for Chemistry Program)
- Inorganic & Analytical Elective Courses (at leSpa 8 Cr. for Chemistry Program)
- Organic Elective Courses (at leSpa 8 Cr. for Chemistry Program)
- Biochemistry Elective Courses (at leSpa 4 Cr. for Chemistry Program)

جدول المقررات الإختيارية لبرنامج الكيمياء التطبيقية

Elective Courses Table for Applied Chemistry Program

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جدول (15): المقررات الاختيارية لبرنامج الكيمياء التطبيقية

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
BCh3109	Biochemistry I	Chm1202	2	2		3
Chm2117	Safety in Lab and Sampling	Chm1202	2			2
Second Semester						
BCh3214	Biochemistry II	BCh3109	2	2		3
ACh2208	Introduction to Nanoscience and Nanotechnology	Chm1202	2			2
ACh2210	Chemistry and Technology of Adhesives	Chm2107	2			2
ACh2212	Industrial Inorganic Chemistry	Chm1202	2			2
Third Level						
First Semester						
Chm4121	Electroanalytical Methods of Aanalysis	Chm 2202 Chm 2218	2			2
ACh3105	Chemistry and Technology of Fertilizers	Chm 2204	2			2
ACh3107	Chemistry and Technology of Iron and Steel	Chm2204	2			2
ACh3109	Chemistry and Technology of Nonferrous and Alloys	Chm2204	2			2
ACh3111	Chemistry and Technology of Insecticides and Pesticides	Chm2212	2			2
ACh3113	Food Science and Technology	Chm2212	2			2
Second Semester						
Chm2210	Soild State	Chm1202	1			1
Chm4210	Physical Polymer	Chm3105	1			1
Chm3226	Environmental Material Analysis	Chm3101	2			2
ACh3208	Pharmaceutical Industry A	Chm2201	2			2
ACh3210	Industrial Organic Chemistry	Chm2212	2			2

ACh3212	Surfactants, Soaps and Detergents Technology	Chm4103	2			2
ACh3214	Industrial WSpae Water Treatment	Chm 3101	2			2
Fourth Level						
First Semester						
Chm4119	Organometallic Chemistry I	Chm3103	2			2
Chm 4109	Chemistry of Natural Products	*Chm4222	2			2
ACh4105	Chemistry and Technology of Petrochemicals	ACh2204	2			2
ACh4107	Chemistry and Technology of ElSpaomers	ACh3202	2			2
ACh4109	Chemistry and technology Ceramics and Refractories	ACh3103	2			2
ACh4111	Forensic Chemistry	Chm2212 Chm 3101	2			2
Second Semester						
Chm4111	Inner transition Elements and Nuclear Chemistry	Chm3103	2			2
Chm3206	Quantum Chemistry	Chm2105	2			2
ACh4210	Industrial Corrosion and Protection	Chm2218	2			2
ACh4212	Application of Nanomaterials	ACh2208	2			2
ACh4214	Pharmaceutical Industry B	ACh3208	2			2
ACh4216	Chemistry and Technology of Glass	ACh3103	2			2
ACh4218	Forensic Examination of Ink and Paper	ACh3101 ACh4202	2			2
ACh4220	Industrial Catalysis	Chm2105	2			2

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جدول المقررات الإختيارية لبرنامج الكيمياء الحيوية
Elective Courses Table for BioChemistry Program

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جدول (16): المقررات الاختيارية لبرنامج الكيمياء الحيوية

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Zoo2103	Physiology I	Zoo1101	2	2		3
Chm4109	Medicinal Natural Products	Chm1202 Chm2107	2	2		3
BPh2101	Biophysics	Phy1101	2	2		3
Second Semester						
Zoo2206	Genetics	Zoo1101	2	2		3
BCh3216	Protein Structure	BCh2101	2	2		3
Third Level						
First Semester						
BCh3107	Toxicology	BCh2202	2	2		3
Zoo3105	Histology	Zoo1101 Zoo1202	2	2		3
Zoo3105	Medical Parasitology	Zoo1101 Zoo1202	2	2		3
BCh3107	Nutritional Biochemistry	BCh2101 BCh2204 BCh2206	2	2		3
Second Semester						
Sta3256	Biostatistics		2			2
BCh3210	Biological Radiation	BCh2101	2			2
BCh3212	Cell Biology 2	BCh3105	2			2
Fourth Level						
First Semester						
BCh4109	Bioethics		2			2
BCh4111	Advanced Molecular Biology	BCh3101 BCh3208	2			2
Mic4208	Bioinformatics, Proteomic and Genomic	Mic3204 Mat1204 Mat1103	2			2

Zoo4101	Physiology III (Neurobiology)	Zoo1101	2			2
Mic3113	Applied Microbiology	Mic2101	2			2
BCh4107	Immunochemistry II	BCh3103	2			2
Second Semester						
Zoo2208	Introduction of Ttissue Culture	Zoo1101	2			2
BCh4210	Stem Cell	BCh3105	2			2
BCh4212	Managing and Marketing		2			2
BCh4214	Genetic Engineering	BCh3101 BCh3208 BCh4202	2			2
ACh3203	Quality Management		2			2
BCh4216	Metabolic Disorders		2			2

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جدول المقررات الاختيارية لبرنامج النبات
Elective Courses Table for Botany Program

Helwan University

جدول (17): المقررات الاختيارية لبرنامج النبات

Course Code	Course Title	Prerequisite	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Bot2109	Plant Cell Biology and Tissue Culture	Bot1202	1	2		2
Bot2111	Plant Geography and Biomes	Bot1202	1	2		2
ZoCh2101	General Entomology	Zoo1202	1	2		2
Second Semester						
Bot2208	Climate Change and Plants	Bot1201	1	2		2
GeCh4204	Principles of Geographic Information System (GIS)		1	2	-	2
Mic3103	Applied Microbiology	Bot1101	1	2		2
Third Level						
First Semester						
Bot3107	Plants and Soil	Bot 2105	2	-		2
Mic3117	Plant Microbiota	Bot 1101	1	2		2
Second Semester						
Bot3210	Plant Genetic Resources and Conservation	Bot2204	2	1		2
Bot3212	Algal biotechnology	Bot2105	1	2		2
Bot3214	Environmental Impact Assessment	Bot2202	1	2		2
Bot3216	Genetic Engineering	Bot2206	2	1		2
Mic2105	Virology	Bot1101	1	2		2
Fourth Level						
First Semester						
Bot4107	Population Genetics and Gene Ecology	Bot2202	2			2
Bot4109	Seed Biology	Bot2103	2			2

Bot4111	Energy Bioconversion in Plants	Bot3103	1	2		2
Bot4113	Bioinformatics in Plant Science	Bot2103	1	2		2
Second Semester						
Bot4210	Current Topics in Plant Science	Bot1101 Bot1102	1	2		2
Bot4212	Genome Biology and Gene Technology	Bot3101	1	2		2
Bot4214	Natural Products and Drugs	Chm4101	2	-		2
Bot4216	Plant Stress Physiology	Bot1101	1	2		2
Bot4218	Horticulture and Ornamental Plants	Bot1101 Bot1102	1	2		2

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جدول المقررات الاختيارية لبرنامج النبات والكيمياء
Elective Courses Table for Botany and Chemistry Program

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جدول (18): المقررات الاختيارية لبرنامج النبات والكيمياء

Course Code	Course Title	Prerequisite	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Bot2109	Plant Cell Biology and Tissue Culture	Bot1101	1	2		2
Bot2111	Plant Geography and Biomes	Chm1201	1	2		2
ZoCh2101	General Entomology	Zoo1102	1	2		2
Second Semester						
Chm2206	Green Chemistry	Chm1101	2	-		2
Chm2224	Inorganic Chemical Industry	Chm1101	1	1		2
Third Level						
First Semester						
Bot3202	Plant Biosystematics and Evolution	Bot2204	2	2		3
Mic2202	Mycology	Bot1101	1	2		2
Bot3107	Plant and Soil	Bot2105	2	-		2
Mic3117	Plant Microbiota	Bot2202	1	2		2
Second Semester						
Bot3208	Plant Cytogenetics	Bot2103	1	1		4
Bot3210	Plant Genetic Resources and Conservation	Bot2204	1	2		
Mic2105	Virology	Bot1101	1	2		
Bot3206	Plant Enzymology	Bot3103	1	2		2
Bot3204	Environmental Pollution	Bot2103	2	2		3
Chm3228	Medicinal Organic Chemistry	Chm2104	2	-		2
Chm3210	Heterocyclic Compounds	Chm2104	2	-		2
Fourth Level						

First Semester						
Bot4105	Desert and Wetland Ecology	Bot2202	1	2		2
Bot4111	Energy Bioconversion in Plants	Bot2101	1	2		2
Bot4113	Bioinformatics in Plant Science	Bot3101	1	2		2
Bot4212	Genome Biology and Gene Technology	Bot3101	1	2		2
Mic3202	Plant Pathology	Bot1101	1	2		2
Chm3101	Methods for Structure and Determination	Chm1101	1	-	1	
Chm3107	Catalysis	Chm1101	1	-	1	
Second Semester						
Bot4202	Ecology and Physiology of Algae	Bot2105	1	2		2
Bot4208	Conservation and Restoration Ecology	Bot 2202	2	-		2
Bot4109	Seed Biology	Bot1101 & Bot2201	1	2		2
Bot4210	Current Topics in Plant Science	Bot2101, Bot2013, Bot2105Bot2202	2	-		2
Bot4218	Horticultural and Ornamental Plants	Bot2204	1	2		2
Bot4220	Biological Control	Bot2204	1	2		2
Chm 2212	Polymer Chemistry	Chm1101 Chm1201	2	-	-	2
Chm 3226	Environmental Material Analysis	Chm1101 Chm1201	2	-	-	2
Chm 4232	Water Treatment	Chm1101 Chm1201	2	-	-	2

جدول المقررات الإختيارية لبرنامج الميكروبيولوجى
Elective Courses Table for Microbiology Program

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جدول (19): المقررات الاختيارية لبرنامج الميكروبيولوجى

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
Mic2107	Environmental Science	----------	1	-	-	1
Mic2109	Actinomycetes	---------	1	2		2
Mic2111	Introduction to Laboratory Science		1	2		2
BPh2201	Biophysics	---------	1	2		2
Mic2210	Aquatic Microbiology	---------	1	-	-	1
Mic2212	Cyanobacteria	----------	1	1		1
Mic2214	Microflora of Food		1	2		2
Third Level						
Mic3109	Biodiversity		1			1
Mic3111	Biological Control	---------	1	2		2
Mic3113	Technical Course		2	-	-	2
Mic3117	Essential Skills for the Life Sciences		1			1
Mic3208	Environmental Biotechnology		1			1
Mic3210	Secondary Metabolite		2	2		2
Mic3212	Forensic Microbiology	---------	1	2		2
Bot3204	Environmental Pollution	---------	1	2		2
Sat3257	Statistics for Science II	---------	1	2		2
Chm3106	Spectroscopic Methods for Structure Determination		1	2		2
Chm3103	Transition Elements Chemistry I	Chm2204	2	2		2
Chm3101	Spectrophotometric Methods of Analysis II	Chm2202	1	2	-	2
Fourth Level						
Mic4107	Biology of YeSpa	---------	1	2		2
Mic4109	Microbial Toxins	---------	1	-		1
Mic4210	Phyllosphere Microbiology	---------	1	2		2

Mic4111	Writing and Referencing Skills		1			1
Mic4212	Experimental Design		1	2	-	2
Mic4214	Seed microbiology	---------	1	2		2
Mic4103	Natural Products		1	2		2
Mic4216	Introduction to Nanotechnology		1			1
Mic4218	Biotic Interactions		1			1
Mic4113	Marine microbiology		1	2		2
Chm2202	Spectrophotometric Methods of Analysis I	Chm2111	1	-	-	1

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جدول المقررات الإختيارية لبرنامج الميكروبيولوجى كمياء حيوى

Elective Courses Table for Microbiology and Biochemistry Program

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جدول (20): المقررات الاختيارية لبرنامج الميكروبيولوجى والكيمياء الحيوية

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
BPh2201	Biophysics	----------	2	2		3
Mic2111	Introduction to Laboratory Science		1	2		2
Mic2212	Cyanobacteria	---------	1	-	-	1
Mic2107	Environmental Science	---------	1	-	-	1
Mic2214	Micro-flora of Food		1	2		2
Third Level						
Mic2109	Actinomycetes	---------	1	2		2
Mic2210	Aquatic Microbiology	---------	1	-		1
Mic3111	Biological Control	---------	1	2		2
Mic3113	Technical Course		2	-	-	2
Mic3115	Infection and Immunology		1	2	-	2
Mic3117	Essential Skills for the Life Sciences		1			1
Mic3212	Forensic Microbiology	---------	1	2		2
Mic4212	Experimental Design	---------	1	2		2
BCh3107	Nutritional Biochemistry	BCh2101 BCh2204 BCh2206	2	2		3
BCh3107	Toxicology	BCh2202	2	2		3
BCh3216	Protein Structure	BCh2101	2	2		3
BCh3210	Biological Radiation	BCh2101	2	2		3
BCh3202	Instrumental Biochemistry		2	2		3
Fourth Level						
Mic4103	Natural Products		1	2		2
Mic4107	Biology of YeSpa	---------	1	2		2
Mic4210	Phyllosphere Microbiology	---------	1	2		2

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Mic4111	Writing and Referencing Skills		1			1
Mic4216	Introduction to Nanotechnology		1			1
Mic4218	Biotic Interactions		1			1
Mic4113	Marine microbiology		1	2		2
BCh3103	Immunochemistry	BCh3103	2	-	-	2
BCh4210	Stem Cell	BCh3105	2	-		2
BCh4214	Genetic Engineering	BCh3101 BCh3208	2			2
Bch4109	Bioetheces		2			2
Bch4204	Bionanotechnology and Application		2			2

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جدول المقررات الإختيارية لبرامج علم الحيوان والكيمياء

Elective Courses Table for Zoology and Chemistry Programs

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جدول (21): المقررات الاختيارية لبرنامج علم الحيوان والكيمياء

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical		Credit
Second Level						
First Semester						
Zoology Elective Courses						
Mic2101	Microbiology	Bot1101	1	2		2
BPh2101	Biophysics	Phy1105	1	2		2
Geo2117	Invertebrate Paleontology	-	1	2		2
Second Semester						
Zoology Elective Courses						
Bot2202	General Plant Ecology	-	1	2		2
Zoo2208	Introduction to Cell Culture	Zoo1101	1	2		2
Zoo2210	Insect Physiology	Zoo1202	1	2		2
Chemistry Elective Courses						
Chm2224	Inorganic Chemical Industries	Chm1202	2			2
Chm2226	Green Chemistry	Chm1202	2			2
Third Level						
First Semester						
Zoology Elective Courses						
Zoo3103	Insect Taxonomy (For Zoology and Chemistry Program Students)	ZoCh2101	1	2		2
Zoo3109	Protozoology	Zoo1202	1	2		2
Zoo3111	Cytogenetics	Zoo1101	1	1		1
Zoo3113	Environmental Pollution	Zoo1101	1	-		1
Zoo3115	Physiology of Reproduction	Zoo1101	2	-		2
Chemistry Elective Courses						
Chm2115	Nanoscience and Nanotechnology	Chm1202	2	-		2

ACh3111	Chemistry and Technology of Insecticides and Pesticides		2			2
ACh3113	Food Science and Technology		2			2
Second Semester						
Zoology Elective Courses						
Zoo3212	Evolution	Zoo1101	1	-		1
Zoo3216	Fauna	Zoo1202	1	2		2
Zoo3218	General Histopathology	Zoo1101	1	2		2
Zoo3220	Human Genetics	Zoo2206	1	1		1
Zoo3222	Medical Entomology	Zoo2105 ZoCh2101	1	1		2
Zoo3208	Marine Biology	Zoo1101	1	2		2
Chemistry Elective Courses						
Chm3228	Medicinal Organic Chemistry		2			2
Chm3230	Bioorganic Chemistry	Chm2107	2	-		2
Chm3210	Heterocyclic Chemistry	Chm2017	2	-		2
Fourth Level						
First Semester						
Zoology Elective Courses						
Zoo4109	Toxicology	Zoo1101	2	-		2
Zoo4111	Advanced Immunology	Zoo3206	2	-		2
Zoo4113	Histology of Sense Organs	Zoo3105 or ZoCh3103	1	2		2
Zoo4115	Radiobiology	Zoo1101	1	-		1
Zoo4117	Bioethics	Zoo1101	1	-		1
Zoo4119	Chronobiology	Zoo1101	1	-		1
Chemistry Elective Courses						
Chm3101	Spectrophotometric Methods of Analysis I		1			1
Chm3107	Catalysis		1			1
ACh4105	Chemistry of Natural Products		2			2
ACh4111	Forensic Chemistry		2			2
Second Semester						

Zoology Elective Courses						
Zoo4212	Bioinformatics		1	2	-	2
Zoo4214	Genetic Engineering	Zoo2206	1	-		1
Zoo4216	Cancer Biology		1	-		1
Zoo4218	Immunohistochemistry	Zoo3206	1	2	-	2
Zoo4220	Veterinary Parasitology	Zoo3101 ZoCh3101	1	2		2
Zoo4222	Stem Cell	Zoo1101	2	-	-	2
Sta3256	Biostatistics		2	-		2
Chemistry Elective Courses						
Chm3212	Polymer Chemistry	Chm1101 Chm1201	2			2
Chm3226	Environmental Material Analysis		2			2
BCh4206	Pharmaceutical Industry		2			2

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جدول المقررات الإختيارية لبرنامج الجيولوجيا
Elective Courses Table for Geology Program

Helwan University

جدول (22): المقررات الاختيارية لبرنامج الجيولوجيا

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester						
Geo2109	Principles of Geological Survey		1	2	-	2
Geo2111	Fundamentals of Remote Sensing		1	2	-	2
Geo2113	Geomorphology		1	2	-	2
Geo2115	Structural Mineralogy		1	2	-	2
Second Semester						
Geo2210	Principles of Geotectonics		1	2	-	2
Geo2212	Principles of Petrology		1	2	-	2
Third Level						
First Semester						
Geo3107	Industrial Minerals	-	1	2	-	2
Geo3109	Engineering Geology	-	1	2	-	2
Geo3111	Rock Mechanics	-	1	2	-	2
Geo3113	Lithostratigraphy	-	1	2	-	2
Geo3115	Marine Geology	-	1	2	-	2
Geo3117	Mathematical Geology	-	1	2	-	2
Second Semester						
Geo3210	Environmental Geology	-	1	2	-	2
Geo3212	Geochemical Techniques	-	1	2	-	2
Geo3214	Sequence Stratigraphy	-	1	2	-	2
Geo3216	Biostratigraphy	-	1	2	-	2
Geo3218	Seismology	-	1	2	-	2
Geo3220	Principles of Geostatistics	-	1	2	-	2
Geo3222	Principles of Structural Analysis	-	1	2	-	2
Fourth Level						
First Semester						

Geo4109	Mining Geology	-	1	2	-	2
Geo4111	Principles of Well logging	-	1	2	-	2
Geo4113	Geology of Coal	-	1	2	-	2
Geo4115	Paleoecology	-	1	2	-	2
Geo4117	Palynology	-	1	2	-	2
Geo4119	Geoarcheology	-	1	2	-	2
Second Semester						
Geo4210	Isotope Geology	-	1	2	-	2
Geo4212	Principles of Petrophysics	-	1	2	-	2
Geo4214	Petroleum Geochemistry	-	1	2	-	2
Geo4216	Hydrogeochemistry	-	1	2	-	2
Geo4218	Geochemical Exploration	-	1	2	-	2
Geo4220	Applications of Remote Sensing		1	2	-	2

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جدول المقررات الإختيارية لبرنامج الجيوفيزياء
Elective Courses Table for Geophysics Program

Helwan University

جدول (23): المقررات الاختيارية لبرنامج الجيوفيزياء

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
First Semester (select only two courses)						
Mat2109	Linear Algebra I	Mat1101	2	-	1	2
GPh2107	Geostatistics		2	-	1	2
Mat2208	Ordinary Differential Equations		2	-	1	2
Mat2113	Mechanics for Geophysics		2		2	3
Second Semester (select only one course)						
Phy2105	Electromagnetic field theory I	Phy1202	2	-	-	2
Phy2107	Physical Electronics I		2	-	-	2
Phy3103	Nuclear physics		2	-	1	2
Third Level						
First Semester Group I (select only one course)						
GPh3107	Remote sensing		2	2	-	3
GPh3109	Marine Geophysics	GPh2206	2	2	-	3
GPh3111	Geographic Information System (GIS)		2	2	-	3
First Semester Group II (select only one course)						
GPh3113	Seismic Data Processing	GPh2206	2	2	-	3
GPh3115	Geotectonics	GPh2204	2	2	-	3
GPh3117	Geological Survey	Geo1101	2	2	-	3
Second Semester Group I (select only one course)						
GPh3210	Ground Penetrating Radar (GPR)		2	2	-	3
GPh3212	Hydrogeophyiscs	GPh2105	2	2	-	3
GPh3214	Potential Data Analysis and Interpretation	GPh2103	2	2	-	3
Second Semester Group II (select only one course)						
GPh3216	Computer Applications in Geophysics		2	2	-	3
GPh3218	Surface Waves Exploration		2	2	-	3
GPh3220	Mineral Deposits	GPh2101	2	2	-	3
GPh3222	Structural Analysis	GPh2204	2	2	-	3

Fourth Level						
First Semester Group I (select only one course)						
GPh4109	Geodesy	GPh2208	2	2	-	3
GPh4111	Modern Geophysical Considerations		2	2	-	3
GPh4113	Exploration Geophysics		2	2	-	3
First Semester Group II (select only one course)						
GPh4115	Programming Language		2	2	-	3
GPh4117	Archeological Geophysics	GPh2105	2	2	-	3
Second Semester Group I (select only one course)						
GPh4210	Inverse Theory		2	2	-	3
GPh4212	Space Geophysics	GPh2208	2	2	-	3
Second Semester Group II (select only one course)						
GPh4214	Formation Evaluation	GPh4101	2	2	-	3
GPh4216	Seismic Stratigraphy	GPh2206	2	2	-	3

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جدول المقررات الإختيارية لبرنامج الجيولوجيا والكيمياء

Elective Courses Table for Geology and Chemistry Program

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Helwan University

جدول (24): المقررات الاختيارية لبرنامج الجيولوجيا والكيمياء

Course Code	Course Title	Prerequisites	Hours			
			Lecture	Practical	Tutorial	Credit
Second Level						
Chemistry Elective courses						
Chm2115	Nanoscience and Nanotechnology	Chm 1202	2			2
Chm2117	Safety in Lab and Sampling	Chm 1202	2			2
Chm2224	Inorganic Chemical Industries	Chm 1202	2			2
Chm2226	Green Chemistry	Chm1202 Chm 2107	2			2
Chm2210	Solid State	Chm1202	1			1
Chm2222	Thermodynamic of Solution	Chm2105	1			1
Geology Elective courses						
GeCh2206	Historical Geology		2	2	-	3
GPh3115	Geotectonics		2	2	-	3
GeCh2208	Computer in Geology		2	2	-	3
Third Level						
Chemistry Elective courses						
Chm3117	Chemistry of Cement	Chm2208	2			2
Chm3119	Chemistry of Ceramics	Chm2208	2			2
Chm3220	Physical Separation and Characterization Techniques	Chm2105	2			2
Chm3222	Metallurgy	Chm2208	2			2
Chm3123	Micro Analysis	Chm2111	2			2
Chm3226	Environmental Material Analysis	Chm3101	2			2
Chm3210	Heterocyclic Chemistry	Chm2212	2			2
Geology Elective courses						
Geo2109	Principles of Geological Survey		1	2	-	2
Geo3107	Industrial Minerals		1	2	-	2
Geo3109	Engineering Geology		1	2	-	2
Geo3111	Rock Mechanics		1	2	-	2
Geo3115	Marine Geology		1	2	-	2

Geo3206	Remote sensing in Geology		1	2	-	2
Geo3212	Geochemical Techniques		1	2	-	2
GeCh3206	Ore Mineralogy		1	2	-	2
Fourth Level						
Chemistry Elective courses						
Chm 4232	Water and WSpaewater Treatment	Chm 2105- Chm 4103	2			2
Chm 4121	Electroanalytical Methods of Analysis	Chm 2202 Chm 2218	2			2
Chm 4123	Industrial Organic Chemistry	Chm 2212	2			2
Chm 4238	Petrochemicals	Chm 4216	2			2
Chm 4240	Chemistry of Dyes	Chm 3210 Chm 2212	2			2
Geology Elective courses						
Geo3210	Environmental Geology		1	2	-	2
Geo4105	Subsurface Geology		1	2	-	2
Geo4109	Mining Geology		1	2	-	2
Geo4111	Principles of Well logging		1	2	-	2
Geo4115	Paleoecology		1	2	-	2
Geo4119	Geoarcheology		1	2	-	2
Geo4210	Isotope Geology		1	2	-	2
Geo4214	Petroleum Geochemistry		1	2	-	2
Geo4216	Hydrogeochemistry		1	2	-	2
Geo4218	Geochemical Exploration		1	2	-	2
GeCh4103	Principles of Economic Geology		1	2	-	2
GeCh4204	Principles of Geographic Information System (GIS)		1	2	-	2
GeCh4206	Recent Sediments		1	2	-	2

رابعا: المحتوى العلمى للمقررات الدراسية

Course Description

جامعة حلوان
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المحتوى العلمى للمقررات الدراسية لقسم الرياضيات

Course Description for Mathematics Department

Helwan University

Mathematics Program Courses Contents

Compulsory Mathematics Courses

Mat1101 General Mathematics I (Calculus I)
Limits, continuity and Differentiation: (Basic ideas; tangent of curve; the product and quotient rule; the chain rule); higher derivatives. Derivatives of trigonometric functions and their inverse- Derivatives of the log function and in function; the exponential function- Derivatives of hyperbolic functions and their inverse and Applications of Differentiation (normal and Tangent lines- Lopital' s Rule- Extreme - Maclaurin and Taylor expansion. Integration and Techniques of Integration: Integration by substitution-Integration of trigonometric and hyperbolic functions - Definite integral- Application of definite integral(Area- volume-Length of arc- Surface Area).

Mat1103 General Mathematics II (Introduction to Algebra)
Sets, famous sets, set operations, subsets, families of sets, power set, Union and intersection, relations, binary relation, equivalence relations, Well Ordered Sets, functions, composition. The theory of equations: Polynomials-algebraic operations on polynomials- long division on polynomials- Synthetic division- The Remainder Theorem-Relations between roots and coefficients-transforming equations – Reciprocal equations – Solution of third and fourthdegree equations. Matrices and the algebra of matrices, determinants and its applications. The binomial theorem. Sum of some particular finite and infinite convergence series.

Mat1202 General Mathematics III (Calculus II)
Indefinite integral- Definite integral- Integration by substitution- Integration by parts-Trigonometric substitutions- Integration rational functions by partial fractions- Integration of trigonometric functions with integer powers-Integration of rational functions of sine and cosine. Applications of integration: Areas between curves and arc length- Using tables of Integrals-Improper integrals- Numerical Integrations: Trapezoid and Simpson's rule.

Mat1204 General Mathematics IV (Mechanics I)
Vectors algebra- Force, classification of forces, moment of a force, principle of moments, moment of a force about a specified axis, moment of a couple, equivalent system of forces-Equilibrium in two dimensions-Support reactions-Equilibrium in three dimension - Support reactions-Internal forces-Friction- Shearing force and bending moments-Trusses.

Mat2105 Analytic Geometry

The equation of the straight line, equations of Bisectors of the Angle between Two Lines, Pair of Straight Lines, equation of a circle, equation of the tangent at a point to the Circle, equation of a Parabola -Length of Latus Rectum- Different Forms of Parabola, Ellipse, Standard Equation - Standard Equation of an Ellipse, Hyperbola: Standard Equation- Important Property of Hyperbola- Equation of Hyperbola in Parametric Form -Polar Coordinates, Relation between Cartesian Coordinates and Polar Coordinates.

Mat2107 Calculus III

Theory of functions of several variables: limits, continuity, differentiability, Inverse Function Theorem, and extrema of functions of several variables with applications. Directional derivatives and the gradient - Normal lines and tangent planes - Lagrange multipliers. Multiple Integrals- Double integrals in different spaces and their application -Triple integrals in different spaces and their applications – Transformation of coordinates – Change of variables in multiple -Line integrals and applications.

Mat2109 Linear Algebra I

Solving linear system of equations, elementary row operations on a matrix - Gauss elimination method, echelon forms and reduced row echelon Form , Euclidean vector spaces, real vector spaces, examples of vector spaces, properties of vector operations in *n*-Space, linear combination of vectors, determining linear independence/dependence, linear independence of functions, Basis and dimension, linear transformations, Subspaces, spanning, uniqueness of basis representation, standard basis, finite and infinite dimensional spaces.Eigenvalues and eigenvectors, diagonalization, and inner product.

Mat2111 Mechanics II

Kinematics of a Particle

Rectilinear motion-General curvilinear motion, cartesian, polar, and intrinsic coordinates-Motion of a projectile-Relative motion of two particles-Simple harmonic motion.

Kinetics of a Particle

Newton's second law of motion, equation of motion in cartesian, polar, and intrinsic coordinates Central force motion and the work of a force, principle of work and energy-Conservative forces and potential energy, conservation of energy-Principle of linear momentum and impulse, impact, angular

momentum-Relation between moment of a force and angular momentum, principle of angular momentum and impulse, motion of a variable mass.

Mat2206 Abstract Algebra

Binary operation, group, semigroup, monoid, examples of groups, permutations, The symmetric groups, subgroups, cyclic groups, cyclic subgroups, cosets and Lagrange's Theorem, groups of cosets, direct products of groups, Homomorphisms and factor groups, group isomorphisms, the isomorphism Theorem for groups.

Mat2208 Ordinary Differential Equations

First order differential equations: Concept of ordinary differential equations – Classifications and terminology-Techniques of solution of the first-order linear differential equations: Separable, homogeneous, reducible to homogeneous, linear, Bernoulli, exact and non-exact differential equations, and Riccati differential equation-Applications-Higher order differential equations: Reduction of order, differential equations with constant coefficients- Second order, linear equation- Euler's equation-Laplace transformations, solutions of differential equations by Laplace transform-Series solutions of the second order linear differential equations-Power series, series solutions about an ordinary point- Equal roots of indicial equation and roots differing by an integer- Introduction to systems of the first order differential equation with different techniques of solution- Solutions of the systems of two linear first-order differential equations by using Laplace transform.

Mat2210 Mechanics III

Center of mass: the definition, center of mass of a body, centroid of a volume, centroid of an area, centroid of a line, composite shapes, resultant of a general distributed loading.

Moments of inertia: Definition of moments of inertia for areas, parallel-axis theorem for an area, radius of Gyration of an area, moments of inertia for composite areas, product of inertia for an area, rotated and principal axes, moments of inertia for an area about inclined axes, Mohr's circle for moments of inertia, mass moment of inertia- Virtual work-Equilibrium of heavy chain, cables and bridges- Catenary, parabolic.

Mat2212 Vector Calculus

Vector fields- Line Integrals - Directional derivatives and the gradient - Normal lines and tangent planes – Green's Theorem –Independent of path and conservatives vector fields – Curl and Divergence- Surface integrals – The divergence Theorem –Applications.

Mat3103 Numerical Methods
Error and Mistakes: Sources of error, error definitions- absolute and relative error round-off error-truncation errors. Solution of equations in one Variable: Bracketing Methods-Bisection & false position Methods. Open Methods-Simple fixed-point iteration-Newton's Method Secant Method. Interpolation and Polynomial Approximation. Some techniques of numerical differentiation and numerical Integration. Numerical Solution to Initial value problems for ordinary differential equations: Euler & Modified Euler's Methods-Taylor's series Method of order *n* - Runge-Kutta Methods.

Mat3113 Mathematical Packages I
An introduction to *Mathematica* as a general-purpose computational and visualization tool. Topics include symbolic and numerical computations, graphics and visualization, and basics of the *Mathematica* programming language. Students will use *Mathematica* in several hands-on exercises to solve typical computational problems such as: solving systems of linear equations, solving nonlinear equations, evaluating integration, obtaining finite and infinite convergence series, and solving ordinary differential equations. Integrates some aspects of statistical data analysis. Basic matrix operations and eigenvalues of a matrix.

Mat3115 Mechanics (IV)
Planar kinematics of rigid body: Planar rigid body motion, translation, rotation about a fixed Axis- Absolute motion analysis, relative motion analysis: Velocity, instantaneous center of zero velocity- Relative motion analysis: Acceleration.
Planar Kinetics of a Rigid Body: Planar kinetic equations of motion, equations of motion: Translation- Equations of motion: Rotation about a fixed axis, general plane motion, kinetic energy- The work of a force- The work of a couple moment, principle of work and energy, conservation of energy- Linear and angular momentum- Principle of impulse and momentum, Conservation of momentum- Space motion of rigid body – Euler's angles-Motion of a symmetrical top, torque free motion of rigid body.

Mat3117 Operation Research I
Introduction; Overview of Operations Research Techniques; Applications; Linear programming problem LP; the canonical form, the standard form. Methods for solving LP; graphical solution of two variables; the simplex

method, the M- method; the two -phase method, the revised simplex method; The dual problem and post optimality analysis. The transportation problem TP; Definition of the TP model; Determination of the Starting Solution; North West Method; LeSpa Cost Method; Vogel's Method.

Mat3119 Real Analysis

Topics include a review of sequences and continuity, differentiability, Taylor's theorem, integration, the fundamental theorem of Calculus, point-wise and uniform convergence, and power series.Cauchy sequences, bounded sequences, monotone sequences, convergence of sequences and series; limit, continuity and differentiation;limsup, liminf, definition of big O and little o notation. Riemann integral; sequences and series of functions, uniformity, and the interchange of limit operations. Basic topology: compactness, metric spaces, open, closed, and bounded sets, connectedness and completeness. Different tests of convergence, absolute and conditional convergence, power series and radius of convergence. De Morgan and Gauss - Series of functions and uniform convergence, Virstrass, Dirchlet tests - Infinite product of series - Fourier series, sin, cos series.

Mat3214 Analytical Mechanics

Generalized coordinates, velocity, and force- Degrees of freedom - Holonomic and non-holonomic system -The Lagrange equations of the holonomic system — cyclic coordinates - The Lagrange equations for Conservative system of forces- Hamilton's canonical equations of motion – conservation of energy - Hamilton equations from Lagrange's equations of motion– Poisson's brackets- Canonical transformations - Hamilton – Jacobi equation-Action - angle variables-Small oscillations - Normal coordinates.

Mat3216 Numerical Analysis I

Error and Mistakes: Sources of error, error definitions- absolute and relative error round-off error-truncation errors. Solution of equations in one Variable: Bracketing Methods-Bisection & false position Methods. Open Methods-Simple fixed-point iteration-Newton's Method Secant Method. Interpolation and Polynomial Approximation: Finite difference -Newton's Interpolation formulas- Divided Differences - Lagrange Interpolation formula. Numerical Differentiation Numerical Integration: Newton Cotes Methods-Trapezoidal & Simpson's Rule Romberg integration. Numerical Solution to Initial value problems for ordinary differential equations: Euler & Modified Euler's Methods-Taylor's series Method of order n - Runge-Kutta Methods.

Mat3218 Partial Differential Equations

Introduction to Partial differential equations: order, homogenous and non-homogenous, degree, linear and nonlinear. Heat equation, Wave equation and Laplace's equation in both one and higher dimensions. Separation of variables, boundary value problems, Fourier series. Fourier and Laplace transform techniques. Applications.

Mat3220 Topology I

Topological spaces (Definitions, Accumulation on points, Closed sets, Closure of set, Interior, exterior and boundary sets, Neighborhoods and neighborhood systems, Subspaces and relative of topologies-Bases and Subbases - Topology generated by graph - Separation axioms (**(**T_0-space, T_1-space, T_2-space and study their properties)- Applications.

Mat4121 Complex Functions

Complex functions: limits, continuity, and the derivative- Analytic functions: Cauchy Riemann equations- Harmonic functions- Elementary analytic functions- Integration in the complex plane: complex line integrals- Cauchy integral theorem- Cauchy integral formula- Taylor and Laurent series- Singularities and the Residue theorem- Some applications of the Residue theorem- Z transform - Inverse Z transform.

Mat4123 Fluid Mechanics I

Kinematics of fluid: Basic concepts (fluid particle, density, pressure, ideal fluid, incompressible fluid, steady flow)- Eulerian and Lagrangiandescriptions, stream lines, path lines- The continuity equation- Potential flow, complex potential, two dimensional flow, stream function- Source,sink, dipole, equation of motion of viscous incompressible fluid (Navier- Stokes equation)- Euler's equation- Bernoulli's equation- Applications, Couette flow and Poiseuille flow.

Mat4125 Measure theory

Outer measure and Lebesgue measure in R^n- On the cardinality of infinite sets. Countable sets-Lebesgue coverings -Outer measure in R^n -Measurable subsets of R^n -Fundamental properties of the Lebesgue measure and of measurable sets- Limit theorems for "nested" sequences of measurable sets- Measurable functions and the Lebesgueintegral- The Riemann integral. The Lebesgue integral for simple functions -The Lebesgue integral for limited functions with a domain of finite measure -The Lebesgue integral for non-

negative measurable functions -Summable functions oand the general Lebesgue integral - Applications.

Mat4127 Special Functions

Improper integral: comparison tests, absolute and conditional convergence. Gamma and Beta functions: Definitions, properties of the gamma and beta functions, relationship between gamma and beta functions, different formulas, and applications. Legendre polynomials and functions: Legendre's equation and its solution, generating function, orthogonality properties, recurrence relations. Bessel functions: Bessel's equation and its solutions; generating function, integral representations for Bessel functions, recurrence relations. Hermite polynomials, Laguerre polynomials. Hypergeometric functions, other special functions: Hankel and Numman functions-Applications.

Mat4222 Differential geometry

Tangent vector. Tangent bundle. Curves. Curvature and torsion. Frenet's equations. Surfaces. The fundamental forms. Curvature. TheoremaEgregium. Vector fields and covariant derivative. Geodetic curves. Two-dimensional Riemannian geometry. Briefly about the global theory of surfaces, *n*-dimensional Riemannian theory, space-time and Einstein's equations.

Mat4224 Functional Analysis

Metric space –limits in matric space-Cauchy sequence- Complete metric space – Separable spaces –Contraction Mapping Fixed Point Theorem-Compactness in metric space - Normed space and Banach space – Riesz Theorem – Linear operators and functionals in normed spaces– Bounded linear transformations and functionals– Finite-dimensional normed spaces – Hahn Banach Theorem – Hilbert space - Orthogonality in Hilbert spaces – Self adjoint and non self adjointoperators – Inner product and Hilbert spaces-Examples and applications.

Mat4226 Integral Equations

Volterra Integral Equations of the 2nd kinds - Resolvent kernel – Solve the integral equation of convolution type by using of Laplace transformation –Integro-differential equations – Volterra integral Equations of the 1st kind – Euler Integrals – Abel's problem and its generalization – Fredholm integral Equations of the 2nd kind – Methods of Fredholm determinants – Fredholm Iterated kernel- resolvent kernel – Degenerate kernels – Approximate methods of solution – application.

Mat4228 Quantum Mechanics

Concepts of quantum mechanics- particle aspect of radiation - de Broglie's hypothesis- wave and particle duality- Heisenberg's uncertainty principle – Dirac notation - operators - eigenvalues and eigenvectors of an operator- the basic postulates of quantum mechanics- expectation values- Schrödinger equation and wave packets- properties of one-dimensional motion- the potential barrier and well- orbital angular momentum- spin angular momentum- eigenfunctions of orbital angular momentum.

Elective Mathematics Courses

Mat2151 History and Philosophy of Mathematics

The historical development of mathematics and certain mathematical concepts from ancient times to the present, with emphasis given to basic and intermediate mathematics concepts to introduce students to basic ideas in the philosophy of mathematics. The focus of this mathematics-driven course will be on the problems mathematicians have faced, and the theory and methodology that were developed to resolve these problems. Topics include: Numbers and their representations; History of place notation and the zero. The development of geometry; The development of algebra; The history of solving equations; The flowering of different branches of mathematics; The history of mathematics outside of western culture; Mathematical superstars (Newton, Archimedes, Euler, etc.)

Mat2153 Logic and Set Theory

Propositional Logic, symbolic logic, propositions, propositional forms, valuations and truth tables**,** Proof methods, languages, Syntactics, **sets,** rosters, famous sets, set operations, subsets, families of sets, power set, Union and Intersection, disjoint and pairwise disjoint, **relations,** equivalence Relations, equivalence Classes, Partitions, Partial Orders, Bounds, Comparable and Compatible Elements, Well Ordered Sets, **Functions,** composition, restrictions and extensions, injections and surjections, bijections.

Mat2252 Discrete Mathematics

Sets Theory and Functions: Sequences; Function Growth; Complexity; Integers; Summation; Product; Primes, Mathematical Induction and methods of proof, Mathematical Logic, Binary Relations, Recurrence Relations, The Binomial Theorem; Counting, Permutations and Combinations, Graph Theory.

Mat2254 Linear Algebra II

Rank, elementary operations and rank, null space and nullity of a matrix, row space, column space, Bases for row spaces, elementary matrices, rank factorization, LU-Decomposition, Inner Product Spaces, Properties of Inner Products, Eigen values and Eigen vectors, Application of Cayley, Hamilton Theorem, Properties of Eigen Values, Diagonalizability andTriangularizability, Diagonalization of Symmetric Matrices.

Mat2256 Solid Geometry

Three dimension, rectangular coordinate axes, spherical coordinate system, cylindrical coordinate system, plane, General Equation of a Plane, plane passing through the intersection of two given Planes, equations of a Straight Line determined by a Pair of Planes in Symmetrical Form, Sphere, the equation of the sphere , definition of Cone, Equation of a Cone with a Given Vertex and a Given Guiding Curve, Right Circular Cone, Tangent Plane, Reciprocal Cone, Cylinder, Definition, Equation of a Cylinder with a Given Generator and a Given Guiding Curve, Equation of a Cone with its Vertex at the Origin.

Mat3155 Mathematical Biology

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.

Mat3157 Electrostatics

Coulomb's law and Electric field intensity - Electric flux density, Gauss's law, and divergence - Energy and electric potential – Electric dipole- Conductors and dielectrics – Displacement vector- Field inside dielectric- Boundary conditions on a separating surface between two media - Poisson's equivalent distribution- Current and current density- Solution of Laplace equation for electric potential in different coordinate systems (Cartesian, spherical and cylindrical)- Capacitance : Parallel plate capacitor – Several capacitance examples.

Mat3159 Space Dynamics

Orbital mechanics: Central forces and trajectories- Kepler's laws- Applications-Space Maneuvers: impulsive motion- Hohmann transfer – Applications-Orbital position as a function of time, mean anomaly- Eccentric

anomaly- Solution of Kepler's equation-Ballistic trajectories-Rocket motion,vertical and horizontal motion of a rocket.

Mat3161 Classical Thermodynamics

Temperature and the zeroth law of thermodynamics-heat and internal energy - Specific heat -work and heat in thermodynamic processes- The first law of thermodynamics- Thermal processes - Adiabatic processes for an ideal gas-reversible and irreversible processes- Heat engines and the second law of thermodynamics- Heat pumps and refrigerators- The Carnot engine – Gasoline and diesel engines- Entropy - Changes in entropy for thermodynamic systems -Entropy and the second law.

Mat3163 ElSpaicity Theory

Transformation of coordinates- Cartesian tensors-Definitions of the continuum mechanics-The theory of stresses, equilibrium equations, the principal stresses-The theory of small strain-Generalized Hooks law-The internal elSpaic energy- Stress-strain relation-Equation of motion.

Mat3258 Electrodynamics

Coulomb's law and the first Maxwell equation - Charge conservation and Continuity equation - Absence of magnetic charges in nature and the second Maxwell equation - Faraday's law and the third Maxwell equation - Laplace's laws and the steady fourth Maxwell equation - Displacement current and the fourth Maxwell equation - Maxwell equations in vacuum - Maxwell equations in matter - Electrodynamic potentials and gauge transformations - Electromagnetic waves - The potential of the electric dipole - Interaction of the dipole with an electric field - Multipole expansion for the potential of a distribution of point charges - Properties of the electric dipole moment - The quadrupole tensor - Relativistic transformation of E and B fields - From charge invariance to the 4-current density - Electric current in a wire and a charged particle in motion - Transformation of the E and B fields - The total charge in different frames - Relativistic covariance of electrodynamics -Electrodynamics and special theory of relativity - 4-Vectors, covariant and contravariant components - Relativistic covariance of the electrodynamics - 4-Vector potential and the equations of electrodynamics - The continuity equation - The electromagnetic tensor - Lorentz transformation for electric and magnetic fields - Maxwell equations inhomogeneous equations and homogeneous equations - Potential equations.

Mat3260 Graph Theory

Definitions and examples on graph, operation on graphs, paths and cycles, connectivity, Eulerian graph, Hamiltonian graphs, Trees, properties of trees, counting trees, applications of trees, planarity, planar graphs, Euler formula, dual graphs, coloring graphs, coloring vertices, coloring edges.

Mat3262 Insurance Mathematics

The course provides basics of actuarial methods and also derive the most common types of insurance products in the life and pension insurance. Mathematical apparatus and its use in insurance: Simple and compound interest, discounting, premium calculations with mortality tables, probability of mortality, life insurance benefit, annuities, loan redemption, netto premium in life and pension insurance, basic principles of personal insurance, more general formulation of the role of insurance, gross premiums and insurance reserve in life insurance.

Mat3264 Number Theory

Fundamentals: The division algorithm, The Euclidean algorithm, Diophantine equations, The Chinese Remainder Theorem. Prime numbers and their Distribution: The infinitude of primes, The fundamental theorem of arithmetic and unique factorization domains (viz "algebraic number theory"), Dirichlet's theorem. Theory of Congruencies: Congruence, Linear congruencies, Modular arithmetic and multiplicative inverses, Fermat's Factorization, Fermat's little theorem. Wilson's theorem. Euler's generalization of Fermat's Theorem, Euler's phi-unction. Euler's theorem. Primitive roots, order and indices Primitive Roots of Primes, Composite Numbers Having Primitive Roots, The Theory of Indices. Number Theoretic Functions, Multiplicative Functions, The Mobius Inversion Formula. Continued Fractions: introduction-Solving Diophantine equations using continued Fractions.

Mat3266 Ring Theory

Ring, division ring, commutative ring, domain and integral domain, zero divisors elements, unites elements, idempotent elements, nilpotent elements, subrings and ideals, prime and maximal ideals, nil ideals and nilpotent ideals, factor rings, homomorphism and isomorphism of rings , isomorphism theorems ,fields and subfields, extension of an integral domain to a field, the polynomials Ring, prime and irreducible polynomials. Module: definition and examples.

Mat4165 General Relativity

Newton's theory off gravitation- the metric tensor and physical law-Riemannian space-the covariant and contravariant derivatives-applications of tensor analysis-Einstein's field equation for a metric distribution- Poisson's equations as a first approximation of Einstein's field equations- Gravity as a metric phenomenon-Solutions of the field equation-relativistic cosmology.

Mat3167 Integral Transforms

The course is designed as an introduction to the theory and applications of integral transforms to problems in linear differential equations, and to boundary and initial value problems in partial differential equations. This course aims at introducing some of the commonly used integral transforms like Laplace, Fourier and Hankel. While the properties of these as well as of some other transforms will be discussed in detail, their usefulness will be demonstrated as an effective tool in solving real world problems.Some applications in applied mathematics, physics, chemistry, biology and/ or engineering are included.

Mat3269 Mathematics for Science

This course is designed to develop a basic competence in many areas of mathematics needed for junior/senior level work in the sciences. Topics involve, basic methods of power series, complex numbers, Fourier analysis, linear algebra, ordinary and partial differential equations and vector calculus, covered clearly and carefully but without detailed proofs. Symbolic computation and scientific visualization tools used as appropriate.

Mat4171 Mathematical Modeling

This course is an introduction to mathematical modeling using graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. Emphasis is on the use of elementary functions to investigate and analyze applied problems and questions, supported by the use of appropriate technology, and on effective communication of quantitative concepts and results.

Mat4173 Mathematical Packages II

Basic syntax and the notebook interface, calculus and linear algebra operations, numerical and symbolic solution of algebraic, differential equations, partial differential equations, and manipulation of lists and expressions, Mathematica programming (rule-based, functional, and procedural) and debugging, plotting, and visualization, multivariate calculus

and multiple integrals. The course will also emphasize good programming habits and choosing the appropriate language/software for a given scientific task. Topics may also include solving a wide variety of problems related to linear programming, nonlinear optimization, numerical methods, group theory, number theory, logic and Boolean algebra, theorem proving, and real & Complex Functions.

Mat4175 Optimal Control Theory

Introduction; Optimization; Basic Concepts; and Hilbert Spaces; Minimization and Maximization problem; Differentiation and Integration in Normed Spaces; Bilinear Forms; Convex and Non-convex functional; Gateaux Derivatives; Frechet Derivatives; Applications; Optimal Control Theory; Introduction; Lagrange Multipliers to find Max and Min for a function; The Hamiltonian and the Maximum Principle; Applications; Pontryagin's Minimum Principle; Introduction; Necessary Conditions for an Optimum; Pontryagin's Minimum (Maximum)-Principle; Optimal control with equality Constrains; Bang-Bang; Optimal Control-Problems; Computational Methods for optimal control problem; Introduction; Steepest - Decent method; Gradient and Conjugate gradient; Method; Quasi Newton's Method; Applications.

Mat4268 Fluid Mechanics II

Boundary layer theory-Derivation of the energy equation-Similarity transformation-Flow through porous medium-Bio fluid mechanics and its applications-Numerical solutions for simple fluid flow problems.

Mat4270 Field Theory

Lagrangian and Hamiltonian formalisms- Neother's theorem in field theory-Hamiltonian formalism in field theory- Laplace and Poisson equations -The Green theorems -Laws of magnetostatics-magnetic (dipole) moment-relativistic particle in electromagnetic field- Lorentz transformations of the electromagnetic field- Maxwell's equations and gauge invariance-Fields of uniformly moving charge-Dipole radiation.

Mat4272 Financial Mathematics

Preliminaries of finance and risk management- basic financial derivatives - Optimization in finance -No- dominance principle and model- independent arbitrage- Modeling financial assets in discrete- time markets. Arrow-Debreu market model -Multiperiod discrete- time markets Binomial model. Modeling financial assets in continuous-time. Trading and arbitrage in

continuous- time markets. Bachelier's continuous- time markets. Continuous-time market of Black- Scholes.

Mat4274 Numerical Analysis II

Numerical Integration: Gauss quadrature formulas numerical solution to initial value problems for ordinary differential equations: Multi-step method one dimensional unconstrained. Optimization: golden-section search quadratic interpolation - Newton's method curve fitting: LeSpa-squares regression line-polynomial regression-Linearization of nonlinear relationships-continuous leSpa-squares approximation-Numerical solutions to boundary value problems for partial differential equations: Methods for elliptic, parabolic, and hyperbolic partial differential equations. Solving linear system of equations by iterations: Jacobi and Gauss-Seidal iterations-Convergence for iteration techniques.

Mat4276 Operation Research II

Integer Programming; Applications; Solution Methods; Cutting-Plane Algorithm; Branch and Bound Method; Zero-One Implicit Enumeration Method; Introduction to nonlinear programming NLP ; Convex and concave functions; Solving nonlinear programming problem with one variable; Unconstrained maximization and minimization NLP with several variables; Quadratic Programming and The Kuhn-Tucker Optimality Conditions; Dynamic Programming; Introduction and Definitions; Examples; Applications; Game theory.

Mat4278 Topology II

Topological metric spaces and Separation axioms -Continuity and Topological Equivalence(Continuous functions, Equivalent definition of continuous functions, Open and closed functions, Topological properties)-Separation axioms **(**Regular space– Normal spaceand study their properties)-Compactness and connectedness -Topologies generated by relations -Pretopological concepts -Applications.

Mat4080 Selected Topics in Mathematics

The content of the course differs from time to time. *Topics selected* by instructor, such as fractional calculus or any other recent topics not included in this academic program.

Description of Statistical Courses
Compulsory Statistical Courses

Sta1208 Introduction to Statistics
Basic concepts of statistics. Descriptive statistics: Measures of central tendency, measures of dispersion. Elementary probability, normal distribution, sampling distribution of the sample mean, the Central Limit Theorem. Confidence intervals and testing hypothesis for one population mean. General applications.

Sta2101 Probability Theory
Random experiments, sample space, random events, types of events. Kolmogorov axiomatic probability, some basic probability theorems, methods of enumeration, independent events, conditional probability, total law of probability, and Bayes theorem. Random variables, expectation, moments, moment generating function, and characteristic function. Some discreate and continuous distributions, including, Bernoulli, binomial, geometric, negative binomial, Poisson, uniform, exponential, gamma, Weibull, and normal distributions. Using computer software to explain basic properties of probability distributions.

Sta2103 Statistical Methods
Techniques for organizing data, computing and interpreting measures of central tendency, variability, and association. Estimation, confidence intervals, tests of Statistical hypotheses, t-test, correlation, and regression. Computer Statistical packages such as Minitab, SPSS, or R.

Sta2202 Mathematical Statistics
Bivariate and multivariate distributions, independent random variables, conditional distributions, conditional expectation,conditional variance,covariance, and correlation. Moment generating function of bivariate distributions,bivariate normal distributions. Sum of independent random variables from specific distributions with moment generating function technique. Functions of random variables: Different techniques. Chi-square distribution, T- distribution, and F- distribution. Sampling distribution theory. Large sample theory and the Central Limit Theorem.

Sta 2204 StochSpaic Processes
Introduction to stochSpaic processes, description and definition, types of stochSpaic processes. Probabilistic description of stochSpaic processes,

properties of stochSpaic processes. Discrete and continuous time Markov chains, recurrence and transience of Markov chains. Introduction and basic concepts of simple random walk, Bernoulli and Binomial process. StochSpaic approximation of Poisson process. The general birth process, the general death process, Birth-Death process, branching process.

Sta3205 Statistical Inference

Modern Statistical concepts and procedures forsampling distribution theory. Point estimation including, maximum likelihood estimation, method ofmoments,and an introduction to Bayesian estimation. Properties of good estimators, unbiased, consistent, complete,and sufficient Statistics. Interval estimation, Tests of Statistical hypotheses,principles and definitions, the null and alternative hypotheses, types of errors, the power of a test,testing of hypothesis about: Population mean, proportion, andthe variance. Hypothesis testing about two independent samplesand paired samples. Neyman-Pearson Theorem.

Sta3107 Time Series Analysis

Principles and definitions; basic concepts, types of Stationarity, and the components of time series. Trend fitting, autoregressive and moving average. Estimation of autocorrelation function and its properties. Linear models, Stationarity and inevitability, autoregressive linear models, Yule-walker estimation, order of autoregressive model. Moving Average models, autoregressive moving average models. Non stationary time series models, difference operator, ARIMA models, explicit forms of ARIMA, properties of spectral density, spectral densities of ARMA models, periodogram.

Sta3206 Order Statistics

Basic distribution theory of order Statistics, distribution of single order Statistics, joint distribution of two order statistics or more, some properties of order statistics, distribution of the median and the range. Single and product moments of order statistics and some recurrence relations. Order statistics from some specific distributions, including the uniform and exponential distributions. Order Statistics in statistical inference, type I and type II censoring samples, maximum likelihood estimation for type I and type II censoring samples with special emphasis for the exponential distribution. Basic asymptotic theory, exponential order statistics, sample minimum, maximum, and other extreme order statistics.

Helwan University

Sta3208 Regression Analysis

Modeling and interpretation of observational and experimental data using linear and nonlinear regression methods. Model building and selection methods. Descriptions: Linear regression with one independentvariable:Relations between variables, regression models and their uses, regression model with distribution of error terms unspecified, estimation of regression function, estimation of error terms variance. Inferences in regression analysis: Inferences concerning $\beta_0$and β_1. Some considerations on making inferences concerning $\beta_0$and β_1,Interval estimation and prediction of new observation. Applications for real data.

Sta4109 Nonparametric Statistics

Basic concepts of nonparametric statistics, nonparametric versus parametric tests**.** Statistical tests based on the binomial distribution, the sign test, tests about categorical data, tests about single median, the sign test of paired samples and independent samples. Rank test for two independent samples (Mann – Whitney),Wilcoxon signed rank test. Rank test for three or more independent samples (Kruskal–Wallis test by ranks)- Test based on runs-Measures of rank correlations. Chi-square goodness of fit tests. Empirical distribution function (definition and properties) and confidence intervals and confidence bands of the distribution function. Tests of the Kolmogorov-Smirnov type (the Kolmogorov goodness of fit tests, Goodness of fit tests for families of continuous distributions).

Sta4111 Statistical Packages

Methods of data description and analysis using R or (Minitab, SPSS, or SAS): Descriptive Statistics, graphical presentation, estimation, hypothesis testing, nonparametric tests, regression and correlation, sample size, power, emphasis on learning Statistical methods and concepts through hands-on experience with real data.

Sta4210 Experimental Design

This course provides knowledge about experimental designs and analysis of data obtained from experiments, from the theory and applications point of view. Detailed discussion for the necessary and sufficient conditions, in order to perform analysis of variance (ANOVA).Analysis of variance, one way ANOVA, two way ANOVA, randomized block designs, Latin-square designs, linear mixed models, split-plot designs, response surface methodology, mixture models and 2^kfactorial design of experiments. Applications to experimental real data.

Sta4212 Reliability Theory

This course is an introductory course in reliability theory. In this course, the four basic measures of reliability theory, are discussed in general for any probability distribution, and in details for important parametric lifetime distributions, for single components, dependent and independent different systems. System maintainability and availability, repair and downtime distributions, maintainability and availability definitions and calculation, system-level availability. The course also contains, some Statistical inference methods from incomplete data.

Elective Statistical Courses

Sta2252 Demography

This course introduces the basic techniques of demographic analysis. Students will become familiar with the sources of data available for demographic research. Population composition and change measures will be presented. Measures of mortality, fertility, marriage and migration levels and patterns will be definedand how these measures influence population growth, composition, and structure. Students should explore the relationship between population and issues such as urbanization, family change, population aging and health, economic growth, and the environment.Life table, Standardization and population projection techniques will also be explored.

Sta2254 Distribution Theory

Basic concepts on random variables, cumulative distribution function and its properties. Introduction to continuous and discrete distributions, Deriving the moments, generating functions, and moment-generating functions for some discrete and continuous distributions. Functions of one and several random variables are considered such as sums, differences, products and ratios. The central limit theorem is proved and the probability density functions are derived of those sampling distributions linked to the normal distribution. Bivariate and multivariate distributions are considered, and distributions of maximum and minimum observations are derived.Explore and explain properties of probability distributions using suitable computer software.

Sta3151 Statistical Computing

An introduction to *Mathematica* as a general-purpose computational and visualization tool. Topics include symbolic and numerical computations,

graphics and visualization, and basics of the *Mathematica* programming language. Students will use *Mathematica* in several hands-on exercises to solve typical computational problems such as: solving systems of linear equations, solving nonlinear equations, and evaluating integration. Integrates many aspects of Statistical data analysis, from getting and exploring data to building high-quality models and deducing consequences. Basic processing of data, including computing Statistical quantities, smoothing, testing, and visualizing. Topics will include optimization of functions, maximization of likelihoods, and exploring properties of probability distributions.

Sta3153 Sampling Theory

This course discusses methods that facilitate the design, collection and assessment of data from sample surveys. After introducing basic sampling terminology and questionnaire design, we will focus on probability sampling from finite populations, and on computing the sampling distribution of sample estimators. We will then move onto specific sampling designs such as: simple random sampling, stratified sampling, and cluster sampling. For each sampling design, we will estimate Standard quantities such as totals, means, proportions, and ratios, along with their corresponding variances, and how to do sample size calculations.

Sta3256 Biostatistics

Statistical concepts and methods for the biological sciences: descriptive statistics, elementary probability, sampling distributions, confidence intervals, parametric and nonparametric methods, one-way ANOVA, correlation and regression, categorical data. Using suitable statistical software package.

Sta3258 Queuing Theory

Some terminology of queuing theory, Description of the queuing systems, Arrival and service processes, Measures of effectiveness, Birth-Death process, Poisson process, Simple Markovian Queue M/M/1 and M/M/C, Truncated simple Markovian Queue M/M/1/K, Infinite channel with infinite queue M/M/∞, Queues with blocking M/M/C/C, M/M/1 queue with additional servant for longer queue, M/M/1 with State dependent**.**

Sta4155 Bayesian Statistics

Bayesian Statistical analysis, with focus on applications, Bayesian and frequentist methods compared, Bayesian model specification, choice of

priors, computational methods including Markov Chain Monte Carlo methods, will progressively be introduced as motivated by the models discussed, hands-on Bayesian data analysis using appropriate software, interpretation and presentation of analysis results.

Sta4157 Economics

Economics introduces you the regression methods for analyzing data in economics. This course emphasizes both the theoretical and the practical aspects of Statistical analysis, focusing on techniques for estimating econometric models of various kinds and for conducting tests of hypotheses of interest to economists. The goal is to help you develop a solid theoretical background in introductory level econometrics, the ability to implement the techniques and to critique empirical studies in economics.

Sta4159 Statistical Methods in Finance

Regression analysis and applications to investment models. Principal components and multivariate analysis. Likelihood inference and Bayesian methods. Financial time series. Estimation and modeling of volatilities. Statistical methods for portfolio management. Gain hands-on experience with financial data and learn about regression analysis and its applications to the capital asset pricing model and multifactor pricing models. Learn how to improve investment outcomes for yourself and/or clients.

Sta4262 Simulation

Simulation studies are computer experiments that involve creating data by pseudo-random sampling. Statistical analysis of realworld systems and models will typically require computer-intensive methods. The course Starts with a study of modern Monte Carlo methods, including Markov chain Monte Carlo, and variance reduction methods. Such methods are useful within Statistical analysis and simulation-based inference like bootstrapping and Monte Carlo tests. Maximization of likelihoods is another important numerical problem.

Sta4264 Introduction to Bootstrap

The bootstrap is a computer-based method for assigning measures of accuracy to Statistical estimates. By substituting computation in place of mathematicalformulas, it permits the Statistical analysis of complicated estimators. Topics: nonparametric assessment of Standard errors, biases, and

confidence intervals,related resampling methods including the jackknife, cross-validation, and permutation tests. Theory and applications.

Sta4266 Survival Analysis
This course aims to make the students aware of principles and methods for the analysis of time to-event data. This type of data occurs extensively in both observational and experimental biomedical and public health studies, as well as in industrial applications. This course discusses the Statistical methods for analyzing survival data from cohort studies. Topics include parametric and nonparametric methods, the Kaplan-Meier estimator, log-rank tests, regression models, The Cox proportional hazards model.

Sta4060 Selected Topics in Statistics
The content of the course differs from time to time. *Topics selected* by instructor, which does not included in this academic program.

Description of Computer Science Courses
Compulsory Computer Science Courses

Com1101 Introduction to Computer Science
Introduction to computer and information systems. Types of computers. Computer hardware and software components. Data representation and number systems. Introduction to networking. Introduction to internet, hardware and software components for internet access. Algorithm development, algorithm representation, stepwise refinement, problem solving tools. Introduction to specialized application areas.
Practical: Microsoft office programs (Excel, Word, and Access etc.) , Microsoft visual studio

Com1202 Introduction to Programming
Main concepts of problem solving and programming, decomposing programs into functions, nested looping. Storing data in homogenous data types using arrays and heterogeneous types (structs), multi-dimensional loops, functions and parameters, passing arguments by value and reference, the concept of pointers and dynamic data allocation, linked lists, accessing external files.
Practical: Python platform,Inputs and outputs orders, if statement, loops, functions, List, dictionary, tuples, and array.

Com2103 Database Systems

The main objective of this course is to provide students with the background to design, implement, and use database management systems. Topics Include: Evolution of database management systems, Relational Data Model and Relational Algebra, Structured Query Language, Entity Relationship Modeling and Design, ERM to RM Conversion, Tables Normalization, Forms / Reports / Menus Implementation successful completion of this course, students will have the skills to analyze business requirements and produce a viable model and implementation of a database to meet such requirements.

Practical: My SQL(Create Database and tables, inserting data, constraints , delete and update, ER diagrams, queries and nested queries, Triggers, designing Er diagrams and converting ER diagrams to scheme)

Com2105 Data Structures

In addition to the traditional representations of Abstract-Data-Types (ADT) of various data structures (such as stacks, queues, linked lists, and trees), this course presents modern implementations of the same structures using the Standard-Template-Library (STL): sets, bags, maps, pairs and iterators. Hashing and Hash Tables. On the other hand, this course presents numerous sorting and searching algorithms.

Practical: Python basics review, Stack with array and linked based implementations, Queue with array and linked based implementations, Heap, Graph and tree implementations.

Com2204 Computer Language

Objects and classes, Inheritance and Polymorphism, Abstract Classes and Interfaces, Object-Oriented Modeling, Getting Started with GUI Programming, Event-Driven Programming, Creating User Interfaces, Applets, Images and Audio, Exceptions, Simple Input and Output, Containers, Layout Managers and Borders, Menus, Toolbars, Dialog and Internal Frames.

Practical: Python(Object oriented programing), Classes, objects, inheritance concept, encapsulation, scope concept, Python standard libraries (Numpy, Pandas, and Math)

Com2206 Algorithms Analysis and Design

Algorithm concept: Analysis and complexity. Design methods, divide and conquer, binary search, merge sort, quick sort, selection, matrix

multiplication, the greedy method. Dynamic programming: shortest paths, optimal search trees. Backtracking. NP-hard and NP-complete problems.
Practical: Net framework, C# program

Com3107 Artificial Intelligence
Knowledge Representations: Predicate Calculus, Structured Representations, Network Representations. State Space Search: trees and graphs, heuristic search, model based reasoning, case-based reasoning, reasoning with uncertain or incomplete knowledge. Overview of AI languages, Overview of AI Application Areas.
Practical: Prolog , C#, Python

Com3109 Operating Systems
Types of operating systems. Operating Systems structures: system components and services, virtual machines. Process management: CPU scheduling: Scheduling concepts, performance criteria, scheduling algorithm. Memory organization and management for single user and multi-user system. Secondary storage management, Disk scheduling, virtual memory.
Practical:

1. Process control system calls: The demonstration of fork, execve and wait system calls along with zombie and orphan states.
    1. Implement the C program in which main program accepts the integers to be sorted. Main program uses the fork system call to create a new process called a child process. Parent process sorts the integers using merge sort and waits for child process using wait system call to sort the integers using quick sort. Also demonstrate zombie and orphan states.
    2. Implement the C program in which main program accepts an integer array. Main program uses the fork system call to create a new process called a child process. Parent process sorts an integer array and passes the sorted array to child process through the command line arguments of execve system call. The child process uses execve system call to load new program that uses this sorted array for performing the binary search to search the particular item in the array.
2. Thread management using pthread library.
   Implement matrix multiplication using multithreading. Application should have pthread_create, pthread_join, pthread_exit. In the program, every thread must return the value and must be collected in

pthread_join in the main function. Final sum of row-column multiplication must be done by main thread (main function).

3. Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.
4. Deadlock Avoidance Using Semaphores:
   Implement the deadlockfree solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources.
5. Inter process communication in Linux using following.
   1. Pipes : Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.
   2. FIFOs: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays on standard output.
   3. Signals : Detecting the termination of multiple child processes :
      Implement the C program to demonstrate the use of SIGCHLD signal. A parent process Creates multiple child process (minimum three child processes). Parent process should be Sleeping until it creates the number of child processes. Child processes send SIGCHLD signal to parent process to interrupt from the sleep and force the parent to call wait for the Collection of status of terminated child processes.
6. Linux Kernel configuration, compilation and rebooting from the newly compiled kernel.
   Requirements:
   a. Get a Linux kernel source code from www.kernel.org
   b. Menu based configuration of Linux kernel using menuconfig/xconfig/gconfig
   c. Creating a monolithic compressed image of a kernel
   d. Compilation of kernel modules

e. Installation of kernel modules
f. Finalize installation

7. Kernel space programming: Implement and add a loadable kernel module to Linux kernel, demonstrate using insmod, lsmod and rmmod commands. A sample kernel space program should print the "Hello World" while loading the kernel module and "Goodbye World" while unloading the kernel module.
8. Implement a new system call, add this new system call in the Linux kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of same.
9. Implementing a CPU scheduling policy in a Linux OS.

OR

Implementing a memory management policy in a Linux OS.

OR

Implementing a file system in a Linux OS

Com3208 Computer Graphics

Introduction, Concepts, Terms and Definitions, A First Graphics Program, Graphics Primitives, Data Structures and Drawing, 2D Transformations, Transformations as Matrices, Simple Animation and Interaction, Curves, 3D Graphics.

Practical:

IMPLEMENT THE EXERCISES USING C / OPENGL / JAVA

1. Implementation of Algorithms for drawing 2D Primitives –Line (DDA, Bresenham) –all slopes Circle (Midpoint) 2. 2D Geometric transformations – Translation Rotation Scaling Reflection Shear Window-Viewport
3. Composite 2D Transformations
4. Line Clipping
5. 3D Transformations - Translation, Rotation, Scaling.
6. 3D Projections –Parallel, Perspective.
7. Creating 3D Scenes.
8. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
9. 2D Animation –To create Interactive animation using any authoring tool.

Com3210 Introduction to Networks and Communications

Introduction to Networking, Networking Fundamentals, Networking Media, Cable Testing, Cabling LANs and WANs, Ethernet Fundamentals, Ethernet Technologies, Ethernet Switching, TCP/IP Protocol Suite and IP Addressing, Routing Fundamentals and Subnets, TCP/IP Transport and Application

Layers. Internet of Things, IoT applications: Industrial, Medical/Healthcare, automotive, energy, acquiring data: sensors and data collection points and cloud and fog computing.

Practical:

1. Overview of Networks and layered communications, understanding of Network equipment, wiring in details
2. CAT6 UTP EIA/TIA 568A/B straight and cross-over wiring, testing
3. Linux OS (Ubuntu/CentOS) installation, practice on basic Linux commands and Networking commands (ifconfig, tcpdump, netstat, dnsip, hostname, route...)
4. Overview of IP Addressing and sub-netting, static ip setting on Linux machine, testing
5. Introduction to Packet Tracer, creating of a LAN and connectivity test in the LAN, creation of VLAN and VLAN trunking Basic Router Configuration, Static Routing Implementation
6. Firewall Implementation, Router Access Control List (ACL)
7. Packet capture and header analysis by wire-shark (TCP,UDP,IP)
8. DNS, Web, DHCP, FTP server configuration

Com4111 Modeling and Simulation

Fundamentals of simulation as a modeling technique – Emphasis is on the value of simulation as an experimental tool to support problem solving and decision making – Concepts of building a complete simulation study through stochSpaic discrete event simulation procedures (event, activity, and process based models) – Input data analysis – Random number generation and sampling – Validation and verification – Output data analysis – Concepts of agent-based modeling (ABM) and complex systems – Agents, their internal structure, their interactions and environment – Complex adaptive systems - Implementing different simulation models using computer programming – Introduction to software tools for simulation.

Practical:

Introduction to Simulink tools

Simulink library, commonly used blocks, sinks blocks, sources blocks etc. D.C motor simulation project, and Three optional projects.

Com4113 Theory of Computation

Models of computation - classification, properties and equivalences. Regular languages models: finite state machines (deterministic and non-deterministic), regular grammars, regular expressions, equivalence of

deterministic and non-deterministic machines and of the three models. Properties: closure, decidability, minimality of automata, iteration theorems. Recursive and recursively enumerable sets models: turing machines, grammars, recursive functions, their equivalence. Church's thesis. Properties: closure, decidability, undecidablity/non-computability, notion of reductions. Context-free languages models: grammars (including different normal forms), pushdown automata, and their equivalence. Properties: closure, iteration theorems, parsing. Hard problems.
Practical: C++, C#

Com4212 Fundamentals of Information Security

Computer Security Concepts**: t**he basic concepts of confidentiality, integrity, and availability. Basic Cryptographic Concepts: Encryption and decryption of data form the basis of information security. Public-Key Encryption**:** basic cryptography concepts and look into the details of asymmetric key encryption techniques based on the concepts of a public-key. Access Control Mechanisms**: t**he access control mechanisms for user authorization. By the means of access control, appropriate authorization to information is provided to different entities in an organization. Firewalls, Intrusion Detection, and Intrusion Prevention**:** the use of security tools such as firewalls and intrusion prevention systems. Following a quick introduction to the concepts of intranet and extranet systems that are frequently used for information exchange by enterprises. Malicious Software and Software Security**:** study common software security issues such as buffer overflow, used by several malware to exploit systems' vulnerability.
Practical: Cisco routers, Packet tracer

Com4212 System Analysis and Design

Introduction to Systems Analysis and Design, Information Systems Building Blocks, Information System Development (System Development Life Cycle) (SDLC), System Analysis, structured analysis, prototyping, JAD, and OOA, Introduction to CASE tools, Rapid Application Development (RAD) Tools (Visual Basic Programming), Data Modeling (Entity Relationship Modeling) , Process Modeling, Data Flow Diagrams, functional decomposition, Object Modeling, Database Design (Data Analysis, intro to normalization) , Introduction to MS-ACCESS, Input and Output Design, User interface Design .
Practical:

1. Introduction to MS-ACCESS, Input and Output Design, User interface Design .

2. SQL
3. Mongo DB
4. Design three use cases using UML.

Elective Computer Science Courses

Com2252 Introduction to Data Science

Data science life cycle – Introduction to Machine learning – Data Gathering – Going from data to insights and Value – Data Prerpration – Model building – Model evaluation – Introduction to data analytic – Introduction to data visualization.

Practical:

Overview on python language, Numpy library, pandas Library and matplotlib library.

Com2254 Image Processing

Image enhancement – Image restoration – Image Compression – Image morphology – Image segmentation – Image transformation – Image recognition.

Practical: MATLAB (image processing toolbox), Python

Com3151 Machine Learning

Concept of Supervised learning versus Unsupervised learning – Feature extraction – Dimensionality reduction – Training and test data – Classifiers and Prediction – Overfitting and underfitting – Decision tree and classification – Bayesian classifiers – K-Nearest neighbor – Linear and Logistic regression – Support Vector Machines (SVM) – Hidden makov model (HMM) – Neural Networks – K-means clustering – Hierarchical clustering – Performance measures.

Practical:

Python overview, OpenCV library, Tensorflow framework, Numpy library, keras library and sklearn library, three milestone projects

Com3153 Computer Vision

Feature extraction for image and video – Video processing – Camera imaging geometry – Feature detection and matching – Multiview geometry including stereo – Motion estimation and tracking – Methods for depth recovery from stereo – Camera calibration – Image stabilization – Automated alignment (e.g. panoramas) – Action recognition.

Practical: Python , Open CV library,Tensor flow frame work

Com3256 Data Mining

Clustering methodologies – Algorithms and applications – Partitioning methods – Hierarchical methods – Density-based methods – Measuring Data Similarity and Dissimilarity – Data Preprocessing – Mining Frequent Patterns – Associations and Correlations – Pattern Evaluation – Outlier detection - Text Mining

Practical:

1. Rapid Miner. Rapid Miner is a data science software platform that provides an integrated environment for data preparation, machine learning, deep learning, text mining and predictive analysis. ...
2. Oracle Data Mining. ...
3. IBM SPSS Modeler. ...
4. KNIME. ...
5. Python. ...
6. Orange. ...
7. Kaggle. ...
8. Rattle

Com3258 Natural Language Processing

Introduction to natural language processing – Regular expression and finite state automata – Morphology and finite state transducer – N-gram – Word classes – Part of speech tagging – Context free grammar – Parsing – Lexical semantic, Named Entity Recognition – Information retrieval (Term Document matrix , f. Term frequency and Weight) – Word to vector – Sentence to vector.

Practical:

1. Jutpyter
2. NLP Architect
3. Flair Spacy

Com4155 Big Data Analytics

The course begins with a basic introduction to big data concept such as volume, exhaustive, resolution and indexicality, relationality, velocity, variety and flexibility. The enablers of big data, Sources of big data, directed data, automated data, volunteered data. pre-analytics, machine learning, data

mining and pattern recognition, Data visualization and visual analytics, statistical analysis, prediction, simulation and optimization. Strength and limitations of big data are discussed in depth using real-world case studies and applications.

Com4157 Introduction to Bioinformatics

Introduction to biological terminologies and the nature of biological data – Sequence Alignment Algorithms – Genome Assembly Algorithms – Genome Compression Algorithms – Gene Expression Microarray Technology – Gene Expression Microarray Datasets – Introduction to Next Generation Sequencing.

Practical:

1. Abalone
2. TINKER A molecular dynamics simulator with a complete and general package for molecular mechanics and molecular dynamics.

Com4262 Data Visualization

Analyzing, modeling, and visualizing complex high dimensional data – Fundamentals of data visualization – Forming analysis around business questions – Answering business questions through use cases – Analyzing trends – Identifying correlations – Geographical-based analysis – ForecSpaing – Generate powerful reports and dashboards that support business decision making process and take action based on business data.

Practical:

1. IBM WATSON
2. DATA WRAPER
3. FUSION CHARTS
4. ZOHO
5. QlikQ
6. INFOGRAM

Com4264 Introduction to Robotics

Theory and application of mathematical models to analyze the kinematics and dynamics of robot mechanisms or their components using vector algebra – Differential equations – Computer simulations – Robot vehicle kinematics – Robot arm kinematics – Robot dynamics with computational examples and problems.

Practical:

1. Mechanical Robotics Tools
2. Soldering Iron
3. Breadboard
4. Electronic Equipment
5. Miscellaneous Robotics Tools
6. ROBODK SIMULATOR

Com4060 Selected Topics in Computer Science

The content of the course differs from time to time. *Topics selected* by instructor, which does notincludedin this academic program.

Com40PT Practical Training

Particular emphasis is placed on the importance of practical experience and all teaching involves industry standard hardware, software, methods and techniques. Students asked to complete training on chosen area of specialization to be familiar with the industry.

Com40RP Reseach Project

This course will continue for two semesters for single programs. In the first semester, a group of students will select one of the projects proposed by the department and analyze the underlying problem. In the second semester, the design and implementation of the project will be conducted

Helwan University

المحتوى العلمى للمقررات الدراسية لقسم الفيزياء

Course Description of the academic courses for the Department of Physics

Helwan University

Physics Program Courses Contents

Phy1101 General Physics I

(A) *An introduction to classical mechanics*; Units and dimensions, Vector analysis, Motion in one dimension, Motion in two dimensions, Newton's law of motion, Momentum of inertia, Circular motion, Work and kinetic energy, Potential energy and conservation of energy, Linear, angular momentum and collisions, Vibration of rigid bodies and pendulum, Gravitational laws.

(B) *Properties of matter;* ElSpaicity: Stress – Strain – ElSpaicity and plSpaicity –Hook's law – Young's modulus of elSpaicity – Bulk modulus of elSpaicity – Shear modulus of elSpaicity. *Fluids statics and dynamics*; Viscosity: Dynamic viscosity – Kinematic viscosity – Effect of temperature on viscosity – Flow of fluids through capillary tubes (Poiseuille's Formula) – Stoke's Law Surface Tension: molecular theory of surface – Laplace theory – pressure difference across a surface film – contact angle and capillarity- Flow of fluids: Laminar and turbulent flow – Stream lines – Continuity Equation – Bernoulli's equation – Applications on Bernoulli's equation.

(C) *Heat*; Quantity of heat: Internal energy - quantity of heat – Thermal Expansion - Heat Capacity - Specific heat of gases - latent heat – thermometers – thermocouples. Heat transfer: Heat conduction (Fourier's Law – heat flow through along bar – across a planar medium – in radial direction through circular pipe). Heat Convection (convection types - Convection coefficient). Heat Radiation (absorption power – reflection power – black body – emissive power – Kirschoff's law – emissivity – Stefan law).

Phy1103 Practical Physics I

The fundamental quantities of physics are through selected experiments in mechanics, properties of matter, sound, and heat. Data are summarized, errors are estimated, reports are presented

Phy1202 General Physics II

Electric charge and Electric Field, Gauss' Law, Electric Potential, Capacitance and Dielectrics, Current, Resistance and electromotive force, DC Circuits, Magnetic Field and magnetic forces, Sources of the Magnetic Fields, Biot-Savart law, Ampere's law, Gauss's law in magnetism, Electromagnetic induction, Faraday's law, Inductance, AC circuits, Electromagnetic waves, Maxwell's equations.

Phy1204 Practical Physics II

The fundamental quantities of physics are through selected experiments in Electricity, magnetism and Geometric optics. Data are summarized, errors are estimated, and reports are presented.

Phy1105 Physics for Biology I

Physical world and measurement, Kinematics, Laws of Motion, Work, Energy, and Power, Motion of systems of particles and rigid body, Gravitation, Properties of Bulk Matter, Fluids statics and dynamics, Thermal Expansion - Heat Capacity Heat transfer, Behavior of Perfect Gas and Kinetic theory, Oscillations and wave**.**

Practical

The fundamental quantities of physics are through selected experiments in mechanics, properties of matter, and heat. Data are summarized, errors are estimated, reports are presented

Phy1206 Physics for Biology II

Electro statistics, Current Electricity, Magnetic effects of Current and Magnetism, Electromagnetic induction and alternating currents, Electromagnetic waves, Optics, Dual Nature of Matter and Radiation, Electronic Devices.

Practical

The fundamental quantities of physics are through selected experiments in Electricity, magnetism, optics, radiation, electronic circuts. Data are summarized, errors are estimated, and reports are presented

Phy2101 Physical Optics

Wave motion, Superposition and standing waves, Nature of light and laws of geometric optics, Image formation, *Interference of light:* Interference of two-beams of light (division of the wave front & division of amplitude) Interferometers (Young, Fresnel's biprism , Fresnel's double mirrors, wedge interferometer, Newton rings, Michelson interferometer, Jamin & Mach-Zehnder refractometers) Interference of multiple beams , Fabry-Perot interferometer, Applications of interferometry. *Diffraction*: Fraunhofer diffraction (single slit , two slits , multiple slits), diffraction grating, Fresnel diffraction (circular aperture & circular Obstacle). *Polarization*: polarization by absorption, reflection, refraction & double refraction, Optical active materials & polarometer, Interference of polarized light, Analysis of polarized light , *Electro-optics* (Kerr effect & Pockels effect), *Magneto-optics* (Faraday effect)

Phy2103 Thermodynamics

Thermodynamic system and processes, Internal energy, External work, First law of thermodynamics and its applications to isothermal and adiabatic changes in ideal and real gases, Specific heats of gases and their relations for ideal and real gases, Second law of thermodynamics: Reversible and irreversible processes, Efficiency of Carnot's engine and Carnot's theorem; Second law of thermodynamics, Its different formulations and their equivalence; Concept of entropy function, Change of entropy in simple reversible and irreversible processes, Thermodynamic potentials: Enthalpy, Helmholtz and Gibb's free energy, Maxwell's thermodynamic relations and its applications, Joule-Thomson effect.

Phy2105 Electromagnetic Field Theory I

Sources and effects of electromagnetic fields,Vector fields, Different cordin ate systems, Vectorcalculus, Gradient, Divergence and Curl, Divergence theo remStoke's theorem, Coulomb's Law, Electric field intensity, Field due to p oint and continuous charges, Gauss's law andapplication, Electric potential, Electric field and equipotential plots, Electric field in freespace, conduct ors, dielectric,Dielectric polarization, Dielectric strength, Electric field in mul tipledielectrics, Boundary conditions, Poisson's and Laplace's equations, Capacitance-Energy density

Phy2107 Physical Electronics I

Alternating current circuits, Impedance, Phase graphical representation, Resonance, Semiconductor devices, Semiconductor diodes, Transistor construction, Transistor characteristics, Conversion formulas, Transistor biasing, Stabilization, Transistor in active, saturation and cutoff region, Single stage transistor amplifier, Frequency response, Multistage transistor amplifier, Clipping circuit, Rectifier circuits, Electric filter, Electric net work theories, three phase circuits.

Phy2109 Practical Physics III

Some selected experiments in physical and optics and physical electronics I. Data are summarized, errors are estimated, and reports are presented.

Phy2111 Classical Mechanics I

Space time, Review of Newton's law and conservation of linear momentum in Cartesian and polar coordinate system, applications on projectile motion in a linear air resistance medium, Quadratic air resistance. Motion of charges in

a uniform magnetic field, The center of mass, angular momentum of several particles, Kinetic energy and work, Potential energy and conservative forces, Gradient relation, Time dependent potential energy, Energy for one-dimensional linear system, Curvilinear one-dimensional systems, Central forces, The energy of interaction of two particles, The energy of multi-particle systems, CM and relative coordinates, The equation of the orbit, Kepler orbits, The unbound Kepler orbits, Change of orbits, Mechanics in non inertial frames, The tides, Rotating frames and angular velocity vector. Newton's second law in rotating frame, The centrifugal force, Coriolis force, Coriolis force and free fall, The Foucault pendulum, Coriolis acceleration.

Phy2113 Alternating Current and Electric Circuit

PRINCIPLES OF ALTERNATING CURRENT: Sinusoidal Voltage Generation - Alternator Construction , Frequency and Voltage Equation - Period Average and Root Mean Square Values, Non-Sinusoidal Waveforms - Form Factor. AC Measurements of Voltage and Current Conversion of ACto DC - Single Phase Rectification Response of Resistance to Alternating Voltage, Response of Inductance to Alternating Voltage, Response of Capacitance to Alternating Voltage , Apparent Power, Real Power and Reactive Power Power Factor - SINGLE PHASE AC CIRCUITS: Impedance in AC Circuits Use of Complex Numbers in AC Circuit Solution Series and Parallel AC Circuits. Power Factor Correction for Inductive Loads. SERIES AND PARALLEL RESONANCE: Series Resonant Circuits - Resonant Frequency-Bandwidth Parallel Resonant Circuits - Tank Circuit Band Pass and Band Block Filters. THREE PHASE AC POWER: Three Phase AC Generation. Advantages of Three Phase Over Single Phase, The Delta and Wye Connections Phase and Line Relations for Voltage and Current, Three Phase Power Measurement-The Two Wattmeter Method Phase Sequence-Phase Sequence Indicator. Three Phase Rectifiers, Construction of the DC Dynamo, Characteristics of DC Generators, Characteristics of DC Motors. Controlling DC Motors (Starting and Speed Control), Transformers, Construction and Operation of AC Generators, Parallel Operation of AC Generators, Operation of the 3 Phase Squirrel Cage Motor, Operation of the 3 Phase Synchronous Motor, Single Phase Motors, Controlling AC Motors.

Phy2115 Spectroscopy

The electromagnetic spectrum, Account for the production of emission and absorption spectra and compare these with a continuous black body spectrum, Mathematical methods, Atomic Spectroscopy, Selection rules and

energy level diagrams, Molecular symmetry and Molecular Spectroscopy, IR- and Raman-pectroscopy, NMR-spectroscopy, ESR-spectroscopy, Laser spectroscopy, Microwave spectroscopy and molecular rotation spectroscopy on surfaces, Atomic absorption and X-ray spectroscopy, Circular dichroism, Fluorescens spectroscopy, Phosphorescence.

Phy2202 Modern Physics

Particle like behaviour of electromagnetic radiation: Electromagnetic waves, Quantization in classical physics, Black body radiation, The photoelectric effect, Production of X-rays, Typical X-rays spectrum, Photons, The Compton Effect, Pair production, Wave like behavior of elementary particles: De-Broglie hypothesis, Diffraction of X-rays, Diffraction of particles, Electron diffraction experiment of Davison and Germer, Electron-microscope, The basic ideas of quantum mechanics, Uncertainty principle, Atomic Structure: Rutherford's Model of the atom, Failure of Classical physics, Atomic Spectra, Bohr theory of the hydrogen atom, Failure of the Bohr theory, Sommerfeld's Model. Quantum model of Hydrogen Atom.

Phy2204 Mathematical Physics I

Essentials of Probability: Probability: Definitions, Simple Properties – Determinates and Matrices – Vector Analysis – Vector Spaces and Operators – Eigenvalue Problems

Phy2206 Practical Physics IV

Some selected experiments in modern physics. Data are summarized, errors are estimated, and reports are presented.

Phy2208 Radiation Physics

Natural and Artificial Radioactivity, Radioactivity and Radioactive Decay, Alpha, Beta and Gamma Decays, X- Rays and Bremssrahlung radiation, Neutron Sources, Interaction of Radiation with Matter, Radiation Detection and Shielding, Radiation Dosimetry, Biological Effects of Radiation and Health Physics.

Phy2210 Crystallography and Diffraction

Order and disorder in materials, Crystalline and amorphous structures, Crystal symmetry, Crystal lattice, Unit cell, Crystal systems, Bravais lattice, Point group, Miller indices, Quasicrystals, Polymorphism, Reciprocal lattice,

Production and spectra of X-rays, Synchrotron radiation, X-ray diffraction, Laue equations, Bragg's law, Intensity of diffraction, X-ray diffraction techniques, Size/strain line profile analysis, Preferred orientation, Phase analysis.

Phy2212 Introduction to Nanoscience

What is nanotechnology?:Definitions, History of nanotechnology, Context of nanotechnology. Motivation for nanotechnology: Materials, Devices, Systems, Issues in miniaturization, other motivations. Scaling laws: Materials, Forces, Device performance, Design Nanometrology: Imaging nanostructures, Nonimaging approaches, Other approaches, Metrology of self-assembly. Raw materials of nanotechnology: Nanoparticles, Nanofibres, Nanoplates, Graphene-based materials, Biological effects of nanoparticles. Nanodevices: Electronic devices, Magnetic devices, Photonic devices, Mechanical devices, Fluidic devices, Biomedical devices. Nanofacture: Top-down methods, Molecular manufacturing, Bottom-up methods, Intermolecular interactions. Bionanotechnology: Biomolecules, Characteristics of biological molecules, Mechanism of biological machines, Biological motors, The cost of control, Biophotonic devices, DNA as construction material. New fields of nanotechnology: Quantum computing and spintronics, Nanomedicine, Energy, Three concepts. Implications of nanotechnology: Enthusiasm, Neutrality, Opposition and skepticism, A sober view of the future.

Phy3101 Solid State Physics I

Lattice imperfections in solids, Color centers, Dislocation interactions, Classification and bonding of solids, Phonons and lattice vibrations, Thermal properties of solids: Classical, Einstein and Debye theories of heat capacity, Thermal conductivity, Thermal expansion, Elements of physical statistics, Free electron Fermi gas, Band theory.

Phy3103 Nuclear Physics I

Discovery of the neutron, Masses and Radii, Binding and Separatio energy, Stability, Nuclear Forces deuteron and Yukawa Potential, Spin and Angular Momentum, Parity, Magnetic moments, Coulomb Barriers, Energy levels, Liquid drop model: the Bethe-Weizsackers formula and applications; Fermi Gas Model: Shell Model, experimental foundation, Construction, Consequences and draw back of the Shell Model; Generalized Model: Single Particle States, Rotational and Vibrational Levels.

Phy3105 Quantum Physics I

Reviews of the fundamental experiments in modern physics, the need for quantum mechanics. Wave packet and uncertainty principle, Schrödinger equation for free particle, Continuity relation, The dynamical variables and calculating the expectation values, Schrödinger equation with a potential in one dimension, Dynamical variables and calculating the expectation values in momentum space, Commutation relations. Hermitian operators, Linear operators, Completeness relation and orthonormality. Schrödinger equation in three dimensions, The fundamental postulates of quantum mechanics, Particle in an infinite well, Spectral expansion theory, The parity, Constants of motion and conservation laws, Momentum eigenfunctions and free body, One-dimensional potentials:(The potential step, The finite potential well at scattering and bound states, The potential barrier, The delta-function potential at Scattering and Bound states, Simple harmonic oscillator, Oscillator eigenfunctions and eigenvalues, Ladder operators and dynamical variables, Schrödinger equation in three dimensions in Cartesian coordinates, Schrödinger equation in in three dimension curvilinear coordinate system, Angular momentum and its eigenfunctions and eigenvlaues, The addition of angular momentum, The central potentials.

Phy3107 Practical Physics V

Some selected experiments in Solid State physics and Nuclear Physics. Data are summarized, errors are estimated, and reports are presented.

Phy3109 Physics of Energy

The world's energy problem, Energy sources, Alternative and renewable energy: Solar, Ocean Thermal energy converter, Wind, conversion, transport, losses, storage, conservation, Fossil Fuel production/consumption, End use, Environmental impacts and the future of energy in our world, Exponential growth and energy usage, Feedback loops/hydrological cycle, Generation of electricity/basic mechanics, physics of energy, energy efficiency and the impact of energy on technology and the environment, Potential/Kinetic energy; Frictional energy losses, Materials for energy, Energy conservation, Lightning and insulation, Greenhouse Effect/CO_2 Pollution, physics behind global warming, Ozone depletion, Transportation and fuel savings

Phy3111 Special Relativity

Situation of science before the theory of relativity(In mechanics –failure of Newton's law - In physics–the Michelson–Morley experiments) - Einstein's

theory of special relativity- The postulates of special relativity- Lorentz transformation relation- Relativistic Kinematics (the interval between two events - Lorenz – Fitzgrald of moving rod- The time Dilation of moving clock-Doppler Effect -The Expanding Universe-Twin paradox) - Relativistic Dynamic (The transformation of velocity- The variation of mass with velocity-Relativistic momentum-Relation between mass and energy-Kinetic energy at low speed- Massless particles.

Phy3113 Fluid Mechanics

Flows – Fluids – Fundamental equations of Ideal Fluids – Viscous Fluids – Flows of Ideal Fluids – Stability and Chaos – Turbulence.

Phy3117 Renewable Energy and sustainability

Energy Fundamentals, Fossil fuels, Renewable energy part 1:- Solar radiation and solar energy (thermal ,photvoltaics and electrochemicals) Renewable energy Part II: Alternatives (hydropower,wind power,ocean thermal energy conversion, biomass, geothermal energy, tidal and wave energy), Energy conservation & storage, energy and transportatio, air pollution and environment.

Phy3119 Electrodynamics

Maxwell's equations and their solutions, Gauge invariance, Lorenz condition, Equations of potentials; Poynting's theorem conservation of energy in E. M. field, Field linear and angular momentum, Macroscopic Maxwell's equations, General wave equation, Plane wave in non conducting mcdial, Polarization, Boundary conditions for two adjacent media, Waves in conducting medial, Dispersion, Group velocity, Emission of E.M. radiation, Oscillatory electric dipole, Radiation field, Unified theory of weak and electromagnetic interaction.

Phy3202 Physical Electronics II

Introduction to Digital Systems: Introduction to Digital electronics ,Digital and Analog Signals and Systems, Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations, Combinational and Sequential Logic Functions, Programmable Logic, Fixed-Function Logic Devices. Number Systems and Codes: Introduction to Number Systems-Types-Decimal, Binary, Octal, Hexadecimal; Conversion from one number system to other; Binary arithmetic operations; Representation of Negative Numbers;1's complement and 2's complement, Complement arithmetic, BCD code,

Digital Codes -Excess-3 code, Gray code, Binary to Excess -3 code conversion and vice versa, ASCII code, EBCIDIC code , Error Detection Codes. Logic Gates: Logical Operators, Logic Gates-Basic Gates, Other gates, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method. Combinational Circuits-Part 1: Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Ripple Carry and Look-Ahead Carry Adders.Sequential Circuits: Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Triggering of Flip Flops; Flip Flop conversions; MSpaer-Salve JK.

Phy3204 Atomic and Molecular Specroscopy

Introduction: Comparing between atomic emission spectroscopy and atomic absorption spectroscopy; Optical spectroscopy, Atomic spectrum, Atomic emission / absorption spectrophotometry Molecular spectroscopy , Spectroscopy of inner electrons. Zeemen's effect, Sodium spectrum, Effect of magnetic field on the energy levels of atom. Theory of magnetic energy, Anomalous Zeeman's effect and Lande splitting factor. Molecular Spectra of diatomic molecules.-Vibrational energy levels in both classical mechanics and quantum mechanics. Rotational spectra of diatomic molecule in gaseous state and rotational energy levels. Molecular spectra; Anharmonic Oscillator-Non Rigid Rotator - Infrared Vibration-Rotation spectra; -. spectrum, IR spectrum, RBS spectra, XRD spectrum - measurements of Absorbance, Transmitting and Reflecting using double beam Spectrophotometers in all ranges of wavelengths (UV-VIS-NIR-IR), Normal modes of vibrations; Natural of infrared absorption, Basic Laser principles ,Laser behavior , Properties of laser radiations , Different types of lasers, Laser spectroscopy, The total losses of the laser system, Transmission at the mirrors . Absorption and scattering by the mirrors, Absorption in the laser medium . Diffraction losses at the mirrors, The Ruby Laser- Three Level Laser (Helium-Neon Laser)-Four Level Laser (Carbon dioxide Laser), Laser applications.

Phy3206 Computional Physics

Basic Concepts in Computational Physics based on deterministic methods: Some Basic Remarks – Numerical Differentiation – Numerical Integration – The KEPLER Problem – Ordinary Differential Equations: Initial Value Problems – The Double Pendulum – Molecular Dynamics – Numerics of Ordinary Differential Equations: Boundary Value Problems – The One-Dimensional Stationary Heat Equation – The One-Dimensional Stationary SCHRÖDINGER Equation – Pseudo-random Number Generators.

Phy3208 Practical Physics VI

Some selected experiments in Physical electronic II and atomic physics. Data are summarized, errors are estimated, and reports are presented.

Phy3210 Cosmic Rays

Study the different kinds of cosmic rays, their sources, energy and acceleration in the universe, the interaction of cosmic rays with the atmosphere and interplanetary medium, the different techniques of detecting the cosmic rays. A survey of the methods for observing high energy cosmic rays and gamma rays, and a description of the results of these observations in terms of their type, energy and direction of arrival. A brief outline of the possible sources for these rays.

Phy3212 Electromagnetic Field Theory II

Magneto statics: The Lorentz Force Law, The Divergence and Curl of B, Magnetic Vector Potential, *Magnetic Fields in Matter*: Magnetization, The Field of a Magnetized Object, The Auxiliary Field H, Linear and Nonlinear Media, *Electrodynamics*: Electromotive Force, Electromagnetic Induction, Maxwell's Equations, *Electromagnetic Waves*: Waves in One Dimension, Electromagnetic Waves in Vacuum, Electromagnetic Waves in Matter, Absorption and Dispersion, Guided Waves, *Potentials and Fields and Radiations*: The Potential Formulation, Dipole Radiation, Radiation Reaction.

Phy3214 Simulation and Modeling

Simulation process, Basic techniques, Programming techniques, Special – purpose simulation languages simulation experiments modeling techniques for system inputs verification and validation procedures. Some application of simulations of techniques

Phy3218 Classical Mechanics (II)

Calculus of variations, The Euler-Lagrange equation and applications, Lagrange's equations for Unconstrained motion, Constrained systems, Generalized momenta and Ignorable coordinates, Lagrange multipliers and constraint forces, Rotational motion of rigid body, The inertial tensor, Principal axes of Inertia, Precession of a top by weak torque, Euler's equations, Euler's angles, Coupled oscillations and normal modes, The double pendulum, Three coupled pendulum, Hamiltonian mechanics for one-dimensional systems, Hamiltonian mechanics in several dimensions, Ignorable coordinates, Phase space orbits, Liouville's Theorem.

Phy3220 General Relativity

Newton's theory of gravitation.--Einstein's Summation convention.--Parallel displacement–christoffel symbols--Application of Tensor Analysis--The Equation of the Geodesic Lines --The Riemann Curvature Tensor-- Material Energy stress Tensor for A perfect fluid--Einstein's field equations for a material Distribution. Poisson's Equations as a First Approximation of Einstein's Field Equations. The Schwarz child's Exterior and interior Solution--Planetary Orbits – the Advance of Perihelion- the Deflection of Light -- Relativistic Cosmology (World Models - Static World Models - Properties of the Einstein's Model - Properties of the De Sitter Model.

Phy4101 Quantum Physics II

Dirac notation, Vector space algebra and Hilbert space, Rephrasing wave mechanics and operator methods in abstract view, Angular momentum commutation relations, Raising and lowering operators for angular momentum, Expansion theory in abstract view, Matrix representation of angular momentum operators, General relations in matrix mechanics, Eigenstates of spin ½, The intrinsic magnetic moment of spin ½ particles, Addition of two spins, Addition of Spin ½ and orbital angular momentum, Time-independent perturbation theory and energy shifts, Degenerate perturbation theory, The Stark effect, Hyperfined splitting, Variational principle and its applications, The WKB approximation, Time-dependent perturbation theory, The interaction of charged particle with electromagnetic field, Two level-system, emission and absorption of radiations, spontaneous emission, Transition rate, selection rule, scattering theory, Partial wave analysis, The Born approximation.

Phy4103 Mathematical Physics II

Tensors and Differential forms – Green's Functions – Angular Momentum – Calculus of Variations – Asymptotic Series. Differential Geometry and Topology: Maps – Topological spaces – Homeomorphisms and topological invariants – Manifolds – Riemannian Geometry – Complex Manifolds.

Phy4105 Solid State Physics II

Semiconductors and its applications (semiconductor materials- Band theory in semiconductor- energy gap in semiconductors- holes- Fermi level in semiconductor- effect of impurities on semiconductors – applications), Magnetism in solid state(magnetic moments- origin of magnetism- diamagnetism- paramagnetism-Ferromagnetism-molecular field theory- exchange energy- Antiferromagnetism- Ferrimagnetism- hystresis loop - magnetic domains-magnetic resonance), Introduction to Superconductivity, Optical properties of solids (Reflection , absorption and emission- optical conductivity), Dielectric properties of solids (polarization and dielectric constants, electric damage for insulators- Ferroelectric).

Phy4107 Nuclear Physics II

Linear and Circular Accelerators, Development of Accelerators. Large Hadron Collider Accelerator, Classification of nuclear Reactions, Conservation Laws, Differential and Total Cross Sections, Kinematics of Nuclear Reactions, Center of Mass and Laboratory Systems. Theories of Nuclear Reactions: Scattering, Compound Nucleus, Direct Nuclear Reactions, Optical Model, Fissioning and Fusion of nuclei.

Phy4109 Practical Physics VII

Some selected experiments in Solid State physics II and Nuclear Physics II. Data are summarized, errors are estimated, and reports are presented.

Phy4111 Semiconductor Technology

Basic semiconductor physics. Operation and modeling of pn-junctions, optoelectronic devices, bipolar transistors, field-effect transistors, and integrated circuits. An overview of processing of semiconductor devices and integrated circuits is given. Introduction into modern semiconductor technologies, such as nanotechnology and spin electronics.

Phy4113 Principles of Group Theory

Definition of a group, Groups as symmetries, Examples: cyclic, dihedral, symmetric, matrix groups, Homomorphisms, Subgroups and quotient groups,

Cosets Conjugacy classes, Normal subgroups, Lagrange's theorem, Isomorphism theorems, Actions of groups on sets, Symmetric group and alternating group, Cayley's theorem, Direct products of groups, Group automorphisms, Sylow's theorem, Applications: classification of groups of small order, The alternating group is simple, Classification of finite abelian groups, Composition series, Jordan-Hoelder theorem, Nilpotent and solvable groups.

Phy4115 Physics of Non-Crystalline Solids

Introduction to non-crystalline and amorphous materials (polymers, glasses, etc.), Structure and chemistry of amorphous and non-crystalline materials: molecular structure of polymers; polarization and defects; thermoplSpaic and thermosetting polymers; crystallinity and elSpaomers, Glass: formation, structure and transition temperature, Thermodynamics of glass formation; kinetics of glass formation, Properties of amorphous and non- crystalline materials: mechanical, electrical, thermal, dielectric, and optical.

Phy4117 Magnetism and Magnetic Properties of Solids

History of magnetism, Magnetic units, Classical and quantum mechanical model of magnetic moment of electrons, magnetic properties of free atoms. Types of magnetism: Classification of magnetic materials, Theories of Diamagnetism, Paramagnetism, Theories of ordered magnetism, Quantum theory of magnetism: electron-electron interactions, localized electron theory, itinerant electron theory. Magnetic interactions: Origin of crystal field, Jahn Teller effect, Magnetic dipolar interaction, Origin of exchange interaction, Direct exchange interactions, Indirect exchange interactions in ionic solid and metals, double and anisotropic exchange interaction. Magnetic domains: Development of domain theory, Block and Neel Wall, Domain wall pinning, Magnons, Bloch’s law, Magnetic anisotropy, magnetorestriction. Competing interactions and low dimensionality. Frustration, Spin glass, superparamagnetism, one and two dimensional magnets, Thin film and multilayers, Heisenberg and Ising models Novel magnetic materials: Colossal and giant magnetoresistive materials, magnetic refrigerant materials, Shape memory alloys, multiferroics, spintronics devices and their application in magnetic storage. Measurements techniques: Production and measurement of field, magnetic shielding, Faraday balance, AC susceptometer, Vibration sample magnetometer, torque magnetometer, SQUID magnetometer, Experimental method in low temperature.

Phy4110 Photonics

Transmission through optical components. Holography. Near field imaging. Guided-wave optics. Photonic crystals. Fiber optics. Electromagnetic optics. EM waves in metallic and dielectric media. Absorption and dispersion. Optics of magnetic materials. Metamaterials and Plasmonics. Superlens. Invisibility. Interactions of photons with matter. Quantum laser amplifiers. Quantum lasers. Radiation by charged particles. Semiconductor photon sources and photon detectors.

Phy4202 Statistical Physics

Basic ideas: statistical distributions – random events – probability calculations – Fundamental postulates of equilibrium statistical mechanics – Statistical calculation of thermodynamic quantities – Statistical formulation of a mechanical problem – properties of Statistical entropy – Micro-canonical, canonical and grand-canonical ensembles – Simple applications of statistical mechanics – Equilibrium between chemical species –Quantum statistics of ideal gases: Maxwell-Boltzmann gases, Bose-Einstein and Fermi-Dirac statistics.

Phy4204 Modern Optics & Laser Physics

Optical boundaries, Maxwell's theory, Fresnel's equations, Metallic reflection, Schlieren Optics, Light scattering, Optics of transformation, Fourier transform spectroscopy, Transfer functions, Two-dimensional transformation, Holography, Wave front reconstruction, Producing holograms, Theory of holography, Applications of Holography, Fiber Optics, Image processing, Laser Speckle, Nonlinear Optics. Nonlinear electron oscillator model, Perturbative solution of the nonlinear oscillator equation, Nonlinear polarization and the wave equation, Second-harmonic generation, Phase matching, Intractivity second-harmonic generation, Three-wave mixing, Parametric amplification, Parametric oscillation, Tuning of parametric oscillators, Nonlinear susceptibilities, Nonlinear susceptibility tensor, Nonlinear materials, National convention for nonlinear susceptibilities

Phy4206 Low Temperature Physics

Low Temperature Properties of Cryoliquids - Solid matter in low temperatures - Helium-4 Cryostats - Helium-3 Cryostats - The ^{3}He-He^{4} Dilution Refrigerator - Refrigeration by Solidfication of liquid ^{3}He - Refrigeration by Adiabatic demagnetization of paramagnetic salts - Refrigeration by Nuclear demagnetization – Low temperature thermometry – some aspects of superconductors

Phy4208 Nanophysics and Nanotechnology
Electronic transport in two-, one- and zero-dimension, Characteristic length scales; Macroscopic, Mesoscopic and Microscopic regimes, Fullerenes and nanotube, Nanomagnetism, Electron properties of clusters, fabrication and nanopatterning techniques of nanometre sized structures: Lithography of low dimensional systems, Top-down, Bottom-up and Wet deposition, characterization of nanostructures, scanning tunnelling microscopy, scanning probe microscopy, atomic force microscopy, Applications: Photonics, Functional Nanostructures, Quantum Wires; Quantum Dots; Single Electron Quantum Tunneling

Phy4210 Elementary Particles Physics
Familiar particles (Photons-Electrons-Proton-Neutrons), Conservation laws and invariance principles - Antiparticles and Dirac relativistic theory – Feynman diagrams –β Decay and neutrino- Pions and its properties, Isospin – Nucleon magnetic moments–Strange particles – Non-conservation of parity- Leptons -The original Quark model.

BPh4212 Practical Physics VIII
Some selected experiments in modern optics and elementary particle physics. Data are summarized, errors are estimated, and reports are presented.

Phy4214 Non-linear Optics
Model for Nonlinear Polarization, Nonlinear Susceptibilities, Self-Focusing, 4 Self-Phase Modulation, Second-Harmonic, Generation, Phase Matching, Three-Wave Mixing, Parametric Amplification and Oscillation, Two-Photon Down conversion.

Phy4216 Neutrons and Reactors Physics
Thermal neutrons and their energy distribution, Slowing-down power and moderating ratio of reactor neutrons, Nuclear chain reactions, Neutron cycle Multiplication and thermal utilization £1ctor, Neutron leakage and critical size, Nuclear reactors, Power reactor control, Reactor shielding, Research reactors, Thermal neutron diffusion, Diffusion equation applied to thermal reactor, Critical equation and reactor buckling, Non leakage f.1ctors, Non-steady nuclear reactors, Time dependent reactor equation, Excess reactivity and reactor period, Effect of delayed neutrons.

Helwan University

Phy4218 Physics of Smart and Functional Materials

Instruction to Smart and Functional Materials: Challenges in the science and technology of advanced materials – areas of applications. Concept of smart materials, smart structures and adaptronics systems. *Materials synthesis and microstructure*: Overview of the materials synthesis techniques. Importance of the relationship between the microstructure on nanoscale and the functional properties. *Properties of active materials and their assessment*: Optical properties (optical bandgap engineering, nonlinear optical effects). Electrical properties (piezoelectric effect). Thermo-mechanical properties (shape memory and phase change alloys). Magnetic properties (magnetoresistance and magnetostrictive effect). *Applications:* Sensors (temperature, strain, stress, magnetic field, electrical field, mechanical quantities, adaptive structures). Actuators (piezo-actuators for advanced microscopy and sonar communications, magnetostrictive-actuators for solid-state speakers). Automotive (valve position, torque sensors for active steering, pedal positions, velocity, acceleration). Energy (solar cells, solar absorbers, piezoelectric energy harvesting). Biomedical (functionalized nanoparticles for cancer detection and treatment, shape-memory alloys for dentistry, bone repair and cardiovascular stents, wear-free switches for peace-makers). Electronics and data storage (rewritable CDs and DVDs, magnetic hard disk technology, non-volatile memories for aerospace applications). Spintronic and optoelectronics devices.

Phy4220 Plasma Physics

Plasma concepts and terminology, Behavior of charged particles in electric and magnetic fields, Interaction of electromagnetic waves with plasma, Magnetic and kinetic pressures Pinch effect, Plasma confinement by electric field and magnetic field, Plasma sheaths and Debye length, Collision and radiation in plasma, Plasma diagnostic techniques.

BioPhysics Program Courses Contents

BPh2101 BioPhysics

Mechanical properties of biological materials, Electrical techniques used in biophysics, Active and passive electrical properties of biological materials, Biopotential: origin and measurement, Electrocardiogram, Transport through membranes, Laws of stimulation, Surface manifestation of biopotentials, Biomagnetism, Biological effects of radiation.

BPh2103 Biomechanics

Force –Acceleration – Newton's laws of motion- Conservation of Momentum – Mechanical work-Potential and Kinetic energy-Power- Moment of a force (Torque) – Physical forces on the human body –Static forces and Levers-Lever examples from Human Body – Biomechanics of Sitting- Biomechanics of standing – Equilibrium and Stability – Dynamic state of the body-Responses of human body to vibrations – Specific Gravity and density – Hydrostatic pressure- Buoyancy- ElSpaicity – ElSpaicity of living cell material- Bone ElSpaicity- PlSpaicity- Fluidity- Rheolgy – Pressure – Types of pressures inside the body.

BPh2201 Electricity in Biological Systems

The nature of bioelectricity-Bioelectric currents-Nernst potentials-Goldman equation-Diffusion - Potentials-Action Events of Nerve-Membrane Bioelectrical models - Propagation of action events – Action event of muscle – Action event of heart- Detection of Bioelectric events- Bioelectrodes-Electrical interference problems in biopotential measurement- Differential biopotential Amplifiers- Bandpass filtering – Biopotential interpretation – Electromyography – Electroencephalography - Electroneurography – Piezoelectricity in Bone.

BPh2203 Practical Biomedical Physics I

Some selected experiments in Biophyics. Data are summarized, errors are estimated, and reports are presented.

BPh3103 Membrane BioPhysics

Models of Membranes – Membrane structure – membrane proteins – Forces responsible for organization of lipid bilayer – Asymmetry in membranes – Fluidity of membranes – Electrical properties of membranes – Membrane resistance – Equivalent circuit for the cell membrane – Response of membrane capacitance and resistance to a pulse of current – Specific resistance and conductance of membrane – Transport processes across the cell membrane – classification of transport processes – osmosis – facilitated diffusion - Active transport – Free energy change during simple and facilitated diffusion and active transport – Antibiotic mediated ion transport – Biophysical techniques employed for investigation of membranes.

BPh3105 Practical Biomedical Physics II

Some selected experiments in Solid state physics and radiation physics. Data are summarized, errors are estimated, and reports are presented.

BPh3107 Electronic Simulation of Biological Systems

Mathematical Basics 1 : modeling and simulation with linear / non-linear differential equations- Mathematical Basics 2- modeling and simulation with automata and stochSpaic process- Systems Biology / Synthetic Biology 1- Biological Information Flow and metabolism in cells Introduction | Computing with MATLAB- Introduction to Dynamical Systems- Bistability in Biochemical Signaling Models- Computational Modeling of the Cell Cycle- Computational Neuro Science 1 : What is Computational Neuro-Science- Molecular Simulation / Bioinformatics 1:bioinformatics- Molecular Simulation / Bioinformatics 2:molecular dynamics simulation- Molecular Simulation / Bioinformatics 3:docking simulation.

BPh3109 Mathematical Biophysics

Calculus and Linear Algebra-basics of multivariable calculus, in particular, vector calculus and curves in space and Fourier series-linear algebra: vectors, matrices, eigenvalues of matrices-complex numbers - symbolic and numerical packages for matrix computations, rotation matrices, Euclidean motions, lattices, continuous and discrete curves in space, torsion angles, gram and distance matrices, graphs, trees and strings. Applications such as: protein secondary structure, structure determination by crystallography and NMR, writhing twisting and knotting of DNA, sequence alignment.

BPh3111 Environmental Biophysics

A quantitative approach to soil-plant-atmosphere interactions with particular emphasis on energy, water and carbon exchanges in agricultural and ecological systems. This includes a description of the physical microenvironments where organisms reside, a discussion of heat and mass transfer models, and applications to exchange processes between organisms and their surroundings. Equations and numerical models are used to provide a quantitative synthesis of information from plant physiology, soil physics and micrometeorology. Some discussion of measurements and instruments is included.

BPh3113 Bioeffects of Electromagnetic Energy

Effects of electromagnetic fields on human beings. Radiation effects. Risks of biological effects of non-ionizing and ionizing radiation. Dielectric properties of biological tissues. Thermal and non-termal effects of electromagnetic fields on living organisms. Physical and chemical mechanisms of interaction between low frequency magnetic fields and living

organisms. Direct impact of EM fields and generation of induced electric fields in the cells. Radio frequency standards, exposure, effects and dosimetry. Effects from transmission lines, substations, antennas of base stations and mobile phones on humans.

BPh3115 Biomathematics

Graphs and functions, Derivative of a function, Techniques of differentiation Differentiation and its application in Biology, Finding maxima, minima,Plotting functions, Integrals, Techniques of Integration Scalars and vectors. Force, Concentration gradient,Polar coordinates Differential equations, Nernst Equation, Diffusion Equation, Mean-square displacement, Einstein's relation Probability and Statistics: Mean and variance, Distribution functions: Normal Distribution, Uniform distribution,Poisson distributions,Knudson's analysis, Wright-Fisher model, Fitting a function to experimental data Fourier Series, Fourier transform, Z-transform, Discussion of the use of Fourier transformation in X-ray crystallography, and other areas in biology. Modeling biological problems:Statistical thermodynamics, Flexible proteins—size and conformations,Polymerization dynamics, Molecular motor motion, Bending and looping of DNA, Protein organization along DNA

BPh3202 Biomolecular Spectroscopy and Spectrometry

Introduction to the General aspects of spectroscopy. Various characterization instruments including NMR spectroscopy, X-ray spectroscopy, and IR spectroscopy will be introduced. Principles, instrumentation and applications of instruments will be covered. Application of molecular spectroscopy to study the biological molecules. Student will perform characterization experiments with modern instruments (Spectrophotometer) in an actual analytical laboratory environment.

BPh 3204 Physics of Radiotherapy I

Fundamentals: (Structure of Matter – Radioactivity – Interactions of Charged Particles with Matter – Interactions of Photons with Matter – The Monte Carlo Simulation of Radiation Transport – Principles and Basic Concepts in Radiation Dosimetry) – Radiobiology: (Radiobiology of Tumors – Radiobiology of Normal Tissues – Dose Fractionation in Radiotherapy) – Equipment: (Kilovoltage X-Ray Units – Linear Accelerators – Cobalt Machines – Simulators – Portal Imaging Devices) – Dose Measurement: (Ionization Chambers – Radiothermoluminescent Dosimeters and Diodes –

Radiation Sensitive Films and Gels – Absolute Dose Determination under Reference Conditions – Relative Dose Measurements and Commissioning).

BPh3206 Practical Biomedical Physics III

Some selected experiments in Physics of Radiotherapy I. Data are summarized, errors are estimated, and reports are presented.

BPh3208 Nuclear Magnetic Resonance

Introduction: static and dynamic aspects of magnetism, Larmor precession, relaxation to equilibrium, *T*1 and *T*2, Bloch equations. Pulse and continuous wave methods: time and frequency domains. Manipulation and observation of magnetisation, 90º and 180º pulses, free induction decay. Experimental methods of pulse and CW NMR: the spectrometer, magnet. Detection of NMR using SQUIDs. Theory of relaxation: transverse relaxation of stationary spins, the effect of motion. Spin lattice relaxation. Spin echoes: 'violation' of the Second Law of Thermodynamics, recovery of lost magnetisation. Application to the measurement of diffusion. Analytical NMR: chemical shifts, metals, NQR. NMR imaging: Imaging methods. Fourier reconstruction techniques. Gradient echoes. Imaging other parameters.

BPhy3210 Computational Biophysics

The objective of this course is to prepare the students for the field of computational biophysics and bioinformatics working either in research or in industry. Therefore, it is developed to introduce the most important and basic algorithmic concepts in biophysics. Content: Introduction, Central dogma of molecular biology, Relevant databases in computational biophysics, Molecular visualization software. Algorithmic techniques for modeling: Monte Carlo simulation, Replica-Exchange Monte Carlo simulation, Simulated Annealing, Neural Network method. Methods for protein secondary structure prediction, Comparative modelling, Threading and fold recognition.

BPh4101 Atomic and Molecular Biophysics

Energy pathways in living Being- Photosynthesis- Radiation- Biophysical Basis of Bioelectricity- Optical filters- CT scan- Ultrasonic- Common Defects of human eye- Physical aspects of hearing- Effect of light- Biophysical laws- Dynamic of Blood flow- Radioactivity- Radiation Detectors- Spectroscopy- X-rays-crystallography- Raman effects- Electrophoresis- Infrared

spectroscopy- Molecular interaction in Bilogical Systems and bonds- Thermodynamic- Cell- Function of cell membrane- Protein – Lasers.

BPh4105 Biomaterials

Basic material properties – Fracture – The hardness test – Fatigue – Corrosion – Corrosion fatigue – Materials used in total Joint replacement – Reaction of bone to an implant- Biophysics of bone- mechanical properties of bone – bone density – Bone materials – bone design.

BPh4107 Practical Biomedical Physics IV

Some selected experiments in modern Biophysics and Biomaterials. Data are summarized, errors are estimated, and reports are presented.

Ph4109 Physics of Radiotherapy II

Clinical Beams: (From Measurements to Calculations – Kilovoltage X-RaysMegavoltage Photon Beams – Manual Dose Calculations in Photon Beams – Electron Beams) – Patient Dose Computation Methods: (Principles of Patient Dose Computation – Patient Dose Computation for Photon Beams – Patient Dose Computation for Electron Beams - Monte-Carlo Based Patient Dose Computation) – Treatment Planning: (Target Definition – Patient Data Acquisition – Magnetic Resonance Imaging in Treatment Planning – Beam Definition—Virtual Simulation - Photon-Beam Treatment Planning Techniques - Beam Electron-Beam Treatment Planning Techniques – Dose Evaluation of Treatment Plans - Biological Evaluation of Treatment Plans – Quality Assurance: (Rationale and Management of the Quality System – Quality Control of Megavoltage Equipment – Quality Assurance of the Treatment Planning Process – Quality Control of Treatment Delivery – Recording and Verification—Networking – Data Communication with DICOM).

Helwan University

BPh4111 Biomagnatism

Fundamental physical knowledge and electrostatic and magnetic field equations. Fundamentals of bioelectromagnetism. Bioelectric sources and conductive environment. Electrodynamics of bioelectrical fields. Concepts of bioelectrical and biomagnetic measurement. Measurement methods, modeling and simulation techniques.

BPh4113 Bioenergetics

Introduction to bioenergetics. Coupling of an exergonic to an endergonic reaction. Transfer of free energy from an exergonic to an endergonic reaction

via a high-energy intermediate compound. Redox cycle of the biosphere. The diversity of membrane proteins. Mechanisms of molecular biological membrane transport. Classes of bioenergetic processes: fermentation, photosynthesis and respiration. Substrate-level phosphorylation. High-energy phosphate compounds. Role of ATP/ADP cycle in transfer of high-energy phosphate. Energy charge. The citric acid cycle. Organization and function of coupling membrane. Mitochondrion. Structure of mitochondrial membranes. Mitochondrial enzymes. ChloroplSpas. Respiratory chain, production of ATP. Electron transport and oxidative phosphorylation. Components of respiratory chain. The mechanism of chemiosmotic coupling of electron transport and oxidative phosphorylation. Fractionation and reconstitution of mitochondrial respiratory chain complexes. Inhibitors of respiratory chain complexes. Uncouplers of oxidative phosphorylation. Inhibitors of oxidative phosphorylation. Ionofores. Endogenous uncouplers. ATP formation under anaerobic conditions and in anaerobic microorganisms.

BPh4115 Signal Analysis and Medical Applications

Signal analysis: time- and frequency, sampling, digital signals, Fouriertransform (FFT), estimation of the power spectrum, input windows, leakage, aliasing, convolution and correlation properties, digital filters Physiological and mathematical models of bioelectricity: cell membrane, resting- and action potentials, Nernst equation, volume conducting, forward- och inverse problems Measurement of bioelectrical signals: electrode properties, measurement systems Electrocardiography: origin of the ECG, ECG-leads, ECG analysis Neurophysiology: nervous system, muscles, EEG, EP, EMG, ERG, EOG, signal analysis Electrostimulation: defibrillation, pacemakers, electrostimulation Laboratory experiment: biosignal processing.

BPh4119 Cell Communication & Signaling Biophysics

The course begins by overviewing the diverse mechanisms used by cells to communicate, considering the main modes of cell-cell communication, the major classes of signalling molecules and the receptor types upon which they act. It then focuses on nuclear, G-protein coupled, and enzyme linked receptors covering in molecular detail these receptors and their associated signal transduction pathways.

BPh4202 Pharmacology

Physiologic Disposition, Pharmacokinetics, Drug Receptors, Drugs for Migraine, Antiepileptics, Anti-Anxiety Agents, Antidepressants, Pumonary Review, Antihistamines, Spahma and COPD Drugs, Cardiovascular and

Autonomic Nervous System Review, Opioids, Alcohol, Cholinergics and Neuromuscular Blockers, Drugs of Abuse, Adrenergics & Antiadrenergic Drugs, Antihypertensives and Antianginals, Lipid Lowering Drugs, Antipsychotics/Anti-Parkinson's Drugs, Drugs for Congestive Heart Failure, Antiarrhythmics, Anti-inflammatory Steroids, NSAIDs, Anticoagulants, Diuretics, Protein and DNA Synthesis Inhibitors, Antivirals, Protein Synthesis inhibitors/Cell Wall inhibitors, Antifungals, Antihelminthics, TB Drugs, Antimalarials.

BPh4204 Physics of Laser and Medical Applications

Physical laser guiding principles. Atomic spontaneous and stimulated radiation. The population inverse levels. Optical and electrical "pumping" scheme. The principle of laser resonator. Resonator modes. Laser operating continuous and pulse mode. Laser Safety. Medical laser safety class and the corresponding potential tissue damage. Most frequently applied medical laser exposure limits. Medical staff and patient laser safety rules. Goggles and other safety equipment. Warning signs of the laser beams, the colour combinations, depending on the degree of danger. National and international laser safety standards. Laser radiation effects on tissues. Living tissue specificity. Scattering and absorption in tissue. Therapeutic window. Skin optics and basic optics of blood. Laser radiation effects on tissues. Laser radiation-tissue interactions' main mechanisms. Laser-induced photochemical, photothermic and photodegradation effects; appropriate radiation dose and temperature ranges. Laser radiation penetration depth in tissue. Cell necrosis. The critical laser power/energy density tissue photocoagulation, photoablation, and evaporation. Laser types. The main types of medical lasers. The use of lasers in therapy and diagnostics. Laser fluorescence diagnostics: basic principles and clinical applications in oncology, cardiology and dentistry. Laser dopplerography principles. Lasers in dermatology. Medium-power laser biomedical applications. Laser photodynamic therapy. Cosmetic laser applications: port-wine stains and tattoos. Laser hair removal. Laser surgery. A high-powered laser medical application. Laser scalpels. Laser surgery, laser angioplSpay and laser dentistry. Eye surgery using lasers. Tissue welding with lasers. IPL (intense pulsed light) therapy: IPL classification. Mechanisms of action. IPL therapy applications in dermatology.

BPh4206 Practical Biomedical Physics V

Some selected experiments in Nuclear Physics and modern and modern optics. Data are summarized, errors are estimated, and reports are presented.

PPh4208 Human Anatomy

Introduction to Anatomy -Integumentary System, Cartilage and Bone Connective Tissue, Axial Skeleton – Skull, Axial Skeleton – Vertebral Column and Thoracic Cage, Appendicular Skeleton – Pectoral Girdle and Upper Limb; Pelvic Girdle and Lower Limb, Articulations, Muscle Tissue and Organization, Axial Muscles, Appendicular Muscles, Nervous Tissue and Nervous System, Brain and Cranial Nerves, Spinal Cord and Spinal Nerves, Heart, Vessels and Circulation, Lymphatics, Digestive System Respiratory System, Reproductive System.

BPh4210 Physics of Diagnostic Radiology

Characteristics of the spectra obtained in diagnostic radiology (structure of carbon atoms, electromagnetic radiation, bremsstrahlung, X-rays, the angular distribution of diagnostic X-ray, "Heel" effect, filtration characteristics of the X-ray spectrum, the quality of the beam, STP). Generating radiodiagnostic spectra (apparatus, X-ray generators and X-ray tube, an exposure time, the influence of kVp, mAs and target material on the X-ray spectrum). The interaction of the diagnostic X-rays with tissue (The influence of the photoelectric effect and the contrSpa produced by Compton effect, the main characteristics of radiation: exposure, the dose, the attenuation coefficients, absorption coefficients, the dosage of the tissue). Basic concepts of imaging. X-ray detectors (Fluoroscopy, X-ray computer systems, Digital Radiography). Imaging modalities with ionizing radiation. Fundamentals of mammography. Physical principles of computed tomography (CT). Dosimetry in diagnostic radiology (doses, an equivalent dose, the effective dose, the absorbed dose in radiography and fluoroscopy, CT dosimetry, diagnostic reference levels, patient dosimetry).

BPh4212 Physics of Nuclear Medicen

Basic Atomic and Nuclear Physics - Modes of Radioactive Decay - Decay of Radioactivity-Radionuclide and Radiopharmaceutical Properties &Production- Interaction of Radiation with Matter - The Gamma Camera: Basic Principles - Single Photon Emission Computed Tomography - Positron Emission Tomography.

Space Sciences Program Course Contents

Spa2101 Astronomy and Astrophysics I
Introduction to Astronomy – solar system, Coordinate Systems, Time ,observable quantities, Stellar Parameters --Brightness, Luminosity, Magnitude Scale, Colour, Black Body Temperature ,Size.- Distances - Spectrum --Spectral Classification - Star Formation---Molecular Clouds, Clusters ---Stellar Evolution --Stellar Old Age_ Planetary Nebulae, White Dwarf,--- Death of A Star-Supernovae, Neutron star, Pulsars, Black Hole and Galaxies.

Spa2103 Star Physics
Broad array of topics in Astophysics including the formation, structure, evolution and observational properties of normal and extreme stars, galaxies and cosmology, and the underlying physical processes governing them.

Spa2202 Space Weather I
Elements of Solar Physics - Sun and its Atmosphere -- Sunspots and Solar Cycles - Solar Flares Solar Wind - Magnetosphere of Earth - Effects of Solar Wind on Interplanetary Magnetic Fields -- Formation of Geomagnetic Cavity -Magnetopause - Magnetosheath and Bow Shock - Polar Cusp and magnetotail -- Plasma Sphere and Van Allen Radiation Belts -- Geomagnetic Storms -- Sub-storms and Current Systems - Coronal Mass Ejections - Effect of Magnetic Disturbance on Ionosphere and Thermosphere System.

Spa2204 Astronomy and Astrophysics II
Large Scale Universe, types of Galaxies, Hubble Classification, -Milky Way---Contents, Inter Stellar Matter,-Dust--Extinction---Active Galactic Nuclei (AGN)---Cosmology (Scale of universe, expansion of universe, Big Bang) , sources of high energy emission including active galaxies, pulsars, gamma-ray bursts and supernova remnants- Astronomical Instruments and Observing Techniques

Spa2206 Satellites
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 the satellite components, the effect of the space

plasma on the satellites and interaction of energetic space particles with the satellite components.

Spa2208 Cosmology
The expansion of the universe and Hubble's law. The cosmological principle. Restrictions of Newtonian mechanics and the theory of special relativity. General relativity and the equivalence principle. The metrics of curved space/space-time. Black holes. Homogeneous and isotropic universes. The Robertson-Walker metric. Cosmological redshift. The Friedmann models. Big Bang. Thermodynamics of the early universe. The theory of inflation. Early fluctuations and their growth. The cosmic microwave background. Early nucleosynthesis and cosmochronology. The matter content of the universe. Dark matter. Dark energy. The determination of the cosmological parameters. Alternative cosmologies.

Spa3101 Radio Astronomy I
Radio Sources and Radiation Mechanisms, Spectra from Sparonomical Objects like Stars, Emission Nebulae, Galaxies, Quasars, Exotic Stars and pulsars - Theory of Pulsars - Types of solar radio-bursts - Radio Telescopes - Detection Techniques for X-ray and Gamma-ray - X-ray Telescopes.

Spa3103 Stellar Evolution
Basic concepts in stellar Sparonomy, morphological types of galaxies, luminosities and spectra of galaxies, stellar dynamics, structural laws for disks and spheroids, modeling stellar evaluation in galaxies, structural components of Milky way, rotation of disk galaxies, star formation and classical dissipative collapse models for galaxy formation.

Spa3105 Celestial Mechanics
Introduction to the Celestial mechanics which focuses on the dynamics of celestial bodies. The basic results concerning the classical models of the two-body and the many-body (including the three-body problems) are presented. Methods dedicated to general and particular perturbations are studied and applied to the basic models of the celestial mechanics, Exercises of both practical and theoretical nature in addition to the using of a variety of analytical and numerical tools.

Spa3201 Geographic Information System
Basic concepts and theory of GIS - Structuration of a geo referenced data base - Presentation of a structured data base on line : SIEREM - Map

reference with GPS - Integration of GPS data to SIG - Request and geo statistic analysis - Handling of a SIG (Map Info or ArcGis) - Presentation of an Open Source : Mapwindow - Extraction of pictures from Google Earth, to manage and bear and integrate geo references in a SIG - Software SIG MapInfo preferentially or ArcGis -GPS Garmin preferentially

Spa3203 The Space Missions Analysis and Design Process

Mission Characterization, Mission Evaluation, Requirements, Definition, Space Mission Geometry, Introduction to Sparo-dynamics, Orbit and Constellation Design, The Space Environment and Survivability, Space Payload Design and Sizing, Spacecraft Design and Sizing, Spacecraft Subsystems, Space Manufacture and Test, Communications Architecture, Mission Operations, Ground System Design and Sizing, Spacecraft Computer Systems, Space Propulsion Systems, Launch Systems, Space Manufacturing and Reliability, Cost Modeling, Limits on Mission Design, Design of Low-Cost Spacecraft, Applying Space Mission Analysis and Design

Spa3205 Space Plasma Physics I

Description of the Earth's plasma environment, plasma parameters, Debye shielding, plasma frequency, the derivation of single particle motions in electromagnetic fields, Trapped Particles, with applications to the Earth's magnetosphere.

Spa4101 Earth's Atmosphere

Basic concepts of Earth's Atmosphere - Hydrostatic Equations - Scale Height - Chemical Concepts of Atmosphere - Thermodynamic Considerations - Solar Radiation and its Effect on Atmosphere - Dynamics of Earth's Atmosphere - Equation of Motion of Neutral Atmosphere - Thermal Wind Equation - Elements of Planetary Waves - Internal Gravity Waves and Atmospheric Tides -- Fundamental Description of Atmospheric Dynamics and Effects of Dynamics on Chemical Species -- Basic Concepts of Neutral Atmospheric Modeling.

Spa4103 Ionospheric Physics

Introduction to Ionosphere -- Basic Concepts of Plasma Physics applied to ionosphere - Structure and Variability of Earth's Ionosphere -Photochemical Processes - Chapman's Theory of Photoionization -- Production of Ionospheric Layers - Ionospheric variability, Disturbance dynamo in different layers, Vertical and zonal plasma motion, External influences to the

ionosphere - Equatorial Electrojet - Refractive Index of the Ionosphere - TEC extraction from dual-frequency GNSS signals

Spa4105 Solar Physics

This is an optional physics course at an advanced level on the structure and dynamics of the Sun. The Sun is the most important source of energy for the Earth. The Sun also makes the most dominant contribution to global climate and the conditions of life on Earth. Therefore solar research is very important. Understanding of the basic features of the Sun already belongs to general education. Contents briefly: Solar structure and history, solar models, energy production in the Sun, solar neutrinos, solar oscillations and helioseismology, convection layer and differential rotation, solar magnetism and dynamo mechanism, solar atmosphere, solar activity, Heliospheric related topics.

Spa4107 Space Environment

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.

Spa4111 Planetary Physics

Study the internal structure of the earth and planets. Constitution, composition, temperature distribution, and energetics of the Earth's interior. Gravity field and density distribution. The geomagnetic field, paleomagnetism, the geodynamo, and concepts in geophysical fluid dynamics, Contents of the solar system. The Sun's composition , evolution of planetary and satellite atmospheres. Solar system dynamics and planetary impacts. Volcanism, earthquakes and internal structure. Origin and age of solar system and extra-solar planets.

Spa4113 Space Plasma Physics II

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.

Spa4115 Materials for Space

Structure of metals, Types and structure of alloys, Types of grain boundaries, Mechanical properties: PlSpaic deformation: Single crystal and Polycrystalline materials, Material tests: Hardness; Tension; Fatigue and Creep, Strengthening mechanisms, Behavior of Materials in Space (Temperature, Pressure and Radiation) -- Outgassing ---Corona Discharge--- Coating and Coating-compounds -- Radiation Damage --Effects of Vibrations and Shocks on Spacecraft Structures -- Spacecraft Thermal Environments – semiconductors and solar cells.

Spa4117 Geoinformatics

Elements of Cartography. Coordinate systems/projections, basic geodesy, photogrammetric and geographic data-base techniques. Spatial database modelling. Data supply for GIS: digital maps, digitisation, scanning and measurements with totalisers. The electromagnetic spectra, reflexion and emission from various ground objects. Digital remote sensing techniques and image analysis, thematic classification of multi-spectral data. Global Positioning Systems (GPS). Project planning, implementation of GIS in organisations

Spa4202 Global Navigation Satellite Systems

Conventional navigation, background, concepts and evolutions of global navigation satellite systems (GPS, GLONASS, Galileo, BeiDou/COMPASS) and regional navigations satellite systems (IRNSS, QZSS). Comparison of GNSS with other navigation systems; GNSS measurements: pseudo-ranges, carrier phase and Doppler, Impact of space weather events on GNSS, Errors in GNSS measurements, GNSS applications.

Spa4204 High Energy Sparophysics

This course covers a wide range of phenomena associated with the Sparophysics of high energy photons, cosmic rays and neutrinos, including the processes of ionization, bremsstrahlung, synchrotron, pion production, Compton and inverse Compton scattering, as well as cosmic ray acceleration. Specific sources of high energy emission will also be discussed, including active galaxies, pulsars, gamma-ray bursts and supernova remnants. Measurement-techniques, detectors and experiments for detecting high-energy cosmic rays.

Spa4206 Meteorological Remote Sensing

Interaction of electromagnetic radiation with matter (absorption, reflection, scattering etc) - Passive and active sensors : Principles of Observations - Passive : Imaging radiometer/Sounder/MW radiometer - Active Scatterometer, Altimeter, Laser, optical/infrared/water vapour and microwave, Operational meteorological satellites and radiosonde data.

Spa4208 Geomagnetism

Description of the geomagnetic filed, geomagnetic coordinates, mathematical models of geomagnetic filed, geomagnetic activity, geomagnetic indices, geomagnetic pulsation, satellite and ground-based measurement techniques of geomagnetic filed.

Spa4210 Image Processing and Analysis

Principles of visual interpretation of photos and satellite imagery, techniques of visual interpretation of thermal and microwave imagery, mathematical treatment, low and high pass filters, image classification and accuracy

Spa4214 Ionosphere and Magnetosphere

Earth's ionosphere and magnetosphere through studying the vertical plasma density profile, global plasma density distribution, vertical profiles of characteristic frequencies and electrical conductivities, current systems of the Earth's ionosphere, Additionally, simple numerical calculations concerning the production of ionospheric layers, the propagation of radio waves in the ionosphere and ionospheric current flows, The dynamics of the magnetosphere, magnetospheric storms and substorms.

Helwan University

المحتوى العلمى للمقررات الدراسية لقسم الكيمياء

Course Description for Chemistry Department

Helwan University

Compulsory Chemistry Program Courses Contents

Chm1101 General Chemistry I

Measurement in Scientific Study: SI-Units and conversion factors. Uncertainty in Measurement. Significant Figures in Calculation, Accuracy and Precision. Concept of Chemical Potential. States of Matters. Changes of States of Matter, Physical and Chemical properties, physical and chemical changes. Intramolecular and Intermolecular forces. Properties of solids, liquids and Gases, Gas Laws, types and properies of solutions, Types of solids and Unit cells. Chemical Reaction and Stoichiometry: Chemical equations, Calculations based on chemical equations, Limiting Reactant Concept, Percent yields. Concentration Units. Thermochemistry and Hess Law. Atomic structure and periodicity: Organization of matter, mixtures, compound, element, molecule, atom and quarck. Periodic trends and quantum numbers. Radioactivity. IUPAC nomenclatures for inorganic compounds. Recent topics. VESPER, VB and MO Theories: Lewis structure and molecular shape, predicting properties from a molecular orbital diagram - bond order, bond strength, bond length, and magnetism. Hyperdization: various types hybridization and shapes of simple molecules and ions.Valence bond theory and its limitations, Bond polarity from molecular oribital Theory.

Chm1103 Practical General Chemistry I

Safety in the laboratory. Physical properties of liquids: The densities of liquids and solid, viscosity and surface tension of liquids. Determination of molecular weight of volatile liquid. Acid radicals or anions: a) Dilute hydrochloric acid group; b) Concentrated sulphuric acid group; and c) Miscellaneous group. Basic radicals or cations: a) The Silver or HCl group: b) The hydrogen sulphide group (IIA the copper group, and IIB the arsenic group); c) Ammonium hydroxide group; d) Ammonium sulphide group: e) Ammonium carbonate group; f) Miscellaneous group. Inorganic mixture separation and identification: Separation of cations of group (I), Separation of cations of group (II), Separation of cations of group (III), Separation of cations of group (IV), Separation of cations of group (V), Separation of mixed cations.

Chm1202 General Chemistry II

Chemical kinetics: rate of reaction, order of reaction, how to determine order of reaction. Chemical equilibrium: reaction extent, reaction quotient and equilibrium constant and their expressions. Electrochemistry: Redox

reactions, balancing redox reactions, cell potenials, batteries, fuel cell, introduction to corrosion.
Organic compounds: structure determination, empirical and molecular formula. Classification according to the functional groups, IUPAC nomenclature, synthesis and reactions for aliphatic and aromatic organic compounds. Recent topics.

Chm1204 Practical General Chemistry II
Identification of simple organic compounds and purification, Common organic laboratories apparatus. Purification of solids and liquids: (i)- Crystallization: simple, fractional crystallization and sublimation, (ii)- Distillation: simple, fractional, vacuum and steam distillation. Extraction and separation. Experimental determination of the melting and boiling point. Detection of elements: nitrogen, sulphur and halogens. Identification of simple organic compounds: Alcohols (methyl, ethyl alcohol and glycerol), Aldehydes (formalaldehyde, acetalaldehyde, chloral hydrates, benzalaldehyde, Ketone (acetone), Acids (formic, acetic, oxalic, tartaric, citric, benzole and salicylic), Carbohydrates: Monosaccarides (glucose, fructose), Disaccarides (Maltose, lactose, succarose), Polysaccharides (starch). Simple scheme for identification of an organic compounds.

Chm2101 Principles of Classical Methods of Analysis
Concept of chemical analysis, steps of chemical analysis, method of expressing concentrations. Equilibrium and equilibrium constant, acid-base theory, calculation of pH: solutions of strong acids and bases, weak acids and bases. Titration curves, acid-base indicators. Acid-base titration in nonaqueous solvents. *Precipitation titrations*: titration with silver, titration curves, indicators. *Oxidation-reduction titrations*: oxidation-reduction indicators, titrations with strong oxidizing agents. Titration curves, direct titration with potassium permanganate, potassium dichromate and iodine. Indirect titrations involving iodine. Complexometric titrations: theory, titrations with EDTA, titration curves, indicators, and applications. Gravimetric analysis: Mechanism of precipitation, conditions for analytical precipitation, impurities of precipitates, washing and filtering precipitates, heating the precipitates, calculating the results, examples for precipitation methods, precipitation from homogeneous solution. Analytical application of precipitation techniques.
Tutorial part:
Errors in Chemical Analysis, precision and accuracy, mean, median, range, arithmetic deviation, relative arithmetic, deviation standard deviation,

variance, relative standard deviation, absolute error, relative error, radom error, systematic error.

Chm2103 Practical Analytical Chemistry I

Volumetric analysis: Neutralization titration; oxidation-reduction titration, precipitation titrations. *Complexometric* titrations. *Gravimetric analysis*: applications for the determination of cations and anions using inorganic and organic reagents.

Chm2105 Chemical Thermodynamics

Basic terminology: system, surrounding, boundary. Types of the Systems, Types of the Boundaries, Extensive Properties, Intensive Properties, Thermodynamic equilibrium, State Functions, Path functions, Reversible process, irreversible process, Interrelation of heat and work with chemical reactions, Heat Capacity, Specific Heat Capacity, Entropy, Free Energy, and the Direction of Chemical Reactions, Laws of Thermodynamics, Exception to the Thermodynamic Laws, Gibbs Free Energy, Helmholtz free energy, Spontaneous and Nonspontaneous Process, Enthalpy in Chemical Reactions, Enthalpy of Formation, Enthalpy of Combustion, Enthalpy of Solution, Enthalpy of Neutralization, Enthalpy of Dissociation, Enthalpy of Dilution, Enthalpy of Precipitation, Enthalpy of Hydration, Enthalpy of fusion, Enthalpy of vaporization, Enthalpy of Sublimation.

Tutorial part:

Selected problems for thermodynamics

Chm2107 Organic Chemistry I

Alkyl halides (nomenclature, preparations, nucleophilic substitution reactions S_N1 & S_N2, Elimination -E1 & E2, Zaitsev Rule, factors effecting S_N1 & S_N2, substitution, elimination and types of nucleophiles, and leaving groups)- Alkenes (stability and properties of alkenes and alkynes, Markovnikov's rule, E+ addition reaction- Alcohols, Ethers and epoxides (preparations, reactions and ring opening of epoxide)- Aldehydes & ketones (structure & nomenclature, physical properties, preparation, addition reactions, Witting reaction, Clemmenson reaction, reactions with 1^o & 2^o amines, hydration; acetal, cyclic and hemicyclic acetal formation)- Carboxylic acids & their derivatives (Structure & nomenclature, physical properties, preparation of carboxylic acids, nucleophilic acyl substitution reactions, reactions of acid halides, anhydrides, esters & amides- Carbonyl condensation reactions (Aldol & Claisen condensation reactions, Dieckmann cyclization, Michael addition, Knoevenagel, Stork reaction and Robinson annulation reaction. Amines

(Structure and nomenclature, physical properties, preparations, basicity of amines, Hofmaann elimination, reaction with nitrous acid, reaction of aryl diazonium slats and their coupling reactions). Recent topics.

Chm2109 Practical Organic Chemistry I

Lab safety and equipment- Determination of physical constants (melting and boiling points), Purification techniques (crystallization, decolorization, distillation)- Detection of elements N, C1, Br, I, S- Identifying an unknown compound by solubility and functional group tests-Separation of organic compounds mixture (acidic, basic and neutral)-Recent topics.

Chm2202 Spectrophotometric Methods of Analysis I

General features of analytical instruments, their performance characteristics, and calibration methods. 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.

Chm2204 Representative Elements Chemistry

Hydrogen: method of preparation, uses, and hydrides. *Alkali metals*: occurrence and isolation. Chemical reactivity, Trends in properties on descending. Group 1: Cesium ratio, the unusual properties of lithium. Oxides, peroxides and super oxides, reactions with water, thermal stabilities, the salts of the alkali metals, solutions of the alkali metals in liquid ammonia. Complexation of the alkali metals with crown ethers and cryptands. *Alkaline earth metals*; occurrence and uses of group 2; elements, trend in properties on descending the group. *Group 3:* general properties, structure, and uses of the elements, chemical properties, trends in the reactivity of the elements. *Group 4:* general properties, group chemical trends in bond strengths, inert pair effect, and first element anomaly, carbon allotropes, graphite, diamond and C_{60}, Oxides and halides of carbon and intercalation compounds e.g. $C_{60}K$.Silicon oxides, hydrides and halides. Catenation in group 4 compounds. *Group 5:* general properties, nitrogen, general properties, hydrides, azides, halides, oxides and oxyacids. Nitrogen fixation, fertilizers. *Group 6:* Oxygen: Structure and bonding of the allotropes of oxygen. Oxidation reactions involving singlet oxygen, atomic oxygen, and peroxo species, Sulphur: Allotropy, polysulphur species and the lability of the S-S bond. The application of VSEPR theory to the compounds of the elements of groups. *Group 7:* general properties, hydrogen halide,

oxides and oxyacids of halogens, interhalogen compounds, polyhalides, and basic properties of halogens. *Group 8:* separation of inert gases, chemical properties of noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Chm2206 Electrochemistry I

Conductance and its applications. Faraday's law of electrolysis. Arrhenius theory. Kholrush's law. Electrochemical reaction. Electrochemical half cell. Reversibility of electrochemical reactions. Electrochemical equilibria. Nernst equation and its applications. Electrode classifications. Electrochemical concentration cells. Liquid junction potential. Electrochemical Cells: Fuel cells, batteries and supercapacitors. Irreversible process. Electrode kinetics. Electrocatalysis: electrocatalyst. Electrochemical polarization (Activation- Concentration and ohmic polarization). Tafel's Equation. Mechanism of water electrolysis. Polarization (cathodic and anodic). Passivity and passive prosperities of passive films on metals. Recent Topics.

Chm2208 Phase Equilibria

Statement of phases, components and degree of freedom. Thermodynamics of phase equilibrium, phase rule. Phase diagram of one and multicomponent system. Applications of phase equilibria. Recent topic.

Chm2210 Soild State

Types and Classifications of Solids, type of bonds in solids, Atomic Structure of Solids, Crystalline, Semicrystalline, Polycrystalline, Amorphous, Atomic Packing in Solids, Properties of Solid materials and Crystal structure: 7 crystal systems, 14 Bravais lattices. Imperfections in solids: point, line, surface. Chemical structure and properties of different types of solids: Glasses, Ceramics, Organic Polymers, and Metal alloys. Diffusion in Solid materials. Characterization technique for solid materials: X-ray diffraction. *Recent topics.*

Chm2212 Organic Chemistry II

Benzene and aromaticity (Structure & nomenclature, stability, reactivity and orbital hybridization, the Huckel rule, anti-aromatic and non-aromatic compounds. Classification of the aromatic compounds)- Electrophilic aromatic substitution (Reactions of aromatic compounds. Mechanism of electrophilic substitution reactions. Effect of substituents on reactivity and orientation in electrophilic substitution)- Alkylbenzene (sources,

nomenclature, introduction of alkyl groups. reactions of alkylbenzene)- Aryl halides (nomenclature, properties, bonding in aryl halid, synthesis, nucleophilic substitution, addition-elimination & Diels-Alder reactions)- Phenols (nomenclature, synthetic methods–properties and acidity, reactions of phenols)- Nitro compounds, aromatic amines and diazonium salts (introduction of the nitro group, reactions of nitro compounds, reduction, introducing of amino group, aniline and its related compounds, reactions of aromatic amines, basicity of amines, diazonium salts and application in synthesis)- Aromatic aldehydes, ketones, carboxylic & sulphonic acids (nomenclature, physical properties, synthesis and reactions)- Polycyclic aromatic hydrocarbons (nomenclature, synthesis, properties and reactions of polycyclic systems. Fluorene, naphthalene, anthracene and phenanthrene)- Recent topics.

Chm2214 Organic Chemistry III

Fundamental principles of polyfunctional groups-Conjugated compounds (stability of conjugated dienes, preparation of dienes, the resonance hybrid, 1,2 & 1,4 electrophilic addition, addition of hydrogen halides & halogen, kinetic versus thermodynamic products, Diels-Alder cycloaddition reactions- Di, Tri and Polyhalogen compounds (synthesis, properties, differentiation and uses)- Polyhydric alcohols (nomenclature, types, methods of preparation, properties and reactions)- Unsaturated aliphatic and aromatic alcohols: Commercial Synthesis and properties- Dihydric and trihydric phenols (synthesis, physical and chemical Properties, uses in industry and medicine- α,β-unsaturated carbonyl compounds (laboratory and industrial methods of preparation, chemical properties mechanism of some reactions such electrophilic and nucleophilic substitution, conjugate addition , Claisen condensation, Perkin`s , Knoevenagel, Michael and Robinson reactions, beside special reactions- Differentiation between- α, β; - β, γ and- γ, δ unsaturated acids-Dialdhyde, diketones and dicarboxylic acids (synthesis, physical and chemical reactions)-Ketonic esters (acetoacetic ester-malonic ester), their uses in organic synthesis-Amino acids (structure, optical activity, synthesis, physical and chemical Properties). Recent topics.

Chm2216 Practical Organic Chemistry II

Multisteps Synthesis-Synthesis of organic compounds based on Oxidation: Benzyl chloride to Benzoic acid, Reduction: Nitro benzene to aniline, Electrophilic aromatic substitution: Nitro benzene, sulphanilic acid, p-bromo acetanilide Synthesis of optically active compounds: benzopinacol, O-

acylation: Asprin & N-acylation, O-benzoylation: phenyl benzoate, Diazotization reaction- Recent topics.

Chm3101 Spectrophotometric Methods of Analysis II

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.

Chm3103 Transition Elements Chemistry I

Transition elements Chemistry: Definition of transition metals in terms of electron configuration. *Occurrence and position of* transition metal elements in the periodic table, Trends in physical properties: size of atoms and ions, melting and boiling points, densities. Ionization enthalpies, magnetism. Trend in chemical properties: metallic character, variable oxidation states, electropositive nature. *Co-ordination Chemistry:* Lewis acids/Bases and complexes. Terminology of coordination chemistry. Survey of common ligand. Classification of ligand as pure σ-donors, π-donors and π-acceptors. Formal oxidation states and effective atomic number concept. Nomenclature. Coordination number and geometry. Structural isomerism: ionization, hydrate, coordination, linkage and ligand isomerism. Stereoisomerism: Geometrical and optical isomerism. Valance bond theory (VBT), limitations of valence bond theory. Crystal field theory (CFT), factors affecting the magnitude of crystal field splitting, crystal field stabilization energy, merits of crystal field theory and limitations of crystal field theory, spinel structures. Jahn-Teller distortion. Ligand Field Theory. Molecular orbital model for σ-bonded ML_6 and ML_4 complexes, high spin and low spin complexes. Applications on 3d elements.

Chm3105 Chemical Kinetics

Introduction to chemical kinetics, Difference Between Chemical Kinetics and Thermodynamics, Chemical Reaction Rates. Factors Affecting Reaction Rate. Determination of reaction order and rate constant. Integrated rate Equations. Half-life Time of a chemical reaction. Temperature dependence of reaction rates. Experimental Techniques for Measuring Reaction Rates. Collision Theory. Transition State Theory, Activation Energy and the Arrhenius Equation, Transition State, Reaction Intermediates. Kinetics of Complex Reactions.

Chm3107 Catalysis

Introduction to catalytic Reactions, Homogenous and Heterogeneous catalytic processes, Activity and Selectivity of the Catalysts, Theories of catalysis, Photocatalysis, Electrocatalysis, Enzymatic Catalysis, Inhibition of Catalytic Reactions, Catalytic Poisoning, Various catalysts characterization Methods.

Chm3109 Practical Physical Chemistry I

Thermodynamics: Heat effects and calorimetry. Heat of solution. Heat of formation of naphthalene or sucrose. Entropy of mixing. Thermochemistry and Hess's law.

Electrochemistry: Electroplating and electrodeposition. Conductmetric titration.

Phase Rule: Construction of phase diagram of the system naphthalene-p-nitrotoluene. Construction of the bimodal curve of the ethylacetate-ethyl alcohol –water system. Construction of a solubility curve for ternary system of liquids. Determination of the eutectic temperature of two component system. Construction of B.P-composition curves for a binary liquid mixtures.

Chm3111 Stereochemistry

Isomerism-2D representations-Optical Isomerism-Geometrical isomerism specification of the Cis/trans, and E/Z systems- The stereochemistry of aldoximes and ketoximes, Cis-trans and E-Z isomerism of cyclic alkanes-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 monosaccharides, conformation of the pyranoses, structure of α-amino acid)-Stereochemistry of organic reactions: stereoselective reactions, stereospecific reactions, reactions which proceed with racemation, elimination mechanisms (E2, Hoffmann), additions to alkenes (syn, anti), additions to carbonyls (Cram's rule), chiral techniques and syntheses, optical resolution, use of catalytic enzymes-Real-world applications, including chiral drugs-Recent topics.

Chm3113 Physical Organic Chemistry

Construction of molecular orbitals for important organic molecules and functional groups. Repetition of thermochemical concepts-Hammett equation and substituent constants and correlations- Dewar number and site selectivity in reactions of areneas Dual parameter linear free energy relations –Yukawa

– Tsuno equation and taft equations-Transmission of electronic effects- Azo-hydrazone, ring chain and annular types of tautomerism –Selectivity phenomena in organic cycloaddition reactions –Tandem and intermolecular dipolar cycloaddition reactions-Recent topics.

Chm3202 Transition Elements Chemistry II

Spectral characteristics of transition elements complexes: types of absorption spectra. Spectral terms; Russell Saunders states. Selection rules for electronic transitions in complexes, width of absorption spectra. Terms generated in ligand fields. Correlation diagrams, Orgel diagram, Racah parameters, Tanabe-Sugano diagrams. Electronic spectra of d^x complexes. Charge transfer spectra. *Magnetic properties of transition elements complexes:* types of magnetic character. Determination of magnetic susceptibility. Magnetic properties of complex ions. Magnetic criterion of bond type in complexes. Orbital contribution to magnetic moment. Quenching of orbital contribution. Spin-orbit coupling and magnetic moments. *Thermodynamics and kinetic aspects of metal complexes:* thermodynamic stability, kinetic stability. Stepwise and overall stability constants. Irwing-William series. Factors affecting stability, chelate effect, size and number of chelate rings, hard and soft acids and bases, macrocyclic effect, steric effect, entering group effects, trans effect. Detection of complex –formation. Determination of stability constants. Applications on 3d elements.

Chm3204 Practical of Chemical Analysis I

Hands-on experience in applying molecular spectroscopic methods to the analysis of different real samples and applying spectrophotometry in fundamental chemistry applications such as calculations of the metal-ligand binding constants and stoichiometry.

Inorganic preparations (double salts and complexes). Analyses of the prepared salts and complexes.

Chm3206 Quantum Chemistry

Basic postulates of quantum mechanics and their interpretation. Methods of quantum mechanics: properties of operators. Eigen value equation and expectation value. The Hamiltonian operator and the time-independent (Schrodinger equation). Potential energy surface. Advances in methodology for equilibrium geometry, properties (dipole moments). Transition moments or spectroscopic constants, (e.g. frequencies). The harmonic Oscillator: Power-series solution. The one -dimensional harmonic oscillator. Vibrational of molecules. Angular momentum. Simulation measurements of several

properties. Vectors. Angular momentum of ion. e-particle system. The hydrogen atom: The central force problem, Reduction of the two. particles problem to two-one particle problems. The rigid rotator. The hydrogen atom. Bound-state wave functions. Hydrogen-like orbital. Zeeman effects. Recent topics

Chm3208 Practical Physical Chemistry II

Kinetics of Decays. Catalytic decomposition of hydrogen peroxide. Hydrolysis and Saponification of ethyl acetate. Persulfate iodide reaction. Iodination of acetone using colorimeter. Determination the order of reaction between bromate and bromide ion in acid solution. Catalytic activity of some catalyst.

Chm3210 Heterocyclic Chemistry

Introduction, classification and nomenclature of heterocyclic compounds including five and six member heterocyclic compounds, unsaturated, saturated containing one, two, three different atoms O, N,S and their substituents- Aromaticity of heterocyclic compounds- Study of five membered heterocyclic including physical properties, synthesis, reactivity and comparison with aromatic system derivatives- Six member ring with one heteroatom (O): 1,2-pyran,1,4-pyran, di and tetrahydropyran and α-pyrone- Fused members ring with one heteroatom (N): Quinoline and Isoquinoline- Fused six members rings with one heteroatom (O)- Heterocyclic compounds containing two or more heteroatoms (O,N,S)- Study of heterocyclic analogues of benzene ring containing two atoms (N)- Study of purines and benzodiazepines chemistry- Recent topics.

Chm3212 Polymer Chemistry

Glossary of basic terms in chemistry of polymers-Types of polymers according to origin- Classification of polymers according to geometrical shape-Classification of polymerization processes according to mechanism of synthesis; Condensation polymerization and Addition polymerization (free radical polymerization, cationic polymerization & anionic polymerization)- Classification of polymerization processes according to technique; Emulsion polymerization, Bulk polymerization, Solution polymerization and suspension polymerization- Synthesis and applications of special industrial polymers such as Polyethylene, Polystyrene, Teflon, Cellulose Acetate, Cellulose Nitrate, Viscose, Lyocell, Nylon 6, Nylon 6-6, Bakelite, Melamine , Polyester, Natural and synthetic rubber, Polyurethanes, Plexiglass, Polymethylmethacrylate, Epoxy-resin- Determination of Polymer molecular

weight and degree of dispersity-Chemical resistance of polymers- Polymer additives- Polymer degradation-Recent topics.

Chm3214 Practical Organic Chemistry III

Synthesis of polyaniline- Synthesis of phenol-formaldehyde resins (Bakelite)- Synthesis of polystyrene- Synthesis of polyester - Determination for Degree of Polymerization- Multistep Synthesis-Synthesis of benzimidazole-Synthesis of benzotriazole -Synthesis of 7-hydroxy-4-methyl coumarin-Synthesis of 2-Amino-4-methylthiazole- Synthesis of Quinoxalines-Recent topics.

Chm4101 Inner Transition Metals Chemistry

Lanthanides: electronic configuration, oxidation states, atomic and ionic radii of M^{3+} ions, lanthanide contraction. Magnetic properties of M^{3+} ions, physical properties, chemical reactivity of lanthanides. Formation of compounds. Formation of complexes. Energy level diagrams for the lanthanide ions and their electronic spectra. Properties dependent on standard reduction potential values. Extraction of lanthanides from monazite sand. Separation of methods based on characteristics of lanthanides elements (separation from rare-earth ores). Production of lanthanides metals. Uses of lanthanides and their compounds. Comparison between 3d and 4f block elements. *Actinides:* trans-uranic elements, position of actinides in the periodic table. Occurrence. Radioactive nature. Electronic configuration. Oxidation states. Radii of M^{3+} and M^{4+} ions. Actinide contraction. Formation of complexes. Electronic spectra of actinide complexes. Properties of actinides. Comparison between lanthanides and actinides. Extraction, properties and uses of some inner-transition metals (thorium, uranium, and plutonium).

Chm4103 Colloidal and Surface Chemistry

Colloidal Chemistry: Types of solutions: true solution, colloidal solution, emulsions, suspensions, Classification of colloidal solutions: lyophilic and lyophobic, hydrophilic, hydrophobic. Properties of colloid solutions: Tyndal effect, Colloidal Stabilization, Zeta potential, electrophoresis, electro-osmosis. Coagulation and precipitation of colloidal particles. Rheology of Colloidal solutions. Preparation of Colloid Solutions, Protective action of sols. Recent topic: Examples of colloidal application in industry.

Surface Chemistry: Surface energy and activity. Cohesion and Adhesion forces, Capillary Action, Surface Tension, Modern methods for characterizing surfaces. Classification and properties of interfaces. Sorption,

Absorption, Adsorption, Adsorption and adsorption isotherms. Surfactants, Classification of Surfactants, Surfactants Assembling, Soaps and Detergents, Saoponification Mechanism, cleaning action of Soaps and Detergents. Introduction to Rheology. Recent topic.

Chm4105 Molecular Spectroscopy

Introduction to the principles of molecular spectroscopy. Application of molecular spectroscopy to study the rotational (microwave spectroscopy), vibrantional spectroscopy (IR and Raman and Electronic spectroscopy). Application to biological and chemical studies. Recent topics.

Chm4107 Organic Spectroscopy

Introduction to spectroscopy - Ultraviolet and visible spectroscopy (UV/Vis) (theory and applications, chromophores and auxochromes, hypso- and bathochromic shifts, molecular orbitals of polyenes, Woodward-Fieser Rules of dienes, and benzoyls)- Infrared spectroscopy (IR), theory, Hooks law, Mode of vibration, Factors affecting IR absorption, IR Spectrum, specification of the functional groups- Nuclear magnetic resonance spectroscopy (NMR), nuclear spin, the chemical shift, integration of the equivalent protons, signal splitting: spin-spin coupling, NMR solvents- ^{13}C NMR spectroscopy: DEPT and APT and hint about two-dimensional NMR spectroscopy- Mass spectrometry (MS), Methods of sample ionization, electron Impact, or Electron ionization (EI), mass spectrum, molecular ion peak, base peak, isotopic peaks, molecular formulas from isotope data, nitrogen rule, fragmentation of organic compound families- Recent topics. Tutorial part: Elucidation of organic structures (problems including U.V, IR, 'HNMR, Recent topics.

Chm4109 Chemistry of Natural Products

Introduction to secondary metabolites and their sources- Classification of natural products- Terpenoids classification - monoterpenoids - acyclic monoterpenoids, diterpenes, triterpenes and tetraterpenes- Steroids-stereochemistry of steroids-Chemistry of cholesterol, vitamin D, sex hormones, Alkaloids classification, phenylethyl amine group, ephedrine, pyrrolidine groups, hygrine-pyridine and piperidine group, pyrrolidine pyridine group, nicotine, phenanthrene alkaloids- Isolation methods of natural products-Recent topics.

Chm4111 Practical Organic Chemistry IV

Purification of natural compounds by column chromatography- Determination of R_f values of compounds by TLC- Spraying agents used for identification of different natural products classes- Extraction of caffeine from tea- Extraction of nicotine from cigarettes- Extraction of lycopene from tomato- Extraction of beta carotene from carrot- Extraction of eugenol from cloves- Extraction of terpenes from plants-Determination of structure of selected natural compounds-Recent topics.

Chm4202 Chromatographic Separations I

Overview of analytical separations. General description of chromatography. Classification of chromatographic methods. General theory of column chromatography. Optimizing chromatographic separations. Principles of gas-liquid chromatography and gas-solid chromatography. High performance liquid chromatography, partition, adsorption. Ion-exchange, size exclusion. Planar chromatography (paper and thin layer). Recent topics.

Chm4204 Nuclear Chemistry and Group Theory

I- *Elements and Radioactivity*: Nuclear structure, radioactivity, binding energy, cosmic rays, radioactivity in nature. Basic nuclear fission. Nuclear reactors, enrichment, fusion conservation laws. Radioactive decay, decay energy of alpha particle, decay energy of beta particle, gamma radiation process, spontaneous fission. Detectors, gas detectors, scintillation detector, liquid scintillation counting, semiconductor detectors. Radiation safety precautions.

II- *Group theory*: molecular symmetry and symmetrical elements, matrix algebra, representation of groups, reducible and irreducible representation, character tables. Symmetry of normal modes of vibration; prediction of infrared and Raman activities. Applications of symmetry to deduce structures of simple molecules.

Chm4206 Practical of Chemical Analysis II

Hands-on experience radioactivity measurements. Hands-on experience in applying basis of separation science by running simple chromatographic experiments such as TLC, PC and ion-exchange chromatography.

Chm4208 Corrosion

Corrosion. Introduction. Costs of corrosion. Thermodynamics of corrosion. Potential - pH diagram (Pourbaix diagram). Corrosion rate measurements

techniques. Forms and mechanisms of corrosion. Prevention of corrosion (Cathodic- Anodic- Inhibitor). Recent topics.

Chm4210 Physical Polymer

The scope of polymer science. Molecular weights of polymers. Polymerization. Crystallization of polymer. Polymer solution and blends. Relaxation and transitions in polymers. Physical characterisation of polymer. Modern topics of polymers. Recent topics.

Chm4212 Practical Physical Chemistry III

Colloidal Chemistry: Determination of the adsorption isotherm of different acids on charcoal. Determination of surface adsorption of amyl alcohol from aqueous solution. Preparation of colloidal solution of As_2 S_3, Sb_2 S and Fe $(OH)_3$, ferric oxide. Determination of the precipitation values of As_2S_3 sol by using monovalent, bivalent and trivalent cations. Preparation of colloidal nano-particles. Surface Chemistry: Determination of the S.T. of the given liquid by a single capillary rise method. Electrochemistry: Determination of solubility of sparingly soluble salts. Determination of the dissociation constant of acetic acid. Determination of the corrosion rate of different metals using microgravimetric method: Effect of temperature (2 Experiments). Determination of the corrosion rate of different metals using. microgravimetric method: Effect of concentration and pH of solution. Corrosion inhibition of different metals using inhibitor: Effect of inhibitor concentration. Corrosion inhibition of different metals using inhibitor: Effect of temperature.Determination of the corrosion rate of metals using electrochemical technique. Determination of the corrosion rate of metals using gasometric method. Determination of the corrosion rate of metals using thermometric method.

Chm4214 Photochemistry

Introduction of some basic concepts of photochemistry, Excitation, Electronically excited states relaxation types and photochemical reactions - photochemical oxidation - photochemical reduction - photochemical rearrangements of dienes - olefinic photochemical geometrical isomerism - photochemical substitution -photochemical elimination - Basic concepts of pericyclic reactions - Molecular orbitals - Frontier molecular orbitals - correlations diagram. Woodward- Hoffmann`s Rules of different types of Pericyclic reactions - cycloaddition, electrocyclic, & sigmatropic reactions and studying their stereochemistry.

Chm4216 Petroleum Chemistry

Origin of petroleum- Chemical properties of petroleum- Composition of crude oil- Oil refinery, Physical processes (Desalting and Dehydration, Crude distillation, Propane deasphalting, thermal processes), Catalytic processes (catalytic cracking, catalytic reforming and alkylation. Current and future trends in oil refining)- Octane and Cetane numbers- MTBE and ETBE production routes-Gaseous raw materials (gases – refinery- synthetic gases). Liquid raw materials (aromatic hydrocarbons- alicyclic (saturated paraffins). Solid hydrocarbons-Recent topics

Elective Chemistry Program Courses Contents

Chm2115 Nanoscience and Nanotechnology

Introduction to Nanoscience and Nanotechnology, History of Nanotechnologies, Standard Definitions of Nanomaterials, Size-dependent properties of nanomaterials, Nanomaterials Fabrication Techniques: Physical, Chemical and Biological Fabrication Techniques, Nanomaterials Characterization Techniques, Applications of Nanomaterials in Energy production and Storage, Applications of Nanomaterials in Environmental Protection and Improvement, Applications of Nanomaterials in Biomedical Fields

Chm2117 Safety in Lab and Sampling

The Safety Management aspect of the course teaches students to, among other things: Basic definitions and Workplace safety programs and their purpose -Who's responsible for workplace safety programs - Challenges for those practicing safety - Critical connections and work site analysis - Safety and special hazards - Implement a state of the art safety program. Recent topics.

- Importance of sampling, designing a sampling plan, implementing the sampling plan, separating the analyte from interferents, general theory of separation efficiency, classifying separation techniques, liquid–liquid extractions, separation versus preconcentration.

Chm2222 Thermodynamic of Solution

Thermodynamics of solution: Molar quantities. Thermodynamics of mixing. Colligative properties of solutions. Mixing of volatile liquids. Real solutions and activities.

Chm2224 Inorganic Chemical Industries

Sulfuric acid and its derivatives. Industrial gases: (nitrogen, oxygen, hydrogen, carbon dioxide,…), economics of industrial gases. Inorganic nitrogen compounds: (ammonia, nitric acid, ammonium nitrate, urea, ammonium sulfate. Chemicals from limestone: (lime, soda ash (sodiumcarbonate), sodium silicate (silica gel), calcium chloride. Sodium chloride derivatives and miscellaneous inorganics sodium chloride, caustic soda (sodium hydroxide, caustic), chlorine economics of caustic soda and chlorine. Hydrochloric acid (muriatic acid). Titanium dioxide.

Chm2226 Green Chemistry

History of Green Chemistry and Sustainability-Principle of green chemistry-Green Solvent (Industrial Applications Volatile Organic Compounds (VOC's)- -Industrial uses of Aqueous Solvents, Super Critical Fluids, and Ionic liquids-Microwave synthesis- Examples on green synthesis Vitamin C Synthesis using enzymes-Methyl Methacrylate syngas process.

Chm3117 Chemistry of Cemen

Calcareous and Argllacious raw materials, Classification and manufacture of Portland cement, cement components, cement phases. Constitution and specification of Portland cement, Chemical analysis, X-ray analysis (XRD & XRF). Burning of Portland cement cliker, phase composition, polymorphism of cement clinker phases, the kinetics of cement making. Hydration, setting and hardening of Portland cement , the strength of hydrated cement. Physicochemical and mechanical properties of Portland cements. Durability of Portland cement against aggressive ions.

Chm3119 Chemistry of Ceramics

Classic ceramics. Mineralogy, structure and green processing of clay minerals, kaolinite, illite, and montmorillonite. Rheology of clay particle suspension, zeta (electrokinetic) potential. Ceramic phase systemsm, phase diagrams, Gibbs phase rule, one,binary and ternary phase diagrams, Eutectic points. Chemistry of ceramic, firing process, thermal transformation of clay minerals. Electroceramic materials, superconducting ceramic. Non-oxide ceramics. Bioceramic materials. Advanced ceramic, processing, manufacturing and application.

Chm3121 Inorganic Reaction Mechanism

Thermodynamics and kinetic aspects of metal complexes: thermodynamic stability, kinetic stability. Stepwise and overall stability constants. Irwing-

William series. Factors affecting stability, chelate effect, size and number of chelate rings, hard and soft acids and bases, macrocyclic effect, steric effect, entering group effects, trans effect. The kinetics and reaction mechanisms of inorganic transition complexes Mechanism of substitution reactions, the general mechanism of squar planar substitution complexes of Pt(II) and other d-block ions. Substitution of octahedral complexes, replacement of coordinated water solvolysis, electron transfer reactions, synthesis of coordination compounds using electron transfer reaction, molecular rearrangements and reaction of coordinated ligands. Recent topics.
Radiation safety, detection of nuclear activity, statistics of counting, absolute disintegration rates and absorption measurements, scintillation spectrometry , separation techniques, uses of radiotracers, measurement of chemical equilibrium constant. Recent topics.

Chm3123 Micro Analysis
Elemental microanalysis. Microdetermination of carbon, hydrogen, oxygen, nitrogen, halogens, sulfur, metals, and other elements in compounds. Functional group analysis. Microdetermination of some functional groups in organic compounds. Recent topics.

Chm3125 Streoelective Synthesis
Asymmetric synthesis terminologies-Principle of stereoselectivity, strategies of asymmetric synthesis- The mechanistic basis of stereoselectivity-Generating stereogenic centers with achiral substrates-Stereo selective reactions of C=C double bond- DiSpareoselective transformations involving catalytic hydrogenation-Free radical reactions of organoboranes, alkenylsilanes and allylsilanes- Stereochemistry of free radical cyclization reactions, Prevost hydroxylation, Simon-Smith reaction. Enantioselective synthesis with chiral racemic catalysts, hydroboration reactions involving chiral boranes, Chiral organometal complexes, Chiral enolate aggregates, reductions with chiral complexes hydrides. Catalysis by chiral transition metal compexes, enantio selective epoxidations of alkenes. Enantioselective hydrogenations.

Chm3218 Organic Stereochemistry
Isomerism-2D representations-Optical Isomerism-Geometrical isomerism specification of the Cis/trans, and E/Z systems- The stereochemistry of aldoximes and ketoximes, Cis-trans and E-Z isomerism of cyclic alkanes-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 monosaccharides, conformation of the pyranoses, structure of α-amino acid).

Chm3220 Physical Separation and Characterization Techniques

I- Physical Separation techniques :

Types of Mixtures: Homogeneous and heterogeneous mixtures, Identify an appropriate separation technique based These properties include solubility, density, melting and boiling points, thermal stability, magnetic properties and particle size.

Magnetic Separation, Adsorption, Electro-refining, Solvent extraction, Sublimation, Volatilization, and Distillation, Filtration, membrane separation. Supercritical Fluids, Commercial supercritical fluids. Safety consideration of high-pressure equipment, tubing and valves. Supercritical fluid extraction and fractionation.

II- Characterization techniques:

Thermogravimetry. Differential thermal analysis. Differential scanning calorimetry. Thermometric titrations. Enthalpimetric methods. Surface potential, Pore size and volume. Recent topics.

Chm3222 Metallurgy

Metals: the first primitive refining techniques; brief descriptions of the cultural significance of metals. Extractive Metallurgy: Techniques used to win metals from mineral ores, including hydrometallurgical, pyrometallurgical, and electrometallurgical techniques. Solidification of Metals: Introduction to the science of metallurgy, including crystal structure; concepts of solidification and solid solubility; basic binary phase diagrams. Metal Forming: Forging, rolling, extrusion, swaging, and other techniques employed to form metals at elevated temperatures; rolling, stamping, coining, spinning, and other techniques used to form metals at ambient temperatures. Mechanical Properties and Their Measurement: Definitions of mechanical properties and explanations of testing procedures; introduction to concepts of standardization and quality control. Steels and CSpa Irons: Applications and Metallurgy: Description of the allotropic nature of iron and its effect on the properties of steels and cSpa irons; listing of selected applications of steels and cSpa irons. Heat Treatment of Steel: Hardness and hardenability of steel; specific processes and their applications; heat treating procedures, equipment, and hardness measurements.

Chm3224 Bio-inorganic Complexes

Medicinal inorganic chemistry of the unique properties of metal ions for the design of new drugs as cis- platin as paradigm of activity. New modes of interaction with the classical target, DNA, Non-covalent interactions with DNA, The metal as scaffold, Proteins and enzymes as non-classical targets, bioorganometallic drugs. Recent topics.

Chm3226 Environmental Material Analysis

Quality control assurance in chemical analysis (glp's requirement for lab quality and management system). Introduction to chemometrics methods for sampling and analysis of gaseous pollutants. Water analysis (parameters for water quality, lab. and field methods for quality analysis). HPLC, capillary electrophoresis, chemical sensors and automated methods of analysis (flow injection). XRF. XRD. GCMS. ICP. Recent topics.

Chm3228 Medicinal Organic Chemistry

Introduction to medicinal chemistry-Drug discovery- Organic synthesis of drug molecules- Antiseptics and Disinfectants-Anticancer agents-• Antiviral agents- Antimicrobial agents and antibiotics- Antiparasitic agents- Drug interactions with receptors- Enzyme inhibition and inactivation-Pharmacokinetics (PK)- Ethics- Recent topics.

Chm3230 Bioorganic Chemistry

Introduction to Bioorganic Chemistry- Biomimetic Chemistry-Biotransformation in Organic chemistry-The Enzyme Models- Enzyme in Organic Chemistry (Examples of catalytic reactions: Acid -base catalysis, enzymatic catalysis, metal catalysis (in biological systems). Sugars and bases and Nucleic Acids- Chemical synthesis of DNA- Fluorescently Labeled Nucleosides and oligonucleotide probes and SNPs. Organic-chemical reactions in water. Comparison between synthesis in biological systems and industrial synthesis.

Chm4111 Inner Transition Elements and Nuclear Chemistry

Lanthanides: electronic configuration, oxidation states, atomic and ionic radii of M^{3+} ions, lanthanide contraction. Magnetic properties of M^{3+} ions, physical properties, chemical reactivity of lanthanides. Formation of compounds. Formation of complexes. Energy level diagrams for the lanthanide ions and their electronic spectra. Properties dependent on standard reduction potential values. Extraction of lanthanides from monazite sand. Separation of methods based on characteristics of lanthanides elements

(separation from rare-earth ores). Production of lanthanides metals. Uses of lanthanides and their compounds. Comparison between 3d and 4f block elements.

Introduction to actinides chemistry.

*Elements and Radioactivity***:** *Elements and Radioactivity*: Nuclear structure, radioactivity, binding energy, cosmic rays, radioactivity in nature. Basic nuclear fission. Nuclear reactors, enrichment, fusion conservation laws. Radioactive decay, decay energy of alpha particle, decay energy of beta particle, gamma radiation process, spontaneous fission. Detectors, gas detectors, scintillation detector, liquid scintillation counting, semiconductor detectors. Radiation safety precautions.

Chm4117 Computational Modeling

Ab initio simulations of crystalline solids:

General background: Electronic structure problem, Born-Oppenheimer approximation, Hamiltonian, Schrödinger equation, First-principles calculations. ABC of ground-state Density-Functional Theory (DFT): Brief history of DFT, Hohenberg-Kohn theorem, Kohn-Sham equations. Common Functionals used in DFT calculations: Local density approximation (LDA), Generalized gradient approx (GGA), Hybrid functionals. DFT calculations for simple solids. Computational modeling of structural properties of materials. Excercises and hands-on: ABINIT, VASP, Quantum Esperesso, Gaussian, VESTA.

Chm4119 Organometallic Chemistry I

Metal Carbonyl and Related Complexes. Full MO description of M(CO)6, M= Cr. Synergic bonding: description, physical consequences, $\square_{CO}$ for isoelectronic series and geometrical polycarbonyl isomers, bond length changes. The 18-electron rule: relative energies of 3d, 4s, and 4p orbitals across the series, deviations from the rule. Tolman's rule. Synthesis of binary carbonyls: high pressure e.g. $Fe(CO)_5$, $Mo(CO)_6$, low pressure by electron transfer e.g. $V(CO)_6^-$, $Ta(CO)_6^-$, $Mn_2(CO)_{10}$. Chemistry of binary carbonyls: thermolysis and photolysis. Dissociative pathways. Preparation of bridging carbonyls: electron counting and the concept of fragments in large cluster building. Supported and unsupported metal-metal bonds in carbonyl clusters. Similarity of synergic bonding for NO, CNR and PR3 compared to CO. Use of Ru and Rh systems to demonstrate associative and dissociative mechanisms in preparation of complexes of these ligands. Stability, application and biological activity of aliphatic and aromatic complexes and

related complexes. The molecular hydrogen ligand and its relevance to catalytic cycles seen earlier. Hydrogenation of d^0 metal alkyls. Recent topics.

Chm4121 Electroanalytical Methods of Analysis

Principles of electrolysis. electrodeposition, coulometric methods of analysis, voltammetry, amperometry, polarography and conductometric methods. Potentiometric methods, overview of potentiometric methods. Direct potentiometry, indicator electrodes, ion-selective electrodes. Potentiometric titrations, potentiometric methods involving enzymes. The electrochemical generation of chemiluminscence biosensors. Recent topics

Chm4123 Industrial Organic Chemistry

Introduction to industrial chemistry, general principle, economic importance of the chemical industry, raw materials conversion, major organic chemical processes (principle and basics), example of some organic industries such as surface coating, adhesives, textiles, plSpaics and cosmetics).

Chm4125 Organometallic Chemistry II

Introduction to Organometallic Chemistry - Metal alkenes and alkynes compounds, synthesis, reactions and bonding- Organo tin reagents, hydrostannation reaction and synthetic utility of vinylstannanes and allylstannanes in addition and substitution reactions. Organoboron and aluminium reagents, alkyl and aryl derivatives, synthesis and examples of applications in C-C bond forming reactions. Metal carbene compounds, Synthesis of Fisher carbene complexes-synthesis of Schrock carbene complexes. Ligand substitution reactions in Organometallic compounds. Metal Clusters: Synthesis and reactions. Homogeneous Catalysis using Organometallic Compounds: Asymmetric synthesis Catalytic Hydrogenation of Alkenes and related compounds-Hydroformylation reactions. Methanol Carbonylation and Olefin Oxidation, Olefin Metathesis-Palladium catalyzed C-C and C-N cross coupling reactions-. Activation of arene nucleus and side chain-Nucleophilic substitution and addition of arene-Metal (Rh, Ir) catalyzed C-H activation reactions and their synthetic utility.

Chm4218 Chromatographic Separations II

General description of chromatography. Classification of chromatographic methods.

General theory of column chromatography. Optimizing chromatographic separations. Principles of gas chromatography. High performance liquid

chromatography, partition, adsorption. Ion-exchange, size exclusion. Planar chromatography (paper and thin layer). Recent topics

Chm4220 Practical of Chemical Analysis IV

Hands-on experience in applying molecular spectroscopic methods to the analysis of different real samples and applying spectrophotometry in fundamental chemistry applications such as calculations of the metal-ligand binding constants and stoichiometry.

-Hands-on experience in applying basis of separation science by running simple chromatographic experiments such as TLC, PC and ion-exchange chromatography.

Chm4222 Basics Chemistry of Heterocycles

Introduction, classification and nomenclature of heterocyclic compounds including five and six member heterocyclic compounds, unsaturated, saturated containing one, two, three different atoms O, N,S and their substituents- Aromaticity of heterocyclic compounds- Study of five membered heterocyclic including physical properties, synthesis, reactivity and comparison with aromatic system derivatives- Six member ring Recent topics

Chm4228 Statistical Thermodynamics

Introduction. Boltzman probabilities for energy levels. The basic of equilibrium statistical mechanics. Ensembles theory and partition functions. Chemical equilibrium and thermodynamic properties. Recent topics.

Chm4230 Advanced Physical Chemistry of Polymer

Structure of polymer chain: Introduction to chain isomerism. Stereochemistry. configurations, and conformations. Amorphous state of polymers: In-depth examination of polymer conformation, microstructure, and dynamics in the amorphous state. Polymer viscoelSpaicity: Stress relaxation, mechanical models of polymer behavior, time-temperature superposition, perhaps rheology. Crystalline state of polymers: Crystallization and kinetics, crystalline structures, experimental methods. Polymer solutions and blends: Thermodynamics, phase separation, mechanisms, kinetics. Relaxation and transitions in

polymers: Polymer relaxation mechanisms, the glass transition, experimental methods, and introduction to viscoelSpaic behavior. Mechanical behavior of Polymers: Polymer fracture, stress-strain behavior, and ultimate properties. Recent topics.

Chm4232 Water Treatment

Water sources, water types, water quality, purification techniques of water, desalination of seawater, industrial and domestic wSpaewater treatment.

Chm4234 Nanomaterials for Energy Conversion and Storage

Energy Production: Electrochemical Cells, Electrochemical Impedance, Type of Fuel Cells, Main Components of Fuel Cells, Chemical Reactions in Fuel Cells, Biofuel Cells, Solid Oxide Fuel Cells. Types of Solar Cells, Main Components of Solar Cells, Principles of Solar Cells. Energy Conversion: Water electrolysis and CO_2 reduction. Energy Storage: Type of Batteries, Main Components of Batteries, Li-ion Batteries, Types Supercapacitors, Main Components of a Supercapacitors, Chemical Reactions in Supercapacitors.

Chm4236 Separation Methods

Oxidation-Reduction Processes, Precipitation, Co-precipitation, Filtration. Adsorption, Ion exchange, Electrodeposition, Solvent extraction, Volatilization and Distillation, Carriers and Tracers. Recent topics.

Chm 4238 Petrochemicals: (2Cr.)

Conversion of Natural gas into petrochemicals, Natural Gas Resources (oil and gas reserves, Natural gas and associated gas, future sources of natural gas)- Composition of natural gas, origin of hydrocarbon & non hydrocarbon components, formation of natural gas, properties of natural gas- Petrochemicals from : methane – methanol – n-paraffins – high – molecular weight paraffins – ethylene – propylene and higher olefins – benzene , toluene and xylene (BTX).

Chm4240 Chemistry of Dyes

Historical and Development of Colorants- Classification of dyes- Important chromophores- Benzenoid and quinonid - Valence bond and molecular orbital theories of color and constitution- Nitro, Azodyes, Mordant Brown, Congo Red, Malachite Green Magenta, Crystal Violet, Alizarin, Phenolphthalein, Fluorescein, Eosin and Indigo- Leather and hair dyes –Food dyes -Photographic dyes – Dyeing technology

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Chm4242 Organic Design: The Disconnection Approach

An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions, importance of order of events in organic synthesis, one and two group C-X disconnections, selective organic

transformations: chemoselectivity, regioselectivity, stereoselectivity, Reversal of polarity, cyclization reactions, amine synthesis, One group C-C disconnections (Alcohols (including stereoslectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis), Two group C-C Disconnections (Diels-Alder reactions, 1,3 difunctionalized compounds and α, β-unsaturated compounds, control in carbonyl condensations, 1,5 difunctionalized compounds, Michael addition and Robinson annelation).

Chm4244 Chemistry of Pesticides

History of pesticides, innovation of pesticides chemistry, development of Pesticides- Pesticides classification (Chemical class, targets), structures, chemical names, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, mode of action, uses, toxicity (acute and chronic toxicity in mammals, birds, aquatic species etc.), methods of analysis. Pesticide management.

Compulsory Applied Chemistry Program Courses Contents

ACh2202 Chemistry and Technology of Textile and Dye

Classification of textile fibres (natural, synthetic and man-made fibres)-physical properties of fibres-manufacture of synthetic fibres- the processing of textiles. Colour and constitution. Classification of dyes. The synthesis and properties of dyes and pigments. Dyeing mechanisms. Chemistry and theory of dyeing. Chemistry and application of reactive dyes. Dyeing machineries, printing technology. Dyeing of natural, synthetic and man-made fibres. Colour fSpaness properties; chalking, bleeding and blooming in dyes. Recent topics.

ACh2204 Chemistry And Technology of Petroleum and Fuel Petroleum:

Origin of petroleum, theories of petroleum formation, chemical composition of petroleum, chemical evaluation of crude oil. Petroleum refining and separation processes (Crude oil pre-treatment, desalting, atmospheric distillation, vacuum distillation, solvent deasphalting and dewaxing processes). Distillates upgrading and the chemistry in the refinery (Thermal cracking, coking, catalytic reforming, catalytic cracking, hydrocracking, catalytic hydrotreating, dehydrogenation, dehydrocyclization, isomerization, alkylation, polymerization, hydrotreating and desulfurization). Heavy feedstocks refining. Petroleum products and their properties and applications. Processing and management of refinery wSpae.

Fuels: Definition of fuel and its different types **(**Petroleum and non-petroleum fuels, LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from wSpae, synthetic fuels (gaseous and liquids), and clean fuels.

ACh2206 Practical Applied Chemistry I

Textile and dyes

Fabric analysis, identification of various types of fabrics (natural and synthetics), testing of selected fabrics (Keir boiling, bleaching…..)

Identification of dyes and laboratory preparation of some dyes. Application of the prepared dyes. Testing for fSpaness properties to light, washing, rubbing, etc. Evaluation of change in color & staining. Preparation and application of printing pSpae.

Petroleum and fuels

Measurement of density, specific gravity and API gravity of crude oil-measurement of aniline point of different fraction from crude oil such as gasoline (octane number 80, 90), solar and diesel- measurement of cetane number for diesel-measurement of cloud and pour point for gasoline and solar-measurement of diesel index and freezing point of solar-determination of total acidity and ash content of crude oil-material safety data sheet for some petroleum component.

ACh3101 Chemistry and Technology of Paper and Board

History of paper of paper making-raw materials for paper and board manufacture- pulping processes (Introduction to pulping- mechanical pulping-semichemical pulping- chemical pulping)-pulp bleaching -screening and cleaning of pulp- non-fibrous additives to paper making stock. preparation of stock for paper making- paper manufacture (paper machine)-surface treatment (sizing, pigment coating, calendaring). Paper testing. Recent topics.

Practical

Selection and testing of fibrous raw materials- pulping using various methods (acidic and alkaline)- Determination of kappa number of the pulp before and after pulping- bleaching of the prepare pulps, hand sheet preparation - physical , mechanical, and chemical testing of the prepared sheets

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ACh3103 Chemistry of Silicate and Binder

General introduction about material Science, structure of silicates. Clay and clay minerals- materials and components from natural rock-properties of building materials-minerals binders- non-traditional binders. Recent topics.

ACh3202 Chemistry and Technology of Polymer and PlSpaic

The nature of polymer (High molecular mass compound) - Outline of sources of raw materials for polymers- Synthesis of polymers (Polymerization process, condensation polymerization in details) - Brief description of individual polymers - Structure and properties of polymer- Additives for plSpaics- Manufacture of thermoplSpaic and thermosetting and their application- Copolymerization, it's mechanism and applications. Polymer processing: injection, extrusion, compression, blowing and transfer molding of thermoplSpaics….ect. Environmental consideration. Recent topics.

Practical General scheme for synthesis of thermoplSpaic and thermoset polymer. Synthesis of some types of polymers (e.g. Backalite-Urea-formaldehyde-Melamine, epoxy-resins-Synthetic rubber, butadiene, acrylonitrile, butadiene styrene, chloroprene, Thiokol, foaming (polyurethane). Characterization of the prepared polymer (e.g. density viscosity, degree of polymerization, IR …)-forming of some plSpaic film and their characterization.

ACh3204 Chemistry and technology of cement and concrete

Chemical reactions of the cement manufacture process their phase relations .Chemical and mineralogical composition of Portland cement. Setting and hardening. Hydration of the individual cement phases and cement as a whole. Types of cement according to the specifications. Chemical analysis. Chemistry of concrete. Chemical admixtures and mineral additives for concrete. WSpaes in construction. Recent topics

Practical

Chemical analyses for building raw materials: **(**Determination of total dissolved solid content in water, loss on ignition for cement, chloride content in water, cement, and aggregates, sulphate content in water, cement, and aggregates, free lime and magnesium oxide content in cement, pozzolanic reactivity for some wSpaes. Overview of XRF, XRD devices in characterization of building raw materials)

Physical and mechanical analyses: Determination of fineness, consistency, setting time, soundness, specific gravity, compressive strength and expansion of cement. Sieve analysis of fine and coarse aggregates, specific gravity and water absorption of fine aggregates, specific gravity and water absorption of coarse aggregates, Bulking of sand, Minislump test, Flow table test.

ACh3206 Quality Management

Basic concepts of quality, global quality Systems: ISO 9001 and other ISO systems (ISO 1400, ISO 17025,,,,,,). quality assurance, bench marking. six

sigma. Total quality management: an integrated approach -New design control - Incoming material and product control. Recent topics.

ACh3208 Pharmaceutical Industry A

Introduction of Pharmaceutical sciences, inorganic and organic pharmaceutical chemistry, drug design and medicinal chemistry, water treatment systems, pharmaceutical formulations and drug-delivery systems. pharmacological basis of therapeutics and major classes of drugs, drug-receptor interactions, biopharmaceutics and pharmacodynamics.

ACh3210 Industrial Organic Chemistry

Reaction mechanisms, basic processes and technology for production of the most important organic compounds, intermediates and final organic chemicals using particular alkylation, acylation, isomerization, polymerization, polycondensation, polyaddition, halogenations, nitration, sulfonation, oxidation, hydrogenation, hydration, esterification, etherification, condensation and amination reaction. The manufacturing processes based on methane, ethylene, propylene, C-4 hydrocarbons, benzene, tholuene, xylene, coal, fat, oils and carbohydrates, Recent topics

Chm3216 Practical Physical Chemistry V

*Thermodynamics***:** Heat of solution. Heat of formation of naphthalene or sucrose.

*Phase Rule***:** Construction of phase diagram of the system naphthalene-p-nitrotoluene. Construction of the bimodal curve of the ethylacetate-ethyl alcohol –water system.

Kinetics of Decays. Catalytic decomposition of hydrogen peroxide. Hydrolysis and Saponification of ethyl acetate. Determination the order of reaction between bromate and bromide ion in acid solution.

*Colloidal Chemistry***:** Determination of the adsorption isotherm of different acids on charcoal. Determination of surface adsorption of amyl alcohol from aqueous solution. *Surface Chemistry***:** Determination of the S.T. of the given liquid by a single capillary rise method.

Electrochemistry: Determination of solubility of sparingly soluble salts. Determination of the dissociation constant of acetic acid. Determination of the corrosion rate of different metals using microgravimetric method: Effect of temperature (2 Experiments). Determination of the corrosion rate of different metals using. Corrosion inhibition of different metals using inhibitor: Effect of inhibitor concentration. Determination of the corrosion rate of metals using gasometric method.

ACh4101 Chemistry and Technology of Paints

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.

Practical

Inspection and testing of paint raw materials, using standard methods to determine the chemical and physical properties of the sample which affect directly on the product quality (Pigments, extender, binder and solvent test.- Final paint product inspection by measuring :Liquid paint tests as general appearance, solid content, viscosity, binder content, density, fineness of grind and PH determination. Dry film tests as general appearance, drying time, hiding power (contrSpa ratio), gloss, washability, chemical tests, acid resistance, alkali resistance, distilled water resistance, petroleum solvent resistance, corrosion resistance test and color "tinctorial" strength.

ACh4103 Chemistry and Technology of Packaging Materials

Definition and functions of packaging. Packaging materials (glass, metals and foils, paper and paperboard. artificial polymers, synthetic organic plSpaics, composites, other materials). Types of packages (traditional package, coupled packages, smart and intelligent package,)- coating and laminating processes. Introduction to printing of different packages. surface treatment of plSpaics. Environmental issue. Recent topics.

Tutorial

Study cases of different packages made from glass, metal, paper, plSpaics and laminated packages-function and properties of lables-Designing of successful packaging. Students will collect samples of various packaging used in industry and prepare a comparison chart for various facility or innovative function.

ACh4202 Chemistry and Technology of Printing Inks

Nature of printing ink. The main printing processes. Printing ink raw materials (pigments, resin, etc). Manufacture of printing ink and pigment dispersion. Principles of printing ink formulation. The colloidal nature and rheology of printing ink. Types of printing ink (letterpress, flexo, screen-printing, etc). Testing of printing ink. Printing ink in relation to paper. Problems of print quality. Recent topics.

ACh4204 Solid WSpae Management

Definition of wSpae, wSpae characterization, classification systems. Strategies for wSpae handling, collection and separation, wSpae minimization, recycling, etc.. Law and means of control, international comparisons, scenarios. WSpae treatment, thermal and biological methods, recycling and reuse, landfill, and treatment of hazardous wSpae. Recycling of paper, plSpaics and metals Recycling of biodegradable wSpaes. Environmental assessment. Recent topics.

ACh4206 Unit Operation

Introduction to chemical technology. Unit systems: SI, CGS, FPS. Evaluation of constants of: Work, energy and power, heat, Temperature, pressure and gravity. Fundamental Concepts of material balance and energy balance. Process Flow diagram. Unit Operations in the manufacture of main industries: mixing and agitation, drying, evaporation, distillation, crystallization, size reduction,… Rheology of liquids and pSpaes: Rheometry, definitions, methods, applications. Recent topics.

ACh4208 Practical Applied Chemistry II

Printing ink; Measurements of printing ink fineness, density - flow time and viscosity by Ford cup No. 4 and rotational viscometer- -Flexography printing by K-Lox and study, Evaluation of Flexography printing (gloss, optical density, adhesion (on plSpaic samples)-Resistance properties of inks against (acids, alkalis, alcohols, detergents) -Screen printing: colour matching, colour mixing, and the effect of substrate.

Solid wSpae; Collection of wSpae samples including various types of packaging materials-Separation the individual items- washing and deinking of some wSpaepaper, bleaching recycled pulp, Physical and chemical characterization of the prepared sheets from recycled pulp. PlSpaic identification and deinking using different solvents -Deinking of printed metal and glass packages

Elective Applied Chemistry Program courses contents

ACh2208 Introduction to Nanoscience and Nanotechnology

General concepts of nanotechnology, classification of different areas of nanotechnology, preparation of nanoparticles (physical, chemical and green routes), theories of nucleation and crystal growth, effect of nanosized on physical, chemical, optical and magnetic properties of nanomaterials, introduction to characterization.

ACh2210 Chemistry and Technology of Adhesives

physical and chemical aspects of adhesion, basic theories of adhesion. Types of adhesives based on polymers (hot-melt adhesives, contact adhesives, solvent type adhesives, dispersed adhesives, pressure-sensitive adhesives etc…) . Adhesives based on natural polymers. ThermoplSpaic type of adhesives. Reactive type of adhesives. Adhesives for special applications (conductive adhesives and glues, high temperature resistant adhesives). Rheology of adhesives, general physical and chemical test procedures

ACh2212 Industrial Inorganic Chemistry

Industrial gases: (nitrogen, oxygen, hydrogen, carbon dioxide, …), industrial processes used to produce acids (Sulphur, hydrochloric aids, nitric acids….) some inorganic compounds based on nitrogen, sulphur, Phosphorus, nitrogen, halogen compounds and their derivates, alkaline salts (e.g sodium chloride, caustic soda (sodium hydroxide, caustic) important types of pigment and (Inorganic pigments; TiO_2, lithopone, ZnS, ZnO and Fe_2O_3) fillers

ACh3105 Chemistry and Technology of Fertilizers

Introduction of fertilizers. Types of fertilizers (nitrogenous fertilizers, phosphatic fertilizers, potassic fertilizers, complex and NPK fertilizers, miscellaneous fertilizers). Industrial production of different types of fertilizers. Use of fertilizers. Types of different soils, dose of fertilizers to each soil. Environmental impact of fertilizers.

ACh3107 Chemistry and Technology of Iron and Steel

Introduction to extractive metallurgy (pyrometallurgy -hydrometallurgy)-Raw materials of iron making (iron ore - fluxing material – fuel - any other wSpae)-Beneficiation (Purification) of iron ore (washing- gravity separation- floatation -magnetic separation -magnetizing roSpaing -electrostatic separation)-Agglomeration of raw materials (sintering and palletization : raw materials, practices, chemical reactions of both processes)-Pig iron production (blSpa furnace reaction, blSpa air composition, thermodynamics in blSpa furnace, blSpa furnace products and their uses)-Direct Reduced Iron (DRI) (Midrex furnace, thermodynamic and reactions)-Iron carbon diagram (steel and cSpa iron)-Steel making (different methods of steel making productions -reactions in basic converter (Thomas) oxygen basic converter (L.T process)- stainless steel production , types and steel alloys Recent topics (carbon dioxide emission and energy consumption problems in ironmaking and steel making industry).

ACh3109 Chemistry and Technology of Nonferrous and Alloys

Brief Introduction of Non Ferrous Ores ore & mineral ,Brief review of traditional methods of metal production of common metals such as copper, zinc, lead, aluminum thermodynamic and kinetic of metal extraction- advanced converters for copper extraction- Hydrometallurgical processes for the extraction of zinc- flow sheets for the extraction of thorium, niobium, cobalt, zirconium, tungsten, molybdenum and gold. Unit processes in each stage,. Alloy production for non ferrous metal such as copper aluminum, magnesium and titanium nickel

ACh3111 Chemistry and Technology of Insecticides and Pesticides

Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical properties, chemical properties, manufacture of some types, degradation, metabolism, formulations, mode of action, uses, toxicity and environmental hazards.

Classification and Study of following insecticides with respect to structure, chemical name, Physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.

ACh3113 Food Science and Technology

Introduction. Packaged product quality and shelf life. Environmental and cost consideration in selecting packaging materials. Packaging aesthetic and graphic design. Interactions between packaging material and foods. Active or smart packaging. Modified atmosphere packaging. Vacuum packaging, gas flush packaging, Quality control in food industries: Testing of packaging; Rigid and semi rigid containers; Flexible containers. Labeling, Barcodes & other marking. Environmental issue. Recent topics.

ACh3212 Surfactants, Soaps and Detergents Technology

Types of surfactants, surface active properties, critical micelle concentration, surfactant-polymer interaction. Biosurfactants and Biodegradation of surfactants, Chemistry and manufacturing technology for soaps and detergents. Sources and types of fats and oils used in soap industry, other raw materials. Cold and hot processes of soap making. Chemistry and technology of synthetic detergents (anionic, cationic, non-ionic, and amphoteric), detergent additives, formulations, and manufacture, of detergent powders, tablets, liquid and pSpaes for household and industrial applications recent topics

ACh3214 Industrial WSpae Water Treatment
Overview and introduction, regulation, environmental problems of industrial wSpae water, categories of industrial pollutants (inorganic and organic pollutants), , methods of treating industrial wSpae water (pretreatment , physical , chemical, biological, a combination methods), characterization and treatability studies of industrial wSpae , water, unit operations and unit processes used in treatments, , examples of wSpae water in some industries (textile, paper, ……etc), Zero Liquid Discharge (ZLD) principles

ACh4105 Chemistry and Technology of Petrochemicals
Primary raw materials for petrochemicals. Crude oil processing and production of basic, intermediate, and final petrochemicals. Chemicals from paraffins (Halogenation, nitration, oxidation, alkylation, Thermolysis). Chemicals from olefins (Hydroxylation, Halogenation, Polymerization, oxidation). Chemicals from aromatics. Chemicals from acetylene. Chemicals from natural gas. Inorganic petrochemicals. Synthesis gas. Conversion processes for selected petrochemicals.

ACh4107 Chemistry and Technology of ElSpaomers
Natural rubber, volcanization, accelerators. Development of synthetic rubber. Catalysts and their mechanisms. Tires and rubber applications. Recent topics.

ACh4109 Chemistry and Technology Ceramics and Refractories
Introduction to ceramics. Ceramic raw material. Ceramic manufacture processing. Types of ceramics and forming technology, physical and chemicals properties of ceramics. Ceramic coatings. Advanced ceramics. Recent topics. Fundamentals of refractory science and engineering. Manufacturing, Properties and applications of following refractories. Testing of important properties of refractories. Monolithics. Non-oxide Refractories. Carbon bearing refractories. Recent topics.

ACh4111 Forensic Chemistry
Introduction to forensic chemistry (drugs and toxic chemicals) ..types of narcotics .. types of poisons.. drug and poisons identification examination methods. Analytical strategies for different types of forensic investigations

ACh4210 Industrial Corrosion and Protection

Introduction to corrosion and its mechanism, factors affecting corrosion, types of industrial corrosion, general methods for corrosion prevention (metallic coatings, organic paints, varnishes, cathodic and anodic protection). corrosion Inhibitors, basics and classification of corrosion Inhibitors. Mechanisms of corrosion inhibition. Techniques for evaluation of inhibition efficiency. Case study for application of corrosion inhibitors for boiler corrosion, cooling water systems, reinforced concrete, chemical and petrochemical industries.

ACh4212 Application of Nanomaterials

Introduction to nanoparticles and nanocomposite, preparation, full characterization, application and benefits (medical, industrial, environmental, energy generation and storage, food processing & packaging drug delivery)

ACh4214 Pharmaceutical Industry B

Industrial pharmacy and parameters of quality, Good manufacture practices (GMP) and basics of quality control and quality assurance, active pharmaceutical ingredients (APIs): specifications and regulations.
spectroscopic characters of drugs, instrumentation in pharmaceutical industry: HPLC, GC and LC-MS.

ACh4216 Chemistry and Technology of Glass

Types of glasses and their chemical compositions- Glass making raw materials. Physical properties of glasses. Absorption and colors in glasses. Glassy State; Kinetic and thermodynamic criteria for glass formation, use of Na2O-SiO2 and Na2O-CaO-SiO2 phase diagrams in glass manufacture. Chemical durability of glasses. Defects in glass. Manufacture of glasses. Glass ceramics. Recent topics.

ACh4218 Forensic Examination of Ink and Paper

Introduction to writing inks. Composition-Manufacture. Instruments. Printing inks. Erasable inks. Forensic examination of inks. Physical examination. Chemical examination. The dating of ink. Water marks of paper. Methods for forensic examination of paper. Principals of documents security features. classifying documents security. developing security procedures. paper security. Court acceptability.

ACh4220 Industrial Catalysis

Definitions of catalysis and turnover. Homogeneous catalysis: Introduction to organometallic chemistry; Ligand effects; Elementary steps of homogeneous catalysis; Kinetics and reaction mechanisms; metal-catalysis in industrial organic processes. Heterogeneous catalysis: Catalyst design and preparation; Characterization of active sites; Catalyst deactivation and regeneration; Chemistry of catalytic processes; Development of industrial catalysts. Industrial applications and case studies.

Biochemistry Program Courses Content

BCh2101 Proteins Chemistry and Metabolism

Chemistry of proteins: Amino acids (structure, classification, physical properties and chemical reactions), Peptides (synthesis of peptides and physiologically active peptides), protein structure and classification. Globular and fibrous proteins. Metabolism of proteins: Catabolism of amino acid nitrogen, catabolism of the carbon skeletons of amino acids, conversion of amino acids to specialized products. proteins synthesis and genetic code.

BCh2103 Vitamins and Minerals

Vitamins and Mineral Metabolism: The fat-soluble vitamins (A, D, E and K chemistry, physiological role and sources). The water-soluble vitamins (B-complex and C chemistry, physiological role and sources). Water metabolism. Mineral metabolism (Na, Ca, K, S, Mg, Li and chlorine) Trace elements metabolism (essential and nonessential trace elements).

BCh2202 Enzymology

Enzymology: Enzyme classification and nomenclature. General properties of enzymes. Kinetic properties of enzymes. Mechanism of enzyme action. Inhibition of enzyme activity, regulation of enzyme activity, isozymes, enzymes in clinical diagnosis.

BCh2204 Carbohydrates Chemistry and Metabolism

Chemistry of carbohydrates: Monosaccharides (chemical reaction of monosaccharides, amino sugars and deoxysugars) Disaccharides, oligosaccharides, polysaccharides and carbohydrates of cell membranes. Metabolism of carbohydrate: Intermediary of metabolism of carbohydrates, digestion and absorption of carbohydrates Glycolysis, glycogenesis, pentose phosphate pathway, glyconeogenesis, citric acid cycle and uronic acid pathway.

BCh2206 Lipids Chemistry and Metabolism

Chemistry of lipids: Fatty acids, triglycerides, phospholipids, glycolipids, steroids, plasma lipoproteins and lipids of the cell membrane. Chemical reactions and properties of lipids. Metabolism of lipids: Oxidation of fatty acids, Biosynthesis of lipids, metabolism of unsaturated and essential fatty acids, the role of liver in lipid metabolism, ketosis, starvation and energy requirements.

BCh3101 Nucleic acids Chemistry and Metabolism

Nucleic acids and nucleoproteins structure. Replication, transcription, regulation of gene expression, restriction enzymes and its function in DNA technology, gene cloning, production of recombinant plasmid, construction of genomic and DNA libraries. Analyzing and sequencing cloned DNA. Analysis of specific nucleic acids in complex mixtures. Polymerase chain reaction (PCR), Mutation.

BCh3103 Immunochemistry I

Natural immunity, structure of immunoglobulins. Antigen, theories of AB synthesis, cell-mediated immunity, humoral immunity, hypersensitivity, complement system, major histocompatibility complex (MHC) molecules, autoimmune disease. Antigen and antibody interaction, cancer immunology transplantation and immunity.

BCh3105 Cell Biology I

Eukaryotic and prokaryotic cells, studies of organelles, cell wall of micro-organisms. Cultivation and growth of micro-organisms. Metabolism and secondary metabolism of micro-organisms. Nitrogen fixation, carbon catabolic and nitrogen metabolite repression.

BCh3107 Nutritional Biochemistry

Free energy and exergonic and endergonic reaction. Caloric value of food and how it is calculated. Define unit of energy—kilocalorie. Factors influencing Basal metabolic rate. Pathological variations of Basal metabolic rate. Respiratory Quotient. Various factors affecting Respiratory Quotient. Specific dynamic action. Role of proteins in the nutrition, factors influencing biological value of proteins, the quantitative aspects of proteins in the diet. Role of carbohydrates in diet, about its requirements and other aspects, study about glycaemic index, the role of lipids in diet, learn about diet or value of trans fatty acids. Balanced diet and how it can be formulated. The conditions of protein-energy malnutrition. Obesity—definition, causes, clinical features,

learn about hormones of adipose tissue and its role in obesity. the nutrient requirements during pregnancy. the dietary requirements of lactating mothers. The composition and nutritive value of certain common food substances.

BCh3109 Biochemistry (I): Introduction in Biochemistry

Carbohydrate chemistry (monosaccharides, oligo and poly saccharides reactions). Amino acids and peptides. Proteins (digestion, classification of proteins, orders of protein structure, protein denaturation). Lipids (fatty acids, steroids, chemical reaction and properties of lipids, the cell membrane). General properties of enzymes**,** Vitamins (fat-soluble vitamins and water soluble vitamins).

BCh3202 Instrumental Biochemistry

The theory and applications of extractions to the biochemistry field and the use of electrochemical methods in chemical analysis where Students apply the principles and laboratory procedures for the modern instrumental methods of chemical analysis: spectroscopic methods including visible, ultraviolet and infrared spectroscopy, chromatography (gas and high performance liquid chromatography), gas chromatography-mass spectrometry, liquid chromatography-mass spectrometry, x-ray methods and electrophoresis. Specific emphasis will be given to the correct operation and troubleshooting of all instruments used.

BCh3204 Body Fluids

This course covers the chemistry and analysis of body fluids (blood, urine, stool, milk, semen and cerebrospinal fluids).

BCh3206 Molecular Physiology

Students in this course gain an understanding of how coordinated regulation of bodily function occurs at the molecular and cellular levels of organization. The focus is on neurons, muscles, and hormones. Specific areas covered for excitable tissue include bioelectric properties of excitable membranes, Hodgkin-Huxley ion currents, voltage-gated ion channels and their structures, synaptic transmission, excitation-contraction coupling, and contractile properties of skeletal, cardiac, and smooth muscle cells. The biotechnological connection is the pharmacological interventions to modulate functioning of excitable tissues. For endocrine physiology, there is an overview of hypothalamic, pituitary, reproductive, and other hormones. The class uses

leptin and obesity as a model hormone and pathology, respectively, and examines in detail its action as a putative fat busting hormone.

BCh3208 Molecular Biology

Nucleic acids and nucleoproteins structure. Replication, transcription, regulation of gene expression, restriction enzymes and its function in DNA technology, gene cloning, production of recombinant plasmid, construction of genomic and DNA libraries. Analyzing and sequencing cloned DNA. Analysis of specific nucleic acids in complex mixtures. Polymerase chain reaction (PCR), Mutation.

BCh3210 Biological Radiation

This course will review types of ionizing radiation and their differences, physical and chemical interactions of radiation with key biological molecules, effects on living matter beginning with molecular and cellular interactions and proceeding to tissue, organ, and organism levels, emphasizing the human system. Radiation's beneficial effects in cancer therapy and medicine as well as detrimental and carcinogenic effects will be discussed. Specific units will consider food irradiation, nuclear power plant accidents, radiation terrorism, everyday sources of exposure to the US population, and other practical situations involving radiation.

BCh3212 Cell Biology II

This course is a continuation of BC 101A (Cell Biology I) and further explores cell organization and subcellular structure. Students examine cell-to-cell signaling that involves hormones and receptors, signal transduction pathways, second messenger molecules, cell adhesion, extracellular matrix, cell cycle, programmed cell death, methylation of DNA and modification of chromatic structure, and mechanisms of the cell. The involvement of abnormalities in signal transduction pathways to oncogenesis and other disease states will be stressed.

BCh3214 Biochemistry II

Biochemistry II: General metabolism

Metabolism of Carbohydrate (glycolysis, Glycogenesis, pentose phosphate pathway, Glyconeogenesis and citric acid cycle. Metabolism of lipids (oxidation of triacylglycerol, metabolism of unsaturated and essential fatty acids. Amino acids metabolism and protein synthesis and the genetic codes.

BCh3216 Protein Structure

This course covers: 3-dimensional structure of proteins. Misfolding of proteins causes diseases like cancer, various encephalopathies, or diabetes. Enzymology and modern concepts of enzyme kinetics are then introduced, taking into account the physiological, pharmacological and medical significance. hæmoglobin and myoglobin, immunoproteins, motor proteins and movement, cell-cell interactions, molecular chaperones and chaperonins, transport of proteins to various cell compartments and solute transport across biological membranes. purification and determination of proteins, as well as their characterisation for size and shape, structure and molecular interactions.

BCh3218 Introduction to Molecular Biology

Nucleic acids and nucleoproteins structure. Replication, transcription, regulation of gene expression, restriction enzymes and its function in DNA technology, gene cloning, production of recombinant plasmid, construction of genomic and DNA libraries. Analyzing and sequencing cloned DNA. Analysis of specific nucleic acids in complex mixtures. Polymerase chain reaction (PCR), Mutation.

BCh4101 Biochemistry of Cancer

This course provides students with knowledge of the fundamental principles of the molecular and cellular biology of cancer cells. This course explains the role of growth factors, oncogenes, tumor suppressor genes, and signal transduction mechanisms in tumor formation. historical perspective, classification& nomenclature of cancer, carcinogenesis types, Cancer initiation, Carcinogenesis promotion, progression, Angiogenesis, invasion& metSpaasis, cellular proto-oncogenes, oncogene activation& retroviral oncogenes, growth factors, growth factors receptors & signal transduction, Tumor suppressor genes& cell cycle transduction, cell: cell interactions & cell adhesion, apoptosis, Necrosis & Senescence, strategies of anticancer chemotherapy& mechanisms of cytotoxic drugs, Cancer immunity& anticancer strategies of immunotherapy.

BCh4103 Hormones

General characteristic of hormones and mode of action, The chemistry and function of hormones (Thyroid and Parathyroid hormones, pancreatic, Adrenal, pituitary, gSparointestinal and sex hormones).

BCh4105 Drug Design

This course will explore the process of drug development, from target disease to lead optimization. It will present drug development process starting from the selection of the biological macromolecular targets to the lead discovery. Computer aided drug design, combinatorial chemistry and high-throughput screening techniques will be covered. Additionally, drug metabolism, drug-receptor interaction, pharmacokinetics, pharmacodynamics, prodrugs, and new strategies for tissue targeting will also be addressed.

BCh4107 Immunochemistry II

This course introduces the concepts of immunochemistry and serology for clinical laboratory practice. It covers essential theoretical principles along with serology techniques most commonly used in the lab. It provides students with knowledge required to perform different serological techniques used in disease diagnosis. It consists of the theory, application, and performance of common serological testing used in a clinical lab including agglutination reactions, precipitation reactions, complement fixation test (CFT), direct and indirect hemagglutination (HA and IHA), hemagglutination inhibition (HAI), Radioimmunoassay (RIA) including instrumental production of immune serum, labeling of antigen, commercial kits, immunodiffusion, immunoelectrophoresis, direct and indirect fluoroimmunoassays (FIA), Enzyme-linked immunosorbent assay (ELISA),and immunoblotting.

BCh4109 Bioethics

Introduction to bioethics. Biosafety. Animal research Ethics. (IACUC). Clinical research Ethics. (IRB). Bioterrorosm. Biosafety.Research ethics.Ethics of reproductive medicine. Euthanasia..Ethics of assisted reproductive ethics.

BCh4111 Advanced Molecular Biology

This course is a literature-driven exploration of current topics and methodologies employed in cell biology research. By closely examining both fundamental and innovative experimental approaches, as well as cutting-edge technologies, we will explore a broad range of cell biology topics, many of which most students have previously encountered, at leSpa at some level, in the core courses. The particular subjects and technologies discussed may vary widely from semester to semester; topics may include but are not limited to expression profiling (microarray analysis),"knock-down" with RNAi, the use of transgenic and knock-out mice, proteomics and mass spectrometry, microscopy applications (epifluorescence, confocal, and/or EM),

characterizing protein/protein interactions, and detection methods for the movement of small molecules and ions. Students enrolling in this course are expected to already have some experience in critical reading and evaluation of the primary scientific literature.

BCh4202 Biotechnology

This course covers the principles of various processes associated with the production and recovery of different bioproducts derived from prokaryotes and eukaryotes. Topics include the classification of microorganisms, media development, instrumentation, fermentation principles, mammalian and insect cell propagation, product recovery, protein purification, and the principles of current good manufacturing practices (cGMP). Emphasis is on large-scale production methods and production of recombinant proteins for diagnostic and clinical applications.

BCh4204 Bio-nanotechnology and Applications

The emerging field of nanobiotechnology utilizes developments in nanotechnology and molecular biology for applications to biomedical science and clinical practice,. Nanobiotechnology is an interdisciplinary field that exploits the unique functional properties of natural and synthetic biomolecular-sized (nanometer-scale) constructs such as quantum dots, carbon nanotubes, nanostructured surfaces, liposomes, artificial membranes, and molecular machines for biotechnology and medicine. This course is designed for biochemistry majors and will survey the research, development, and applications of nanotechnology to medical diagnostics, imaging, and therapeutics (including drug delivery and anticancer treatments); cell biology and single-cell analysis, nanofluidics, bioassays, biosensors, and bio-inspired engineering.

BCh4206 Clinical Biochemistry

This course covers basic concepts and practical applications of modern laboratory diagnostic techniques. Topics include the principles of testing methodology, quality assurance, and the application of molecular methods to the clinical and research laboratory. The test methods to be covered include nucleic acid-based methods such as hybridization, amplification, and sequencing; non-nucleic acid methods such as HPLC, GLC, and protein analysis and serological testing methodologies. In addition to the test procedures, students are exposed to aspects of statistics, quality control, regulatory issues, and applications of these methods to the diagnosis and prognosis of human disease.

BCh4202 Pharmaceutical Industry

This course gives an introduction to the pharmaceutical sciences. It will cover the following topics: industrial pharmacy and parameters of quality, specifications and regulations of the active pharmaceutical ingredients (APIs), good manufacture practices (GMP), basics of quality control and quality assurance, spectroscopic characters of drugs and instrumentation in pharmaceutical industry: HPLC, GC and LC-MS.

BCh4210 Stem Cell

The Stem cell Biology course will involve discussion and debate on current topics concerning stem cell biology and the use of stem cells in biotechnology and therapeutics. Topics will include review and discussion of developmental & cell biology, stem cell characteristics, stem cell preparation & therapeutic uses, tissue engineering, global regulatory and ethical issues, and commercialization of stem cell therapy. Current peer-reviewed literature and guest experts in the field will provide up to date information for discussion, Tissue engineering is a highly multidisciplinary field that involves cell biology, chemistry, materials science, engineering, and medicine. This course will be a survey that introduces students to the field from scientific, clinical, manufacturing, and regulatory perspectives. Roughly the first half of the course will be devoted to background material, and the second half will focus on applications. Readings will be drawn from books and journals.

BCh4212 Managing and Marketing

This course includes an overview of :A- Managing and Leading Biochemistry Professionals: The roles of managers and leaders within Biochemistry companies undergo constant change. Biochemistry managers and leaders must engage in new and innovative problem-solving strategies; lead a diverse and global workforce; develop partnerships with other businesses, customers, and competitors; manage horizontally and across teams; and utilize technology as a competitive advantage. The student is able to address current challenges in his/her own organization and learn methods of implementing change, such as negotiation techniques and motivation. The course includes in-depth discussions of leadership skills, communication, conflict resolution, and goal integration. Students research a Biochemistry organization and analyze what is working and not working within the management systems and suggest alternatives. B-Marketing Aspects of Biochemistry: This course introduces students to the strategic and

tactical approaches used in the marketing of Biochemistry products and services. Students gain a thorough understanding of the research and planning necessary to develop a marketing plan, the relationship between the marketing and sales functions, the difference between marketing a scientific product and a scientific service, pricing strategies, distribution alternatives, communications, promotion, and the importance of perception. Knowledge of marketing terminology and techniques prove helpful to anyone in the industry.

BCh4214 Genetic Engineering

Tools in genetic engineering, Expression strategies and methods for producing industrially important molecules. Applications: Genetic diseases – Detection and Diagnosis, Gene therapy – ex vivo, in vivo, gene delivery systems, viral and non-viral. DNA marker technology in plants, DNA fingerprinting. Genetically engineered bio-therapeutics and vaccines and their manufacturing, Transgenic animals and Bio – pharming.

BCh4216 Metabolic Disorders

The principles of metabolism and the differences between anabolism and catabolism, the metabolic pathways of carbohydrates, amino acids, fatty acids and nucleotides. The types of genetic mutation and inborn errors of metabolism, the methods for detecting and correcting inborn errors of metabolism, 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. exercise starvation and diabetes).

Helwan University

المحتوى العلمى للمقررات الدراسية لقسم النبات والميكروبيولوجى

Course Description for Botany and Microbiology Department

Helwan University

Botany Program Courses Contents

Bot1101 General Botany I: Plant Systematics and Plant Physiology
The aim of this course is to give the students basic knowledge on the diversity of plants and microorganisms dealing with the following topics. Major taxonomic groups emphasizing general characteristics, diagnostic features, phylogenetic classification, economic importance, and life cycle of some representative examples of viruses, bacteria, cyanobacteria, (blue green algae), protists, fungi and algae. From the plant kingdom, general feature and examples of bryophytes (liverworts, mosses), pteridophytes should be described. The course also covers the major plant physiological functions with emphasis on cellular and organismal functions, particularly the translocation, transpiration, water transport, osmosis, respiration, photosynthesis, and growth.

Bot1103 Introduction of Botany
An introductory course for non-majors that emphasizes the unique features of plant biology. Included are discussions on: the origins of life; important plants of the world and their habitats; plant diversity, structure, function, and reproduction; plants and environmental science; plants that changed history; practical botany; and botany as a science.

Bot1202 General Botany II: Plant Morphology and Anatomy
The aim of this course is to give the students basic knowledge on the external and internal structures of plants. The external morphology criteria may deal with the following topics. Seed types and seed germination and factors affecting seed germination. Description of external plant parts morphology particularly the roots and shoot systems, types of roots, stems, leaves and types of inflorescences. The internal structures of should deal with the following topics: types of plant cells and tissues (types and classification).Classification based on 1- cell wall structure and shape, 2- origin, and 3- function. Anatomy of young roots, stems and leaves of monocot and dicot plants. Morphological and anatomical adaptation of plants to different environments. Introduction to plant genetics and evolution and principles of plants ecology.

Bot2101 Advanced Plant Anatomy
Plant anatomy allows students to integrate organismal structure and function. Further, it helps to reveal the relationships between structure, function,

taxonomy, ecology and developmental genetics. It covers fundamental aspects of ferns and lycophytes as part of discussions of the evolution of plant structure but does not cover them in great details. The main topics are plants tissue systems in different plant groups, epidermal system - stellar structure, development and evolution- types of secondary thickening – anatomical adaptation to extreme environment, aquatics plants, desert and arid environments plants. Evolutionary history and taxonomic variation of vascular plant anatomy. The course is extended to the types of secondary thickening, wood formation and environment. Effect of climate change on plant anatomy. dendrochronology and dendro-anatomy as advanced branches in plant anatomy. Application of dendro-anatomy in indicating and solving ecological problems. New perspectives and trends in plant anatomy. New technologies in plant anatomy.

Bot2103 Principles of Genetics

Introduction to the science of genetics, an overview of the short history of genetics. Mendel's principles of segregation and independent assortment, (Mendel's monohybrid cross, dihybrid cross, and extension of Mendelism and its applications. Chromosome theory of inheritance, (Sutton-Boveri hypothesis Thomas Morgan's Theory of gene transmission). Cell mitotic division and cell cycle; meiotic division and gametes formation. Modifications of Mendelian ratios; allelic variation and gene interaction, epistasis, and modifier/modifying genes. Non-Mendelian genetics. multiple alleles, pseudo-alleles, and pleiotropy and expressivity of genes. Polygenes and quantitative genetics. Linkage and crossing over – sex linkage. Epigenetic inheritance and imprinting. Outlines of population genetics and allele frequency in populations, selections and heritability. Introduction to gene structures, replication, and mutation: causes, types and applications.New trends, discoveries and technologies in genetics.

Bot2105 Algae

This course gives is an opportunity to explore the fundamental principles of systematics of and ecology of algae with reference to occurrence and distribution, structural differentiation of algal cells, tissues and forms. In addition, the course deals with the different types of life cycles and bases of algal classification, general characteristics and classification of major algal groups - describing life cycle of common marine and freshwater algae in addition to the methods and approaches for cultivation of algae in the laboratory**.**

Bot2107 Economic Botany and Crop plants

Introduction and objectives of the course. Grains and forage grasses, the grass plant, major grain crops, forage crops. Wood plants and wood products and forests. Fibers, dyes, inks and tannins. Classification, origin and use of plant fibers. Stimulating beverages, coffee, tea, chocolate, mate, kola, guarana. Spices, herbs and perfumes. History of spice trade, distribution of spices in the world. Essential oils, hydrogels, latexes, gums, resins and natural rubber. Uses of plants in the future, plants as alternative sources of energy. Selected crop plants and their domestication history, genetic resources and cultivation and ways of their yield improvement and utilization.

Bot2109 Plant Cell Biology and Tissue Culture

Introduction to plant cell and tissues culture. Culture media components, and factors promoting cell differentiation and root and shoot growth and differentiation *in vitro*. Objectives and applications of tissue culture micropropagation - germplasm preservation – soma-clonal variation and mutation selection - embryo culture - haploid and di-haploid production - *In vitro* hybridization – protoplSpa fusion - industrial and pharmaceutical products from cell cultures - plant genetic engineering and crops improvement

Bot2111 Plant Geography and Biomes

This course address basic concepts towards understanding plant cell structure, biochemical and molecular organization, development and function. Interaction between cell compartments and cells and their environment will be studied. The mechanisms involved in the targeting and transport of proteins across membranes and the basic principles of signal transduction processes.

Morphogenesis in plant cells and tissues *in vivo* and *in vitro* will be addressed. The genetic, molecular and physiological basis of morphogenesis will be studied. Several tissue culture protocols and their different applications will be studied.

Bot2202 Plant Ecology

This course is an introduction to plant ecology and should provide knowledge about topics dealing with the plant and environment, particularly the following topics. Physical environmental factors such as climate, landforms, and soil. Vegetation structure and development, interaction between

vegetation and biotic and abiotic environment, adaptation of plants to different habitats - Seeds dispersalPlant Population dynamics, adaptation of plants to landforms and climate, Energy, carbon balance and climate change, biogeochemical cycles, Ecology of ecosystems, ecosystem biodiversity and ecosystem goods and services, case studies.

Bot2204 General Plant Taxonomy

Historical development of plant taxonomy. Definitions and use of terms in plant taxonomy. Botanical nomenclature identification and classifications. Development of plants classification systems from artificial to modern phenetics and phylogenetics classification.Taxonomic characters and taxonomic categories, orders, families, genera species and subspecies concepts. Evolutionary trends in plant classification systems. Other sources of taxonomic information. Modern systems of plant taxonomy and systematics. Major groups of angiosperms. Methods and practice of plant classification at the family level and differentiation of Selected families based on plants growing in Egypt, of Magnoliopsida (Dicotyledoneae) and Liliopsida (Monochlamydeae) – Examples of common and useful plants of each family.

Bot2206Plant Water Relations:

Water and plant cells – structure and properties of water – water transport processes in plant tissues, osmosis, water potential and matric potential, water balance in the plant. Mechanism of water transport from the soil to the atmosphere through the plant. Mechanism of stomatal movement and transpiration ratio. Factors affecting water absorption. Mineral nutrition of higher plants, methods of studying plant nutrition. Mechanisms of mineral salts absorption (passive and active transport), radial transport of ions across the root, distribution and circulation of ions in the plant. Factors affecting ion uptake. Role of macronutrients and micronutrients in plants and the minerals deficiency symptoms in plants. New perspectives, trends and methods in Plant Water Relations and mineral nutrition.

Bot2208 Climate Change and Plants

The course has a broad content ranging from topics as fundamental to specific topics. The main topics are: Introduction to causes of global climate change, climate change effect on the performance, survival and distribution of plants. Plant function in relation to global climate change from cellular functions to community processes. Plants and carbon dioxide uptake of carbon in relation to photosynthesis and use of water. Plants in changing

environmental factors such as temperatures, drought, salinity and acidity in ecosystems across the globe. Climate change effects on diversity and distribution of plant species. PSpa and future predictions of plant species distribution. Methods, tools and mitigation of climate change.

Bot3101 Plant Molecular Biology

Molecular organization of genome and chromosome structures in both prokaryotes and Eukaryotes. The course unfolds details about DNA synthesis, and its repair mechanism. Apart from the theoretical information, the course also covers the experimental knowledge of deducing data from the molecular structures. The molecular basis of transmission of genetic information in gene expression and genetic code. Regulation of gene expression covering transcriptomic and metabolomics. Introduction to techniques of basic molecular biology including DNA, RNA and protein isolation and quantification. DNA Isolation and purification, Vector systems, restriction enzymes and ligation, PCR and electrophoresis, sequencing DNA and DNA hybridization (southern blot, northern blot, western blot. Study cases and applications.

Bot3103 Plant Growth and Development

This course focus is on the regulation of cell division, meristem activity, plant cells, embryogenesis and organogenesis of the plant structure, signal transduction and plant hormones. Introduction to plant growth factors affecting plant growth – plant growth regulators (auxins, gibberellins, kinins, abscisins, ethylene, florigen, etc.), chemical nature, metabolism, transport, mechanism of action, biological role, commercial applications. Tropisms, morphogenesis, dormancy, flowering. Plant growth and differentiation. Plant hormones (auxins, gibberellins, cytokinins, ethylene etc.), their structure and functions in plant growth and development. Agricultural application of plant hormones to control growth and improve yield.

B3105 Plant Tissue Culture

Introduction to plant cell and tissues culture. Aseptic culture, culture media, factors promoting cell growth and differentiation *in vitro*.

Morphogenesis and the physiological, molecular and genetic control of development. Applications will include micropropagation, somaclonal variation and mutant selection, embryo culture, dihaploid production, *in vitro* hybridization, protoplSpa culture, industrial and pharmaceutical products from cell cultures. Plant genetic engineering in crop improvement, *in vitro* conservation of germplasm will be addressed.

Bot3107 Plants and Soil

It is focused on the abiotic and biotic soil factors that affect plant life in wild and agricultural ecosystems. The main topics are availability of nutrients in soil; effects of fertilizers, and other soil amendments on plant productivity and soil quality; nutrient sustainability in alternative agricultural and natural ecosystems; water availability, soil salinity and soil fertility. The course also covers oil microorganisms and their interaction with plants and soil. In particular, plant growth-promoting rhizobacteria and mycorrhiza, nitrogen fixations, phytohormones and siderophores productions, Decomposition of soil-plant remains. Principles and procedures on biological weed control for Egyptian and worldwide weed species.

Bot3201 Plant Biosystematics and Evolution

Plant systematicsis the integration of taxonomy (identification, nomenclature, classification emphasizing flowering plants), evolution (speciation, reproductive biology, adaptation, convergence, biogeography), and phylogenetics (phenetics, cladistics, morphology, chromosomes and molecules). The course will explore the origin and diversification of land plants while emphasizing flowering plants. The practical classes will emphasize learning representative families and genera of flowering plants in from Egypt and use of keys and manuals. A plant collection of 25 species is required from each student. A comprehensive introduction to vascular plant phylogeny. The evidence described includes are mainly derived from chromosomes, palynology, secondary plant products, proteins, and DNA. Cytotaxonomy and molecular taxonomic methods are fully presented, illustrating their value in recent systematics studies. The practical classes will emphasize learning representative families and genera of flowering plants in from Egypt and use of keys and manuals.

Bot3204 Environmental Pollution

This course is an introduction to the main sources of environmental pollution either natural or artificial. It explains the anthropogenic participation in the environmental pollution. It explains also the different types of pollution - atmospheric, aquatic, and soil pollutions giving examples. The course covers methods used for mitigating the effect of pollutants on plants and other ecosystem components and the wSpaewater pollutions causes and treatments. It concentrates also on the usage of pesticides in agriculture and its consequences on the environment and on plant growth and productivity. Through many recent publications, the course will concentrate on

environmental problems showing the negative impacts of different types of pollution on plant vegetation, species composition and diversity, heavy metals accumulations and agricultural yields.

Bot3206 Plant Enzymology

Introduction to Enzymology - distribution in plants - nature of enzyme action - mode of enzyme action - mechanism of enzyme action - code numbering of enzymes - nomenclature and classification of enzymes – enzyme reactions - coenzymes – structure and mechanism of action of coenzymes – protein structure of enzymes – the active site - factors affecting enzyme activity - enzyme kinetics - inhibition of enzyme activity - Biological regulation of enzyme activity – gene expression and turnover.

Bot3208 Plant Cytogenetics

This course offers comprehensive reference to plant cytogenetics, including a compilation of information on classical cytogenetics, chromosome structure, functional molecular cytology, and plant genome dynamics. One part is a comprehensive review of classical cytology, chromosome structure and behavior during division and mitotic cell cycle and meiosis, types of chromosomes, including autosomes, sex chromosomes, and supernumerary B chromosomes and various chromosomal changes such as haploidy, aneuploidy and polyploidy, Conventional and modern mapping techniques for karyotype preparation and determination of regional chromosome properties are also discussed. Chromosome banding, high-resolution mapping with fluorescence in situ hybridization and FISH will be addressed in detail

Bot3210 Plant Genetic Resources and Conservation

This course offers the ways and means to improve student's understanding of the conservation and utilization of plant genetic resources, clarify the role of molecular techniques in analyzing and exploiting their diversity; elucidate the use of genetic resources in plant breeding, the pharmaceutical industry and other areas of utilization and creating awareness of the controversies involved in intellectual property rights applied to plant genetic resources. The topics include overview of plant conservation, genetic strategies for *in situ* conservation, techniques for ex situ plant conservation including the strategies employed to collect plant genetic resources for *ex situ* conservation in addition to the role of genetic resources held in seed banks in plant improvement and the role of DNA banks and molecular analysis of plant genetic resources in plant conservation and the role of genomics and plant biodiversity management

Bot3212 Algal Biotechnology

This course explores the fundamental principles of the economic importance of algae with reference to its application in food production, agriculture, industry, wSpae-water treatment and medicine. The major topics cover photobioreactors as modern strategies for commercial production of algae, algal production systems, indoor and outdoor cultivations, evaluation of harvesting method, future of ecology and biology of diatoms and application of nanotechnology of diatoms, value morphogenesis, Spirulina as food and other potential health benefits, its production and cultivation, role of blue green algae (BGA, Cyanobacteria)in agriculture: introduction and significance, maintenance and scaling up of algal strains, algal biofertilizer production technology, field application techniques for BGA. Algal biodiesel: establishment of algal biodiesel (laboratory study), changes of fatty acids with culture conditions. Bioremediation of heavy metals by algae, toxicity and pollution of heavy metals, tolerance of HM in algae, HM bioremediation technology.

Bot3214 Environmental Impact Assessment

Environmental Impact Assessment: Theory and Practice describes the various pieces of knowledge necessary to speak the language of EIA and carry out EIAs focusing on a variety of environmental issues, including impacts on environmental components, like air, water, soils, land, noise and biological environments. This course should present detailed methodologies for air pollution control, wSpae treatment schemes, phytoremediation, bioremediation, hazardous wSpae, green belt development and rainwater harvesting. In addition, the concepts and important definitions of EIA and the planning and management of EIA study should be highlighted. In addition, the impacts on valued environmental components, like air, water, soils, land, noise, and biological and socioeconomic environments may be dealt with in a systematic manner.

Bot3216 Genetic Engineering

The course deals with the manipulation of genes for crop improvement and for the production of commercial plant products using biotechnological approachesin particular gene technology methods. Chimeric gene constructs, basics and tools of genetic engineering of plants,enzymes, vectors, methods of gene cloning, genetic libraries, construction and screening of libraries will be covered. Methods of gene transfer to plants, *Agrobacterium* mediated gene transfer, gene gunsand other methods. Application of genetic engineering in

improving plant productivity, environmental protection, pharmaceuticals production and disease diagnosis and resistance will be introduced. The course willbe o covering gene editing and transposons and their applications in the genetic modifications of plants.

Bot4101 Plant Metabolism

Reviewing the major metabolic processes. Photosynthesis - Electromagnetic Spectrum - Light Reaction - Two pigment system (PSI & PSII) – Photophosphorylation. Types of pigments (Structure and distribution) –dark reaction (Calvin Cycle) - Hatch-Slack C4 Pathway - Crasssulacean acid metabolism (CAM)- Photorespiration- Types of respiration - Factors affecting the rate of Photosynthesis and Respiration - Lipids (Classification- Composition - Oxidation of fatty acids)- Nitrogen metabolism (Role and sources of nitrogen to plants – Types and biosynthesis of Amino acid).

Bot4103 Plant Biotechnology

This course explores the use of biotechnology to understand how factors at the cellular level contribute to the expression of genotypes and hence to phenotypic variation and generate novel characters in plants. The course will focus on vector types and their construction, a number of plant tissue culture techniques and culture types necessary for gene delivery, evaluation of several methods for stable and transient plant transformations.es Applications for plant improvement under biotic and abiotic stress and strategies to increase plant yield and improve quality will be addressed.

Bot4105 Desert and Wetland Ecology

This course is an introduction to geography of the deserts including physical environment (climate, landforms and soil). Plant adaptations to avoidance desert of extremes at the morphological, anatomical and physiological levels. Primary production in the desert ecosystem, nutrient cycles and decomposition in the desert ecosystem, desertification, case studies. Food web interactions in the desert ecosystems including, nutrient cycles and decomposition in the desert ecosystem, desertification, case studies. This course provides also a comprehensive highlight on wetland ecosystems management. Biological, physical, chemical, and hydrological aspects of wetland ecosystem structure and function. Major wetland types and resources and the biogeochemical and ecological diversity of wetland waters, soils, and vegetation. Current issues on desert and wetland valuation, classification, management and other topics.

Bot4107 Population Genetics and Gene Ecology

Introduction -genetic diversity - causes of genetic diversity -Natural selection- Gene flow -Genetic variability -Type of genetic variability - polymorphism - survival and adaptation -genetic drift- genetic distance - Factors that decrease genetic variability population genetics, allelic frequencies changes in allele frequencies. Hardy-Weinberg equilibrium and its applications – calculating allelic frequencies, assumptions of Hardy-Weinberg equilibrium, proof of Hardy-Weinberg equilibrium - testing for fit to Hardy-Weinberg equilibrium. Selection – overview, types and subtypes, negative and positive selections, patterns of selection. The Population genetics will also focus on the interpretation of genetic variation in natural populations and the basic models that connect genetic variation to underlying evolutionary and genetic processes, including mutation, recombination, genetic drift, migration, and natural selection. The methods for measuring genetic variation, including the analysis at the genome-scale will be discussed.

Bot4109 Seed biology

Seed morphology, structure, composition. The development of seeds. This will include the different stages, the regulation of development at the cellular, molecular, physiological levels, as well as the genetic control of seed development and maturation. Seed ecology and taxonomy. Diversity, reproductive strategies, dispersal, conservation and seed bank. Germination and dormancy. Hormones, biochemical, physiological, cellular, molecular, genetic and environmental aspects. Seed pathology. Applied aspects of seed biology. Basic production systems for plant propagation and seed storage. Biotechnology for seed improvement.

Bot4111 Energy Bioconversion in Plants

The course provides in depth information on the fluxes of solar radiation and absorption of light by plants, nature of light, transfer of energy, the quantum yield, photosynthetic pigments, photosynthetic electron transport, photo-phosphorylations, carbon pathway in photosynthesis with emphasis on the differences between the C_3, C_4 and CAM plants, Photorespiration, synthesis of sucrose and starch, respiration, transformation of energy during respiration, mechanism of aerobic and anaerobic respiration, oxidative phosphorylation, HMP pathway, factors affecting the rate of respiration, Gluconeogenesis, Interactions between respiration and other metabolic pathways – Lipid metabolism – amino acid metabolism.

Bot4113 Bioinformatics in Plant Science

The basic statistics should be reviewed particularly types of variable and scales of measurement, comparison of discrete and continuous data including ANOVA, and significance tests, probability correlation and regression as well as univariate and multivariate analysis and modeling and data presentation in graphs using different software applications. Special attention may be given to macromolecular data particularly DNA and protein sequencing. multiple sequence alignments and phylogenesis, primer design, gene annotation, genome mapping, cis-element predictions and handling gene expression data and protein interaction networks. Practical training should cover DNA and protein databases, data storage, file formats, information retrieval, Database queries, sequence retrieval, Creation of restriction endonuclease maps, Dot plots, sequence alignment. alignment scores, Statistical significance of database searches. Genetic distances, phylogenetic tree construction, consensus sequences. Finding genes and open reading frames in DNA sequences, Microarrays and the transcriptome, Microarray analysis and applications of microarrays, Introduction to proteomics, Prediction of protein structure and function. Comparative genomics, Comparative genomics continued, Future directions of bioinformatics.

Bot4115 Medicinal and Aromatic plants

The course deals with classification, ecological, anatomical, biological, and chemical characteristics of Egyptian medicinal and aromatic plants and plant parts. It also focuses on the safety, quality, and chemistry of plant products, highlighting characteristics related to human health and nutrition. Characteristics of some selected medicinal and aromatic plants. Phytochemical medicinal compounds chemical constituents, usage and safety will be described in detail. Theproperties, role in plants and pharmaceutical uses, of major compounds will be of special importance. Laboratory activities include the extraction and chemical analysis of specific plant products (e.g., essential oils, fatty acids) and provides a primer on protocols used to analyze the quality and chemistry of raw botanical ingredients (e.g., herbs, spices, medicinal plants, extracts), which are the type of analyses conducted by industry to assess quality. Students work in groups on specific products to assess quality and will prepare a report and a product specification sheet.

Bot4202 Ecology and Physiology of Algae

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. The course also deals with the fundamental principles of the physiological processes of 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 lipidsand 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.

Bot4204 Plant Breeding and Crop Improvement

Introduction to general principles, practices, and techniques used to breed plants, select traits, and develop crop cultivars. Concepts discussed will range from quantitative and population genetics, historical through conventional plant breeding through self- and cross-pollinations and hybridization. Contemporary approaches to improve plant traits including molecular breeding. Plant's reproductive system and appropriate selection methods. Changes in population structures due to selection in self and cross-pollinated crops. Approaches of selection to improve plant genetic potential and the role of advanced tools in cultivar improvement. Breeding self-pollinated crops. Pure line breeding. Mass selection. Pedigree breeding. Bulk population breeding. Breeding cross pollinated crops. Single plant selection. Mass selection. Progeny selection. Line breeding. Recurrent selection. Backcross breeding. Hybrid seed production. Dormancy factors affecting germination (eg. hard seeds, impermeability to water, chemical inhibitors, undeveloped embryos, etc. Genomics in plant breeding.

Bot4206 Flora of Egypt

Introduction and definitions - Main characters of the flora of Egypt. Phyto-geographical territories of Egypt and main habitats with characteristic plants. Notes of the old plants in Egypt, endemic species, and protected areas. Scientific excursions to different habitats in Egypt to perform vegetation analysis and collect, preserve identify and classify wild plants. The recommended areas are the Cairo-Suez Road, Oasis & El Fayoum, Nile valley, salt march plants and coSpaal areas, on the Mediterranean coSpa and in the Cairo - Alexandria - Sallum Road and Sinai.

Bot4208 Conservation and Restoration Ecology

This course gives students an understanding of biodiversity and conservation biology as scientific disciplines whose aims are to reduce impacts of human activities on biological diversity. We'll explore the following topics: the

history and subject matter of conservation biology, including a discussion of the scientific approach 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 basic principles of ecology as well as how these principles are used to design 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

Bot4210 Current Topics in Plant Science

This course should deal with recent topics in plant science spanning plant biotechnology through to plant ecology including an integration of these sub-disciplines. Cutting edge advancements on plant molecular biology, plant development, plant improvement, plant ecophysiology and sustainability, including the regional & international context of global warming, water shortage, nitrogen fertilizer and fossil fuel limitation.

Bot4212 Genome biology and Gene technology

This course introduces you to the basic biology of modern genomics and the experimental tools that we use to measure it. We'll introduce the Central Dogma of Molecular Biology and cover how next-generation sequencing can be used to measure DNA, RNA, and epigenetic patterns. You'll also get an introduction to the key concepts in computing and data science that you'll need to understand how data from next-generation sequencing experiments are generated and analyzed. Advances in application of genome biology.

Bot4214 Natural Products and Drugs

This course should cover topics on the pharmaceutical potential of plant natural products and other sources including microorganism, and marine organisms. The main topics may be as follows: definition of natural products, classification of natural products and their biological function. Primary and secondary metabolites and their biosynthetic pathways. Pharmacognosy -Medical uses in traditional medicine and modern natural product-derived drug. Isolation and purification of natural products and their use in rug industry.

Bot4216 Plant Stress Physiology

Plants cannot move to avoid challenging environmental conditions. Hence, plants developed other mechanisms that allow them to cope with stress. This

course focuses on the mechanisms deployed by plants to respond to stressful conditions, some responses being nothing short of chemical and biological warfare. Biotic and abiotic stresses covered include pathogens, herbivores, drought, salinity, temperature, UV radiation, and heavy metals. Agricultural and ecological implications of stress are discussed. Moreover, plant cell as a sensor of environmental changes, role of cell membranes in signal perception, ways of signal transduction in cells and whole plants as a response to external factors such as water stress. mineral nutrition stress. temperature stress, radiation stress, salinity stress. UV stress and biotic stress. Knowledge on mechanisms of abiotic and biotic stresses in plants for improvement of plants / crops by means of physiological breeding and biotechnologies will also be discussed.

Bot4218 Horticulture and Ornamental Plants

Introductionto horticulture plants (medicinal, vegetables crops and ornamental plants) based on classification and utility of various plant groups for food and medicine. Landscaping; landscape design–(home garden, recreational gardens and children's parks, educational institutions, public places, interior scaping, cultural practices, special practices, care, and maintenance; flower arrangement - principles and styles; value addition in flowers). Identification and description of trees, shrubs, flowering annuals, bulbous ornamental climbers, creepers, palms, ferns cycads, ornamental grasses, cacti and succulents, indoor plants, foliage plants and water plants and their uses and application in landscaping, environmental protection and in green architecture.

Bot4220 Biological Control

The course cover topics of a comprehensive approach to biological control of plants and the environment. The recommended topics include: The ecological principles and applied practices of modern biological control of pests, weeds and plant pathogens; including the history, scope, strengths and weaknesses, scientific basis of biological control, the biology of pest pathogens, microbial control, biological control methods, population ecology as it relates to biological control, biological control in integrated pest management, techniques and protocols in implementation of control programs and related topics.

Microbiology Program Courses Contents

Mic2101 General Microbiology & Biodiversity

Microbiology historical background – Microbial diversity- prokaryotes and eukaryotes- Bacterial Morphology and structure – Gram stain method – Bacterial Genetics – principle modes of metabolism- taxonomic diversity of useful bacteria- characteristics of the fungi – classification of fungi- Culture collections and the preservation of microorganisms.

Mic2103 Molecular Microbiology

This module provides an introduction to molecular biology and is focused on how cells store and express genetic information, together with the application of this knowledge to genetic engineering. In the first part of the module, the structural organization of eukaryotic cells and the storage of genetic information at the molecular level will be considered. The molecular mechanisms by which genetic information is used and how genes can be switched on and off¿ will then be addressed. We shall then consider how specific proteins are targeted to their site of action within the cell. The second part of the module is concerned with how loss of controlled gene expression within cells can lead to cancer, and how our knowledge of gene expression can be applied to clone DNA in order to engineer proteins and cells.

Mic2105 Virology

Virus structure, replication, 'life' cycles including bacteria, plants, humans and animals. A typical like virus including prion, viroid, pseudovirions and incomplete virus (Satallite virus). Mechanism of viral infections, Symptoms and medical treatments for viruses. Methods of viral detection including molecular and serological methods.

Mic2107 Cell Biology and Genetics

The basic of structure, composition and function of cells, the organization and specialization of eukaryotes, prokaryotes and viruses, Define the cellular components involved in the regulation of key functions such as the generation of energy, movement, cell growth and division and differentiation, Describe the latest techniques that are used in cell biology to determine cell structure and function; This unit introduces the principles of genetics and considers the application of these principles to diverse aspects of biology and human welfare. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange, mutation, and gene mapping. Human examples are stressed where appropriate. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics more directly concerning human welfare, such as the genetic and biochemical

bases of inherited disorders, prenatal diagnosis, genetic - 299 -amiliariz, gene therapy, and the genetic basis of antibiotic resistance in bacteria

Bot3103 Plant Growth and Development

This course focus is on the regulation of cell division, meristem activity, plant stem cells, embryogenesis and organogenesis of the plant structure, signal transduction and plant hormones. Introduction to plant growth factors affecting plant growth – plant growth regulators (auxins, gibberellins, kinins, abscisins, ethylene, florigen, etc.), chemical nature, metabolism, transport, mechanism of action, biological role, commercial applications. Tropisms, morphogenesis, dormancy, flowering. Plant growth and differentiation. Plant hormones (auxins, gibberellins, cytokinins, ethylene etc.), their structure and functions in plant growth and development. Agricultural application of plant hormones to control growth and improve yield.

Mic2202 Mycology

Introduction to fungi; general characteristics of fungi,fungal genetics- nature and habitat- applications of fungi-,Fungal life cycles, ecological role of fungi, Division or Phylum Zygomycota (General overview) , Class Zygomycetes (Order Mucorales) , Class Trichomycetes, Saprophytic activities of fungi, Division or Phylum Basidiomycota (General overview), Class Basidiomycetes, Cultivation of mushrooms & other fungi, Spore release and dispersal, Mycotoxins in the grain and other food products, Division or Phylum Ascomycota (General overview), Apothecial, Perithecial, Pseudothecial, Cleistothecial, and Unicellular Ascomycota and Allies, Ergot & ergotism; Mycotoxins in Food, Form Division or Form Phylum Deuteromycota: (General overview) – the Imperfect Fungi, Fungus Like Organisms: Myxomycetes (true slime molds); Acrasiomycetes (cellular slime molds), Fungus Like Organisms: Zoosporic Fungi: Chytrids, Oomycetes, and others.

Mic2204 Bacteriology

*Bacterial history.*Cell structure and function in Bacteria and Archaea: diversity among Bacteria and Archaea, cell shapes and arrangements, an overview to Bacterial and Archaeal cell structure, external cell structures, the cell envelope, the cell cytoplasm and internal structures*Bacterial growth and nutrition: Bacterial reproduction, Bacterial growth, Culture media and growth measurements.*Bacterial genetics: DNA and chromosomes, DNA replication, Mutations, identifying mutants, bacterial recombination and biotechnological applications.

Mic2206 Microbial Control
Control of micro-organisms by physical agents- Fundamentals of physical control, Control of micro-organisms by chemical control, fundamentals of chemical control, Antibiotics and other chemotherapeutic agents. Microbial control by using antagonistic microorganisms.

Mic2208 Soil Microbiology
Physical characteristics of soil – The rhizosphere- Microbial flora of soil (bacteria, fungi, algae, protozoa, viruses) – Role of soil microorganisms in soil environment- The nutrition and energy requirement of soil microorganisms. Interactions among soil microorganisms – Mycorrhizal Symbioses – The role of soil microorganisms in nutrient cycles important to agriculture (nitrogen cycle, carbon cycle, sulfur cycle and other elements) – herbicide and pesticide degradation - wSpae disposal – bacterial fertilizers.

Mic3101Microbial Physiology
Introduction. Microbial culture media. Diversity of methods in microbial growth. Kinetics of microbial growth and characteristics of various growth stages. Environmental, physical and chemical factors affecting microbial activity. Inorganic nutrition. Carbon sources and metabolism. Nitrogen sources and metabolism. Biochemistry of nitrogen fixation. Energy production Carbohydrates breakdown by different pathways. Lipids and proteins as sources of energy. Biosynthesis of intermediates to increase supply ofC4 compounds. Photosynthesis in energy production. Introduction to chemical inhibitors.

Mic3103 Applied Microbiology
Water sources and water pollution, water purification, Sewage treatment. Microbial flora of fresh food, Biochemical types of bacteria in milk, Microbes and food production,Probiotics and Prebiotics,Microorganisms and food spoilage, Food preservation, Dairy products, Food products of plant origin, Apparent health benefits of fermented foods. Microbes in Production of Commodity Chemicals. Agricultural Applications of Microbes (Biofertilisers and Biopesticides).

Mic3105 Host Parasite Relationship
*Parasitism and Disease development: Parasitism and Pathogenicity, host Range of Pathogens, Development of Disease in Plants, Stages in the Development of Disease: The Disease Cycle, Inoculation, Prepenetration

Phenomena, Penetration events, Infection, Dissemination of the Pathogen. *How pathogen attack plants: Mechanical Forces Exerted By Pathogens on Host Tissues, Chemical Weapons of Pathogens (enzymes, toxins, growth regulators and polysaccharides).*How plants defend themselves against pathogens: Preexisting Structural and Chemical Defenses, Induced Structural and Biochemical Defenses.

Mic3117 Plant Microbiota

The plant microbiota **c**omprises all microorganisms and microbial genomes in the rhizosphere, phyllosphere and endosphere of plants. The plant microbiota particularly endophytes living fully within plants are essential for plant life as they provide a multitude of benefits to the plants including nitrogen fixation, phosphorous solubilization, increased photosynthetic, water use efficiency, stress tolerance and pathogen resistance. Other microbiota are plant pathogens that retard plant growth and reduce yield. This course offers an introduction to plant microbiota in plants and soil, particularly microbial biodiversity in bulk soil and rhizosphere and endophytes and pathogens. Microbial communities on plant surface, the leaf surface, microbial modification of the leaf, cell density- modifications, interaction of bacteria on plants. Plant growth promotion by Microbiota. The topics should include quantitative and qualitative (taxonomical) estimation of selected groups such as plant growth promoting rhizobacteria (PGPR), symbiotic Rhizobia and association with legumes. Mycorrhizal associations, ecto-mycorrhizae and endo-mycorrhizae. Classification and interactions of microbiota with plants in root and shoot, their mutual association and impact on plant growth and yield.

Mic3202 Plant Pathology I

Description of main groups of plant pathogens, General disease cycle; economic impact of plant diseases; basic notions of epidemiology. Plant diseases caused by Fungal-Like Organisms with detailed examples including control methods, Plant diseases caused by True Fungi with detailed examples including control methods, General features of Oomycetes. Plasmopara viticola, Phytophthora spp.; General features of Ascomycetes, with examples: Erysiphe necator, Podosphaera leucotricha; Venturia inaequalis, Monilia spp., Botrytis cinerea; General features of Basidiomycetes. Esca disease and root rotting pathogens.The fungal infection process from spore germination to evasion from the host. Fungal pathogenicity: phytotoxins, Tools for the identification of other pathogenicity factors Diagnosis of phytopathogenic fungi, Introduction to phytopathogenic viruses. Taxonomy, morphology,

replication cycle. Strategies of viral protein and viroids . Diagnosis of phytopathogenic viruses and viroids. Serological and molecular techniques. Resistance of plants to pathogens – Pathogen perception; signals and molecules involved in plant resistance.

Mic3204 Microbial Genetics

Mutation (wild and mutant types), Mutagenesis- Types of Mutations – Genetic Analysis of Mutations – Genetic Mapping - Gene expression (transcription, translation, genetic code) - Gene regulation, Gene transfer Nucleic Acids – Plasmids – DNA repair system.

Mic3206 Microbial enzymes

Nature of enzymes – chemical properties of enzymes- classification and nomenclature of enzymes- factors affecting enzymes activity- application of enzymes (detergent industry, fuel production, food production, catalyst in organic industry and in medicine) – Enzyme production, purification, and estimation – Enzyme immobilization – Industrial applications of immobilized enzymes.

Mic4101 Medical Microbiology

Classification of medically important bacteria, Normal Flora, Opportunistic bacteria, Principles of pathogenesis, Types of bacterial infection, Determinants of bacterial pathogenesis, Stages of bacterial pathogenesis and Examples of human pathogenic bacteria.Objectives of medical mycology, Introduction to Fungal pathogens, Some special structure formed by some medically important fungi, Dimorphism, Classification of medically important fungi. Isolation and identification of medically important fungi (Clinical Specimens examination and culturing methods), Mycosis (Superficial – cutaneous – Subcutaneous – Systemic – Opportunistic mycosis) including Diagnosis and Chemotherapy methods, Fungal pathogenicity.

Mic4103 Industrial Microbiology

Introduction – Methods of fermentation – Classification of fermentation processes – Test systems for new metabolites- Substrates for industrial fermentation processes-Microbial product- Examples of industrial products -Organic feed stocks (Ethanol, Acetone / Butanol, Glycerol) – Production of organic acids: Citric acid – Amino acids production – Enzymes production- Enzymes and antibiotics- chromatographic methods- stabilization of enzymes.

Mic4105 Biotechnology and Tissue culture
Technique in Molecular Biology – Techniques in tissue culture – Techniques in Genetic Engineering – Applications in Biotechnology.

Mic4208 Bioinformatics
Bioinformatic, proteomic and genomics
This course is designed to give students both a theoretical introduction to algorithms, statistical methods and a working knowledge of data analysis programming techniques employed in bioinformatics. Emphasis will be placed on biological sequence (DNA, RNA, protein) analysis and its applications. The topics that will be covered in this course include DNA Sequence Assembly and Annotation of Genes, Pairwise Alignment, Multiple Alignment, and BLSPA, primer design, Short Introduction to Phylogenetic Analysis of Molecular Sequence Data, Sequence-Based Classification and Identification of Prokaryotes, 16S rRNA Amplicon Sequencing for Metagenomics, Full Shotgun DNA Metagenomics. This course will provide the student with the computer analytical methods for gene identification, promoter analysis, introductory gene expressionanalysis using software methods and gene mutation. The students will have the ability to become proficient in annotating large genomic DNA sequences. it will provide students with basic information to complete two large sequences and its protein analysis projects during the course, motif searching, gene expression data analysis and cis-element predictions.

Mic4202 Plant Pathology II
Classification of plant diseases, Non-Parasitic causes of diseases: Diseases caused by environmental factors such as adverse temperatures, moisture, Lack of oxygen, Soil pH and Soil Structure and Air pollutants. *Diseases caused by Parasitic higher Plants and their control. *Plant diseases caused by bacteria and their control: Bacterial spots and blights, Bacterial blight of bean, Bacterial Soft Rots, Bacterial Vascular Wilts, Bacterial Galls and bacterial cankers.

Mic4204 Microbial Ecology
Microbial communities, nature of microbial ecology; interaction of microorganisms and different habitats; physical and chemical factors affecting distribution in different habitats; morphological, physiological and

genetical adaptation of microorganisms in different habitats; microbial degradation of wSpaes; bioremediation.

Mic4206 Principals of Immunology
Overview of immune system – Innate immune system (component, recognition) – Recognition, Processing & presentation of antigens- cell mediated immune response – Humoral Immune response- immunization- vaccination- immunity to different microbes- antigen and antibody reactions- cancer immunology.

Elective courses

Mic 2107 Environmental Science
Science and the Environment, Tools of Environmental Science, The Dynamic Earth, The Organization of Life,How Ecosystems Work**,** Understanding Populations Biodiversity, Biomes, Biomes, Aquatic EcosystemsAquatic Ecosystems, Water, Atmosphere and Climate Change, Nonrenewable Energy, Renewable energy and WSpae

Mic2109 Actinomycetes
Introduction to actinomycetes- Nature and Habitat- cellular structure of actinomycetes- growth and life cycle of actinomycetes- classification and taxonomy of Actinomycetes- Types of actinomycetes- genetic system of actinomycetes- different applications of phylum actinomycetes- Actinobacteria secondary metabolites- Role of Actinomycetes as Potential Producer of Antibiotics- Available antibiotics of Actinomycetes- harmful effects.

Mic2111 Introduction to Laboratory Science
To introduce students to the basic skills and techniques that underpin laboratory investigation; to build the expertise and knowledge that will be required by students to undertake both the Introduction to Experimental Biology unit offered and the practical modules offered at level 2

Mic 2212 Cyanobacteria
Nature and diversity**,**Systematics**,** Occurrence in nature, Organisation, function and behavior, Biological diversity,Practical scope,Factors affecting bloom formation,Light intensity,Growth rate,Population stability,Cyanobacterial ecostrategists,Scum-forming

ecostrategists,Homogeneously dispersed ecostrategists,Nitrogen fixing ecostrategists,Benthic cyanobacteria,Additional information.

Mic3113 Technical Course

This course in technical communication emphasizes the principles and strategies of good technical communication, both written and oral, and gives you practice in applying them to present technical and scientific material informatively and clearly. It is specifically designed to allow students from different majors to interact and communicate with each other and with various other audiences about subjects their disciplines may have in common. The course involves applied, activity-based collaboration and therefore relies heavily on a team approach to learning

Mic2210 Aquatic Microbiology

Nature of aquatic environment- Diversity of aquatic microflora- Ecology and physiology of microbes in aquatic systems with emphasis on their roles in food webs, chemical cycling, and human health – Aquatic microbial parasites- Microbial aspect of water management, eutrophication and bioremediation.

Bot3102 Environmental Pollution

This course is an introduction on the main sources of environmental pollution either natural or artificial. It explains the anthropogenic participation in the environmental pollution. It explains also the different types of pollution – Atmospheric, Aquatic, and soil with examples – it gives examples for new methods used for mitigating the effect of pollutants on plants and other ecosystem components. It covers also the wSpaewater pollutions topic, causes and treatments and using of markers to indicate water pollution. Through many recent publications, the course will concentrate on environmental problems showing the negative impacts of different types of pollution on vegetation, species composition and diversity, heavy metals accumulations and agricultural yields.

Mic3111 Biological Control

Microorganisms which are used as a biological control agent, mechanism of biological control, using microorganisms as a biological control agent of plant diseases, microorganisms as a biological control agent of insects, nematodes and weeds, commercial production biological control agent. Factors affecting on the success of biological control in the field.

Mic3210 Secondary Metabolite

Primary and secondary metabolites, microbial secondary metabolites, Conditions for secondary metabolites production, Overview of different types of secondary metabolites, Role of secondary metabolites in medicine, industry, agriculture and in the environment and toxicity of secondary metabolites.

Mic4117 Biology of YeSpa

Introduction to yeSpa – YeSpa taxonomy, morphology, and reproduction – Nutrition of yeSpa – Ecology and biodiversity of yeSpas - Physiological characteristics of yeSpa – yeSpa genetics and yeSpa technology – Biotechnological applications

Mic4109 Microbial Toxin

The concept of toxicity to microorganisms, microbial toxins and intoxication; Division of microbial toxins by origin, chemical structure and mechanism of action; The basic types of microbial product toxicity mechanisms – the effect on the components and processes in the cell; Functioning of microbial toxins on target organs (hepatotoxicity, enterotoxicity, hepatotoxicity, neurotoxicity, nephrotoxicity, reproductive toxicity, immunotoxicity, genotoxicity); Toxic effect of bacterial toxins acting on the surface of the cell; Toxic effect of bacterial toxins that affect the cell membrane by creating pores; Bacterial toxins that affect intracellular structures and processes (on cytoskeleton, enzymes, protein synthesis, transport); Neurotoxic and hepatotoxic effects of cyanotoxin; Cytotoxic and dermatotoxic effect of cyanotoxins; Reproductive toxicity, immunotoxicity and cyanotoxin genotoxicity; Mechanisms of toxicity of microalbumine toxins; Mycotoxicosis-definition, etymology and basic principles; Mechanisms of action of mycotoxin type aflatoxin, citrinin, ergot alkaloid, fuminozin, ochratoxin, patulin, trichothecene, zearalenone; Biotoxins in bioterrorism; Detection of toxicity of microorganisms in different in vitro (cell lines, microphysiological systems, enzymes) and in vivo assays.

Mic4210 Phyllosphere Microbiology

Plants as a habitat for beneficial and / or human pathogen, microbial communities on plant surface, the leaf surface as a microbial habitat, microbial modification of the leaf habitat, cell density- modifications, interaction of bacteria on plants. Phyllosphere microbiology, food safty and human health. Human pathogens and the health threat of the phyllosphere.

Mic4214 Seed Microbiology

Significant of seed infection, Transmission of pathogens via pollen and seed, Control of seed borne diseases, Biological control of seed borne diseases , Microbial inoculation of seed for improved crop performance; inoculation of plant growth promoting microorganisms, The main methods for microbial inoculation of seed, Examples on Formulations used in seed treatment processes, Consistent field performance check to evaluate efficacy of biological seed treatments under field conditions, Co-inoculation with multiple microorganisms, Seed and rhizosphere biology.

Mic3109 Biodiversity

Identify the key characteristics of major groups of prokaryotes and eukaryotes; Explain how eukaryotes arose from prokaryotes and how multicellular organisms evolved from unicells. Describe the relationships between major groups of organisms and to identify key innovations which led to their divergence

Mic3212 Forensic Microbiology

A primer on microbiology- History, current, and future use of microorganisms as physical evidence- Approaches and considerations for forensic microbiology decomposition research-Sampling methods and data generation-Culture and long-term storage of microorganisms for forensic science- Clinical microbiology and virology in the context of the autopsy-Postmortem bacterial translocation- Microbial impacts in postmortem toxicology- Microbial communities associated with decomposing corpses-Microbes, anthropology, and bones- Forensic microbiology in built environments-

Helwan University

Mic4212 Experimental Design

Introduction to experimental design – Introduction to Statistical Analysis Software- Factorial designs- Plackett-Burman design- Taguchi OA design – Response Surface Methods (RSM) – Central Composite design – Box-Behnken design- Analysis of variance.

Mic3208 Environmental Biotechnology

The course introduces the applications of biotechnology in management of environmental problems as well as the interaction between microorganisms and the environment. The main topics covered will be wSpaewater treatment, bioremediation of organic and inorganic pollutants, bioremediation of

contaminated soil, microbes as indicators of risk factors in the environment, microbes in agriculture (biocontrol and biofertilisers), the role of microorganisms in bioenergy production.

Mic2214 The Microflora of Food

The characteristics of microbial growth in food; intrinsic and extrinsic factors and their relationship to microbial growth; the principles of food fermentation; the role of beneficial microbes in food industry; the role of microorganisms in food spoilage; pathogenic microorganisms, infection and intoxication, mycotoxin, viruses and parasites; the principles to control microbial growth in food; as well as principles and methods for qualitative and quantitative microbiological analysis of foods and microbiological quality control according to the international standards.

Mic3101 Essential Skills for the Life Sciences

Search online databases efficiently for scientific literature on specific topics- Perform and interpret simple descriptive statistics and statistical tests- Interpret and evaluate numerical scientific data- Prepare presentation graphics of numerical data and molecular structures- Describe and explain common laboratory techniques for isolation- visualization and investigation of biological samples.Effective report Writing- Computer publishing skills- Working in teams- Ethics, Academic and personal/professional integrity.

Mic3115 Infection and Immunity

In this module you will study basic immunology, learning about the organs, cells and molecules of the immune system and the mechanisms engaged in the generation an of immune response to pathogens. You will learn by studying examples of types of human pathogens (viral, bacterial, fungal, protozoa and helminths), the varied nature of the immune response, depending on the pathogen, its niche(s) in the host and pathogen strategies for invading and surviving in the host. You will learn how immunological methods can be effectively utilized for disease diagnosis and vaccine development, and about the consequences of failure of normal immune function, including autoimmunity and hypersensitivity.

Mic4107 Natural Products

Plant and microorganism as natural product sources, Role of natural products for producing organisms, Classes of natural products; their structure, synthesis, separation and biological activities (Carbohydrates – Glycoproteins, lipoproteins and glycopeptidolipids – Glycosides and

saponins – Alkaloids – Steroids and triterpenoids – Flavonoids –lignans – Lipids), Genetically engineered natural product

Mic4111 Writing and Referencing Skills

Current language skills,constitutes academic malpractice, including how we as a University detect plagiarism, and how to avoid it,academic reading and writing skills, and good practice in time management and organizational skills as part of continued learning, training in literature searching, training in the use of referencing software (Endnote), self-learning through the use of computer-based training.

Mic4210 Introduction to Nanotechnology

Definition of nanotechnology; methodology of nano-compound preparation including physical, chemical and biological (green synthesis); methods of nano-compound characterization for their particle size, morphology, surface properties as well as their release study; applications of nano-compounds in different fields; such as food production and packaging and in disease treatment for improving efficiency and in drug targeting.

Mic4113 Marine Microbiology

Most of the world's organismal diversity is found in the sea and it is a diverse and a relatively unexploited, but potentially large, resource for areas such as pharmacology and biotechnology. The marine organisms live in (and are adapted to) a variety of habitats that have no counterparts in terrestrial and freshwater environments. In this course, Marine biology, with the subtitle Organisms and biotopes, you have the opportunity to further - 309 -amiliarize yourself with these organisms and environments, and immerse yourself in this field.

Mic4218 Biotic Interactions

Our reductionist approach to biology leads us to underestimate the influence that biotic interactions have on the physiology, development, ecology and evolution of a given organism. This unit will introduce the different types of organismal interactions between animals, plants and microbes. Particular emphasis will be placed on an integrated understanding of those interactions from the molecular to the ecological level, as well as an appreciation of parallels between similar processes across different kingdoms. We will

discuss how knowledge of biotic interactions can be applied to agro-ecosystems, human health and conservation.

Free elective courses of Botany and Microbiology Department

Food and Physiology

Learn how our body reacts when it first senses the presence of food, and how hormones are activated in response to hunger and food consumption. The microbiome and gut health will be covered, both in the healthy state and when undesirable reactions occur, leading to disease. You will explore how certain foods can impact the body, affecting our cognitive and physical health.

The Biosciences and Global Food Security

The above is a sample of the typical modules that we offer at the date of publication but is not intended to be construed and/or relied upon as a definitive list of the modules that will be available in any given year. This prospectus may be updated over the duration of the course, as modules may change due to developments in the curriculum or in the research interests of staff.

Pharmacological Basis of Therapeutics

This module will provide an in-depth analysis of drug action, and its application to the design and use of current therapeutics. You will learn to define what drugs are, the different ways they act at the cellular and molecular level, and the pharmacokinetic principles underlying drug absorption, distribution, metabolism and elimination. You will explore examples in cardiovascular and respiratory disease, diabetes and obesity, CNS disorders, cancer and infectious disease. Overall, you will develop a deep understanding of what the discipline of pharmacology represents, and its application to both basic biological research and current and future medical advances.The above is a sample of the typical modules that we offer at the date of publication but is not intended to be construed and/or relied upon as a definitive list of the modules that will be available in any given year. This prospectus may be updated over the duration of the course, as modules may change due to developments in the curriculum or in the research interests of staff.

Microbes and You

How microbes interact with humans, animals, plants and other organisms, role of human normal flora, Microbes and food production, microbes and human health, microbes and industry, pathogenic microbes and diseases.

Professional Skills for Bioscientists

Professional Skills is centred on delivery of some key core professional skills through timetabled lectures, group activities and self-directed learning.

Rapid Methods in Microbial analysis

This course aims to provide more sensitive, accurate, precise, and reproducible test results when compared with conventional, growth-based methods. Rapid methods normally involve some form of automation, and the methods often capture data electronically. With several different technologies available on the marketplace, the microbiologist has a difficult, and sometimes expensive, choice to make in selecting the optimal method. Rapid microbiological methods (RMMs) include Growth-based Methods, Direct Measurement, Cell Component Analysis, Optical Spectroscopy, Nucleic Acid Amplification, Micro-Electrical-Mechanical Systems.

Microbial Fermentation

Introduction to fermentation biotechnology- concepts in microbiology of Industrial Fermentation- Concepts Fermentation Kinetics- Types of fermentation- Microbial Synthesis of Primary Metabolites- Microbial Synthesis of Secondary Metabolites and Strain Improvement- Applications of Metabolomics to Microbial "Cell Factories" for Biomanufacturing- Conversion of Renewable Resources to Biofuels and Fine Chemicals- Cell Immobilization and Its Applications- Bioreactors: Design, Operation, and Applications- Control of Industrial Fermentations- Monitoring and Control Strategies for Ethanol Production in *Saccharomyces Cerevisiae*.

Bioinformatics and Biomathematics

The topics that will be covered in this course include Databases and Protein Structures, multiple functional annotations, protein structural prediction, molecule visualisation, drug targeting, and protein interaction, in two separate parts. The first part, Bioinformatic Methods I (this one), Omic tools, MicroRNA target prediction tools, CRISPR Guide RNA prediction, UniProt database.Basicinformation about Gene Ontology (GO) and function will be covered and the information on the disease(s) and phenotype(s) associated

with a protein and metagenomics. This, the second part, Bioinformatic Methods II, Provide the students with computer skill about drug target prediction and docking study to build up protein model (homology model) from DNA sequence and information on the quaternary structure of a protein, protein-proteininteractions, antibody prediction including the prediction of the variable loop(CDR) region of anantibody. Students will work on individual computational modules in the exercises/projects leading to the creation of an integrated whole-class tool suitable for general bioinformatic analysis (gene and protein workflow analysis).

Microbial Structure, Identification and Distribution

General characteristics of microbes, bacterial, fungal and viral structure, different methods for microbial identification, distribution in different environments.

Microbial Metabolism and Genetics

Investigate the energy-yielding mechanisms in aerobic, anaerobic and fermentative systems and their diversity and importance to humans.

Introduction to Biosafety and Risk Assessment

Biosafety policies and procedures associated with the introduction and use of biotechnological tools - Guidelines and regulation of biosafety- Biosafety measures in the laboratory, greenhouse and open field. - Laboratory biohazard wSpae management - Regulatory review and approval to commercial release - Biosafety and public awareness-Risk assessment of GMOs. (Genetically Modified Organisms) - Risk management of GMOs and their possible impact on the environment

Helwan University

المحتوى العلمى للمقررات الدراسية
لقسم علم الحيوان والحشرات
Course Description for Zoology and Entomology Department

Helwan University

Compulsory Zoology and Entomology Programs Courses Contents

Zoo1101 General Zoology I

Study the structure and function of animal cell and basic tissues. Introduction of physiology: nutrition, digestion and metabolism, blood (structure and function). Introduction of embryology, spermatogenesis, oogenesis. Introduction to genetics.

Zoo1103 Introduction to Zoology

Study the structure and function of animal cell and basic tissues. Introduction of physiology. Introduction of embryology, spermatogenesis, oogenesis. Introduction to genetics.

Zoo1202 General Zoology II

Theories of taxonomy of Kingdom Animalia. General characters of Kingdom Protista. Phylum Porifera, Phylum Cnidaria, Phylum Platyhelminthes, Phylum Aschelminthes and Phylum Annelida. A comparison among the different phyla in morphology, structures and systems.

Zoo1204 Introduction to Zoology II

Theories of taxonomy of Kingdom Animalia. General characters of Kingdom Protista. Phylum Porifera, Phylum Cnidaria, Phylum Platyhelminthes.

Zoo2101 Invertebrates

General characters, morphology, internal structures, systems and economic importance in examples of Phylum Arthropoda, Phylum Mollusca and Phylum: Echinodermata.

Zoo2103 Physiology I

Nutrition, digestion, absorption and excretion of nutrients (carbohydrates, protein and lipids). Metabolism of carbohydrates; glycolysis, glycogenolysis, gluconeogenesis, Krebs' cycle and hexose monophosphate shunt. Metabolism of proteins and lipids (β-oxidation of fatty acids and formation of triglycerides). Liver and pancreatic functions. Examples of digestive system diseases.

Zoo2105 Entomology

This course is designed to provide the student with comprehensive information about the morphology and internal structure of the insects and their suitability for the living more environmentally and to know the applied

aspects of economic entomology, which encompasses the harmful and beneficial impact of insects on humans and their activities.

Zoo2107 Introduction to Physiology
Nutrition, digestion, absorption and excretion of nutrients (carbohydrates, protein and lipids). Metabolism of carbohydrates; glycolysis, glycogenolysis, gluconeogenesis, Krebs' cycle and hexose monophosphate shunt. Metabolism of proteins and lipids (β-oxidation of fatty acids and formation of triglycerides). Liver and pancreatic functions. Examples of digestive system diseases.

ZoCh2101 General Entomology
This course is designed to provide the student with comprehensive information about the morphology and internal structure of the insects and their suitability for the living more environmentally and helping the student at the completion of insects to distinguish it from other objects and recognize their importance.

Zoo2202 Chordata
Introduction and Classification. External features, internal structures and systems of examples of different classes of Protochordates, Pisces and Tetrapoda (Amphibia, Reptilia, Aves and Mammalia).

Zoo2204 Immunology I
Basic knowledge of immunology. Topics include: History and definitions in immunology, structure of the immune system innate versus acquired immunity, differences between active, passive and adaptive immunity, characteristics of the immune response, cells and mediators involved in the acquired immune response and humoral and cellular immunity. Disorders of the immune system.

Zoo2206 Genetics
Mendelian inheritance and its extensions. Non-mendelian inheritance. The relationship between genes and traits. The chromosomal basis of inheritance (Chromosomes, cell cycle, mitosis, meiosis and chromosome theory). Mutations, mechanisms of DNA repair and sex-determination in eukaryotes. Introduction to genetic engineering and its applications.

ZoCh2202 Introduction to Immunology
Basic knowledge of immunology. Topics include: History and definitions in immunology, structure of the immune system innate versus acquired immunity, differences between active, passive and adaptive immunity, characteristics of the immune response, cells and mediators involved in the acquired immune response and humoral and cellular immunity.

Zoo3101 Parasitology
Identification of different Protozoans and Helminthic parasites and their relationship with their hosts. How to determine: the site of infection, various methods of diagnosis and diagnostic stages, pathogenicity and treatment and finally the prevention and control for each parasite. Elucidate the life cycle of the parasite and mode of transmission to the host (s).

Zoo3103 Insect taxonomy
The immense diversity of insects and related arthropods. Classification and evolution of insects. Diagnostic keys to identify insect species and to differentiate among a diverse array of insect families from around the world. Valuable collection and preservation techniques to distinguish key morphological characters in different insect lineages. Diversity in adult forms and terrestrial habitats of insects.

Zoo3105 Histology
Major classes of animal tissues: Epithelial, connective, muscular and nervous tissues. The various classes of animal tissues involved in the structure of digestive, respiratory, and urinogenital systems and the relationship between these structures and their functions.

Zoo3107 Ecology
Introduction to Ecology. Ecosystem. Ecosystem structure and function. Terrestrial ecosystem. Aquatic ecosystem. Biogeochemical cycles. The interaction between the animals and their environments. Pollution.

ZoCh3101 Medical Parasitology
Identification of different Protozoans and Helminthic parasites that infect humans, the diseases caused by them, and their relationship with their hosts. How to determine: the site of infection, various methods of the diagnosis and diagnostic stages, pathogenicity and treatment and finally the prevention and control for each parasite. Elucidate the life cycle of the parasite and mode of transmission to the host (s).

ZoCh3103 Histology and Microtechniques

Major classes of animal tissues: Epithelial, connective, muscular and nervous tissues. The various classes of animal tissues involved in the structure of digestive, respiratory, and urinogenital systems and the relationship between these structures and their functions. The different types of chemical fixatives: Advantages and disadvantages. Steps used in animal microtechniques and how to stain a specimen with chosen dyes. Steps used in preparing and staining of animal tissues for electron microscopy.

ZoCh3105 Ecology and Marine Biology

Introduction to Ecology. Ecosystem. Ecosystem structure and function. Terrestrial ecosystem. Aquatic ecosystem. Biogeochemical cycles. The interaction between the animals and their environments. Pollution. Study marine environment especially those of the Red and Mediterranean seas and comparing it with freshwater environment especially the Nile River. Study the representative organisms in different localities.

Zoo3202 Physiology II

Circulatory system, body fluids, blood components, blood groups, hematopoiesis. Blood disease (anemia and blood pressure). Systemic and pulmonary circulation, control mechanisms of circulatory function. Excretory system, anatomical structure of the excretory system, kidney functions and urine formation. Respiratory system, blood gases and gases transport, the mechanism of breathing.

Zoo3204 Embryology

General principles of embryology: gamete formation, fertilization, cleavage, gSparulation, organogenesis and comparative study of organs formation in different embryos.

Zoo3206 Immunology II

The course covers the innate and adaptive immune mechanisms. The cells, receptors, signaling pathways and soluble mediators associated with the innate immune response will be covered. Emphasis will be placed on the molecular and cellular mechanisms that are used by the innate immune system to detect and respond to microbial pathogens to provide the first line of defense. Lymphocyte receptors, types, structures and functions of antibodies. Types of antigens, antigen antibody interaction and blood groups,

major histocompatibility molecules and antigen presentation, pathways of the complement system, diseases of the immune system and vaccination.

Zoo3208 Marine Biology
Study marine environment especially those of the Red and Mediterranean seas and comparing it with freshwater environment especially the Nile River. Study the representative organisms in different localities.

Zoo3210 Microtechniques
The different types of chemical fixatives: Advantages and disadvantages. Steps used in animal microtechniques and how to stain a specimen with chosen dyes. Steps used in preparing and staining of animal tissues for electron microscopy.

Zoo4101 Physiology III
Neurophysiology, Types of nerve cell, central nervous system (brain regions and spinal cord) - reflex arc, action potential, synapses, neurotransmitters, autonomic nervous system, receptors. Muscles: skeletal, cardiac and smooth muscles (structure - function - mechanism of action). Sense organs: cutaneous sensation, hearing, vision, olfaction and tSpae receptors (structure - function - mechanism of action).

Zoo4103 Molecular Biology
The characteristics of the genetic material. DNA as a genetic material and RNA as a genetic material in some viruses. DNA structure and gene concept at the molecular level. DNA organization in chromosomes and DNA replication. Gene expression concept: Transcription, RNA processing and translation. Regulation of gene expression in prokaryotes. Introduction to regulation of gene expression in eukaryotes.

Zoo4105 Immunology (III)
This course will provide an in-depth analysis of the immune cells (T, B and antigen presenting cells), and tissues that comprise the adaptive immune response. The course will examine how cells of the adaptive immune system discriminate self from non-self, including the nature of antigen receptors, the types of antigens recognized, and the signals involved in the generation of effector cells that mediate the response.

Zoo4107 Cell Biology

The emergence of modern cell biology. Prokaryotic and eukaryotic cells. Biological membranes: Structure and function. Transport across membranes. Signal transduction. Protein targeting. Cell organelles: Structure and function. Cytoskeletal system. Cell cycle. Apoptosis. Stem cells. Glycolysis. Krebs cycle. Oxidative phosphorylation.

ZoCh4101 Physiology IV

Neurophysiology, nervous system, action potential, structure of nerve cell, chemical neurotransmitters. Muscle (types- structure – mechanism of action) and sense organs.

Zoo4202 Histology and Histochemistry

The theoretical and practical basis for the detection of chemicals existed in animal tissues including carbohydrates, proteins, lipids, amino acids, nucleic acids, various enzymes, pigments and minerals. Principles of Immuno-histochemistry. Histological structure of reproductive, endocrine and nervous systems.

Zoo4204 Comparative Anatomy

Reviewing anatomical terms, historical brief, methods of studying this science and its importance. Comparative anatomy of the skin and skeletal systems of different vertebrate classes.

Zoo4206 Experimental Embryology

Experimental application in embryonic stages of organogenesis. Some application of stem cells. Mechanism of implantation in some organs.

Zoo4208 Physiology V

Coordination of endocrine system: General characteristics of hormones - mechanisms of action - hypothalamic-pituitary axis regulation of hormones and feedback mechanism. Different endocrine glands and their hormonal secretion (structure of hormones - functions - abnormalities of hypo- and hypersecretions).

Zoo4210 Animal Behavior

Introduction to animal behavior. Types of behavior. Natural selection and behavior. Ecology and adaptive behavior. Foraging behavior for foods. Genetics and behavior. Altruism and instinct behavior. Living in groups and their types. Behavior: Cooperative, social and anti-predatory. Hormones and

behavior. Nervous system and behavior. Communication in animals. Learning and experiments. Intelligence and behavior regions.

Elective Zoology and Entomology Program Courses Contents

Zoo2208 Introduction to Cell Culture

Studying principles of cell and tissue culture, types of cell culture, stem cell types and application, cryopreservation, thawing technique and aseptic technique.

Zoo2210 Insect Physiology

Structure and function of internal organ systems and their role in insect success.

Zoo3103 Insect Taxonomy (elective for Zoology and Chemistry Program)

The immense diversity of insects and related arthropods. Classification and evolution of insects. Diagnostic keys to identify insect species and to differentiate among a diverse array of insect families from around the world. Valuable collection and preservation techniques to distinguish key morphological characters in different insect lineages. Diversity in adult forms and terrestrial habitats of insects.

Zoo3109 Protozoa

Introductory study of Kingdom Protista. Classification of different phyla. Structure and function of protozoal organelles. Free-living and parasitic examples. Life cycles, pathogenesis and symptomatology, diagnosis and treatment in some parasitic examples.

Zoo3111 Cytogenetics

Chromosome structure and terminology. Chromosomal variations and aberrations. Karyotyping and staining technologies. Examples of new techniques.

Zoo3113 Environmental Pollution

Introduction. Industrial pollution: sources, types and causes of occurrence in terrestrial and marine environments, chemical industry, heavy metals, sewage treatment, radioactive wSpae, pesticides and fertilizers. Adverse impacts of industrial pollution on the environment and wildlife. Strategic control. Standards and legislation. Monitoring industrial pollutants. Prevention,

reduction and removal of industrial pollution. Industrial study cases: Petrochemicals, fertilizers and petroleum

Zoo3115 Physiology of Reproduction
Anatomical structure of the mammalian reproductive system. Physiology of reproduction in males including puppetry, determination and differentiation of sex and spermatogenesis. Reproductive system in females. Oogenesis and fertilization.

Zoo3212 Evolution
Introduction. Evidences. Theories. Modern theories and their objections.

Zoo3214 Organic Adaptations of Chordates:
Studying several systemic organs such as skin, skeleton, heart, kidney and others in groups of chordates to show their functional skills that enable the chordates to live in their environments with less pressure of different stimuli.

Zoo3216 Fauna
Study the geographical, geological and ecological ranges of Pisces, Reptilia and Mammalia. Study the adaptation, nutrition and general characteristics of different examples.

Zoo3218 General Histopathology
Studying the pathological changes of the tissue including tissue injury, mechanism of tissue repair and cell apoptosis and nuclear degeneration, different types of abnormal cell growth with etiology and pathogenesis.

Zoo3220 Human Genetics
Pedigree analysis and modes of Mendalian inheritance in humans. Non-Mendelian inheritance (Mitochondrial inheritance, anticipation, genomic imprinting and dosage compensation). Twin studies and their genetic applications. Chromosomal aberrations and syndromes. Multifactorial inheritance and common genetic diseases in human. Consanguineous marriages. Genetic counseling.

Zoo3222 Medical Entomology
Biology, disease relationships and control of insects and other arthropods parasitic on or in humans; aspect of the fields of clinical preventive medicine; survey, collection and taxonomy of medically important arthropods in laboratory sessions.

Zoo4109 Toxicology
Introduction to toxicology. Toxicological concepts. Routes of exposure. Dose-response relationships. Toxicokinetics absorption, distribution, storage. biotransformation and elimination of toxicants. Toxicodynamics: target organ toxicity, mode of action. Environmental toxicants

Zoo4111 Advanced Immunology
Fine structure and functions of lymphoid organs. Cytokines. Adhesion molecules. Lymphocyte recirculation and homing. Immunity to infections with viruses, bacteria, fungi and parasites. Antimicrobial immunity and immune regulation.

Zoo4113 Histology of Sense Organ
Studying the histological and cellular structure and function of different sense organs with different clinical notes.

Zoo4115 Radiobiology
Introduction. Types of ionizing and radiation exposure. Sequential development of radiation injury. Linear energy transfer. Relative biological effeteness. Classification of radiation effects: Dose effect relationships and acute radiation syndromes. StochSpaic and non stochSpaic effects. Delayed somatic effects.

Zoo4117 Bioethics
Introduction to bioethics. Biosafety. Animal research Ethics. (IACUC). Clinical research Ethics. (IRB). Bioterrorosm. Biosafety. Research ethics. Ethics of reproductive medicine. Euthanasia. Ethics of assisted reproductive ethics.

Helwan University

Zoo4119 Chronobiology
Definition and types of biological rhythms. General properties of circadian rhythms. Circadian clock (clock genes). The superchiasmatic nucleus structure. Organization of afferent, efferent and local circuits within the superchiasmatic nucleus. Resetting the circadian clock. Development of the circadian clock. Photoperiod and its role in regulating the circadian clock function. Circadian rhythms and human health.

Zoo4212 Bioinformatics

An introduction to computational biology and bioinformatics. Data analysis, protein and nucleic acid sequence analysis, genome sequencing and assembly, protein structure prediction, data analysis of DNA microarray, data clustering, biological pattern recognition, and biological networks. Online applications of bioinformatics web-based tools and software.

Zoo4214 Genetic Engineering
An introduction treatment to genetic engineering. The course covers a definition of the term, Human Genome Project, gene therapy, biotechnology and genetically-engineered agriculture and genetically-modified animals and food. Basic overview of some aspects of the genetic engineering debate and legislation.

Zoo4216 Cancer Biology
Definition and stages of Carcinogenesis. Oncogenes and proto-oncogenes. Growth factors. Cancer genes. MetSpaasis. Tumor markers. Examples of tumor markers.

Zoo4218 Immunohistochemistry
Principles of immunohistochemically detection from tissue fixation till antigen-antibody reaction process. Methods of chelation of primary and secondary antibody including peroxidase, alkaline phosphatase and avidin-biotin complex. Blocking process, antigen retrieval and immunofluorescent process.

Zoo4220 Veterinary Parasitology
Study of animal parasites, especially relationships between parasites and animal hosts. Parasites of domestic animals**, (**livestock and pet animal**s), as** well as wildlife animals, the taxonomy and systematics of parasites, including the morphology, life cycles, and living needs of parasites in the environment and in animal hosts. Zoonotic diseases.

Zoo4222 Stem cell
Introduction to cytology, introduction to stem cell research and history of stem cell research, types of stem cells, cell culture labs.

Zoo4208 Physiology V
Coordination of endocrine system: General characteristics of hormones - mechanisms of action - hypothalamic-pituitary axis regulation of hormones and feedback mechanism. Different endocrine glands and their hormonal

secretion (structure of hormones - functions - abnormalities of hypo- and hypersecretions).

جامعة حلوان
Helwan University

المحتوى العلمى للمقررات الدراسية
لقسم الجيولوجيا
Course Description for Geology Department

Helwan University

Geology Program Courses Contents

Geo1101 General Geology I

Earth structure and plate tectonics, Rocks (igneous, sedimentary, metamorphic), Weathering (mechanical and chemical weathering), Soil horizons and types, Mass wSpaing (mass movement), Running water (rivers), Groundwater and its geologic work, Aeolian processes (deserts and winds).

Geo1202 General Geology II

Introduction, crystallographic elements, crystal parts, crystal symmetry, classification of crystals into seven systems, parameters, Miller indices and crystal forms, description of the seven crystal systems: triclinic, monoclinic, orthorhombic, tetragonal, cubic, trigonal and hexagonal systems, Physical properties of minerals (characters depending upon light, mechanical properties, cohesion, mass, magnetic properties, electric properties, tSpae and feel), physical properties of mineral groups (native elements, sulphides, oxides, carbonates, silicates, etc.).

Geo2101 Mineral Optics

Some elementary concepts of light, polarizing microscope, sample preparation for microscopic study, classification of minerals according to optical properties (isotropic, uniaxial and biaxial minerals), optical properties of isotropic minerals (reflection and refraction of light, refractive index, dispersion of light, ray velocity surface, isotropic indicatrix, total reflection and critical angle, measurement of refractive index), uniaxial minerals (double refraction, uniaxial indicatrix, ray velocity surface, polarization of light, Nicol prism), optical properties of uniaxial minerals in plan-polarized light, optical properties of uniaxial minerals between crossed nicols (interference coloures, extinction, zoning), optical properties of uniaxial minerals in convergent light (interference figures, optic sign), Biaxial minerals (double refraction, biaxial indicatrix, ray velocity surface), optical properties of biaxial minerals in plan-polarized light, optical properties of biaxial minerals between crossed nicols (interference coloures, extinction, zoning), optical properties of biaxial minerals in convergent light (interference figures, optic sign and optic angle).

Geo2103 Macropaleontology

Scope of paleontology; The nature of fossils (fossilization, types of preservation, kinds and names of animals, adoption to environment, development, fossil-bearing rocks), invertebrate paleontology; porifera, the different structural features and geologic distribution; Corals characteristics

classification of corals, geological environment and geologic distribution of corals), Brachiopods (morphology, ontogeny, classification, evolution, ecology and stratigraphic distribution, faunal provinces, stratigraphic use), different classes of Mollusca; Pelecypods (range of form and structure, classification, evolution, functional morphology and ecology, stratigraphic distribution), GSparopods (anatomy, classification, shell structure and morphology, evolution), Cephalopods (characteristics and subclasses, morphology, ontogeny, classification, evolution, uses as index fossils), Echinoderms (classification, morphology and different classes, life habits); Graptolites (classification, biological affinities, evolutionary trends, faunal provinces, stratigraphical use); Trilobites (classification , morphology, ontogeny, faunal provinces, stratigraphic use as Cambrian index fossils); principles of vertebrate paleontology.

Geo2105 Crystallography

Crystal projection (spherical and stereographic projection), Hermann Mauguin notation, classification of crystals into 32-classes according to Hermann, Mauguin notation, the two crystal classes of triclinic system, the three crystal classes of monoclinic system, the three crystal classes of orthorhombic system, the five crystal classes of trigonal system, the seven crystal classes of hexagonal system, the seven crystal classes of tetragonal system, the five crystal classes of cubic system.

Geo2107 Principles of Historical Geology

The dynamic and evolution 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; coSpaal and marine environments, the Proterozoic Eon**;** the Paleozoic life history; (life in coal swamps); flora in Paleozoic; the age of trilobites and fishes; glaciations; Orogenies; 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; Paleogene and Neogene Geology; scatterings of Africa; flora in Cenozoic; Cenozoic periods in Egypt; ice age (Pleistocene); The Age of Mammals and primitive human evolution.

Geo2109 Principles of Geological Survey
Principles of survey, Type of survey, surveying equipment's, Basic trigonometry functions for distance and angular measurements, Distance and angle measuring, Bearings and Azimuths, Co-ordinates systems, Compass survey, Traverse, Survey grids, Global Positioning System (GPS), differential leveling, Basic geologic field techniques, Air reconnaissance, subsurface geologic mapping, Making a geological map and cross-section.

Geo2111 Fundamentals of Remote Sensing
History of Remote Sensing, Electromagnetic Spectrum, Aerial Photography, Photogrammetry, Satellites and Sensors, Digital Images, Radiometric and Geometric Correction, Image Enhancement, Thermal Sensing, RADAR Sensing, Remote sensing and GIS Applications.

Geo2113 Geomorphology
Fundamentals of geomorphology, mass wSpaing, fluvial geomorphologic processes, arid cycle and landforms, relationships of geologic structure to topography, applied geomorpholgy, geomorpholgy of Egypt.

Geo2115 Structural Mineralogy
General principles of mineral structure: Interatomic binding forces, Coordination, The mineral species; Description of mineral structures with notes on some physical properties: Structural classification of minerals, The metallic minerals (true metals and metalloids), Homopolar and molecular minerals (e.g. diamond and graphite structures), Ionic minerals with isodesmic structures (e.g. fluorite and spinel structures), Ionic minerals with anisodesmic structures (e.g. calcite and gypsum structures), Ionic minerals with mesodesmic structures (Silicates structure: Nesosilicates, Sorosilicates, Cyclosilicates, Inosilicates, Phyllosilicates, Tectosilicates).

Geo2202 Micropaleontology
Scope of micropaleontological studies; evolution and biodiversity; techniques of micro-organisms studies; studying of some important microfaunas and microfloras; inorganic-walled microfossils such as: Foraminiferida (living animal, life history, morphological characteristics; taxonomy, geological distribution; paleoecological parameters controlling the distribution of foraminiferas; larger forminiferida (fusulinids, orbitoidids, discocylinids, miogypsinids), nummulitids (skeletal structure, physiological features, classification, geological distribution and stratigraphic importance); Ostracods (hard parts, growth stages, physiological features, mode of life,

classification, geological distribution and importance); Calcareous nannoplanktons, coccolithophores and discoSpaers (hard parts, growth stages, classification, geological distribution and application); Radiolaria (skeletal structure, physiological features, classification, geological distribution and stratigraphic importance); Silicoflagellates and diatoms; principles of paleopalynology (Spores, Pollen grains & Dinoflagellates (classification, microstructure and morphology, stratigraphic distribution and use as index fossils); application of microfossils in stratigraphy and environmental geology.

Geo2204 Descriptive Mineralogy

Crystal chemistry of minerals (unit cells, atomic packing, chemical bonds), polymorphism, isomorphism, twinning , crystal habit, classification of minerals, internal structure and classification of silicate minerals, description of silicate mineral groups (chemical composition, crystallography, optical properties and occurrence): silica group, feldspars and feldspathoids, pyroxenes and pyroxenoids, amphiboles, mica, chlorite and talc groups, serpentines and clay minerals, olivine and garnet groups, internal structure and classification of non-silicate minerals, description of non-silicate minerals (chemical composition, crystallography, optical properties and occurrence): carbonates, sulphates, sulphides, oxides, hydroxides, phosphates and halides).

Geo2206 Stratigraphy

The scope and fundamental of modern stratigraphy; the evolution and importance of stratigraphy; stratigraphy and geologic time scale; geochronology; chronostratigraphy; time units and time- stratigraphic units; way-up indicators (sedimentological and biological tools); lithostratigraphy and sedimentology; lithostratigraphic nomenclature; procedures for establishing rick units; lithostratigraphic units; lithodemic units, application of lithostratigraphy (environments; geological maps); lithostratigraphic correlation; parameters contributing in biostratigraphy; mass extinction in the Phanerozoic time; stratigraphic procedures; rate of speciation; Biostratigraphic nomenclature; taxa used in biostratigraphy; biostratigraphic correlation; Biostratigraphy: its integration into modern geochronology; cyclostratigraphy; Biostratigraphy and chronostratigraphic classification; biostratigraphic zonation (biozones); procedures of biozonation; the different index fossils in biostratigraphy; distribution of organisms in space (palaeobiogeography); radiometric dating and chemostratigraphy, principles of environmental stratigraphy.

Geo2208 Computer in Geosciences
Introduction and operation system, nature and types of geological data, the important of computer in earth science, examples of state-of-the-art software that are used in teaching earth science, Spreadsheets and Graphing and charting geologic data, simulation, Spreadsheets fitting models, and applied problems, Surfer and gridding and contouring methods, Surfer for crating and visualizing different type of maps, Grapher, line graphs and statistics, Mathcad, introduction, linear regression, error analysis, Corel Draw software for digitizing map, cross sections, use GIS and image enhancement, computer applications in different branches of earth science with case study.

Geo2210 Principles of Geotectonics
History of the evolving continents, sea floor spreading, plate tectonics theory, types of plate boundaries, divergent plate boundaries, convergent plate boundaries, transform plate boundaries, geometry of plate motion, triple junction, driving mechanism for plate motion.

Geo2212 Principles of Petrology
Introduction, Igneous rocks and their origin, Classification and textures of igneous rocks, Common igneous rocks and their composition, Sedimentary rocks, Origin of sedimentary rocks, Structure of sedimentary rocks, Classification of sedimentary rocks, Metamorphic rocks, Agents and types of metamorphism, Textures of metamorphic rocks, Classification of metamorphic rocks.

Geo3101 Igneous Petrology
Earth structure and petrotectonic assemblages, structures of igneous rocks (extrusive and intrusive structures), texture of igneous rocks, chemistry and mineralogy of igneous rocks, classification of igneous rocks (textural, mineralogical, chemical and multiple criteria classification), petrographical description of common igneous rocks, petrogenesis, movement and modification of magmas.

Geo3103 Sedimentary Petrology
Introduction, Formation of sedimentary rocks (weathering, transportation, deposition, lithification), Structure of sedimentary rocks, Textures of sedimentary rocks, Classification of sedimentary rocks: clSpaic or detrital rocks (Conglomerates, breccias, sandstones, mudstones, shale), chemical

rocks (carbonates, chert & flint, evaporites, ironstones), biochemical or organic rocks (organic limestone, chalk, coal, phosphorite).

Geo3105 Structural Geology

Definition of structural geology, faults and fractures, rock fractures , fault geometry and nomenclature, rocks produced by faulting (fault rocks), features associated with fault planes, fault associations, thrust systems, extensional fault systems, strike-slip fault systems, inversion, joints, folds, meaning and significance of folds, basic fold geometry and nomenclature, fold orientation, classification of folds, geometry of the fold profile, description of fold systems, folds in three dimensions, folding mechanisms and fold geometry, relationship between faults, folds and shear zones, foliation, lineation, boudinage, fabric, gravity-controlled structures, the effect of topographic relief, effects of gravity on thrust sheets and nappes, salt domes, mantled gneiss domes and granite diapirs, stress, strain.

Geo3107 Industrial Minerals

Introduction (Definitions, Examples of industrial minerals and their uses, Industrial minerals and national economy), Raw materials for glass industry (Glass manufacture, Geology of glass raw materials: Silica sand and Limestone, Minor constituents, Some environmental aspects of glass manufacture), Cement (Raw materials and manufacture of Portland cement, Setting of Portland Cement, Special cements, Selection and blending of raw materials), Refractories (Conditions of Service, Silica Refractories, Magnesia Refractories, Aluminosilicate Refractories, Other Refractory Products and Raw Materials, Applications of Refractories), Clays for construction (Raw Materials, Mineralogical Changes during Firing, Mineralogy of Bricks, Assessment of Brick Clay Raw Materials, Environmental Aspects of Brick Production), Aggregates for construction (Aggregates for tarmac and roads, Assessment of aggregates for road construction: Shape and grain size, Strength, Mechanical durability, Physico-chemical durability, Aggregates for concrete: Requirements for concrete aggregates and Aggregates reactivity), Minerals for agriculture and the chemical industry.

Geo3109 Engineering Geology

Strength of geological material, ground investigations, laboratory investigations, geological maps, slope stability, reservoirs and dams, excavations, ground treatment and support, development and redevelopment.

Geo3111 Rock Mechanics
Classification of physical properties of rocks, effect of internal factors and external factors on the properties of rocks, mechanical properties of rocks, characteristics of loosened rocks, technological indices of rocks.

Geo3113 Lithostratigraphy
Concepts and objective of lithostratigraphy; stratigraphy and sedimentology; principles of stratigraphy; stratigraphy and geologic time; geochronology, time- stratigraphic units; unconformities, different criteria for recognizing it; primary structures (physical or organic) in sedimentary rocks and its usage as way-up indicators; chronostratigraphy, time- stratigraphic units; stratigraphic nomenclature; lithostratigraphic units; procedures for establishing rock units; application of lithostratigraphy (environments; geological maps); lithostratigraphic correlation; stratigraphic procedures; outcrop procedures, measuring of horizontal and inclines strata, presentation of outcrop data, subsurface procedures; mechanical logging (E- log, sonic log,….etc); presentation of subsurface data; sedimentary environments; (non-marine environments, transitional environments and marine environments); tracing environments in space and time; lateral and vertical relationships among lithosomes.

Geo3115 Marine Geology
Topographic features of the sea floor; Passive and active continental margins; Mid-oceanic ridges and fracture zones; Oceanic crust and ophiolites; Marine sedimentary environments; Accumulation of marine organic materials; Marine sedimentary process; Marine sediments; Marine recent sediments; Coral reefs; Sea water characteristics; Wave destruction action; Petroleum potentiality of off-shore areas; Marine geology of Egypt.

Geo3117 Mathematical Geology
Definition of orientation data, processing, measuring linear and planar elements, presentation of linear and planar elements on maps and stereogram, problems of modeling, models of geological phenomena, models in terms of geological processes, models of geologic objects, analysis of geological models.

Geo3202 Metamorphic Petrology
Introduction to metamorphic rocks, metamorphic grades, metamorphic facies, textures and structure of metamorphic rocks, thermal metamorphism of different rocks types, autometamorphism and metasomatism, regional

metamorphism, common triangular plots used in metamorphic rocks, common metamorphic rocks.

Geo3204 Geochemistry

Periodic Table, Crystal Chemistry, Crystal Structure, Chemical Differentiation of Solar System, Meteorites and their classifications, Geochemical Differentiation of Rocks, Geochemical classification of Elements, geochemical differentiation of elements in igneous rocks, geochemical differentiation of elements in sedimentary rocks, geochemical differentiation of elements in hydrosphere - Rock Cycle - Geochemical cycles of Elements – Introduction to isotope geochemistry- Introduction to analytical geochemistry.

Geo3206 Remote Sensing in Geology

Remote Sensing Defined, History of photography, Applications of Remote Sensing, Digital images Characteristics, Evolution of platforms, Sensor Characteristics, Remote Sensing Data Collection, Remote Sensing Process, Electromagnetic Radiation, Atmospheric Energy-Matter Interactions, Color formation and false color images, Biophysical interpretation of vegetation, soil and water reflectance, Observing vegetation, soil, and water reflectance in multispectral imagery, Sensors & Spectroscopy & Bands, Image Enhancement & Band Ratios, Unsupervised, supervised classification of digital images, Change detection, Active and passive Sensors.

Geo3208 Applied Geophysics

Introduction, basis of geophysical prospecting, basic principles of different geophysical methods (Gravity, Magnetic, Seismic, Electric, Electromagnetic), basic principles of borehole geophysics, and case studies.

Geo3210 Environmental Geology

Basic Concepts in Environmental Geology, plate tectonic theory and related geologic hazards, Earthquakes and Related Phenomena, Volcanic Activity, Rivers and Flooding, slope Processes, Landslides, and Subsidence, CoSpaal Processes, Water Resources, Water Pollution, Mineral Resources, Soils and the Environment, Global Climate Change.

Geo3212 Geochemical Techniques

Wet chemistry techniques (gravimetric, volumetric and colorimetric methods), Spectroscopic techniques: atomic absorption spectroscopy (AAS), inductively coupled plasma optical emission spectroscopy (ISP-OES), Mass

spectroscopy techniques: Inductively coupled plasma mass spectroscopy (ICP-MS), Isotope dilution mass spectroscopy (ID-TIMS), In-situ spectroscopy: transmission electron microscope (TEM), scanning electron microscope (SEM), electron microprobe (EMP), sensitive high-resolution ion microprobe (SHRIMP), Thermal analysis techniques (Fluid inclusion microthermometry), Chromatography (Gas chromatography, Ion-exchange chromatography).

Geo3214 Sequence Stratigraphy

Concepts and principles of sequence stratigraphy and its importance; 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; sequences in carbonate depositional environments; chronostratigraphic charts; causes of sea level fluctuations; principles of seismic stratigraphic interpretation, interpreting shallow to deep carbonate and clSpaic depositional tracts.

Geo3216 Biostratigraphy

Concepts and development classical of biostratigraphy; Time in geology (dating of rocks by fossils); biostratigraphy: its integration into modern geochronology; biostratigraphy 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, depositional environments; 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 (development of life trilobites, brachiopods, molluscs, graptolites, paleogeography, records in sedimentary rocks and flooding the continental margins); Mesozoic life (evolution of reptiles) and Cenozoic life (paleogeography and human development).

Geo3218 Seismology
Interior structure of the earth, plat tectonics and its relation to earthquake activities, Classification of earthquakes, Relation between stress and strain, Seismic waves, Wave propagation (Hook's law, stresses affecting propagation of seismic waves), Magnitude and intensity, Fault plane solution, Induced seismicity, Seismic instrumentation, Seismic hazard, Earthquake activities in Egypt.

Geo3220 Principles of Geostatistics
Definition of spatial analysis and concept of regionalized variable, sampling of spatial data, analysis of spatial data, autocovariance and semivariogram, Gridding and interpretation of irregularly spaced data, Kriging as the Best Linear Unbiased Estimator (BLUE), applications of geostatistics in estimation of reserves of geological reserves.

Geo3222 Principles of Structural Analysis
Sources of structural data, Directional data analysis, Geometrical analysis, Cross section balancing, 3D structural modelling, Analysis of fractures and joints, Stress analysis, Strain analysis, Rheology, Analysis of poly-deformed terranes, Computer applications in structural analysis (Orient, Ellipsefit, Move, StrainSim, FaultFoldForward (FFF)).

Geo40PT Practical Training
This course includes practical training in companies related to geology such as petroleum and mining companies, and in research institutes as well as, in the laboratories of the university.

Geo4101 Geology of Egypt
Basement complex of Egypt: Distribution of the basement complex units, classification of basement complex, General characteristics (lithology, distribution, age, tectonic setting, economic importance, etc.) of the different basement rock units, tectonic evolution of the Precambrian rocks within the Arabian-Nubian shield. Geomorphologic features and geologic provinces of Egypt, general stratigraphy, general tectonic framework, Paleozoic, Mesozoic and Cenozoic rocks (surface exposures and sections, rock types, rock units, trace fossils, paleogeography, depositional paleoenvironments, tectonics).

Geo4103 Field Geology

Principles of field geology, equipments, preparation, compilation of field maps and Satellite images, detailed field mapping, observations, notes and diagrams, igneous rocks in the field, sedimentary rocks in the field, metamorphic rocks in the field, geological structures in the field, methods of gathering and measurement of orientation data of geological structures, measurement of thickness of stratigraphic sections, drawing geological maps.

Geo4105 Subsurface Geology

Source of subsurface data, Well-site geologist, drilling methods, drilling operations, analysis of well rock samples and fluids, presentation of subsurface data, subsurface map-reading and interpretation, writing a geologic subsurface report, subsurface correlation, subsurface stratigraphy and structures, subsurface geology of Egypt.

Geo4107 Hydrogeology

Occurrence of groundwater and hydrological cycle, Water balance equation, Precipitation Arithmetic Mean Method, Thiessen Method, Isohyet Method, Runoff and infiltration, geologic formations, aquifers, aquicludes and aquifuges with examples, Unconfined and confined conditions, water table, perched water table, Homogeneity, heterogeneity, isotropy and anisotropy. Hydraulic Terminologies, Hydraulic Head (Piezometric Level) and Gradient, Aquifer Parameters Porosity, permeability, hydraulic conductivity. Transmissivity, Specific Capacity and Productivity, Storage Coefficient (Storativity) and Specific, Darcy's law and flow net with its applications, surface water groundwater interaction, Groundwater Hydraulics, Well Types, Aquifer Test methods and confined aquifers, hydrogeology of coSpaal zoon, aquifers in Egypt.

Geo40RP Research Project

The course represents research titles related to any branch of Earth Sciences, such as Structural Geology, Hydrogeology, Petroleum Geology, Stratigraphy and Paleontology, Mineralogy and Petrology, Ore Deposits, … etc. The prepared manuscript includes introduction, topics related to the research title and whenever possible a case study as well as list of references.

Geo4109 Mining Geology

Geology and mining , ore prospecting and exploration, ore development, mine types, mining operation, mine opens (levels, panels, shafts), sloping faces, ore examination and evaluation, estimation of ore reserves, geologic problems in mining.

Geo4111 Principles of Well logging

Definitions of well logs, importance of well logs, logging techniques and measurements, well logging tools (principle, geological factors affecting each tool, environmental corrections of each tool, applications), well log interpretations.

Geo4113 Geology of Coal

General aspects of coal Formation; Formation of peat, Mire types and rate of coal accumulation, Different types of coalification pathways. macrolithotypes of black coal, Coal rank Classification; Microlithotypes of Coal macerals; Coal Facies as paleoenvironmental indicators , Distribution of worldwide coal deposits. Coal as a source of kerogen types III; Coal deposits in Egypt.

Geo4115 Paleoecology

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.

Geo4117 Palynology

The concept of paleopalynology; 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.

Geo4119 Geoarcheology

Introduction to geoarcheology, application of geological methods to archaeological problems, types of building materials, methods of rock and mineral identification, Quaternary paleoecology and human evolution, classification of ancient Egyptian time, mining and exploration during different Egyptian civilizations (Ancient Egyptian, Roman, Christian and Islamic cultures).

Geo4202 Petroleum Geology

Introduction (Petroleum definition, composition, forms), occurrences, origin and formation of petroleum, elements of a petroleum system, source rock (evaluation parameters), kerogen types and generation potential, reservoir rock (types, classification, conditions, fluids), petrophysical properties (porosity, permeability), petroleum migration, roof rocks and sealing efficiency, petroleum traps, petroleum accumulation mechanisms, crude oils (composition and classification), geological exploration, evaluation of petroleum prospects, petroleum potentiality of Egypt, North Africa and Middle ESpa.

Geo4204 Economic Geology

Principles of ore geology, aerial distribution of ore deposits, morphology of ore deposits, nature of ore bearing fluids, migration of ore bearing fluids, physical and chemical controls of ore deposition, classification of ore deposits, magmatic ore deposits, pegmatitic-pneumatolitic stage, hydrothermal deposits, sedimentary ore deposits, supergen sulphide enrichment, metamorphic ore deposits, important types of ore deposits in Egypt.

Geo4206 Ore Microscopy

Introduction, The Ore Microscope (Components of the Ore Microscope and Accessories), The Preparation of Samples for Ore Microscopy (Polished sections – Polished thin sections), The Optical Properties of Ore Minerals (Observations in Polarized Light: Colour - Reflectivity- Bireflection - Internal reflection; Observations between Crossed Nicols: Anisotropism and

polarization colours; Polarization figures), Physical Properties of Ore Minerals (Crystal form and habit - Zoning - Cleavage and parting – Twinning - Inclusions and Intergrowths, Grain size and quantitative modal analysis – Hardness: Scratch hardness, Indentation hardness and Polishing hardness), Textures of the Ore Minerals (Introduction - Descriptive Classification of Ore Textures - Genetic Classification of Ore Textures), Ore Minerals Paragenesis.

Geo4208 Field Trips

Four days for training to recognize the different rock units and their relations under supervision of the department staff and four days are for the students to prepare a field geological map based on chosen traverses and satellite images, observation points, collecting rock samples, structural measurements, relations between different rock units, sample location map, and finally field geological map.

Geo4210 Isotope Geology

Introduction, internal structure of atoms, decay mechanism of radioactive atoms, basics of radioactive isotope geochemistry, decay systems and their applications, age dating methods (Rb-Sr method, Sm-Nd method, K-Ar method, U-Th- Pb method), stable isotope geochemistry, uranium Deposits in Egypt- application of Isotope geology in Well logging.

Geo4212 Principles of Petrophysics

Reservoir rocks (classification, lithology of clSpaic and non-clSpaic reservoir rocks), pore spaces of sandstones and carbonate reservoir rocks (classification, distribution, arrangement), formation evaluation factors, grain density, formation resistivity factor, porosity, permeability, water saturation, reservoir fluids, geo-pressures, reservoir pressures, petrophysical reservoir characteristics based on core analysis data, Graphical presentation of petrophysical parameters (horizontal and vertical distribution of parameters).

Geo4214 Petroleum Geochemistry

Aspects of petroleum organic geochemistry; Organic carbon; organic matter; Geochemical Fossils; From kerogen to petroleum; Geochemistry of reservoir waters; Chemical composition of gaseous hydrocarbons and condensates; Geochemical aspects of petroleum migration; Petroleum degradation; Identification of source rock; 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.

Geo4216 Hydrogeochemistry
Hydrochemistry, Ionic Constituents, Major Cations, Major Anions, Chemical Units and Balance, Groundwater Sampling and Analysis, Composite Quality Indicators, Electrical Conductivity (EC), Total Dissolved Solid (TDS), Total Hardness (TH), pH, Sodium Adsorption Ratio (SAR), Sodium Content (SC), Residual Sodium Carbonate (RSC), Permeability Index (PI), Chloride Classification, EC-TDS Relationship, EC-SAR Relationship, Water Quality Graphical Representations, Environmental Isotopes, Groundwater Rise and Quality, Standard Ion Index for Groundwater Quality Evolution Variations, Water Quality Index (WQI), rock-water interactions process, Climate Change and Groundwater Quality.

Geo4218 Geochemical Exploration
Introduction, abundance of element in earth materials, geochemical anomalies, primary dispersion, mobility of elements in the surficial environment, secondary dispersion, exploration methods.

Geo4220 Applications of Remote Sensing
Remote Sensing introduction, Image Interpretation & Analysis, Detecting land cover/use types for decision making, Locating mineral deposits with hyperspectral remote sensing, Discrimination rock unit, Studying geology of the Earth's surface, Delineating watersheds using DEMs for hydrologists, Evaluation of flash flood hazard, Mapping soil types for agriculture planning, Measuring gravity with the GRACE satellites, Monitoring active volcanoes using thermal remote sensing, Inventorying potential landslides with interferometry, Measuring the rise of sea levels, Detecting oil spills for marine life and environmental preservation, Estimating surface elevation with the Shuttle Radar Topography Mission, ForecSpaing weather to warn about natural disSpaers.

Geophysics Program Courses Contents

GPh1202 General Geophysics
Definition of geophysics, the relation between geophysics and other sciences like geology, physics, mathematics, geography ……..etc., History of geophysics Classes of geophysics, methods in geophysics, stages of geophysical work (Preliminary, Data acquisition, processing, and interpretation) , uses and limitations of geophysics.

GPh2101 Petrology

Structure of the Earth, The theory of plate tectonics (divergent, convergent and transform plate boundaries), Igneous rocks, Origin of igneous rocks, Classification of igneous rocks (forms and textures), Main groups of igneous rocks and their composition, Sedimentary rocks, Sedimentary rock formation, Texture and structure of sedimentary rocks, Classification of sediments and sedimentary rocks, Metamorphic rocks, Metamorphism, Agents of metamorphism, Metamorphic changes, Types of metamorphism, Metamorphic rocks and their origin, Common metamorphic rock names.

GPh2103 Magnetic Methods

Fundamental magnetic theories, The Earth's magnetic field, Similarities and differences with gravity methods, The magnetic properties of rocks, Measurement procedures of magnetic field, Acquisition, External variation corrections, Reduction-to-pole corrections, Magnetic anomalies, Potential fields and models, Magnetic data surveying, processing and interpretation

GPh2105 Geoelectric Methods

Basic Principles and classification of Electrical methods, relation betweenElectrical methods and other geophysical methods,current and potentials, electrical properties of the rocks, current flow inground, Electric conduction in rocks, factors affecting electrical conduction in rocks, isotropy, anisotropy, principles of equivalence, Dar Zarrouk parameters-Longitudinalconductance and transverse resistance, Resistivity methods: concepts of resistance and resistivity, true and apparentresistivity and apparent resistivity for multilayer Earth and super position.Different Electrode arrays, Wenner, Schlumberger, Dipole-diploe and its Geometric factor calculation.Vertical Electrical Sounding (VES),Field equipment,Field measurements, curve processing, Ambiguities of sounding curve interpretation, Geological and hydrogeological interpretation.Self-potential method (SP):Basic principles of streaming potential measurements, Field procedures, Data processing and interpretation. Induced polarization method(IP): mechanism, relation between chargeability and resistivity, data acquisition, corrections, interpretations and applications in mineral ores prospection.

GPh2107 Geostatistics

Definition of spatial analysis and concept of regionalized variable, sampling of spatial data, analysis of spatial data, autocovariance and semivariogram, Gridding and interpretation of irregularly spaced data, Kriging as the Best

Linear Unbiased Estimator (BLUE), applications of geostatistics in estimation of reserves of geological reserves.

GPh2202 Principles of Lithostratigraphy

The scope and fundamental of modern stratigraphy; the evolution and importance of stratigraphy; stratigraphy and geologic time scale; geochronology; Chronostratigraphy; lithostratigraphy and sedimentology; lithostratigraphic nomenclature; procedures for establishing rick units; lithostratigraphic units; application of lithostratigraphy (environments; geological maps,…….etc); lithostratigraphic correlation; cyclostratigraphy; radiometric age dating and chemostratigraphy; the different index fossils in biostratigraphy; sources of subsurface data; subsurface stratigraphy; Borehole stratigraphy and sedimentology; subsurface facies analysis; use of borehole data; subsurface procedures; mechanical logging (E- log, sonic log,….etc); presentation of subsurface data.

GPh2204 Principles of Structural Geology

Definition of structural geology, faults and fractures, rock fractures , fault geometry and nomenclature, rocks produced by faulting (fault rocks), features associated with fault planes, fault associations, thrust systems, extensional fault systems, strike-slip fault systems, inversion, joints, folds, meaning and significance of folds, basic fold geometry and nomenclature, fold orientation, classification of folds, geometry of the fold profile, description of fold systems, folds in three dimensions, folding mechanisms and fold geometry, relationship between faults, folds and shear zones, foliation, lineation, boudinage, fabric, gravity-controlled structures, the effect of topographic relief, effects of gravity on thrust sheets and nappes, salt domes, mantled gneiss domes and granite diapirs, stress, strain.

GPh2206 Seismic Methods

Introduction including (scope of seismic methods, relation between seismic methods and other geophysical tools, difference between seismic methods and earthquake seismology, types of seismic methods: reflection and refraction). Relation between stress and strain. Seismic waves. Wave propagation (Hook's law, stresses affecting propagation of seismic waves). ElSpaic moduli (Young's Modulus, Poisson's ratio, rigidity Modulus, shear Modulus). Refraction method including:Theoretical aspects, refraction on horizontal and dipping interfaces, calculation of velocities, depths, incidence angle, and dip angle,seismic refraction data (acquisition, corrections and processing, interpretations). Reflection method including:Theoretical aspects,

conditions of seismic reflection, reflection on horizontal and dipping interfaces, acquisition of seismic reflection data in land and marine, reflection data processing and interpretations. Applications of seismic reflection and refraction in oil and gas explorations, mineral explorations, and environmental assessments.

GPh2208 Gravity Methods

Principles and Characteristics of Earth's Gravity Field, Rock densities andfactors affecting on density, density measurement techniques of the samples, Gravity units, concept of geod and spheroid, gravity base, collection of gravity data (plan of gravity surveys), driftcorrection, reduction of gravity, Bouguer gravity anomalies, airborne and ship bornegravimetry. 2D Gravity Modeling; Gravitational effect of a buried sphere (Size Effect, Gravity ContrSpa, Depth Effect); Regional Gravity due to dipping plane; Sources of the Local and Regional; Gravity Anomalies; Wavelength Changes of Anomaly regarding the burial depth of material; Factors effecting the Gravity Anomalies (Density ContrSpa; Depth to anomaly Source; Geometry); Gravity Effect of Sphere; Depth Estimates (Half-Width Approach); Ambiguity in Gravity Interpretation; Gravity variation due to infinite slab; Gravity variation due to Semi-Infinite slab, case study for one of gravity Applications.

GPh3101 Seismology I

Interior structure of the earth, plate tectonics and its relation to earthquake activities. Geographical distribution of earthquakes (active belts). Classification of earthquakes. Seismic waves/phases. Magnitude and intensity. Seismic wave propagation in earth's layers. Earthquake activities in Egypt.

GPh3103 Radiometric Geophysics

Radiometric characteristics of minerals and rocks, origin of radioactive emanations of atoms, difference between radioactivity and spectrometry. Radiometric methods including (physical background, instrumentations, data acquisition, corrections, and interpretations, applications of radiometric data in mapping geologic outcrops). Spectrometric methods including: (origin of thorium, uranium, and potassium elements, techniques, data acquisition, processing, and interpretations, environmental applications of spectrometric data for human health), Role of radioactivity in subsurface geological mapping, Effect of radioactivity in hydrocarbon prospection, applications of radioactivity in well logging, origin of the harmful effects of radioactive

elements on human being, ways of mitigating the harmful effects of radioactive elements on the surrounding environments.

GPh3105 Geophysical Data Analysis

Geophysical data processing, reduction of gravity and magnetic data, upward and downward continuation, Separation of Regional and residual fields, Vertical gradient, total horizontal gradient, Analytic signal, Euler deconvolution, Werner Deconvolution, Talwani modeling technique. Forward modeling, spectral analysis in geophysics, analysis of sequences of data, analysis of geophysical map, analysis of multivariate geophysical data, applied analysis and interpretation of geophysical data using computers, Introduction to using Python in data analysis and modeling.

GPh3107 Remote Sensing

Remote Sensing Defined, History of photography, Applications of Remote Sensing, Digital images Characteristics, Evolution of platforms, Sensor Characteristics, Remote Sensing Data Collection, Remote Sensing Process, Electromagnetic Radiation, Atmospheric Energy-Matter Interactions, Color formation and false color images, Biophysical interpretation of vegetation, soil and water reflectance, Observing vegetation, soil, and water reflectance in multispectral imagery, Sensors & Spectroscopy & Bands, Image Enhancement & Band Ratios, Unsupervised, supervised classification of digital images, Change detection, Active and passive Sensors.

GPh3109 Marine Geophysics

Locating Offshore Observations, Seabed Imaging by Sonar and Lidar, Seismic Exploration at Sea, Seismic Data Acquisition at Sea, The Marine Gravity Field, The Earth's Magnetic Field at Sea, Heat Flow, Investigations of the Sea Floor using Electrical Methods, Seabed Exploration using Radiometric Methods, Geophysical Observations in Offshore Boreholes, Deep-Sea Geophysics and the Changing Geometry of the Oceans, Studies of the Oceanic Lithosphere (The Sedimentary Cover), Studies of the Oceanic Lithosphere (The Crustal Basement and Upper Mantle), Investigations of Divergent and Transform Continental Margins, Studies of Subduction Zones.

GPh3111 Geographic Information System (GIS)

Introduction to GIS, Geo-reference, Create Geo-database, Digitizing and Editing, Relational database (attribute table), Layer properties, Spatial interpolation, terrain analysis.

GPh3113 Seismic Data Processing

Mathematical basis including complex numbers, approximation series, Fourier Series and transform, Convolution and Deconvolution, Digital Filters, Basic Processing Sequence including, Sorting of seismic traces such as common mid-point, common offset and common receiver, CMP gathering, Zero-offset definition, normal moveout correction, root mean square velocity, velocity analysis, Muting, stacking, Migration, seismic attributes including amplitude versus offset, instantaneous amplitudes, instantaneous phase and instantaneous frequency.

GPh3115 Geotectonics

Major Earth structures, continental drift, polar wondering curve , sea floor spreading and paleomagnetism, plate tectonics theory, types of plate boundaries, divergent plate boundaries, convergent plate boundaries, transform plate boundaries, geometry of plate motion, triple junctions, convection currents, driving mechanisms of plate tectonics, ridge push, drag pull, orogenic belts, ophiolites, Alpine continental collision, Himalayas continental collision.

GPh3117 Geological Survey

Principles of survey, type of survey, surveying equipment's, Basic trigonometry functions for distance and angular measurements, distance and angle measuring, Bearings and Azimuths, Co-ordinates systems, Compass survey, Traverse, Survey grids, Global Positioning System (GPS), differential leveling, Basic geologic field techniques, Air reconnaissance, subsurface geologic mapping, Making a geological map and cross-section.

GPh3202 Electromagnetic Methods

Electromagnetic methods: basic concepts, Maxwell's equations for electromagnetic field, boundary conditions, attenuation of electromagnetic fields. Diffusion equations, skin depth, geometry of electromagnetic processing system. Electromagnetic techniques: dip-angle, parral-line, fixed transmitter, audio-frequency magnetic, very-low frequency, interpretation of field data. The telluric and magneto telluric methods: basic concepts, field measurements and interpretation.

GPh3204 Seismology II

Wave equation, plane and spherical wave solution of the wave equation, types of seismic waves and propagation, seismic wave propagation in layered

medium, earthquake sources, focal mechanism and source inversion, seismic hazard analysis.

GPh3206 Geothermal Methods
Geothermal reservoirs, Measurement of temperature and heat flow in drilled holes, large-scale electrical surveys, passive seismic surveys, analysis of magnetic data, detection of the depth to Curie-point effects, soil and water geochemical studies.

GPh3208 Petroleum and Subsurface Geology
Introduction (Petroleum definition, composition, forms), occurrences, origin and formation of petroleum, source rock, rock-eval pyrolysis, reservoir rock (types, classification, conditions, fluids), petrophysical properties (porosity, permeability), petroleum migration, roof rocks, petroleum traps, Basin modeling (Geothermal and Burial history), Geophysical exploration, evaluation of petroleum prospects, petroleum potentiality of Egypt, North Africa and Middle ESpa, source of subsurface data, drilling methods and operations, geophysical methods, presentation of subsurface data, subsurface map-reading and interpretation, subsurface geology of Egypt.

GPh3210 Ground Penetrating Radar (GPR)
History of GPR, Nature of GPR signals, Interaction of GPR signal with earth's material, Generation and recording of GPR signals, Types of GPR techniques, Processing and enhancement of GPR data, Modeling and Interpretation of GPR data.

GPh3212 Hydrogeophyiscs
Complex Conductivity Measurements: Introduction, Complex conductivity and transfer function of wet rocks, Quantitative interpretation of Complex conductivity measurements, Low Frequency conductivity model, Complex conductivity measurements, Relations between complex electrical parameters and mean parameters of rock state and texture, The potential of complex conductivity for environmental applications, Organic and inorganic contaminants, Monitoring subsurface hydraulic processes and Geohydraulic parameters. Using of geophysical well logs to estimate water quality, use of Gamma logs for aquifer monitoring, use of IP for groundwater contamination.

GPh3214 Potential Data Analysis and Interpretation
Potential Geophysical Fields: Similarity and Difference, Different Kinds of Noise and Ways for Their Removing, Qualitative Analysis of Potential Fields, Quantitative Analysis of Potential Field Anomalies, Algorithms for Combined 3D Modeling of Gravity and Magnetic Fields, Methodology of 3-D Combined Gravity–Magnetic Modeling, Studying Deep Structure.

GPh3216 Computer Applications in Geophysics
Introduction to computer science in Geophysics. Operating systems overview. Programs/software and techniques available for statistical analysis, display and presentation of geophysical data. Coordinate systems. Gridding, interpolation, contouring and mapping of xy and xyz data. Statistical analysis of geophysical data. Modeling of geophysical data.

GPh3218 Surface Waves Exploration
Introduction including (definitions, microtremor/seismic noise, physical and spectral characteristics, sources of seismic noise). Surface waves dispersion. Data acquisition (active and passive, geometry, instrumentation). Site effect estimation (reference site method and Horizontal-to-Vertical Spectral Ratio method). Inversion of surface waves (different methods of inversion). Surface wavesfor shear wave velocity determination (MASW, f-k, SPAC, CCA methods). Joint inversion (Love and Rayleigh Waves, dispersion curves and ellipticity curves).

GPh3220 Mineral Deposits
Introduction, Basic vocabulary, Evolutionary concepts about the origin of mineral deposits, Mineral deposits and plate tectonics, Criteria for the classification of mineral deposits, Ore-forming processes (Magmatic processes, Metamorphic processes, Sedimentary processes, Hydrothermal processes), Genetic classification of mineral deposits, Magmatic ore deposits, Hydrothermal ore deposits, Sedimentary ore deposits, Metamorphic and metamorphosed mineral deposits.

GPh3222 Structural Analysis
Structural data, Sources of structural data, Directional data analysis, Orthographic projection, Geometrical analysis, Cross section balancing, 3D structural modelling, 2D and 3D kinematic modelling, Analysis of fractures and joints, Stress analysis, Strain analysis, Rheology, Analysis of shear zones, Analysis of poly-deformed terranes, Computer applications in

structural analysis (Orient, Ellipsefit, Move, StrainSim, FaultFoldForward (FFF)).

GPh40RT Practical Training
This course includes practical training in companies related to Earth sciences such as petroleum and mining companies, and in research institutes as well as in the laboratories of the university.

GPh4101 Petrophysics
The properties of fluids (gases, hydrocarbon liquids, and aqueous solutions), The porous rock properties of reservoir rocks, The mechanism of multiphase fluid flow in porous medium, The physical Properties of Reservoir Fluids Under Reservoir Conditions, The porosity of Reservoir Porous Medium.

GPh4103 Engineering Geophysics
Advanced application of geophysical methods in engineering purposes and problems. Geophysical assessment for soil and rock properties including the estimation of ElSpaic moduli and geotechnicalparameters for engineering applications, calculation of VS30, classification of surface soils. Engineering applications in geophysics (bearing capacity of soil, seismic amplification, vulnerability index, strong ground motion parameters, importance factor and classes for different types of buildings, building codes and land planning).

GPh4105 Mathematical Geophysics
Modeling techniques, problems of modeling, computer modeling in geophysical and geological phenomena, models in terms of geological processes, models of geologic objects, analysis of geological model.

GPh4107 Paleomagnetism
Geomagnetism. Historical. Main Features and Origin of the Geomagnetic Field, Rock Magnetism, Basic Principles of Magnetism. Magnetic Fields, Remanent and Induced Magnetism, Magnetic Domains, Magnetic Viscosity, Critical Size for Single Domain Grains, Remanent Magnetization, Sampling and Measurement. Statistical Methods. Some Statistical Concepts, Calculating Paleomagnetic Poles and Their Errors, Laboratory Methods and Applications. Magnetic Field Reversals. Oceanic Paleomagnetism. . Continental Paleomagnetism. . Paleomagnetism and Plate Tectonics. Non Plate Tectonic Hypotheses. True Polar Wander

GPh40RP Research Project

The course represents research titles related to any branch of Geophysics, such as Seismology, Potential fields (magnetism, gravity, electromagnetic, etc), Geothermal energy, Fluid dynamics, Well logging, Petrophysics, Geophysical engineering … etc. The prepared text includes introduction, topics related to the research title and whenever possible a case study, as well as list of referenc.

GPh4109 Geodesy

History of Geodesy, Geodesy in the Service of Mapping Geodesy of the Modern Era, Geodesy and Other Disciplines, Applications of Geodesy, Symbiotic Relation Between Geodesy and some Other Sciences, Theoretical Basis of Geodesy, Mathematics and Geodesy, Algebra, Analysis, Geometry, Statistics, Structure of Geodesy, Functions of Geodesy, Geodetic Theory, Geodetic Practice, Geodetic Profession, The Earth, Earth and its Motions, Earth's Annual Motion, Earth's Spin, Precession, and Nutation, Earth's Free Nutation, Observed Polar Motion and Spin Velocity Variations, Earth and its Gravity Field Gravity Field, Geoid and Deflections of the Vertical, Earth and its Size and Shape, Actual Shape of the Earth, Geoid as a Figure of the Earth, Biaxial Ellipsoid as a Figure of the Earth, Other Mathematical Figures of the Earth, Earth and its Deformations in Time, Tidal Phenomena, Crustal Loading Deformations, Tectonic Deformations, Man-Made and Other Deformations, Earth and its Atmosphere, Gravitational Field of the Atmosphere.

GPh4111 Modern Geophysical Considerations

Aspects of modern geophysical techniques adopting Arduino and Raspberry-Pi technology for advanced low-price field equipments using the advances in microcontrollers technology, modelling and interpretation using artificial intelligence and deep learning, Application of the big data technology in geophysical projects

GPh4113 Exploration Geophysics

The seismic reflection method, the seismic refraction method, gravity measurements, magnetization and magnetic measurements, electrical methods, electromagnetic methods including ground penetrating radar, radiometric methods, borehole logging, petrophysics, geophysical field techniques, geophysical modelling and interpretation, Demonstration of using these various techniques in shallow and deep exploration of economic resources.

GPh4115 Programming Language
Introduction of the concept of open source and free software resources, Python as an advanced and rich language for geophysics, OBSPY for seismological observatory analysis, Numpy, Scipy and Matplotlib for geophysical data enhancement and mapping, SIMPEG project for modelling various geophysical data.

GPh4117 Archaeological Geophysics
Using geophysics from an archaeological point of view, Exploration and delimitation of archaeological sites, Basics. Imaging the subsoil with non destructive methods, Overview of common survey techniques applied on archaeology, The theory and application of geophysical techniques used in archaeology, Geophysical techniques associated with gravity, magnetometry, waves, electromagnetic induction, ground penetrating radar, geotomography, and electrical resistivity tomography. Each technique is explored in depth, with detailed case studies illustrating both technical applications and interpretations of data.

GPh4202 Well Logging
Definitions of well logs, importance of well logs, The Borehole Environment, logging techniques and measurements, well logging tools (principle, geological factors affecting each tool, environmental corrections of each tool, applications), well log interpretations.

GPh4204 Principles of Hydrogeology
Occurrence of groundwater and hydrological cycle, Water balance equation, Precipitation Arithmetic Mean Method, Thiessen Method, Isohyet Method, Runoff and infiltration, geologic formations, aquifers, aquicludes and aquifuges with examples, Unconfined and confined conditions, water table, perched water table, Homogeneity, heterogeneity, isotropy and anisotropy. Hydraulic Terminologies, Hydraulic Head (Piezometric Level) and Gradient, Aquifer Parameters Porosity, permeability, hydraulic conductivity. Transmissivity, Specific Capacity and Productivity, Storage Coefficient (Storativity) and Specific, Darcy's law and flow net with its applications, surface water groundwater interaction, Groundwater Hydraulics, Well Types, Aquifer Test methods and confined aquifers, hydrogeology of coSpaal zoon, aquifers in Egypt.

GPh4206 Environmental Geophysics
Geophysical techniques applied to selected environmental problems. The role of geophysical methods to handle some environmental problems (e.g. soil liquefaction, landslides, soil swelling and shrinking, Tsunami, floods). Application of geophysical methods in the detection of hazardous wSpae sites and subsurface contamination. Land use planning. Case studies.

GPh4208 Field Trips
Training or providing the students with knowledge of data collection and geophysical survey of realistic areas for available geophysical instruments. Visiting the sites of "scientific research centers or institutes that specialized in the field of geophysics" or "public or private companies in the fields of oil and mining".

GPh4210 Inverse theory
Formulation of the geophysical problem, Curve fitting as a tool for geophysical problem solution, Linear problems, leSpa squares solution, Overdetermined and underdetermined problems. Non-linear inverse problem definition, linearization of the non-linear problem, iterative solution to non-linear problem, tomography and location of earthquake focus as examples of iterative solution techniques.

GPh4212 Space Geophysics
The rotation of the Earth, modelling of the terrestrial rotation, monitoring of the earth rotation, time reference frames, Geophysics and planetary sciences, space studies of the Earth's, gravitational potential, the internal structure of the Earth, study of planetary interior structure from space missions, tidal effects in the solar system.

GPh4214 Formation Evaluation
Well logging, Lithological correlation, Formation density and porosity, Microgravity, Moisture content, Permeability, Degree of fracturing and rock mass deformability. Formation evaluation tools: Geophysical borehole, Electrical resistivity, Seismic method, Coring, Mud logging, Wireline logging, Electric logs, Porosity logs, Lithology logs - SP and gamma ray, Tomography. Interpreting the tools.

GPh4216 Seismic Stratigraphy
Non-sedimentary reflections, Sedimentary reflections: Unconformities, Seismic facies units, Sequence Stratigraphy, System Tracts, Technical Errors.

Seismic Stratigraphy Workflow. Analysis of seismic sequence; Analysis of seismic facies; Analysis of reflection character.

Geology-Chemistry Program Courses Contents

GeCh2101 Paleontology
Scope of paleontology; The nature of fossils (fossilization, types of preservation, kinds and names of animals, adoption to environment, development, fossil-bearing rocks), invertebrate paleontology; Corals characteristics classification of corals and geologic distribution of corals), Brachiopods (morphology, classification, evolution and stratigraphic distribution; different classes of Mollusca; Pelecypods (classification, evolution, functional morphology and stratigraphic distribution), GSparopods (classification, shell structure and morphology, Cephalopods (characteristics and subclasses, classification, evolution, uses as index fossils), Echinoderms (classification, morphology and different classes, life habits); Trilobites (classification, morphology, stratigraphic use as Cambrian index fossils); inorganic-walled microfossils such as: Foraminiferida (living animal, life history, morphological characteristics; taxonomy, geological distribution; paleoecological parameters controlling the distribution of foraminiferas; nummulitids (skeletal structure, physiological features, classification, geological distribution and stratigraphic importance); Ostracods (hard parts, growth stages, physiological features, mode of life, classification, geological distribution and importance); Calcareous nannoplanktons, coccolithophores and discoSpaers principles of paleopalynology (Spores, Pollen grains & Dinoflagellates; application of paleontology in stratigraphy and environmental geology.

GeCh2202 Mineralogy
The polarizing microscope, optical properties of minerals in plane-polarized light, optical properties of minerals in crossed polars, optical properties of minerals in convergent light, Crystal chemistry, Classification of minerals, Mineral descriptions (silicate and non-silicate minerals).

GeCh2204 Principles of Stratigraphy
The scope and fundamental of modern stratigraphy; the evolution and importance of stratigraphy; stratigraphy and geologic time scale; geochronology; chronostratigraphy; lithostratigraphy and sedimentology; Lithostratigraphic nomenclature; procedures for establishing rick units;

lithostratigraphic units; application of lithostratigraphy (environments; geological maps); lithostratigraphic correlation; parameters contributing in biostratigraphy; mass extinction in the Phanerozoic time; stratigraphic procedures; biostratigraphic nomenclature; taxa used in biostratigraphy; biostratigraphy: its integration into modern geochronology; evolution and extinction; biostratigraphic correlation; cyclostratigraphy; radiometric dating and chemostratigraphy; biostratigraphic zonation (biozones); procedures of biozonation; the different index fossils in biostratigraphy; subsurface stratigraphy; Borehole stratigraphy and sedimentology; Subsurface facies analysis; subsurface procedures; mechanical logging (E- log, sonic log,….etc); presentation of subsurface data; application of stratigraphy in petroleum exploration.

GeCh2206 Historical Geology

The evolution of Earth; development of atmosphere and biosphere; the solar system; the Hadean Eon; the age of worms, Pre-Cambrian glaciation; concepts and principles of geologic time; Geologic Time Scale; organic evolution; absolute time and radioactivity; radiometric dating; absolute and relative dating; correlation, unconformities; coSpaal and marine environments, the Proterozoic Eon**;** the Paleozoic life history; (life in coal swamps); flora in Paleozoic; the age of trilobites and fishes; glaciations; Orogenies; paleogeography of Paleozoic, Gondwana land; mass extinction; Pangea and Gondwana; Marine invertebrates; Paleozoic periods in Egypt; the Mesozoic life history; breakup of Pangea; marine transgression; black shales and chalk Seas**;** the age of Dinosaurs**;** flora in Mesozoic; the ammonite Era; the angiosperms; the Spaeroid impact; Mesozoic periods in Egypt; Tertiary mammals; the age of advanced species; the Cenozoic mountain building; the Cenozoic life history; Paleogene and Neogene Geology; scatterings of Africa; flora in Cenozoic; closing of the Tethysis; Quaternary glaciation; Cenozoic periods in Egypt; the Pleistocene ice age (Pleistocene); The Age of Mammals and primitive human evolution.

GPh3115 Geotectonics

Major Earth structures, continental drift, polar wondering curve , sea floor spreading and paleomagnetism, plate tectonics theory, types of plate boundaries, divergent plate boundaries, convergent plate boundaries, transform plate boundaries, geometry of plate motion, triple junctions, convection currents, driving mechanisms of plate tectonics, ridge push, drag pull, orogenic belts, ophiolites, Alpine continental collision, Himalayas continental collision.

GeCh2208 Computer in Geology
Introduction and operation system, nature and types of geological data, the important of computer in earth science, examples of state-of-the-art software that are used in teaching earth science, Spreadsheets and Graphing and charting geologic data, simulation, Spreadsheets fitting models, and applied problems, Surfer and gridding and contouring methods, Surfer for crating and visualizing different type of maps, Grapher, line graphs and statistics, Mathcad, introduction, linear regression, error analysis, Corel Draw software for digitizing map, cross sections, use GIS and image enhancement, computer applications in different branches of earth science with case study.

GeCh3101 Principles of Igneous Petrology
Structures and textures of igneous rocks, chemistry and mineralogy of igneous rocks, General classification of igneous rocks, petrogenesis, movement and modification of magmas.

GeCh3103 Principles of Sedimentary Petrology
Introduction, Formation of sedimentary rocks (weathering, transportation, deposition, lithification), Structure of sedimentary rocks, Textures of sedimentary rocks, Classification of sedimentary rocks: clSpaic or detrital rocks (Conglomerates, breccias, sandstones, mudstones, shale), chemical rocks (carbonates, chert & flint, evaporites, ironstones), biochemical or organic rocks (organic limestone, chalk, coal, phosphorite).

GeCh3202 Principles of Metamorphic Petrology
Introduction to metamorphic rocks, metamorphic grades, metamorphic facies, textures of metamorphic rocks, thermal metamorphism, regional metamorphism, common triangular plots used in metamorphic rocks.

GeCh3204 Principles of Geochemistry
Introduction to crystal chemistry, Geochemistry of the solar system, Meteorites and their classifications, Geochemical classification of elements and differentiation of elements in igneous, sedimentary and metamorphic rocks, Geochemical cycles of elements, Introduction to analytical geochemistry

GeCh3206 Ore Mineralogy
Introduction, The reflected-light microscope, Preparation of samples for investigation in reflected light, Optical properties of ore minerals, Physical properties of ore minerals, Textures of the ore minerals.

GeCh4103 Principles of Economic Geology
Principles of ore geology, aerial distribution of ore deposits, morphology of ore deposits, nature of ore bearing fluids, migration of ore bearing fluids, physical and chemical controls of ore deposition, classification of ore deposits, magmatic ore deposits, pegmatitic-pneumatolitic stage, hydrothermal deposits, sedimentary ore deposits, supergene sulphide enrichment, metamorphic ore deposits, important types of ore deposits in Egypt.

GPh4202 Principles of Petroleum Geology
Introduction (Petroleum definition, composition, forms), occurrences, origin and formation of petroleum, source rock (evaluation parameters), kerogen types, biomarkers, reservoir rock (types, classification, conditions, fluids), petrophysical properties (porosity, permeability), petroleum migration, roof rocks, petroleum traps, crude oils (composition and classification), evaluation of petroleum prospects, Geochemical exploration, petroleum potentiality of Egypt, North Africa and Middle ESpa.

GeCh4204 Principles of Geographic Information System (GIS)
Introduction (What is a GIS, RSpaer and vector, ArcGIS Applications, Data frame, Data View and Layout View, Symbology, MXD, Data formats), Georefrence (What is georeferencing?, Coordinate systems, Map projections, Georeferencing tool bar, Viewing projection information), Create Geodatabase (Geodatabase basics, Creating a new geodatabase, Creating the geodatabase structure, Creating tables, Fields types of table, Import Schema from other), Digitizing + Editing (Editor tool bar, Edit sessions, Selecting features, Standard tool bar, Advanced Editing tool bar), Relational database (Understanding table, Table Functions, Table Options, Graphs, Reports, Select by Attribute, Select by location, Selection by graphics), Layer properties (General, Source, Selection, Display, Fields, Definition Query), Spatial interpolation, terrain analysis.

GeCh4206 Recent Sediments
Aeolian sediments, Rivers (the fluvial environment), Lakes and lacustrine environment, Glacial environment, River mouths and deltas, ClSpaic temperate coSpas and tropical coSpaal environments (coral reefs and mangroves), Estuaries, Soils and paleosols.

GeCh40PT Practical Training
Practical training in companies related to geology and chemistry such as petroleum, mining and chemical industry companies, and in research institutes, as well as in the laboratories of the university.

GeCh40RP Research project
The course represents research titles related to any branch of Earth Sciences, such as Structural Geology, Hydrogeology, Petroleum Geology, Stratigraphy and Paleontology, Mineralogy and Petrology, Ore Deposits, … etc. The prepared manuscript includes introduction, topics related to the research title and whenever possible a case study as well as list of references.

جامعة حلوان
Helwan University