برنامج علوم البيئة والفضاء

ENVIRONMENT AND SPACE SCIENCES PROGRAM (ESS)

قسم الجيولوجيا

كلية العلوم

جامعة طنطا

2021

جامعة طنطا
كلية العلوم

اللائحة الداخلية لبرنامج "بكالوريوس علوم البيئة والفضاء"

بنظام الساعات المعتمدة

Bylaw of B.Sc. Program in Environment and Space Sciences (ESS)

Credit Hours System

قسم الجيولوجيا – كلية العلوم – جامعة طنطا

جامعة طنطا
كلية العلوم

2021

برنامج " علوم البيئة والفضاء"

بنظام الساعات المعتمدة

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رؤية البرنامج Program Vision

أن يوفر البرنامج خريج متميز قادر على الريادة والمنافسة على المستوي المحلي والإقليمي والدولي في التطبيقات التقنية المتميزة في مجالي علوم البيئة والفضاء وتطبيقاتها داعمة بذلك خطة الدولة للتنمية المستدامة ورؤية مصر 2030.

رسالة البرنامج Program Mission

يقدم هذا البرنامج دعائم وأسس متطورة لتأهيل خريجين متخصصين أكفاء في مجالات رصد وتقييم المخاطر البيئية وحماية البيئة واستدامتها وكذا الموارد الطبيعية وطرق رصد جودتها بأحدث تقنيات الإستشعار عن بعد والفهم الأعمق العلوم الفضاء الداعمة لفهم أشمل وأعم لمسببات تلوث البيئة والإستخدام الجائر للموارد الطبيعية من أجل الحد من آثار تلك المخاطر وتعظيم الإستفادة من الموارد علي مستوي الممارسة والبحث العلمي المتميز وتوفير المعرفة القائمة على التطبيقات وإتاحة الفرصة للخريجين لتطبيق معرفتهم التقنية في البحث والابتكار من أجل التنمية المجتمعية والبيئية.

الفئات المستهدفة:

طلاب الثانوية العامة والطلاب الوافدين والمحولين من كليات وجامعات أخري وكذا خريجي كليات العلوم والهندسة والزراعة والآداب (أقسام المساحة والجغرافيا ونظم المعلومات الجغرافية)

متطلبات سوق العمل للبرنامج وفرص العمل المتاحة للخريجين:

يخدم الخريج أسواق عمل متعددة محلية وعربية وعالمية أمثلة:

1- وكالة الفضاء المصرية والأفريقية والعربية ووكالة ناسا الأمريكية،
2- مراكز أبحاث الفضاء العربية والدولية،
3- الهيئة القومية للإستشعار عن بعد،
4- المعهد القومي للبحوث الفلكية والجيوفيزيقية،
5- مركز دعم وإتخاذ القرار بمجلس الوزراء ومقراته بالمحافظات،

6- وزارة البيئة وجهاز شئون البيئة بالمحافظات،
7- هيئة الطاقة الجديدة والمتجددة،
8- المحميات الطبيعية،
9- مراكز أبحاث الطاقة والبيئة والمياه والصحراء محليا وعربيا ودوليا،
10- معيدين وأعضاء هيئة تدريس بالجامعات المصرية الحكومية والخاصة.

Program Goals أهداف البرنامج

The program aims to prepare qualified pioneering cadres equipped with basic information on the environment and space sciences by studying specialized courses in accordance with the program regulations, which in turn contribute to the following:

1. Provide the students with specialized studies relevant to the basic sciences, in which students are provided with educational foundation for a range of careers in the environment and space sciences and their related industries.
2. Establishing the modern concept of the profession of environmental scientist and astronauts in field and laboratory practice and distinguished scientific research.
3. Practice the students on a range of skills and techniques related to the environment and space sciences, to carry-out experiments using advanced techniques considering risk management and safety requirements.
4. Developing the student's employment skills, with understanding the problems and developing appropriate solutions, which qualify them to work in the environmental protection, space sciences fields and the related industries.
5. Practice students on the large and small industrial, water treatment and desalination, waste disposal and management, air quality, energy production projects as well as reviewing of quality control processes. Introduce the student to the concepts of quality control assurance systems and their applications to familiar situations.
6. Instill in students the role of the environmental and space sciences in society developments with approaches that meet community needs taking into account economic, environmental, social and ethical requirements.
7. Enhance student's self-long life – learning, personal skills and attitudes essential for successful performance, as a basis for future studies and career development.
8. Cooperate with industrial and service institutions through training and providing consultations and professional services in the various fields serving the environment and the space sciences.

القواعد والأحكام العامة للبرنامج

مادة (1): <u>الدرجة العلمية:</u>

تمنح جامعة طنطا بناء على طلب مجلس كلية العلوم درجة البكالوريوس في العلوم تخصص "علوم البيئة والفضاء".

مادة (2): <u>متطلبات التخرج:</u>

متطلبات التخرج للحصول على درجة البكالوريوس في العلوم تخصص (علوم البيئة والفضاء) هي 136 ساعة معتمدة وبمعدل تراكمي المتوسط النقاط (**Cumulative GPA**) لا يقل عن (2). وتوزع كما هو مبين بالجدول:

	نوع المقررات	عدد الساعات المعتمدة	النسبة المئوية
1	متطلبات الجامعة (الإجبارية)	4	5.88 %
2	متطلبات الجامعة (الاختيارية) متطلبات الكلية	4 28	20.59 %
3	متطلبات البرنامج التخصصية (الإجبارية) متطلبات البرنامج التخصصية (الاختيارية)	60 28	64.71 %
4	مقررات الإختيار الحر	6	4.41 %
5	تدريب ميداني	3	2.21 %
6	مشروع تخرج	3	2.21 %
7	إجمالي عدد ساعات البرنامج	136	100 %

1. متطلبات الجامعة: 8 ساعات معتمدة (س.م) توزع على النحو التالي:

(أ) عدد 4 ساعة معتمدة اجبارية بواقع ساعتين لكل مقرر في كل فصل دراسي وبيانها كالتالي:

-
- ساعتان معتمدتان لغة إنجليزية".
- ساعتان معتمدتان " تكنولوجيا المعلومات".

(ب) عدد 2 ساعة معتمدة اختيارية في كل فصل دراسى، بواقع ساعة معتمدة لكل مقرر من المقررات التالية:

الثقافة البيئية - تاريخ وفلسفة العلوم الابتكار وريادة الأعمال- مهارات التواصل- ثقافة الجودة -- التغيرات البيئية- أخلاقيات مزاولة المهنة.

2. يجب على الطلاب اجتياز مقرر حقوق الإنسان ومكافحة الفساد بواقع ساعة واحدة نظرية أسبوعية، ولا يمنح درجة البكالوريوس إلا بعد اجتيازها.

3. متطلبات الكلية: عدد 28 ساعة معتمدة موزعة كالتالي:

المقررات	الجيولوجيا	الفيزياء	الكيمياء	بيولوجي	الرياضيات	حاسب الي

4. مقررات الاختيار الحر: 6 ساعات معتمدة من خارج مقررات التخصص.

5. متطلبات التخصص: عدد88 ساعة معتمدة تشمل جميع المقررات التخصصية الإجبارية والاختيارية.
6. مشروع التخرج: مقرر المقال والبحث في احدى مجالات علوم البيئة والفضاء ويخصص له 3 ساعات معتمدة في الفصل الدراسي الثاني من المستوى الرابع على أن يدرس للطلاب أسس الكتابة العلمية بعدها يقوم الطالب أو مجموعة من الطلاب بالبحث وكتابة المقال تحت إشراف أحد أعضاء هيئة التدريس بقسم الجيولوجيا ووكالة الفضاء المصرية. وعلى أن يتم تقييم الطلاب في المقرر في نهاية الفصل الدراسي الثاني.
7. التدريب الميداني: يسمح للطلاب التدريب 6 ساعات يوميا لمدة 8 أسابيع في احدى المؤسسات ذات الصلة بالبرنامج (حكومية أو خاصة) وذلك بعد انتهاء امتحانات الفصل الدراسي الثاني للمستوى الثالث وذلك بواقع عدد 3 ساعات معتمدة. ويجوز أن يتم التدريب بمعامل الكلية، وذلك إذا تعذر إيجاد موقع للتدريب خارجها.

مادة (3): القيد والقبول والتحويل

1- يشترط في المتقدم للالتحاق ببرنامج "علوم البيئة والفضاء" أن يستوفي الشروط التالية:
أولا: الحصول على شهادة الثانوية العامة المصرية (شعبتي علمى العلوم والرياضيات) أو ما يعادلها وفقا لشروط القبول التي يحددها المجلس الأعلى للجامعات. ويلتحق الطالب المستجد بالمستوى الأول لهذا البرنامج.
ثانيا: القبول بكلية العلوم- جامعة طنطا سواء عن طريق الترشيح أو التحويل أو تغيير المسار للطلاب المقيدين بالكلية أو الوافدين بشروط القيد والتحويل المطبقة على المصريين وبشروط إضافية تقترحها اللجنة التنفيذية ويوافق عليها مجلس الجامعة.

2- يكون قبول الطلاب بالبرنامج سنويا حسب مجموعهم الاعتباري (يتكون من المجموع الكلي للدرجات في شهادة الثانوية العامة أو الشهادة المعادلة والدرجة الحاصل عليها في اللغة الإنجليزية ويتم ترتيب الطلاب تنازليا وفقا لهذا المجموع الاعتباري) وفقا للعدد الذي تقرره اللجنة التنفيذية.

3-يجوز قبول طلاب حاصلين على درجة البكالوريوس من كليات العلوم والهندسة والزراعة وليسانس الآداب أقسام المساحة والجغرافيا ونظم المعلومات الجغرافية) وفقا للضوابط التي تحددها اللجنة التنفيذية واللجنة العليا للبرنامج وتعتمد من مجلس الجامعة.

مادة (4): نظام الدراسة

1. لغة الدراسة بالبرنامج اللغة الإنجليزية.
2. يتبع البرنامج نظام الساعات المعتمدة (Credit Hours System) حيث تحدد متطلبات التخرج بوحدات دراسية مقننة تعرف بالساعات المعتمدة(Credit Hours)
3. الساعة المعتمدة هي وحدة قياس أكاديمي لتحديد وزن كل مقرر في الفصل الدراسي الواحد. وتعادل ساعة واحدة من الدراسة النظرية للمقرر، أو ساعتين أو ثلاثة للدروس العملية أو التمارين في الأسبوع خلال الفصل الدراسي، وتمثل الساعة المعتمدة الأساس الذي يتم عليه حساب المعدل الفصلي والتراكمي للطالب.

مادة (5): الفصول الدراسية

يتكون العام الدراسي من فصلين دراسيين رئيسيين هما الفصل الأول والفصل الثاني مدة كل منهما سبعة عشر أسبوعا، ومن فصل ثالث اختياري مكثف خلال فترة الصيف (فصل صيفي) لمدة ثمانية أسابيع. ويتكون الفصل الدراسي الرئيسي من سبعة عشر أسبوعا موزعة على النحو التالي:

(أ) فترة التسجيل مدتها أسبوع واحد ويجوز التسجيل المبكر إلكترونيا قبل بدء الفصل الدراسي الطلاب المستويات الثاني والثالث والرابع

(ب) فترة الدراسة مدتها أربعة عشر أسبوع منها أسبوع للامتحانات النصف فصلية.

(ج) فترة الامتحانات النهائية ومدتها أسبوعين.

الفصل الصيفي:

(أ) هو فصل دراسي إختيارى مدته تسعة أسابيع على أن تتضاعف عدد الساعات الدراسية المخصصة لكل مقرر ويسجل فيه الطلاب المقررات الدراسية المؤجلة ومقررات الرسوب وكذلك المقررات اللازمة للتخرج أو دراسة مقررات لتحسين التقدير بحد أقصي تسعة ساعات معتمدة، وتكون المقررات المطروحة متاحة طبقة الضوابط تحددها اللجنة التنفيذية وتوافق عليها اللجنة العليا ويقرها مجلس الجامعة.

(ب) وبالنسبة للفصل الدراسي الصيفى تكون:

1. فترة التسجيل أربعة أيام.
2. فترة الدراسة سبعة أسابيع مكثفة.
3. فترة الامتحان عشرة أيام.

مادة (6): المواظبة

يتابع أستاذ المقرر تسجيل حضور الطلاب في بدء كل محاضرة أو درس عملي أو تدريب في سجل معد لذلك من قبل إدارة شئون التعليم والطلاب مع مراعاة ما يلي:

(أ) الحد المسموح به لغياب الطالب بدون عذر مقبول هو 25% من مجموع ساعات المقرر ويتولى أستاذ المقرر إخطار ادارة شئون التعليم والطلاب بالكلية بخطاب من رئيس القسم في حالة تجاوز هذه النسبة الإنذار الطالب مرتين وبعد ذلك تعرض حالة الطالب على اللجنة التنفيذية لإتخاذ اللازم

(ب) يحرم الطالب من دخول الامتحان النهائي ويسجل له تقدير محروم (م) إذا زادت نسبة غيابه عن 25% في المقرر وكان الغياب بدون عذر تقبله اللجنة التنفيذية واللجنة العليا، ويرصد له التقدير راسب.

(ت) يسجل للطالب تقدير منسحب بعذر (من) إذا زادت نسبة غيابه عن 25% في المقرر وكان الغياب بعذر تقبله اللجنة التنفيذية واللجنة العليا للبرنامج.

مادة (7): المرشد الأكاديمي

تحدد اللجنة التنفيذية للبرنامج مرشدا أكاديميا من بين أعضاء هيئة التدريس لكل مجموعة من الطلاب يقوم بمهام الرعاية والإرشاد العلمي ويكون مسئولا عما يلي:

- مساعدة الطلاب في اختيار وتسجيل المقررات الدراسية.
- متابعة الطلاب أثناء الدراسة وحل أي مشكلة تواجههم.
- إعداد ملف كامل لكل طالب يشمل جميع بياناته الخاصة والإنجازات. ويحتوي الملف على إستمارة بيانات الطالب- قائمة مقررات التخصص الدراسي المؤدية لتخرج الطالب من القسم) - إستمارة التسجيل - نسخة حديثة من السجل الدراسي (كشف العلامات الوثائق الإدارية الأخري (كإستمارة الحذف والإضافة..... إلخ).

- إقتراح المقررات المطلوب طرحها في الفصل الصيفي طبقا لإحتياجات الطلاب.
- إرشاد الطلاب في حالة تسجيل المقررات أو الإضافة أو الحذف أو الإنسحاب أو الغياب والتوقيع علي الإستمارة الخاصة بذلك.
- رفع تقارير وتوصيات عن الطلاب أصحاب المعدلات التراكمية المتدنية لمنسق البرنامج.

مادة (8): تسجيل الطلاب

يتابع وكيل الكلية لشئون التعليم والطلاب مع منسق عام البرنامج تنفيذ قواعد التسجيل وإجراءاته وإعداد قوائم الطلاب للمجموعات الدراسية، وإعداد الجداول الدراسية، وتوزيع الطلاب على المرشدين الأكاديميين، ويتم الإنتهاء من إجراءات تسجيل الطلاب في الأسبوع الأول من بدء الفصل الدراسي، ويجوز في حالة وجود أعذار قهرية أن يتم التسجيل حتى نهاية الأسبوع الثاني.

مادة (9): مواعيد التسجيل

تقوم اللجنة التنفيذية للبرنامج بالإعلان عن مواعيد التسجيل في المقررات قبل بدء الدراسة في كل فصل دراسي، وعلى الطلاب أن يراجعوا إختياراتهم مع المرشدين الأكاديميين المخصصين لهم، ويشترط موافقة المرشد الأكاديمي في تسجيل أو حذف المقررات، كما يشترط موافقة اللجنة التنفيذية للبرنامج على تسجيل المقررات للطلاب المتخلفين عن التسجيل في المواعيد المعلنة.

مادة (10): قواعد وآليات التسجيل

1. تقوم ادارة شئون الطلاب بالكلية من خلال وحدة الإرشاد الأكاديمي وبعد موافقة المرشد الأكاديمى بتسجيل المقررات الكترونية لكل طالب في الأسبوع الأول من الفصل الدراسي.
2. يجوز للطالب الذي لم يتمكن من التسجيل لأسباب قهرية تقرها اللجنة التنفيذية أن يسجل متأخرة خلال الفترة الاضافية للتسجيل (الأسبوع الثانى).
3. يشترط لتسجيل المقرر أن يكون الطالب قد درس المتطلب السابق لهذا المقرر (ان وجد).
4. يتم تسجيل عدد من المقررات لكل طالب بحد أقصى 18 ساعة معتمدة وحد أدني 12 ساعة معتمدة في كل من الفصلين الدراسيين الأول والثاني، ولا يزيد عن 9 ساعات معتمدة في الفصل الدراسي الصيفي. ويكون التسجيل على النحو التالي:

(أ) يجوز للجنة التنفيذية زيادة الحد الأقصى للعبء الدراسي في الفصلين الدراسيين الأخيرين للطالب بحد أقصى 4 ساعات معتمدة بواقع 2 ساعات معتمدة لكل فصل دراسي بغرض إتمام متطلبات التخرج.

(ب) لا يسمح للطالب الذي له معدل تراكمي أقل من (2) بالتسجيل في أكثر من 12 ساعة معتمدة في الفصل الدراسي التالي لحصوله علي هذا المعدل.

(ج) يجوز بعد موافقة اللجنة التنفيذية واللجنة العليا أن يعفي الطلاب المحولين من كلية مناظرة يتم التدريس فيها بنظام الساعات المعتمدة أو الطلاب المحول مسارهم إذا ثبت أنه قد درس ونجح في مقررات تعادلها في الكلية المحول منها ولا يجوز إعفائه من أي مقرر من مقررات المستويين الثالث والرابع.

مادة (11): مواعيد حذف وإضافة مقرر والانسحاب وتعديل المسار

1. يجوز للطالب بعد موافقة المرشد الأكاديمي أن يضيف أو يحذف مقررا أو أكثر حتى نهاية الأسبوع الثاني فقط من الدراسة أو نهاية الأسبوع الأول من الفصل الصيفي، وذلك بما لا يخل بالعبء الدراسي للطالب.

2. يجوز للطالب أن ينسحب من دراسة أي مقرر حتى نهاية الأسبوع الثامن من بدء التسجيل للفصل الدراسي وذلك بموافقة المرشد الأكاديمي. ويسجل هذا المقرر في سجل الطالب الأكاديمي بتقدير منسحب (من) بشرط ألا يكون الطالب قد تجاوز نسبة الغياب المقررة 25% قبل الانسحاب. وتعرض حالات الانسحاب الاضطرارية بعد هذا الميعاد على اللجنة التنفيذية واللجنة العليا للبرنامج، على ألا يخل الانسحاب بالعبء الدراسي للطالب.
3. إذا انسحب الطالب من المقرر بعد نهاية الأسبوع الثامن يعتبر راسبا في هذا المقرر
4. يجوز للطالب تعديل مسار تخصصه بشرط استكمال متطلبات التخصص المرغوب فيه مع عدم احتساب الساعات المعتمدة التي اجتازها الطالب من قبل ولا تقع في مجال متطلبات التخصص الجديد. وذلك بعد أخذ رأى المرشد الأكاديمي وموافقة اللجنة التنفيذية واعتماد اللجنة العليا للبرنامج على هذا التعديل.

مادة (12): مستويات الدراسة

مدة الدراسة في هذا البرنامج هي أربعة مستويات دراسية (ثمانية فصول) وينتقل الطالب من مستوى إلى المستوى الأعلى بعد اجتياز عدد محدد من الساعات المعتمدة كما هو مبين بالجدول التالي:

المستوي الدراسي	عدد الساعات المعتمدة التي اجتازها الطالب بنجاح	
	اكبر من	اقل من او يساوي
الأول	0	30
الثاني	30	64
الثالث	64	100
الرابع	100	136

مادة (13): الدلالات الرقمية والرمزية للمقررات

(1) يرمز للمقررات المختلفة للبرنامج بثلاثة حروف لاتينية تدل على القسم أو البرنامج الذي يتبعه المقرر، يتبعها كود من ثلاثة أرقام بيانها من اليسار إلى اليمين على النحو التالي:

جدول كود الأقسام العلمية المنوط بها تدريس المقررات

Department / Program)) القسم/البرنامج	Code)) الكود
Geology	Geo
Mathematics	Mat
Physics	Phy
Chemistry	Chm
Zoology	Zoo
Botany	Bot
Environment and Space Sciences	ESS

UN: University Code;
Com: Computer Sciences

(2) تقسم المقررات الدراسية إلى:
(أ) مقررات (كود **100**) تدرس أساسا بالمستوى الأول.
(ب) مقررات (كود **200**) تدرس أساسا بالمستوى الثاني.
(ج) مقررات (كود **300**) تدرس أساسا بالمستوى الثالث.
(د) مقررات (كود **400**) تدرس أساسا بالمستوى الرابع.

(3) يوضع الرقم الدال على مستوى المقرر في خانة المئات ثم رقم المقرر في خانتي الأحاد والعشرات ويتراوح بين **1** و **99** بحيث تمثل الأرقام الفردية مقررات الفصل الدراسي الأول، وتمثل الأرقام الزوجية مقررات الفصل الدراسي الثاني، ويجوز للجنة شئون الطلاب طرح المقرر في أكثر من فصل بناء على اقتراح الأقسام. ولمجلس القسم إضافة مقررات جديدة لقائمة المقررات في حدود الأرقام المخصصة للبرنامج بعد موافقة مجلس الكلية.

مادة (14): إعادة المقررات

1. يحق للطالب اعادة التسجيل في مقرر أو مقررات سبق له الرسوب فيها، في أي فصل دراسي لاحق بشرط عدم الإخلال بالعبء الدراسي المبين بمواد هذه اللائحة، مع احتساب التقدير الذي يحصل عليه الطالب عند اجتياز الامتحان.
2. إذا رسب الطالب في مقرر اختياري فعليه إعادة دراسة نفس المقرر أو دراسة مقرر اختياري آخر لاستكمال

مادة (15): الحرمان من أداء امتحان مقرر

يحرم الطالب من أداء الامتحان في مقرر دراسي أو أكثر إذا تجاوز غيابه نسبة 25% في المقرر الواحد ولم يقدم عذرا تقبله اللجنة التنفيذية واللجنة العليا للبرنامج. ويعتبر الطالب في هذه الحالة راسبا في المقرر أو المقررات التي حرم من التقدم لأداء الامتحان بها. على أن تعتمد القرارات في هذا الشأن من مجلس الجامعة.

مادة (16): تقييم المقرر

1. النهاية العظمى لكل مقرر دراسي **100** (مائة) درجة.
2. يتم تقسيم درجة كل مقرر بين الأعمال الفصلية والامتحانات الشفهية والتطبيقية والامتحانات العملية وامتحانات منتصف الفصل ونهاية الفصل الدراسي كما هو مبين كالآتي:

أ – في حالة المقررات النظرية فقط (بدون عملي)		
1	أعمال فصلية (اختبارات دورية وتمارين)	% 10
2	امتحانات شفوية	% 10
3	امتحانات تطبيقية	% 10
4	امتحانات نصف فصلية	% 20
5	امتحان نظري نهائي	% 50
ب – في حالة المقررات العملية فقط (بدون نظري)		
1	أعمال فصلية (اختبارات دورية وتمارين)	% 20
2	امتحان عملي نصف فصلي	% 20
3	امتحانات شفهية	% 10
4	امتحانات تطبيقية	% 10

5	امتحان عملي نهائي	% 40
ج – المقررات النظرية (التي تتضمن جزء نظري وجزء عملي)		
1	أعمال فصلية (اختبارات دورية وتمارين)	% 10
2	امتحانات عملية نهائي	% 20
3	امتحانات نصف فصلية	% 10
4	امتحانات شفهية	% 10
5	امتحانات تطبيقية	% 10
6	امتحان نظري نهائي	% 40

وتعقد الامتحانات النهائية (نظري وعملي) في الأسبوعين الأخيرين من الفصل الدراسي في موعد تحدده اللجنة التنفيذية وتعتمده اللجنة العليا.

3. تقييم الطلاب في مقرر المقال والبحث:

60% من النهاية العظمى لدرجة المقال والبحث تخصص لتنظيم وتقييم المادة العلمية للبحث ويتم التقييم من خلال لجنة ممتحنين ثلاثية.

20% من النهاية العظمى لدرجات المقرر تخصص لمتابعة الطالب ويتم التقييم من خلال المشرف.

20% من النهاية العظمى لدرجات المقرر تخصص للمناقشة الشفهيه ويتم التقييم من خلال لجنة الممتحنين.

4. تقييم التدريب الميداني: بالنسبة للتدريب الميداني يخصص له 3 ساعات معتمدة توزع درجاته بواقع 40% على جودة تقرير الطالب، و40% لتقرير مشرف التدريب و20% للمناقشة.

5. تتم الامتحانات الشفهية والتطبيقية والنهائية (تحريرية أو عملية) للمقرر من خلال لجنة مشكلة من السادة أعضاء هيئة التدريس بالقسم المختص ويتولى أستاذ المقرر إعداد أوراق أسئلة الامتحانات. ويعتبر الطالب الغائب في حالة المقررات العملية فقط أو الامتحان التحريري النهائي غائبة في المقرر.

6. يجوز أن تؤجل نتيجة مقرر من المقررات لعدم اكتمال متطلباتها لأسباب قهريه (عذر مقبول) بعد عرضها على اللجنة التنفيذية واللجنة العليا للبرنامج خلال مدة لا تتجاوز فصل دراسي واحد، ويعطى الطالب في هذه الحالة تقدير غير مكتمل (غ م) وإن لم يستكمل الطالب متطلبات المقرر في الفترة التي يعقد بها الامتحان النهائي للمقررات غير المكتملة وهي الأسبوع الأول من الفصل الدراسي التالي مباشرة، يعتبر الطالب راسبة ويرصد له التقدير (راسب).

7. يجوز بناءا على اقتراح اللجنة التنفيذية للبرنامج موافقة اللجنة العليا واعتماد مجلس الجامعة عقد الامتحانات التحريرية عن بعد (إلكترونيا) مع وضع الضمانات الكاملة لتأمين أعمال الامتحانات وذلك بما يسمح بالتعليم الإلكتروني.

مادة (17): الدلالات الرقمية والرمزية للدرجات والتقديرات:

1. تقدر النقاط التي يحصل عليها الطالب في كل مقرر دراسي على الوجه التالي:

النسبة المئوية	المكافئ الرقمي	رمز التقدير		التقدير	
100 > -90	4.000	أ+	A^+	ممتاز	Excellent

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	IC	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

2. إذا تكرر رسوب الطالب في مقرر ما، يكتفي باحتساب الرسوب مرة واحدة فقط عند حساب معدله التراكمي ولكن تسجل عدد المرات التي أدى فيها امتحان هذا المقرر في سجله الأكاديمي وتحسب درجة النجاح التي حصل عليها عند اجتياز الامتحان.
3. (أ) الحد الأدنى للنجاح في المقرر هو (60%) = (2) مقبول.
(ب) الحد الأدنى للمعدل التراكمي هو (60 %) = (2) مقبول.

مادة (18): تقييم الحالات الخاصة

1. عدم دخول الطالب الامتحان النهائي لمقرر أو أكثر لعذر مقبول (ظروف قهرية أو مرضية) يعطى له في هذه الحالة تقدير غير مكتمل (غ م).
2. أن لم يستكمل الطالب متطلبات المقرر في الفترة التي يعقد بها الامتحان النهائي للمقررات غير المكتملة وهي الأسبوع الأول من الفصل الدراسي التالي مباشرة يعتبر الطالب راسبا ويرصد له التقدير راسب (ر).

إذا زادت نسبة الغياب عن 25% وكان غياب الطالب بدون عذر مقبول يحرم من دخول الامتحان النهائي ويسجل
للطالب تقدير محروم (م) ويعتبر الطالب راسبا.

مادة (19): التدريب الميداني

يؤدى كافة الطلاب بعد الانتهاء من امتحانات الفصل الدراسي الثاني للمستوى الثالث (بعد اجتياز 64 ساعة) تدريبات تطبيقية ميدانية 6 ساعات يوميا لمدة 8 أسابيع في شركة أو مؤسسة صناعية

أو هيئة حكومية أو خاصة ذات صلة بالتخصص (من خلال بروتوكول تعاون تحت إشراف عضو هيئة تدريس من الكلية ومشرف ميداني ويقدما تقريرا مشتركا عن حالة الطالب. ويجوز أن يتم التدريب بمعامل الكلية إذا تعذر إيجاد موقع خارجها ولا يمنح الطالب درجة البكالوريوس إلا بعد اجتياز التدريب الميداني.

مادة (20): حساب المعدل الفصلي والتراكمي

أولا: حساب المعدل الفصلي: هو متوسط ما يحصل عليه الطالب من نقاط في الفصل الدراسي الواحد ويقرب إلى ثلاثة ارقام عشرية فقط ويحسب كما يلي:

المعدل الفصلي =	مجموع (حاصل ضرب نقاط كل مقرر x عدد ساعاته المعتمدة)
	حاصل جمع الساعات المعتمدة لهذه المقررات في الفصل الدراسي

ثانيا: حساب المعدل التراكمي العام: هو متوسط ما يحصل عليه الطالب من نقاط خلال الفصول الدراسية ويقرب إلى ثلاثة ارقام عشرية فقط ويحسب كما يلي:

المعدل التراكمي العام =	مجموع (حاصل ضرب نقاط كل مقرر تم دراسته x عدد ساعاته المعتمدة)
	حاصل جمع الساعات المعتمدة لهذه المقررات التي تم دراستها

مادة (21): إيقاف القيد

يجوز للطالب أن يتقدم بطلب لوقف قيده المدة فصليين دراسيين وبحد أقصى أربعة فصول دراسية متقطعة طوال فترة بقائه بالبرنامج وذلك لأسباب قرية توافق عليها اللجنة التنفيذية واللجنة العليا للبرنامج.

مادة (22): إلغاء القيد

يلغى قيد الطالب إذا ارتكب مخالفة تخل بالآداب أو تخالف لوائح أو أنظمة الكلية أو الجامعة أو طبق في حقه
لائحة تأديب الطلاب بما يتفق وقانون تنظيم الجامعات ولائحته التنفيذية وقرارات مجلس الجامعة في هذا الشأن.

مادة (23): حالات الفصل

يتعرض الطالب للفصل من الكلية طبقا لعدد مرات الرسوب على النحو التالي:

- يفصل طالب المستوى الأول إذا لم يجتز **30** ساعة معتمدة من المقررات التي سجل فيها وأدى فيها الامتحان خلال أربعة فصول دراسية رئيسية.
- يفصل طالب المستوى الثاني إذا لم يجتز **64** ساعة معتمدة من المقررات التي سجل فيها وأدى فيها الامتحان خلال ثمانية فصول دراسية رئيسية، مع إعطاء الطالب فرصة امتحان من الخارج بعد فصل دراسي تاسع بمصروفات يحددها مجلس الكلية ولمرة واحدة.
- يفصل طالب المستوى الثالث إذا لم يجتز **100** ساعة معتمدة من المقررات التي سجل فيها وأدى فيها الامتحان خلال عشرة فصول دراسية، مع إعطاء الطالب فرصة امتحان من الخارج بعد فصل دراسي حادي عشر بمصروفات يحددها مجلس الكلية ولمرة واحدة.
- إذا اجتاز الطالب **100** ساعة معتمدة على الأقل يكون له حق الاستمرار في الدراسة حتى التخرج بمصروفات يحددها مجلس الكلية.

مادة (24): استيفاء المقررات المؤهلة (المتطلب السابق)

المتطلب السابق هو مقررا دراسيا يتعين علي الطالب دراسته قبل التسجيل في مقرر لاحق وفقا للشروط التالية:

أ) أن يكون هذا المتطلب من المقررات الإجبارية فقط. ولا يكون المقرر الاختياري متطلب لأي مقرر آخر.

ب) يجب أن يكون المتطلب السابق لأي مقرر هو مقرر واحد فقط.

مادة (25): دراسة مقررات خارج الكلية (الجامعة)

يجوز للجنة التنفيذية وبعد موافقة اللجنة العليا وبما لا يتعارض مع مواد هذه اللائحة أن يسمح للطلاب المقيدين بالبرنامج بدراسة مقرر أو أكثر بإحدى الجامعات المصرية او العربية او الأجنبية وبها برامج مماثلة ضمن برنامجه الدراسي، وبما يحقق أهداف المقرر المناظر بالكلية في نفس المستوى الدراسي وبحد أقصى أربعة مقررات طوال فترة الدراسة.

مادة (26): بيان بالسجل الأكاديمي

السجل الأكاديمي وهو بيان يوضح المقررات الدراسية التي درسها الطالب في كل فصل دراسي ورموزها وأرقامها والدرجات والنقاط والتقديرات التي حصل عليها ورموز التقديرات والمعدل الفصلي والتراكمي والتقديرات الفصلية ورموزها والتقدير العام حتى تخرج الطالب من الكلية. وللطالب الحق في الحصول علي بيان معتمد لسجله الأكاديمي بعد سداد جميع الرسوم الدراسية.

مادة (27): الإنذار الأكاديمي والمراقبة الأكاديمية

(أ) إذا حصل الطالب على معدل تراكمي أقل من 2 (60% من الحد الأقصى لمجموع درجات المقررات التي درسها) ينذر للمرة الأولى من قبل إدارة شئون الطلاب بالكلية.

(ب) إذا تكرر تدني المعدل التراكمي للطالب عن 2 لفصل دراسي ثان، ينذر للمرة الثانية ويعتبر الطالب مراقب أكاديمية ولا يسمح له بالتسجيل إلا في الحد الأدنى وهو 12 ساعة معتمدة.

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

مادة (28): نظام الاستماع لطلاب من خارج الكلية والأستاذ الزائر

(أ) يجوز للجنة التنفيذية بعد أخذ رأى مجالس الأقسام العلمية المختصة أن تقبل طلاب من كليات الجامعة أو الجامعات الأخرى كمستمعين لبعض المقررات بالكلية وفقا لقواعد تحددها اللجنة التنفيذية ويوافق عليها مجلس الجامعة، وتمنح الكلية شهادة تفيد حضور هذه المقررات مع الإفادة عن دخول الطالب الاختبار والنجاح أو الرسوب فيه.

(ب) يجوز استقدام أساتذة زائرين من جامعات عربية أو أجنبية لتدريس بعض المقررات أو نقل الخبرات والتقنيات البحثية.

مادة (29): المنح الدراسية

يخصص البرنامج نسبة تقررها اللجنة التنفيذية لحالات الإعفاء من الرسوم ويكون الإعفاء طبقا للقواعد التي
تضعها اللجنة التنفيذية للبرنامج وتوافق عليها اللجنة العليا ويعتمد من مجلس الجامعة.

1. تطبق قواعد الإعفاء على الطلاب المتفوقين (الثلاثة الأوائل) بشرط ألا يقل المعدل التراكمي لكل منهم عن 3.5 نقطة كما يلي:
   الطالب الأول: إعفاء بنسبة 75% من قيمة الرسوم الدراسية.
   الطالب الثاني: إعفاء بنسبة 50% من قيمة الرسوم الدراسية.
   الطالب الثالث: إعفاء بنسبة 30% من قيمة الرسوم الدراسية.
2. يتم إعفاء الطلاب المصرين الأوائل على الجمهورية في الثانوية العامة، أو الطلاب الحاصلين على منح خاصة مقدمة من الحكومة المصرية لتقوية الدور المصري في القارة الأفريقية والدول العربية من قيمة الرسوم الدراسية المفروضة لكل سنة دراسية من البرنامج، ولا يعفى الطالب الموفد من رسوم الشهادات والإفادات وبيانات القيد.
3. يتم إعفاء أبناء الشهداء من أفراد القوات المسلحة والشرطة وأبناء الشهداء المدنيين والطلاب المصابين من جراء العمليات الإرهابية بنسبة 25% من قيمة الرسوم الدراسية المفروضة لكل سنة دراسية من البرنامج.
4. يتم إعفاء أبناء السادة أعضاء هيئة التدريس والعاملين بجامعة طنطا بنسبة 25% من قيمة الرسوم الدراسية المفروضة في كل سنة من سنوات البرنامج.
5. في حالة استيفاء الطالب شروط الاستفادة من اعفائيين يطبق عليه الإعفاء الأعلى فقط.

مادة (30): وثيقة التخرج ومرتبة الشرف

تمنح وثيقة تخرج لكل طالب متخرج ويكتب فيها اسم، ورقمه الأكاديمي، والدرجة العلمية، والتخصص، والمعدل التراكمي مقربة إلى رقمين عشريين إلى جانب التقدير العام للتخرج. وتمنح مرتبة الشرف للطالب الذي ينهي دراسته بالكلية في غضون المدة الاعتيادية للتخرج والتي لا تزيد عن 8 فصول دراسية أساسية بتقدير ممتاز **A** بحد أدنى **85%** من المجموع الكلي للدرجات بما يحقق معدل تراكمي من النقاط قدره **3,667** أو أكثر وبشرط ألا يقل معدله التراكمي في أي فصل دراسي عن 3,0 (75% من مجموع الدرجات) وألا يكون قد رسب في أي مقرر دراسي خلال دراسته في الكلية أو في الكلية المحول منها إذا كان قد قضى مدة دراسة لا تزيد عن عامين في كلية أخرى.

مادة (31): نظام التعليم

يجوز استخدام نظم ونماذج تعليم مختلفة مثل التعليم الهجين والتعليم عن بعد بحيث تكون الدراسة من المقرر بنسبة 60% –70% وجها لوجه بالحضور داخل الكلية أو بواسطة التعليم المتزامن التفاعلي عن بعد ومن 30% – 40% بنظام التعليم الإلكتروني على المنصة الإلكترونية أو بأي نسب أخري تقترحها اللجنة التنفيذية للبرنامج وتوافق عليها اللجنة العليا ويعتمد من مجلس الجامعة.

مادة (32): يجوز للجنة التنفيذية للبرنامج بناء على اقتراح مجلس القسم العلمي تعديل المحتوى العلمي (بنسبة لا تتجاوز 20%) لأي مقرر من المقررات الدراسية وتوافق عليه اللجنة العليا ويعتمده مجلس الجامعة.

مادة (33): المصروفات الدراسية

يسدد الطالب المصروفات الدراسية ومصاريف الامتحانات وغيرها من الخدمات الخاصة التي تؤدي للطلاب طبقا اللائحة المالية للبرنامج والتي تحددها اللجنة التنفيذية للبرنامج وتوافق عليها اللجنة العليا ويعتمدها مجلس الجامعة.

مادة (34): القواعد التأديبية

الطلاب المقيدون بالبرنامج خاضعون للنظام التأديبي المبين في قانون تنظيم الجامعات ولائحته التنفيذية.

مادة (35): تطبيق أحكام قانون تنظيم الجامعات

(أ) تطبق هذه اللائحة اعتبارا من العام الجامعي التالي لتاريخ صدورها على الطلاب المستجدين بالمستوى الأول بالكلية.

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

مادة (36): المقررات الدراسية

First Level (Semester 1)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/ T**	
Historical and Physical Geology	Geo 101	-	2	2	3
Computer Basics and Programming Languages	Com 101	-	2	2	3
General Chemistry I	Chm 101	-	2	2	3
General Physics	Phy 101	-	2	2	3
General Botany	Bot 101	-	1	2	2
Scientific English Language	UN 101	-	2	-	2
Human Rights and Anti-corruption	UN 103	-	1	-	
B-Elective: Select 2 credit hours from the following:					

Environmental Culture	UN 105	-	1	-	1
History and Philosophy of Sciences	UN 107	-	1	-	1
Innovation and Entrepreneurship	UN 109	-	1	-	1
Total			13	10	18

L = Lecture, **P**/ **T** = Practical/Tutorial, **Cr.**= Credit Hours

First Level (Semester 2)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/ T**	
Rock-Forming Minerals and Petrology	Geo 102	Geo 101	2	2	3
Differential Equations and Numerical Analysis	Mat 102	-	1	2	2
Electricity and Basics of Electronics	Phy 102	-	2	2	3
General Zoology	Zoo 102	-	1	2	2

Principles of Calculus	Mat 104	-	1	1	1
General Chemistry II	Chm 102	-	2	2	3
Information Technology	UN 102	-	1	2	2
B-Elective: Select 2 credit hours from the following:					
Transferable Skills	UN 104	-	1	-	1
Quality Culture	UN 106	-	1	-	1
Environmental Changes	UN 108	-	1	-	1
Professional Ethics	UN 110	-	1	-	1
Total			12	13	18

Second Level (Semester 1)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/T**	
Structural Geology and Natural Resources	ESS 201	Geo 102	2	2	3
Surveying and Field Mapping	ESS 203	Geo 101	1	2	2
Electronic circuits	ESS 205	Phy 102	2	2	3
Space Dynamics	ESS 207	-	1	2	2

C-Elective: Select 6 credit hours from the following:					
Space Plasma Physics	ESS 209	Phy 101	1	2	2
Space Chemistry	ESS 211	Chm 101	1	2	2
Disaster, Vulnerability and Resilience	ESS 213	-	1	2	2
Environmental Economics and Quality Management	ESS 215	-	1	2	2
Ecology, Pollution, and Nature Conservation	ESS 217	Zoo 102	1	2	2
Total			9	14	16

Second Level (Semester2)

A- Compulsory					
Course Title	**Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/ T**	
Industrial Geology and Environment	ESS 202	Geo 102	1	2	2
Geographic Information Systems	ESS 204	-	2	2	3
Environmental Geology	ESS 206	ESS 203	2	2	3
B-Free: Select 6 credit hours from the following					

Microbial Toxins and Bioremediation of Polluted Water	Bot 202	Bot 101	1	2	2
Industrial Ecology	Zoo 202	Zoo 102	1	2	2
Environmental Physics	Phy 202	-	1	2	2
Environmental Nanotechnology	Chm 202	-	1	2	2
Environmental Statistics	Mat 202	-	1	2	2
C- Elective: Select 4 credit hour from the following:					
Energy and Solar Energy Physics	ESS 208	Phy 101	1	2	2
Energy Chemistry	ESS 210	-	1	2	2
Environmental Microbiology	ESS 212	Bot 101	1	2	2
Space Atmosphere and Ionospheric physics	ESS 214	-	1	2	2
Introduction to Astronomy	ESS 216	-	1	2	2
Total			10	16	18

Third Level (Semester 1)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/ T**	
Environmental Remote Sensing	ESS 301	ESS 204	2	2	3
Water Quality Protection and Management	ESS 303	-	1	2	2
Python Programming	ESS 305	Com 101	1	2	2
Water Treatment Technology	ESS 307	ESS 206	1	2	2
Environmental Management and Impact Assessment	ESS 309	-	1	2	2
B- Elective: Select 6 credit hours from the following:					
Solving Complex Problems	ESS 311	-	1	2	2
Industrial Biochemistry	ESS 313	-	1	2	2
Medicinal Plants and Bio-products Technology	ESS 315	-	1	2	2
Biodiversity and Natural Reserves	ESS 317	Zoo 102	1	2	2
Environmental and Industrial Chemistry	ESS 319	-	1	2	2
Total			9	16	17

Third Level (Semester 2)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/ T**	
Geospatial computing of Big Data	ESS 302	ESS 207	1	2	2
Space Environment and Technology	ESS 304	ESS 205	1	2	2
Spacecraft Systems and Satellite Engineering	ESS 306	-	1	2	2
Satellite Payload	ESS 308	ESS 303	1	2	2
B- Elective: Select 8 credit hours from the following:					
Algae Remote Sensing and Biotechnology	ESS 310	ESS 301	1	2	2
Treatment and processing of construction industrial/glass wastes	ESS 312	-	1	2	2
Waste Unit Preparation Technology	ESS 314	-	1	2	2
Environmental Risk Assessment and Contaminated Site Remediation	ESS 316	-	1	2	2
Waste incineration and air quality control	ESS 318	-	1	2	2
Space Physics	ESS 320	ESS 209	1	2	2
Space Microbiology	ESS 322	ESS 212	1	2	2
Total			8	16	16

Fourth Level (Semester 1)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	P/ T	
Landfills and Waste Management	ESS 401	ESS 305	2	2	3
Waste Containment and Remediation Technology	ESS 403	ESS 303	2	2	3
Water Desalination and Purification	ESS 405	ESS 309	1	2	2
Spacecraft Power Systems	ESS 407	ESS 205	1	2	2
Satellite Launch Systems	ESS 409	ESS 306	1	2	2
Field Training	ESS 411	-	2	2	3
B- Elective: Select 2 credit hours from the following:					
Space Nanotechnology	ESS 413	Chm 202	1	2	2
Space flight Dynamics and Orbital Mechanics	ESS 415	ESS 207	1	2	2
Space Computing, Artificial Intelligence, and Decision support Technology	ESS 417	ESS 302	1	2	2
Total			10	14	17

Fourth Level (Semester2)

A- Compulsory					
Course Title	**Course Code**	**Prerequisite**	**Hours**		**Cr.**
			L	**P/ T**	
Spacecraft Attitude Dynamics and Control	ESS 402	ESS 403	2	2	3
Space Propulsion	ESS 404	ESS 207	1	2	2
Satellite Communications	ESS 406	ESS 401	1	2	2
Space Mission Analysis and Design	ESS 408	ESS 403	1	2	2
Space Medicine and Life	ESS 410	-	1	2	2
Graduation Project	ESS 412	-	2	2	3
B- Elective: Select 2 credit hours from the following:					
Spacecraft Materials	ESS 414	Chm 202	2	-	2
Environmental Law and Sustainable Development	ESS 416	ESS 309	2	-	2
Space Law	ESS 418	ESS 401	2	-	2
Total			10	12	16

مادة (37): محتوي المقررات الدراسية

Code	Name	L	P/T	Cr.
Geo 101	Historical and Physical Geology	2	2	3

Physical Geology: Introduction, Theories on the origin of the Universe and the Solar System – The atmosphere, the hydrosphere, the lithosphere and the Earth's interior – The Earth's crust, mantle, and core. Introduction to Plate tectonic theory and Earth's material. The origin of mountains and oceans – Internal geologic processes and tectonic movements – Structures – Earthquakes and Volcanicity –External geologic processes; Weathering (physical and chemical), wind action, running water (rainfall, rivers and deltas), groundwater and its geologic action, waves and current actions in coastal areas, glacial erosion –. **Laboratory studies** of topographic and geologic maps, hand specimen description and simple classification of crystal models, minerals and rocks. **Historical Geology**: Introduction to the Earth's history, the most important events occurred during the geologic history of the Earth (e.g. orogenic, sedimentologic, biologic climatic, etc.). The origin of the atmosphere and ocean, orbital forcing and its effect on the earth's climate. Earth's age-dating, origin of life on the Earth, the record of life forms (fauna and flora) that evolved throughout the geologic time. Quaternary history of mammals. Extinct fossil groups and vertebrate evolution. Laboratory studies of paleogeographic and geologic maps.

Com 101 Computer Basics and Programming Languages 2 2 3

Basics: Introduction to Computers, History of Computers, Types of Computers, Parts of Computer, Input and Output Devices, Hardware and Software, Storage Devices. Data types and data representation. Understanding the design and functioning of hardware and software computer systems. Computer networks and types. WWW (World Wide Web). Computer virus. Introduction to operating systems. **Software**: Introduction to Office software, Word, Excel, and PowerPoint.

Programming: Programming as a tool in Environment and Space Sciences. Students will learn how to program in a variety of languages. The course will introduce: Primitive data types and expressions-Control flow operations (if-then-else, for loops, while loops)-Basic object- oriented concepts (classes, objects, instance variables, methods)-Subclassing, inheritance and polymorphism-Abstract classes and interfaces-The Swing library for graphical user interfaces-Error handling and debugging-Documentation-Good programming style.

Chm 101 General Chemistry I 2 2 3

Topics covered include: Matter and measurements, atoms, molecules and ions, stoichiometry and mass relation in chemical reactions; properties of gases and gas law calculations; Atomic, electronic structure and periodic correlations; Covalent bonding, hybridization, Lewis structure and molecular geometry; Liquid and solids.

Practical, 2 hrs: qualitative inorganic analysis: analysis of acid and basic radicals, analysis of mixtures. Some organic chemistry experiments for organic acids and its salts are carried out.

Phy 101 General Physics 2 2 3

Properties of Matter: Standards of Length, Mass, and Time - SI system of units -Density and Atomic Mass. Dimensional Analysis - Conversion of Units. Pressure-Pressure Measurements-Pascal's law. Buoyant Forces- Archimedes' Principle. Steady and turbulent flow- Equation of continuity. Bernoulli's Equation. Gravitation. Kepler's Laws. The Gravitational Field- Energy Considerations in Planetary and Satellite Motion- Black Holes. Motion of an Object Attached to a Spring- Simple Harmonic Motion. andUniform Circular Motion. Pendulum -Damped Oscillations - Forced Oscillations.

Heat: Temperature and heat - Zeroth law of thermodynamics- Thermometers- Calibration of thermometers – Constant Volume Gas Thermometer. Celsius, Fahrenheit, and Kelvin Temperature Scales. Calendar and Griffiths Bridge- Linear and volume expansions. Unusual Behavior of Water. Relation among the quantities volume, pressure, and temperature of a sample of gas- Ideal gas- Ideal gas law. Heat and Internal Energy- Units of Heat. Latent Heat. Molecular Model of an Ideal Gas - Molecular Interpretation of Temperature. Molar Specific Heat of an Ideal Gas - Adiabatic processes for an ideal gas. Energy Quantization- Molar Specific Heat of Solids. Thermal Conduction - Home Insulation- Definition of thermal conductivity. Searle's Method for good conductors- Lee's Method for bad conductors - Spherical Shell Method- Cylindrical flow of heat. Heat Transfer by Convection- Newton's law of cooling - Heat Transfer by Radiation- Kirchhoff's Law of Heat Radiation. Practical experiments related to Part 1 and Part 2 during the whole semester**.**

Sound waves: What is ultrasound? .Ultrasound and energy. How echoes are formed. How to produce ultrasound. Images from echoes.

Geometrical Optics: The Nature of Light- The Ray Approximation in Geometric Optics. Reflection: the law of reflection - The Double-Reflected Light Ray. Measurements of the Speed of Light- Refraction. Index of Refraction - Snell’s law. Dispersion and Prisms- Rainbow- Measuring the refractive index by using the prism- Total Internal Reflection. Optical fibers. Fermat's Principle- Images Formed by Flat Mirrors- Images Formed by Spherical Mirrors and Refraction. Thin Lenses – The eye. The Simple Magnifier - The Compound Microscope. Practical experiments related to Part1 and Part2 during the whole semester.

Bot 101 General Botany 1 2 2

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

UN 101 Scientific English Language 2 - 2

This course is designed primarily to improve the student’s level in the English language and through the consolidation of the basic linguistic structure that preceded the study and training as well as through the use of language and writing daily speaking. In addition, and course aims to introduce the basic concepts and key technical terms in their field and through the texts for the view will include drills on the absorption and use of specialized vocabulary and structures. It also intends to give students an access to the literature of other countries by teaching them how to read the foreign language with facility and so add to their cultural and recreational resources. Course includes four main parts: reading, listening, speaking, writing and grammar.

UN 103 Human Rights and Anti-corruption 1 - 1

Basic concepts of human rights: human rights definition, importance of studying human rights, human rights and people rights. Origin and sources of human rights: origin and development. Sources: national source, international source. Categories of human rights and constrains.

Rights: civilian and political rights, social and economic rights, human rights in Islamic religion and in other religions. Constrains: constrains under normal conditions, constrains under critical conditions. Tactics for human rights protection: constitutional tactics, national legislative tactics, international legislative tactics. Applied aspects of human rights: in the medical fields, in the engineering fields, in the agricultural field, in scientific research field. Study cases of human rights at the national and international levels.

UN 105 Environmental Culture 1 - 1

هذا المقرر يشرح الأسس والقواعد العامة لمفهوم البيئة والذي بدورة يزيد الطالب بالمعارف والمفاهيم والمهارات اللازمة في مجال التأقلم مع الظروف البيئية المتباينة كما انه يكسب الطالب الأسس المعرفية و المهارية التي تلزم لإجراء برامج تربية للاقلمة مع الظروف البيئية الحيوية والغير حيوية. مما يؤدي إلى تنمية القدرة لدي الطالب علي اقتراح حلول عملية لحل مشاكل تربية وتحسين المحاصيل تحت ظروف الإجهادات البيئية. كما يهدف هذا المقرر إلي تنمية قدرات الطالب علي التفكير المنطقي والمنظم نحو وضع حلول للمشاكل التي يمكن أن تواجهه مربي عند التربية للاقلمة مع الظروف البيئية المتباينة.

UN 107 History and Philosophy of Sciences 1 - 1

يهتم مقرر تاريخ وفلسفة العلوم بدراسة طرق وأسس ومضامين العلم ومدي القدرة على الاعتماد على النظريات العلمية. والهدف النهائي للعلم بالإضافة العلاقة بين العلم والحقيقة وبطها علي مدار التاريخ والمقارنة بين الماضي والحاضر والمستقبل.

UN 109 Innovation and entrepreneurship 1 - 1

This is an interdisciplinary course combining skills from all areas of business. It focuses on the creation of new business ventures with an emphasis on personal rather than corporate goals. Special focus is placed on problems encountered by the entrepreneurs in the Middle East and development of solutions to those problems. The course also prepares students for entrepreneur or entrepreneur business careers in startups and small and large corporations. It offers and understanding of the stages of business formation and what activities are appropriate at each stage of business development to meet financial goals including preparations of feasibility studies for business start-ups.

UN 102 Rock-Forming Minerals and Petrology 2 2 3

Introduction, definition of mineral, physical properties of minerals, classification of minerals, origin and processes of mineral formation; rock definition, rock types and rock cycles, classification and descriptions of igneous rocks, sedimentary rocks and metamorphic rocks.
Laboratory work: Identification and descriptions of physical properties of minerals, minerals in hand specimens; identification, classification and descriptions of different types of rocks in hand specimens.

Mat 102 Differential Equations and Numerical Analysis 1 2 2

Differential Equations: Basic concepts definition of order, degree, solution of differential equation, formulation equation. Equation of the first order and first degree (separation variable, homogeneous, Exact equation, Integrator factor, Bernoulli equation). Equation of the first order

and first but not the degree, Equation solvable for (x,y), Lagrangian's, Clairaot's equation. Linear equations with constant coefficients, Definition, Auxiliary equation complementary function, Determination of particular integral (solution). System of differential equations. Application and modeling (Population Dynamics, Chemical reaction, Orthogonal trajectories, Economics infected diseases

Numerical Analysis: Basic properties of numerical methods for partial differential equations: consistency, convergence, stability, efficiency. Applying stability theory for multi-step and Runge-Kutta methods on initial value problems for ordinary differential equations. Fourier methods for analyzing stability, dissipation and dispersion of finite difference methods for linear hyperbolic and parabolic systems with periodic boundary conditions. Energy methods for analyzing stability and well-posedness for simple initial-boundary-value problems and corresponding finite difference methods. Analyzing properties of non-linear scalar partial differential equations and corresponding finite difference methods, such as hyperbolicity, parabolicity, Rankine-Hugoniot condition, conservation, total variation diminishing. Spectral methods, Finite Volume methods and fast Fourier transform (FFT).

Phy 102 Electricity and Basics of Electronics 2 2 3

This course covers basic theory and practical applications of electricity and electronics through a combination of lecture and practical sessions. This is to cover Network theorizing: Kirchhoff's laws, mesh and nodal Analysis, alternating voltage and current: currents and voltages, harmonics, sinusoidal alternating quantities, sinusoidal quantities, single and phase circuits. Semi-Conductor Materials: Intrinsic and Extrinsic Semi-Conductors; p-n junction, junction barrier, applications of p-n dioxides, rectifiers; Transistors: junction transistor, Transistors as amplifiers: electronic amplifiers, voltage regulation, transistors-operation and characteristics, will be presented. In addition, students will be trained to conduct virtual experiments.

Zoo 102 General Zoology 1 2 2

This course will enable students to gain knowledge and understanding to zoological principles relating to cells, organ systems, genetics, development, physiology and environmental relations. Laboratory exercises illustrating animal structure, physiology, embryology, and ecology.

Mat 104 Principles of Calculus 1 1 1

Functions, Definition of a Function, The Domain and Range of a Function, Algebraic of Functions, Composition of Functions, Implicit Relations and Inverse Functions, Classification of Functions, Limits and Continuity, Definition Of Limit, Limit Theorem, Continuous Functions, The Derivatives, Evaluation of the Derivatives Geometric Interpretation of the Derivatives, General Rule of the Derivatives, The Derivatives of Composite Functions Implicit Differentiation, Higher Derivative, Derivative of Inverse Trigonometric Functions , Derivative of Trigonometric Functions, Derivative of the Logarithmic Functions, Derivative of Exponential Functions,: Derivative of Hyperbolic Functions, Derivative of Inverse Hyperbolic Functions, Definite and indefinite integrals. The fundamental theorem of calculus and applications of definite integral. Area arc length, volumes and surfaces of revolutions Differentiation and integrations of exponential, logarithmic

trigonometric and transcendental functions. Techniques of integrations, trigonometric and transcendental functions. Techniques of integrations -1m proper integrates.

Chm 102 General Chemistry II **2 2 3**

Thermodynamics; reaction kinetics; Gaseous chemical equilibria; Acids and bases; Chemical equilibrium in acid and base solutions; Precipitation equilibria; Spontaneity of chemical reactions; electrochemistry; nuclear reactions; Properties of metal and metal complexes; Introduction to organic compounds and macromolecules.
Practical, 2 hrs: determination of some physical constants, and carry out some simple kinetic experiments.

UN 102 Information Technology **1 2 2**

This class includes broad coverage of technology concepts and trends underlying current and future developments in information technology, and fundamental principles for the effective use of computer-based information systems. There will be a special emphasis on networks and distributed computing, including the World Wide Web. Other topics include: hardware and operating systems, software development tools and processes, relational databases, security and cryptography, enterprise applications, and electronic commerce. Hands-on exposure to Web, database, and graphical user interface (GUI) tools.

UN 104 Transferable Skills **1 - 1**

Effective presentation skills, Microsoft power point, Communications skills, Communication dynamics, The importance of removing barrier, Effective E-mail, Charts as tools for communications.

UN 106 Quality Culture **1 - 1**

This course aims to introduce students to the concepts of quality. It will introduce the student to the basic concepts and terms of quality, introducing accreditation, its types and importance in higher education. In addition, during the study of this course the student will learn about accreditation standards and the mechanisms for achieving them, in addition to highlighting the students' role in the quality assurance system.

UN 108 Environmental Changes **1 - 1**

اكتساب الطالب المعلومات اللازمة عن المؤثرات البيئية في مصر والعالم – أهمية دراسة المشكلات البيئية – نماذج من المشكلات البيئية المعاصرة – زحف الجفاف وتناقص الأراضي الزراعية – زيادة الحرارة ونتائجها – أسباب المشكلات البيئية – مستقبلا المشكلات البيئية ودور الإنسان فيها.

UN 110 Professional Ethics 1 - 1

إكساب الطلاب المعلومات اللازمة عن مفهوم الأخلاق ومكانتها – مفهوم المهنة والعمل ومكانتها – مقومات أخلاقيات المهنة – أخلاقيات المهنة في الإسلام – أخلاقيات المهنة في أنظمة جمهورية مصر العربية – وسائل ترسيخ أخلاقيات المهنة وحلول عقبات تطبيقها.

ESS 201 Structural Geology and Natural Resources 2 2 3

Introduction to structural Geology, measurements of attitudes of strata and bedding planes, primary sedimentary structures, primary igneous structures, stress and Strain, types of unconformities, folds and their types, faults and their classification, joints and their types, types of foliation, types of lineation and linear structures, shear zones and shear sense indicators. Strike-slip tectonics, fold and thrust belts, structural framework of Egypt. Practical Course: Reading structural maps of dipping beds, folded beds, faulted beds, folded and faulted beds. Plotting of planes, lines, Pole to a plane, trend and plunge on stereographic Determining the orientation of the intersection of two planes and Measuring the angle between two planes using stereographic projection. Drawing Rose Diagrams for Azimuthal Data. Software in structural geology. Periodic field trips are needed to make measurements, interpretation, and visualization of structural elements. The structural factors controlling the distribution of the natural resources and hazards.

ESS 203 Surveying and Field Mapping 1 2 2

Survey: Introduction, traverse types, methods and techniques of surveying, Laboratory and field training applying traverses and preparation of topographic maps. Observing and collecting data and samples, using geological compass, clinometer, hand level, GPS and Total Station, plotting features on a base map, mapping features on aerial photographs, making a map from aerial photographs, measuring stratigraphic sections. Laboratory and field training include preparing and interpretation of maps and cross-sections. Field study of rocks and structures. Periodic field trips are needed to make student training in situ in the field, to activate the teamwork and student groups, to learn how to describe, to measure and to interpret in the field.
Field Mapping: Introduction, methods and techniques of surveying. Field equipments (Compass, Alidade, Total Station, GPS), the nature and construction of topographic and geologic maps, Preparation of topographic maps. Detailed mapping and sampling, Mapping and field geology of Igneous, Sedimentary and Metamorphic Rocks. Cross-sections. Preparing and writing a geologic report. Map projections, layout, and designs.
GPS: How GPS works, Pseudo-ranges, Orbits and Signals, Modern GPS receivers. Coordinate (latitude and longitude/ Universal Transverse Mercator-UTM) registration, and Map production with collected X, Y, and Z in-situ point data.
Laboratory and field training applying geologic traverses and preparation of topographic maps. Sampling and interpreting maps, applied field problems, Stereonets and faults, Cross- sections.

ESS 205 Electronic circuits 2 2 3

Circuits Theory: DC circuits, resistors, Kirchhoff's Laws, electrical instrumentation, operation

and appreciation of accuracy and errors. AC circuits and transient responses, use of an oscilloscope. Diodes and diode circuits. Ideal operational amplifier operation. **Digital electronics**: Combinational logic: the binary system, Boolean algebra and gates, logic maps, minimization. Applications: adders, subtractors, comparators, parity circuits, multiplexers, encoder/decoder circuits. Programmable logic implementations: ROM, PLA and PAL structures and implementation of logic circuits. Sequential logic: synchronous and asynchronous circuits, latches and flip-flops, registersand counters. State machines and design methods, internal state reduction, state assignment methods.

Practical: To introduce students to the key concepts required for the manufacture of electronic circuits including Printed Circuit Board (PCB) design, soldering, surface mount and packaging. To gain experience in making simple circuit boards. To gain an insight to important practical aspects of electronic components including parasitic elements, real world behaviour and connections. The unit will also complement the practical aspects of electronic circuit manufacture with theoretical background on electronic components, design tools, PCB manufacture techniques, and some design techniques. To introduce students to the design processes by taking a requirement through to a prototype device. To provide students with knowledge and awareness of the legal framework under which professional engineers operate, knowledge of innovation in products and in manufacturing processes applicable to the area of Electronic and Electrical Engineering.

Content: Principles of PCB manufacture, fundamentals of passive components, practical construction techniques including soldering and reflow for surface mount, principles of connectors, wires and tracks, basics of electronic systems packaging, design tools for simulating electronic circuits, simple operational amplifier circuits, placement of electronic components, power management for electronic circuits - with basics of power supplies and delivery on PCBs. Design Automation techniques for PCB design, Implementation of PCB design, Track analysis, layout optimization, advanced component selection, EMC considerations, packaging, thermal management.

ESS 207 Space Dynamics 1 2 2

The two-body problem - Barker's equation and Kepler's equation-The initial-value problem-Euler angles-The orbital boundary-value problem (BVP)-Optimum orbital transfer-Analytical and geometric properties of the BVP-Lambert's theorem and the Lagrange time equation-Transformation of the BVP. Hyperbolic orbits -Patched conics and planetary flybys - Gauss's method for the time-constrained BVP-Hypergeometric functions and continued fractions-The fundamental ellipse of the BVP-Non-singular "Gauss-like" method for the BVP-The Battin-Vaughan algorithm for the BVP- Preliminary orbit determination using Taylor series- The state transition matrix- Powered flight guidance- Space navigation: the position fix - The covariance, information, and estimator matrices- Estimation of position and velocity in space navigation-Basic elements of the three-body problem- The restricted problem of three bodies- The Clohessy-Wiltshire equations of relative motion- Variation of parameters.

ESS 209 Space Plasma Physics 1 2 2

Definition of plasma, Plasma Parameters, Geophysical plasmas: Solar wind, Magnetosphere, Ionosphere. Plasma models: Single particle motion and drifts, Fluid model, kinetic model.

Particle trapping, radiation belt, magnetic storms. Ionospheric conductivity and currents, Convections and sub-storms, Plasma magnetohydrodynamics: Multi-Fluid theory and equation of states. Flows and discontinuities: Plasma waves and instabilities.
Practical: Analytical and computational techniques of space and atmospheric phenomena.

ESS 211 Space Chemistry 1 2 2

Space chemistry: spans the disciplines of chemistry, planetary science, chemical biology, physics, astronomy, and computational science, science of the solar system, space travel, and outer space. Composition and reactions of atoms, molecules and ions in space. Gathering of spectroscopic information from ground-, air- and space-based observatories, lab-based studies that replicate the harsh environments of space and modeling. Astrochemists perform experimental and computational laboratory studies (including quantum chemical calculations) to generate data for interpreting or explaining astronomical observations. Sapce Objects and the Solar System Chemistry-Solar Power-Atmodpheric Chemistry-Space Analytical Chemistry- Composition of the solar system-Space Probes – Solar System Atmosphere-Mass Spectroscopy in Solar System-Lunar and Planetary Surface Analysis- Recovered Extra-terrestrial Materials**. Atmospheric Chemistry**: Introduction; atmospheric composition- Chemical kinetics: Reaction rates and mechanisms. Photochemistry and spectroscopy -Temperature, pressure, radiance. **Stratospheric chemistry**: OX, HOX, NOX,ClOX, BrOX- Stratospheric geoengineering. **Tropospheric chemistry**: NOX and HOX , CO and CH4- Atmospheric organic chemistry - Reactive (oxidized) nitrogen chemistry-Ozone pollution -Atmospheric aqueous chemistry - Acid formation in droplets -**Atmospheric aerosol**: Size, physics, Climate effects -Aerosol inorganic and organic chemistry-Atmospheric chemistry and climate.

ESS 213 Disaster, Vulnerability and Resilience 1 2 2

Environmental Economics: Development of environmental thinking; environment and economy relationship; The Sustainable development ; Environmental Policy - Environmental Action Program –and the Cardiff process; Externalities, environmental damage and environmental risk ; environmental assessment ; Cost-benefit analysis ; The role of market- based environmental policy instruments, taxes; The regulation of environmental policy and the operation of the company; Energy and climate policy ; Water Quality Protection; Efforts to reduce waste and problems- and economic impacts. **Quality Management:** Perform professional tasks of quality management, principles, concept and terminology, history, standardization (ISO 9000 family. Concept of quality management by ISO 9001) – Process approach in quality management- ISO 9001 requirement (Management system - Product and production)- Auditing quality management system (ISO 19011:2011 standard), quality-related corporate activities, requirements of the ISO 9001 standard and specialities of project. Enhancing quality management, integrated management systems-Quality tools - Quality Awards- Tools and methods of self-evaluation-Project quality planning and management (risk analysis, monitoring and performance evaluation).

ESS 215 Environmental Economics and Quality Management 1 2 2

This course aims to develop and deepen your economic thinking regarding local and global environmental problems, such as air pollution and climate change, and expand your knowledge of economic solutions to such problems. Discuss the reasons behind why environmental problems exist, why unregulated markets sometimes fail in this context, and potential economic solutions to these problems, which include regulations, taxes, subsidies, and pollution permit trading schemes. Also, cover methods for determining the benefits and costs of environmental preservation. The course will equip students with the necessary knowledge to take part in the discussion about environmental policy from an economic perspective.

ESS 217 Ecology, Pollution, and Nature Conservation 1 2 2

Objects, factors and definition of ecology. Ecosystem Components (energy flow, food chain, ecological pyramids, bio-geochemical cycles, Temporal Variations (at population and community Level).Biotic and abiotic (climate, topography, soil) ecological factors and their effect on the ecosystems. Elements of the ecosystem and its greater units. Characteristics and loadibility of ecosystems. Material cycles and food chain, energy flow. The circuit of biogeochemical cycles (C, nitrogen, water, phosphor, sulphur, biogenic elements).Anthropogenic effects and their roles. The relationship system of ecology and nature protection (nature conversation).Introduction to pollution, particles, gases, ozone, layer heavy metals, oil, radiations, noise and food pollution, pollutant side effects on animals, relationship between pollutant and ecological factors, method of pollution control. Methods for measurement of water air and soil pollutants. Determining the internationally accepted pollution percentages, some methods adopted for measurement of pollutants in Egypt. Environmental flow and fate of contaminants. Ecological risk assessment. Connection of nature protection and conversation to environmental protection, complementing each other. Elements and tasks of nature protection. Emphasizing mind shaping, presentation and research activities among the practice-centered ecological-nature protection tasks. The organizations of the Egyptian and international nature protection. International nature protection values in Egypt. Nature protection: International law -Egyptian laws-Legal and economics connections.

ESS 202 Industrial Geology and Environment 1 2 2

Mineralogical-petrological aspects of raw materials; methods for their investigation; processes and products in the cement, water treatment and purifications, refractories and ceramics industries; recent application of nano-clay particles in drilling. Overview of environmental mineralogy, including the location of potentially toxic elements in mineral phases. **Minerals and Rocks in Industry** (Metals as Aluminum, Iron, Copper, Gold, Manganese, Lead, Tungsten, Chromium, Nickel, Cobalt, Silver, Platinum, Tin. Typical examples of industrial minerals and rocks. Talc, phosphate, coal, sulphur, gypsum, barite, silica, bentonite, kaolin, diatomite, uranium, graphite, gravel, sands, clays, limestones. Applications for industrial minerals (Electronics, paints, ceramics, construction, paper, detergents, glass, plastics and filtration).
Rock Properties Relevant to Industrial Uses (Rock Strength, Abrasion Resistance, and Impact Resistance, Porosity, Density)- (Absorption, Adsorption and Permeability, chemical stability, physical stability, thermal stability)- Unconsolidated Material Properties-**Utilization of Rocks**

(Dimensioned and cleaved blocks, Large Blocks (riprap) for Erosion Control (shorelines, jetties, groins, riverbanks, and embankments), Crushed Stone in Concrete and Bituminous Mix- (Source for Cement and Lime, Base Course, and Drainage Bed, Embankments and Fills, Rockfill in dams) -**Utilization of Unconsolidated Materials** (Crushed Gravel and Sand in Concrete and Bituminous Mixture, Mixed Soils and Clay as Fill (for dams and embankments)-**Utilization of Clay Raw Material- Raw materials** for ceramics and glass, refractories, and fertilizers. **Representation of environment-related aspects of minerals extraction**: air, flora / fauna, soil, landscape, water, mining waste. Including measures to the harmonization and case examples.

ESS 204 Geographic Information Systems 2 2 3

The basic knowledge - overview on the most commonly used GIS software and application possibilities. GIS basics, vector and raster format, digital mapping. Vector based data format, setup of GIS databases. Setup and characteristics of geometric data model. Setup and characteristics of semantic data model and metadata. Tools and methods of digitization. Set up of Point, polyline, and polygon shapefile. Setup of geodatabase. Possibilities of visualization, and thematic mapping. Data analysis, basics of spatial analysis. Digital mapping. Spatial data types, Types of geographic phenomena, Computer representations of geographic information, Organizing and managing spatial data, Spatial referencing and positioning, Map projections, GIS data sources, Data management and processing systems, Data entry and preparation, Raster based surface analysis, Network analysis, Geospatial analysis, advances of GIS softwares, Geomorphological and geological applications of GIS, Terrain and hydrological analyses, lineaments and structural elements automatic extraction.

Practical Course: include GIS different software, introduction to ArcGIS package, How to enter data (direct and indirect methods), Geo-referencing, Geocoding and registration, Map projections and transformation, Editing in ArcMap, Introduction on Arc Catalog and Arc Toolbox, geo-statistical, surface analysis, network analyst, how to use open source data, how to download free GIS data, building a geodatabase, application on geological and structural examples, Periodic field trips are needed to draw base maps, collecting ground control points and validation. Creation of a pilot project.

ESS 206 Environmental Geology 2 2 3

Philosophy and Fundamental Concepts, Ecology and Geology, Introduction to Natural Hazards, Water Resources, Water Pollution, Water Quality, Mineral Resources and the Environment, Energy Resources, Soils and Environment, Waste as a Resource, Waste Management, Global Climate Change, Geology, Society, and the Future, Field visits are needed to some hazardous and polluted areas. Renewable resources (soil, forests, water, wildlife), and nonrenewable resources (oil, metals and minerals). Renewable Energy sources (Solar, Wind, Biomass of Algae and Waste, Wave Energy, geothermal energy, Hydropower). Concepts dealing with natural (e.g., ecology) and social (e.g., economics, politics, and planning) processes. Ecological Restoration, Natural Resource Conservation- Community Values- Economics and Policy.

Bot 202 Microbial Toxins and Bioremediation of Polluted Water 1 2 2

Microbial toxins: This part will give a spot on the severity of microbial toxins produced in contaminated food, textile, and paper industry; and their characterization, detection methods,

and expected hazards. Bioremediation is the use of plants and microorganisms to combat pollution. **Water pollution**: Different types of harmful substances (pollutants) - Nutrients and eutrophication. Oil pollution in the marine environment - Biological pollutants - Plastics as pollutants - Metals as pollutants-Pollution sources: wastewater management. **Introduction of bioremediation** - Process of bioremediation - Bioremediation of wastewater - Bioremediation of contaminated soil - Treatment of common contaminants. The course will focus on addressing the traditional methods of bioremediation, investigating the interactions between metals and microorganisms, including discussions of metal toxicity, biosorption, biosenses and metal leaching/mining. The course will highlight the role of biotechnology of micro-algae and the bioremediation of polluted groundwater systems. The course will also deal with the role of genetic engineering of plants and microbes in developing new approached for bioremediation.

Zoo 202 Industrial Ecology 1 2 2

Introduction- Views on Industrial Ecology-What is Industrial Ecology?-Environmental Paradigm-Sustainability: Concepts and Metrics-Resource Economics- LCA: Method Basics: Life-cycle Assessment - Overview Using the Software- Scope- Inventory- Inventory Allocation- Recycling-Materials Flow Analysis-Environmental Evaluation and Advanced Methods:- Impact Assessment-EcoPoints-Research-Aggregate Materials Flows- National Materials Flows- Environmental Policy Strategies: Environmental Policy Making.

Phy 202 Environmental Physics 1 2 2

Forces in nature, Elementary particles. Radiation Units and quantities, stopping power, Cavity theory. Hot Particles Problem: formation, release and health hazard. Radiation Dosimeters. **Nuclear radiation detectors**. Different types of energy resources. Earth Climate and Climate change. Radiation Safety Sound and noise and Heat and radiation. Environmental Problems: Air pollution, Water pollution. Global warming: causes of global warming, greenhouse effect. Sustainability, Principles of sustainability, population growth and environmental impact, environmentally sustainable societies, sustainability of natural resources. **Renewable and non-renewable energy**, major sources of energy, nuclear power, natural gas, oil, coal, biomass, hydropower, solar energy, wind, geothermal energy, advantages and disadvantages of various sources of energy, energy efficiency and energy waste. **Heat and mass transfer**: conduction, convection, radiation, evaporation, water vapor, airborne particles, sources of atmospheric particles, smog, volatile organic compounds, bioaerosols. **Atmosphere and radiation** (structure and composition of the atmosphere, the electromagnetic spectrum, ionizing radiation, UV radiation, terrestrial radiation, Earth as a blackbody, greenhouse effect, greenhouse gasses, attenuation of radiation). **Temperature**: atmospheric temperature, soil temperature, temperature of water reservoirs, effects of temperature on living organisms, survival in cold climates, survival in hot climates. **Water resources and water pollution**: surface water, streams, lakes, oceans, groundwater, sustainable use of water, water pollution, point and non- point sources of water pollution, major water pollution problems, groundwater pollution. **Air pollution**: outdoor air pollution, indoor air pollution, major sources of air pollution, harmful chemicals, health effects of air pollution.

Chm 202 Environmental Nanotechnology 1 2 2

Nanotechnology is regarded world-wide as one of the key technologies of the 21st Century. Nanotechnological products and processes hold an enormous economic potential for the markets of the future. The production of ever smaller, faster and more efficient products with acceptable price-to-performance ratio has become for many industrial branches an increasingly important success factor in the international competition. The course introduces the several Nanotechnology applications commonly used to improve the environment including cleaning up existing pollution, improving manufacturing methods to reduce the generation of new pollution, and making alternative energy sources more cost effective. It is very important to understand the potential risks of the nanoscale to human health and to weight the benefits and risks of using such materials. Beside active researches of nanomaterials application in the field of environmental protection, there is no sufficiently reliable information concerning potential environmental risks and harmful effects associated with advanced nanotechnology application. The aim of the course is to review the influence of different environmental, nanotechnology-based treatments of polluted air, contaminated wastewater, groundwater, surface water and soil. Ecotoxicology and potential risks connected with nanotechnology application are also discussed.

Mat 202 Environmental Statistics 1 2 2

Environmental data types: Descriptive statistics- Measures of central of tendency – Measures of spread – frequency distribution and graphical representation- cumulative frequency distributions – Descriptive statistics for grouped data – Coding of the data- Elements of univariate and bivariate probability distributions - Definition and elementary proprieties of characteristic functions- moment generating function- probability generating function – basic concepts of inferential statistics – Analysis of variance. Use of statistics for quality control; Use of statistics for productivity improvement; Control chart calculation; Graphing, process control and specification; Sampling plans and reliability; Computer use for performing calculations and graphing.

ESS 208 Energy and Solar Energy Physics 1 2 2

Energy: The energy problem- energy transformation. Power and energy- solar energy- balance equation. Global warming- greenhouse gases- electrical energy- nuclear fission- nuclear fusion. Breeder reactor – nuclear fusion reactors- renewable energy. Solar energy- advantages of solar energy – reappraisal of solar energy- characteristics of Sun. The electromagnetic energy spectrum – spectral distribution of solar radiation. Solar collectors- flat plate collector – thermal losses and energy balance equation. Ways of decreasing losses in the solar collector- concentrating (focusing) collectors – the advantages of concentrators systems over flat plate type collectors. Other thermal applications of solar energy. Storage of solar energy. Photovoltaic principles - photovoltaic power generation. Wind energy- wind turbine setting. The types of wind turbines- advantages and disadvantages of wind turbines. Hydropower- biomass- geothermal energy. **Solar Energy Physics**: Introduction : The sun as a source of clean and renewable energy

source, Basic principles of heat transfer, Dimensionless numbers and their physical meanings, Nusselt Number , Reynolds Number, Prandtl Number , Rayleigh number and Fourier number, Measurements of solar radiation intensity, Solar collectors, Efficiency calculations of solar collectors, Factors effecting the efficiency of solar collectors, Some other solar energy conversion thermal applications (solar cooking , solar ponds and solar distillers, Solar energy storage.

ESS 210 Energy Chemistry 1 2 2

Potential future energy systems, covering resources, extraction, conversion, and end-use technologies, with emphasis on meeting regional and global energy needs in the 21st century in a sustainable manner. Overview of energy use and related issues- Major energy options; issues of supply and demand- Overview of units and dimensions for global energy flows; energy conversions (chemical to thermal, chemical to electric, etc.); and economic considerations- Energy transfer and conversion methods- Energy sources and uses- Survey of conversion processes - Conversion efficiency and rate considerations- Sustainability, energy, and clean technologies. Energy conversion, transmission, and storage:-Matching supply and demand to minimize losses- Energy storage and transmission issues- Energy chains and connected efficiencies- Storage modes- Ragone plot. Energy supply, demand, and storage planning:- Matching energy density of supply and demand- Temporal and geographical distributions- Energy transmission and distribution (pipelines, tankers, rail, power lines)- Role of energy storage; intermittency; influences of pricing during demand peaks and valleys. Nuclear energy: Basics and current status-Fusion as a future energy source. Fossil energy: Fuel conversion, power cycles, combined cycles- Alternative transportation fuels- Emission performance improvements- - Connections to new engine technology- Cleaner fuel. Biomass: Resource and uses-Resource types and requirements- Technical and environmental issues- Utilization options- Economic projections-Producing liquid fuels. Lifecycle analysis of biomass conversion: Land use issues (ecological stress, competition with food, water use, topsoil erosion, occupational hazards)- Net energy balance and energy integration opportunities. Electrochemical Approaches to Electrical Energy Storage- Electrochemical energy conversions:- Fuel Cells- Batteries. Overview of renewable energy techniques, and associated issues (artificial photosynthesis, solar cells, biomass and other biofuels, biological hydrogen production, fuel cells, batteries, other renewable energy sources of energy (e.g. hydroelectricity, wind power, tidal power, Biogas production and optimization from co- digestion of water hyacinth, municipal solid waste, and cow dung ..etc.), sustainable development).

ESS 212 Environmental Microbiology 1 2 2

Environmental microbiology studies how microorganisms interact with the **environment** and each other. They may study the use of microbes to clean up areas contaminated by heavy metals or study how microbes could aid crop growth **environmental** microbes can affect so many aspects of life, and are easily transported between environments, the field of **environmental microbiology** interfaces with a number of different subspecialties, including soil, aquatic, and aero-microbiology, as well as bioremediation, water quality, occupational health. Environmental microbiology provides a basic understanding of environmental microbiology (terrestrial, aquatic, aero and extreme) including; the functional diversity of microorganisms in

the environment in relation to human welfare and ecosystem health, microbial interactions with pollutants in the environment and the fate of microbial pathogens in the environment. Topics covered include microbial environments, detection of their activities in the environment, microbial biogeochemistry (Microbial metabolic activity lies at the heart of the myriad of interactions between the environment and microorganisms that shape the dynamics of ecosystems.), bioremediation, and water quality. General objectives can include the basic principles of environment microbiology and be able to apply these principles to understanding and solving problems in water quality and bioremediation. 2) To become familiar with current research in environmental microbiology. 3) To learn how to read and contextualize current research articles.

Lectures: Introduction to environmental microbiology- Scope: different types of microbes and their habitat-:prokaryotic diversity from Eco physiology and habitat- microbial cultivation(sampling, detection, identification, enumeration, biomass, activity)- microbial consortia and communities (Interactions within and between populations, interactions with plants and animals, structure and dynamic of communities, abiotic factors)- molecular approach for measuring density, diversity, and phylogeny – **applications.** Microbial indicators of aquatic environment and water quality (including: detection of viruses, pathogenic bacteria and others pathogenic fungi in water, sewage, sludge,).control of microorganisms in water sources. Soil microbial communities including soil and plant associated microbial communities, and their benefits. Metabolic diversity under extreme environment and oil field microbiology.

Labs: sterilization and disinfection - isolation of different microorganisms from different environmental sources - subculture, purification and preservation of isolated microorganisms - identification of isolated microorganisms - methods of soil microbial community analysis - detection of microorganisms in different water communities - detection of viruses in different environmental communities - isolation of different microorganisms from different oil fields - detection and isolation of total and fecal coliform bacteria and E.coli - microbial detection by molecular methods - DNA extraction and gel electrophoresis demonstration - bioinformatics, sequencing, BLAST and phylogenetic trees of 16S rRNA genes in isolates.

ESS 214 Space Atmosphere and Ionospheric physics 1 2 2

Structure, composition, and dynamics of Planetary Atmosphere. **Basic concepts of Earth's Atmosphere**: Basic structure- Hydrostatic Equilibrium- Scale Height- Geopotential Height- Thermodynamic considerations- Elementary chemical kinetics- Chemistry of Atmosphere (lower, middle, and upper) -Thermal balance in the thermosphere. **Solar Radiation**: attenuation-radiative transfer- Thermal effects- Photochemical effects. **Aerosol, Greenhouse Gases and Radiation Budget**: Aerosols and Radiation Budget-Long-term Climate Impact- Black Carbon and Dust-Greenhouse Gases-Carbon monoxide-Carbon Dioxide- Oxides of Nitrogen – Methane – Atmospherice Ozone- Ozone Chemistry- Ozone Hole. Atmosphere Dynamics: Equation of Motion of Neutral Atmosphere- Thermal Wind Equation- Elements of Planetary Waves- Internal Gravity Waves and Atmospheric Tides. **Atmosphere of other planets and Satellites**: Inner and Outer Planets- Characteristics of Atmosphere Structure and Composition of Jupiter, Mars, Venus, Saturn and their important satellites. **Ionospheric physics: Structure and variability of the Ionosphere**: Chapman's Theory of photo- ionization- Continuity equation and photo-chemical equilibrium- Loss processes of Chapman layers – Diffusion between ionosphere and protonosphere – Morphology – diurnal and seasonal, and solar cycle variations. **Ionosphere Plasma Dynamics**: Magneto plasma properties- Gyro frequency- Plasma frequency-Debye length

and Frozen in field- Basic fluid equation-Steady state plasma motion due to applied forces- Electrical conductivity of the ionosphere- Generation of electric field and its mapping- Ionospheric dynamo- irregularities. **Electromagnetic Wave Propagation in Ionosphere**: Theory of Wave propagation- Properties of plane waves- Group propagation- Ray and group velocities in ionized media- Propagation in isotropic plasma and refractive index- Concepts of critical frequency and virtual heights- Magnetoionic theory-Ordinary and extraordinary waves- Reflection conditions- Deviative and nondeviative absorption formulas- Oblique incidence propagation-MUF and skip distance. **Solar and Magnetosphere physics**: Origin of Magnetic Field of Earth - Dipole Description of Geomagnetic Field – Load Elements and determination- Secular and Diurnal Variation of Geomagnetic Field – Determination of Geomagnetic Coordinates of Station- Magnetic Field of other Planets. **Elements of Solar Physics**: Sun and its Atmosphere – Solar Magnetic Field- Sunspots and Solar Cycles – Solar Flares, Coronal Mass Ejections (CME) and Solar Wind. **Magnetosphere of Earth**: Effects of Solar Wind on Planetary Fields – Formation of Geomagnetic Cavity- Magnetopause – Magnetosheath and Bow Shock – Polar Cusp and magnetotail – Effect of Interplanetary Magnetic Field on Magnetosphere – Plasmaspher and Van Allen Radiation Belts- Magnetotail Dynamics – Substorms, Aurorae and Storms – Magnetosphere of other Planets. **Space Weather and its Effects**: Geomagnetic Stroms- Sub- storms and Current Systems – Coronal Mass Ejections- Effect of Magnetic Disturbance on Ionosphere and Thermosphere System - Effects on Space and Ground-based Systems.

ESS 216 Introduction to Astronomy 1 2 2

This course introduces the field of Astronomy, including the current investigations for life on other planets. Course topics include modern methods of observational astronomy, an overview of the scientific method, age and origin of the Solar System, descriptions of the planets and discussions of the possibility of life on other planets. Introduction -Discussion of the Field of Astronomy, Units and Measurements, Overview of Objectives. The Big Bang, Elements and Radiation -The Big Bang, Formation of Elements, Different Kinds of Radiation. Discovery of the Galaxy and the Vastness of Space -Discovery of the Galaxies, Expansion of the Universe. Age and Origin of the Solar System -Discovery of the Solar System, Age of the Solar System, Clues from Meteorites, Clues from Comets. Methods of Observational Astronomy - Introduction to Telescopes, Spectroscopy and Stars, Measuring Distances to Stars. The Life- Giving Sun -The Electromagnetic Spectrum, The Sun's Structure and Nuclear Fusion. Planets of the Solar System -The Jovian Planets, The Terrestrial Planets. The Earth in Space - Introduction to Earth, Comparing Earth to other Terrestrial Planets. The Search for Extrasolar Planets -The First Discoveries of Extrasolar Planets, Are there Planets like Earth, Methods for finding Extrasolar Planets. Modern Views of Mars -Life on Mars. Atmosphere and Geology of Mars. Universe Endgame -Predictions for the Future of our Universe.

ESS 301 Environmental Remote Sensing 2 2 3

Remote Sensing History, Electromagnetic spectrum, Sensors, Types of RS resolutions (radiometric, spectral, and spatial). Data correction and enhancement techniques. Image classifications, information extraction, environmental indices (NDVI, soil, land surface temperature and urban heat island detection,…etc). Data validation using in-situ field measurements, and error analysis.

Practical: ENVI basics, data subset, staking, color composites, band rationing, indices, classification algorithms, model building and expert systems, and deep/machine learning techniques in remote sensing. Applications in geologic, agricultural, water, renewable energy resources mapping. Drone remote Sensing and environmental applications.

ESS 303 Water Quality Protection and Management 1 2 2

Water Quality Protection: Water as an environmental agent. General tasks and objectives. Water chemistry. Qualification of water samples. Transport processes in water. Vulnerability methods concerning groundwater resources. Remediation methods in case of different contaminations. Water quality models. Current quality status of national water resources. Water quality balance calculations. Natural water purification methods. Practical work: self-made solutions of simple case-study problems. Hydrogeological cycle and water balance, Surface Water Resources, Flooding and Flash Flood water and risk management, Occurrence of groundwater, Types of aquifers, Darcy's law, Aquifer hydrologic properties, Aquifer test. Groundwater flow system and flow net, Water well design. Water Pollution and sources, Modeling of Environmental Processes and Technologies, Remediation Techniques, Desalination.

ESS 305 Python Programming 1 2 2

Introduction to Python Language- Language Syntax - Keywords and Identifiers - Comments - Variables - Data Types - Operators - Control Flow – Decision Making - Control Flow – Looping– Branching– Branching Statements - Numbers - Lists - Tuples - Sets - Sequences, Iteration and String Formatting - Dictionaries - Arrays - user defined Functions - Built-in Functions - Exceptions, Testing- Iterators, Iterables, and Generators- Decorators, Context Managers, Regular Expressions, and Wrap Up. System Programming, Classes and Objects, Persistence and Databases, Network Programming, Web Programming, Deep Learning with Python. Building of GIS models and remote sensing data analysis in python.

ESS 307 Water Treatment Technology 1 2 2

Water quality and impurities- Major quality parameters (pH, redox potential-CO2 content, acidity and alkalinity, Hardness, dissolved oxygen-Nitrogen content, sulphide, phosphorous, metals, solids, temperature- Water sampling-Municipal water treatment and treatment of water for industrial use-Sewage treatment (primary and secondary stages-removal of solids, dissolved phosphates, calcium-removal of iron and manganese, organics, inorganics - removal of nitrogen, water disinfection, sludge treatment-Chemical analysis of water (gravimetric, volumetric, spectrophotometric - electrochemical methods, chromatography, mass spectrometry, automated analyses.

ESS 309 Environmental Management and Impact Assessment 1 2 2

Regulation and regulatory framework of the environmental and hazardous - Waste law; Definitions; policy guidance vs. regulations; role of the states, municipalities and the EEAA, compliance issues; case studies. Environmental management system (EMS) understanding ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; environmental planning; implementation and operation; checking and corrective action; environmental auditing and the environmental management system in Egypt. Objective and

needs of the environmental impact assessment (EIA); activities involved in EIA, characteristics of impacts); EIA methods, checklists, overlay mapping, networks, matrices; estimates of resources demand for EIA studies; Recommended methodologies for rapid EIA; case studies; guidelines for EIA in developing countries; environmental impact statement; land evaluation and suitability analysis. Current ecological and environmental problems that may include the threats to natural resources, energy problem, food problem, desertification, grazing problem in dessert regions, pollution and global climate change. Sustainable development, soil quality, waste management, and water shortage problem in the Middle East, management of water resources in arid lands, human impact and ecosystem restoration.

ESS 311 Solving Complex Problems 1 2 2

The study of complementary case histories and the development of creative solution strategies. The course includes training in Web site development, effective written and oral communication, and team building. Solving the large and complex problems related to the natural resources and hazards of the earth environment that are logistically complex, incredibly expensive, and require unprecedented international cooperation based on advanced techniques such as Internet of things and Artificial Intelligence...etc. Examples are sequester enough carbon in geologically stable reservoirs to stop the steady increase of atmospheric CO2 and to stabilize it, Trans-boundary water conflicts, Waste Management, in addition to student suggestions. Managing our planet's atmosphere, water resources, Energy resources, sources of pollution and control (Physical, chemical, and biological).Methods to sequester CO2 include storing in porous rock formations, the deep ocean, forests and soils, and precipitating carbonate minerals to name a few. The student mission is to propose an integrated global solution to the rapid rise in natural resources depletion and mitigation of natural hazards that will require a major interdisciplinary, international, innovative effort unlike anything ever attempted in human history. The course offers freshmen a completely different way to learn. In contrast to the core classes that rely on lectures and problem sets, the course attempts to teach students how to think about solving complex problems. Students are independent, largely self-directed, and interactive. They learn how to build teams and develop solutions that require teamwork between scientists and engineers.

ESS 313 Industrial Biochemistry 1 2 2

Introduction- Bioproducts - Production of penicillin- Extraction of caffeine- Production of ethanol and acetic acid- Production of citric acid- Immobilized enzyme-Production of enzyme by genetic engineering- Production and extraction of biofuels from plants. Practical estimation and determination of Glucose, Cane-Sugar, Acetone, Formaldehyde, Glycine, Amino Acids, Fat and Oil, and Ascorbic Acid. Laboratory analyses of Carbohydrates, Amino Acids, Protein, Lipids, Urea, Urine, Blood, and Unknown Solutions.

ESS 315 Medicinal Plants and Bio-products Technology 1 2 2

Medicinal Plants: Introduction, Classification, Sources, geographic distribution in Egypt, Collection and drying, processing and storage. The advantages and problems of medicinal plants agriculture. The active ingredient and the separation / purification methods.

Medicinal/Aromatic plants production. Some drugs or medicinal products and methods of their uses. Medicinal plants in Egypt and their products in pharmaceuticals. Herbal Therapeutics. Plants in Egyptian Pharmacopoeia. Labs: Preparation of plant herbarium-Families includes medicinal plants-Compositae- Leguminosae – Gramineae - Demonstration of specimens of medicinal plants- Industry of aromatic oils- Methods of Separation of active substance- Separation of active substance of Camellia sinensis- Separation of active substance of Ocimumbasilicum- Separation of active substance of Mentha spicata.

Bio-Products Technology: Agbiotechnology, bioprospecting, bioremediation, biotherapeutics, crop protection, diagnostics, functional foods, genomics, industrial feedstocks, marine biotechnology, microbial inoculants, pharmacognosy, plant molecular biology and renewable feedstocks. Advances in molecular biology give new opportunities to draw judiciously upon the worlds rich genetic and natural product resources and to use the associated know-how to develop novel practices and products that can be generally more efficient, more cost-competitive, better targeted, cleaner, and more sustainable say the BioMarket organizers.

ESS 317 Biodiversity and Natural Reserves 1 2 2

This course will cover the ecological principals dealing with the conservation theory and its application, conservation for sustainable development. The main topics of the world include species declination and biodiversity, importance of biodiversity, in situ and ex-situ conservation types, sustainable development and conservation in dry and wetland regions. Special attention will be given to the concepts and measurements of biodiversity (diversity, naturalness, rarity other characters), conservation at individual and population level and ecosystem, human impact on diversity, construction and development of natural reserved areas in Egypt with a description for these protected areas. The concept of biodiversity as an ordered progression in biological complexity, from genes to ecosystems, is reviewed. Student will gain an understanding of current threats to biodiversity; tools and strategies to prevent declines and extinctions of species in the wild and maintain functioning ecosystems; impacts of global climate change; restoration of species and ecological processes to degraded landscapes. The course will include field trips to some of the natural reserves.

ESS 319 Environmental and Industrial Chemistry 1 2 2

Environmental: This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given. Also to introduce the chemical techniques on environmental pollution treatment, waste recycling and treatment, as well as on pollution control. Theory of mass transfer, laws, relationships, diffusion equations. Principles and fundamentals of design of chemical techniques and reactors. Solid-liquid extraction as a technique for the treatment of solid wastes, methods and equipment. Treatment of contaminated fluids: adsorption, precipitation (cementation), ion exchange, liquid-liquid separation. Thermal techniques like rectification, thermal oxidation, pyrolysis and gasification. Industrial: Introduction, principles of industrial inorganic/organic chemistry. Selected topics as Nitrogen, phosphorous, sulfur and their compounds, chlorine oxygen compounds: manufacture

and applications, petroleum and petrochemicals, raw materials, dyes, fats, oil and detergents industry, pigments and their application.

ESS 302 Geospatial computing of Big Data 1 2 2

This course teaches students to use cloud and server GIS resources to solve problems for which geospatial data is an integral element. It will focus on the critical thinking and technical skills needed to evaluate and develop successful cloud GIS projects. It draws upon engineering, computer science, math, and spatial thinking to solve data-intensive, large-scale, and location-based problems. This class will cover the concepts, theory, methods, techniques, and programming for spatial computing. This includes the latest research in a variety of topics that are central to spatial computing, including geospatial mashups, cyberGIS and cloud GIS, spatial data Mining, essential python geospatial libraries, volunteered geographic information (VGI) and big data, geocoding and the geospatial semantic web. Students will also gain a deep understanding and hands-on software experience, including Virtual Machines, ArcGIS Desktop, Google Map and Google Earth, SPARQL, and CyberGIS applications. As an example of a typical lab in class, students will install and use an advanced Python Geospatial library - GeoPandas and all its dependencies. They will download land use and land cover data for large urban zones from the Urban Atlas website. They will use GeoPandas to do spatial operations based on geometric types, such as re-projecting and making choropleth maps of density of the urban fabric, querying the centroid and distance between an airport and a neighborhood, creating a buffer around green urban areas, and selecting cities that all connect to the same railway. With GeoPandas, students can easily do operations for Big Spatial Data in Python that would otherwise be too time-consuming for ArcGIS Desktop or require a spatial database such as PostGIS. In this way, students will learn how to collect, analyze, and visualize large-scale spatial datasets while avoiding common pitfalls and building better data-intensive applications and location-aware technologies. Students will also gain a deep understanding about related fundamental research questions in individual disciplines and cross-cutting research questions requiring novel, multi-disciplinary solutions. Students will evaluate and implement systems using three cloud service models (infrastructure services, platform services, and software services). The course will contain both worked exercises and critical reading and writing for infrastructure, platform, and software service models. Cloud computing objectives, based on the NIST definition of cloud computing:-Cloud computing technologies (Network access-On- demand self-service-Resource pooling-Elasticity-Measured Service)- Service Models of Cloud computing technologies (Cloud Software as a Service (SaaS)-Cloud Platform as a Service (PaaS)-Cloud Infrastructure as a Service (IaaS))- Cloud GIS Skills: Scalable web mapping using the Esri ArcGIS Server platform and open source GIS - Scalable geo-processing using open source GIS - Google Fusion Tables - ArcGIS Online.

ESS 304 Space Environment and Technology 1 2 2

Orbit perturbations- Gravity field- Atmosphere- The thermosphere and exosphere - Foreign objects- Radiation- Magnetic field- **Space and near-Earth**: environment Effects on materials - Spacecraft charging -**Human Spaceflight**: Discovery of post-flight health issues in astronauts.

Effect of spaceflight on human physiology and countermeasures - **Modeling**

Space Debris: Natural and artificial space debris Hazards, space surveillance and tracking, Modeling Protection Mitigation, space traffic management, remediation and space sustainability. **The Space Environment and Its Effects on the Spacecraft:** Gravitational perturbations-Aerodynamic drag-Gravity gradient effects-Magnetic and solar light pressure effects-Outgassing-Radiation and effects on electronics-Atomic oxygen-Orbital debris-Internal disturbances. **Orbital Mechanics:** Kepler's laws-Gravitation-Energy and momentum- conservation-Conic sections-Orbital elements-Special orbits (geostationary, Molniya, sun- synchronous, several others). **Orbital Maneuvers and Rendezvous:** Orbital transfers, including Hohmann, bielliptic, and fast transfers-Plane changes, patched conics, planetary transfers-Low-thrust trajectories, aerobraking, gravity assists-Rendezvous, timing, Clohessy- Wiltshire equations. **Atmospheric Entry Environment:** Trajectory effects-Prediction of orbital decay- Aerodynamic braking and heating- Deceleration and loads estimation- Shape and ballistic coefficient effects - Heating profiles and thermal protection methods. **Space Weather**: Types of space weather Impacts of space weather Space weather scales- Remote and in-situ monitoring/measurement of space weather - **Modeling Space Climate**: Space climate drivers, solar and anthropogenic - measurement of space climate - Impacts of space climate change.

Launch Vehicles, Satellites and their Orbits: Principles of Rocketry- Rocket Motors- Solid and Liquid Fuel Rockets- Sounding Rockets- Cryogenic Engines- Multi-stage Rockets- Satellite Launch Vehicles- Basic of Satellite Orbits- Keplers's Laws- Sub-satellite Point- Orbital Parameters- Sun-synchronous and Geosynchronous Orbits – Low Earth Orbits. **Spacecraft Cameras and Antennas**: Types, Material, characteristics, and Design.

Spacecraft Attitude Control, Power and Thermal systems: Attitude Sensors- Sun Sensors- Star Sensors- Earth Sensors- Magnetic Aspect Sensors- Accuracy- Spin Stabilization and Gyros- Control of Flight-path – Close-loop Guidance- Spacecraft Power System- Solar Cells and Panels- Primary and Secondary Batteries- Special power Sources- Radioactive Thermoelectric Generators (RTG)-Spacecraft Thermal Control Techniques.

Space-borne payload selection of materials: Behavior of Materials in Space (Temperature, Pressure, and Radiation)- Outgassing- Corona Discharge- Coating and compounds- Radiation Damage- Mounting of Subsystems- Structural and Mass Limitations- Carbon Fiber Reinforced Plastic (CFRP)- Honeycomb Structures- Effects of Vibrations and Shocks on Spacecraft Structures- Spacecraft Thermal Environment- Thermal Paints and Surface Finish.

Reliability, Tests and Qualification of Payloads: Fabrication of Electronics-Subassemblies-Electromagnetic Compatibility- Checkout, Reliability Considerations and derating- Test and Evaluation – Thermovac Tests- Vibration and Shock Tests.

Telemetry, Tracking, Command (TTC) and Data Handling Systems: Telemetry System- Signal Conditioner, Onboard Data Recorder, Telecommand – Encoder- Decoder- Pulse and Data Commands- RF Systems- Receivers, Transmitters and Antenna – Ground Segments- Real-time and Off-line Tracking.

ESS 306 Spacecraft Systems and Satellite Engineering 1 2 2

Systems Engineering - Engineering design cycle – Payload – Structures - Mechanisms-Structural Analysis-Attitude Dynamics - Attitude Sensing - Attitude Control -Thermal Control- Thermal Analysis and Test-Environmental Control and Life Support Systems - Propulsion – Power – Telecommunications - Command and Data Handling - Fabrication and Test - Cost Estimation. Space and Launch Vehicle History -Spacecraft Design Drivers, Launch

Vehicle Performance, and On-Board Spacecraft Environment - Efficient Orbit Transfer - Space Hotel Design.

ESS 308 Satellite Payload 1 2 2

Payload Environments: Thermal – Pre-launch – Ascent fairing radiant – Aero-heating (Free molecular heating) - Electromagnetic - Contamination - Venting - Acceleration - Vibration - Acoustics – Shock. **Payload Integration:** Fairing size and shape - Maximum accelerations - Vibration frequencies and magnitudes - Acoustic frequencies and magnitudes - Temperature extremes - Air cleanliness - Orbital insertion accuracy. **Payload Integration Procedures**: Mating spacecraft to launch vehicle. - Spin tests -Propellant loading. - Pre-launch test of all subsystems.

ESS 310 Algae Remote Sensing and Biotechnology 1 2 2

This course gives an opportunity to explore the fundamental principles of **Algal Remote Sensing**, Biodiversity, Harmful Blooms, Renewable Energy Potentials and Biotechnology. The ecological importance of algae for food chain and the aquatic ecosystems The algal abundance and classification in the ecosystem according to their habitat and environmental conditions- The role of role harmful and toxic algae in blooms, their counts, and the methods of identification, Algae as indicators of water pollution and water quality assessment and biotechnology of bioactive compounds using biohazard of algae. Also, the course will assess the algae as a source of renewable energy by investigation their abundance, chlorophyll-a, Protein, Carbohydrates, and Lipids. Remote Sensing Techniques will be applied on Sentinel 2 and 3 imageries for Atmospheric correction and retrieval of the Chlorophyll-a, Total Suspended Matter (TSM), and the Color Dissolved Organic Matter (CDOM). These data will be correlated to the in-situ measured data to evaluate the potential of monitoring the algal conditions in the coastal marine and the inland water of the northern lakes of Egypt. The algal distribution will be converted to biofuels potentiality maps. The **Algae biotechnology** covers uses and economic importance of algae with reference to its application in medicine, as food, agriculture, industry, bioremediation and nanotechnology. Algae as human food and food supplements (A model microalgal human food "Spirulina". Porphyra as food (cultivation and economics). Uses of Edible kelps, diatomaceous earth. Medical uses of algae (Antibacterial and antifungal activities). Antiviral and antitumor activities of algae. Commercial applications of algal hydrocolloids (alginates, carrageenan and agar). Algae and Nano-technology. Algae and agriculture (cyanobacteria as biofertilizers). Algal plant growth regulators (PGR). Marine microalgae used for aquaculture. The role of **algae in bioremediatio**n. **Biodiesel from microalgae** as renewable energy source. Lab analyses include the estimation of the Chlorophyll-a, TSM, and CDOM from two different dates to detect the change, of assess multi-sensor performance. Aslo, analyses will determine the algae Chlorophyll-a, proteins, carbohydrates, lipids contents and to perform carbon sequestration to produce the particulate biopolymeric organic carbon (BPC), and to disclose the relationship to the renewable energy potential.

ESS 312 Treatment and processing of construction industrial/glass wastes 1 2 2

Construction industry wastes' types, their generation, fundamental process engineering and chemical properties, international experience of their utilization in the road construction. Process engineering technologies. General utilization possibilities. Main types, properties, generation of glass wastes. Types, composition and properties of glass, with special regards to

the process engineering, mechanical and chemical characteristics. Utilization. Preparation technologies. Recovery of valuable components. Mechanical and thermal processes. Quality control methods.

ESS 314 Waste Unit Preparation Technology 1 2 2

Theoretical and practical fundamentals of the design of waste preparation unit operations and technological processes for management. Fundamental terms and application fields of unit operations and process engineering. Production and consumption wastes. Characterization of coarse disperse systems. Characterization of waste materials in unit operations. Changing of the disperse- and mixed state of multi-phase dispersed materials - the acting forces. The characterization and evaluation of contamination and agglomeration technological processes. Features of the change of the particle size and volume, rate of contamination and the breakage work. The material and energy transfer balances of material component separation technological processes. The unit operation features of the separation processes, evaluation of productivity (component content, yield and recovery, efficiency). Production of secondary raw materials and secondary fuels from municipal solid wastes (MSW). The comparison of different MSW processing technologies in respect of the material and energy balances.

ESS 316 Environmental Risk Assessment and Contaminated Site Remediation 1 2 2

Environmental Risk Assessment: History of Risk Assessment, principles and background of RA methodology, Overview of risk related terminology and definitions, Elements of HHRA methodology, Problem formulation, Exposure assessment, Toxicity assessment, Risk Characterization, Risk assessment and its role in site remediation, Risk interpretation, Egyptian legislation and practice of RA methods, Egyptian legal background, various applications of RA methods, risk based target value and its determination, Case studies. Practical work: self-made solutions of simple case-study problems. Environmental testing phase, preliminary environmental study, detailed requirements for environmental compatibility studies. Acting factors stakeholders, impact processes, the spread effects. The effect areas, control areas. The main aspects of recruitment procedures and environmental standards. In the effectiveness test methods and procedures. Impact Assessment and Monitoring. The impact assessment public of the hearing, public hearing. Analysis of practical examples. Preparation of an impact test, study management, presentation, public discussions.

Contaminated Site Remediation: Setting the stage, context of contaminated site remediation - Historical overview of site remediation - The process of site remediation - Site Investigation on contaminated land - Type and behavior of contaminants in the subsurface environment - Behavior of contaminants in groundwater - Chemistry of site investigation; Threshold value systems and their role in remediation -Quantitative risk assessment and site specific, risk based remediation; Remediation methods and aspects of their selection; Remediation without excavation; Remediation with soil excavation Hydraulic protective measures; Isolation from the environment; Monitoring activities -Legal framework Risk Assessment and its role in remediation - Case studies.

ESS 318 Waste incineration, air quality control 1 2 2

Flow diagram of waste processing; basic regulations for thermal treatment and disposal. **Combustion parameters of wastes**: physical state (solid, liquid, gaseous), particle composition, density, moisture and ash content; chemical composition (C, H. N, S, Cl), calorific value. **Calculation of combustion parameters**: the chemical reactions of combustion, minimum oxygen and air requirement of fuels, optimal air excess necessary for complete combustion. **Gaseous wastes**, normal burning velocity of fuels, flame velocity, flammability and explosion limits, operating conditions for safe combustion; methods for flame stabilization. **Flame and flue gas characteristics**: specific volume, chemical composition, specific heat capacity; combustion temperature (theoretical and actual), dissociation and adiabatic flame temperature (definition, calculation methods); methods for increasing/reducing combustion temperature. **Technical parameters of waste incineration**, auto-ignition range; grid types and grid structures, combustion chamber geometry, the construction of refractory walls (design and structure). **Hazardous waste disposal** (by incineration), required minimum incineration temperature, the thermal treatment of halogenated waste, present-day waste incinerators, determination of post-combustion chamber (’afterburners’). **Characterization of solid combustion residues**: physical-chemical properties, mineral composition, thermal behavior, sintering and ash fusion characteristics, melting temperature. Treatment and disposal of slags and fly ash. **Burners**: classification, geometry, sizing, fuel injection by spray nozzles (oil burners). **Air pollution control**: regulatory measures and provisions for waste incineration; possible allowed emission and concentrations (Egyptian and International target values). **Gaseous pollutants**: CO, radicals, sulphur oxides, NOx formation (conditions, intensity), primary reduction methods, determination of gas emission concentrations. Characterization of gaseous pollutants; options for secondary emission reduction; flue gas cleaning methods and equipment. Definition of dust (for environmental regulations), properties of particulate matter (PM), separation and collection mechanisms, design and operation of dust collection systems (separators).

ESS 320 Space Physics 1 2 2

Solar System: An Introduction to Comparative Planetology, Earth: Our Home in Space, Moon and Mercury: Scorched and Battered Worlds, Venus: Earth's Sister Planet, Mars: A Near Miss for Life?, Saturn: Spectacular Rings and Mysterious Moons, Uranus, Neptune, and Pluto: The Outer Worlds of the Solar System, Solar System Debris: Keys to Our Origin, The Formation of Planetary Systems: The Solar System and Beyond, The Sun: our parent star, Measuring the stars: giants, dwarfs and the main sequence, The solar neighborhood, Luminosity and apparent brightness, The interstellar medium and matter ; Gas and dust among the stars, Emission Nebulae, Star formation :A traumatic birth, Stellar evolution - Stellar explosions: Novae and supernovae and the formation of elements, Neutron stars and black holes, The milky way galaxy – galaxies and dark matter, Cosmology; The big bang and the fate of the universe. Astrophysical and Computational Techniques-Microgravity-Gravitational Physics-Asteroids, Meteorites, Comets.

ESS 322 Space Microbiology 1 2 2

This course covers the primary aspects of space microbiology that have been studied to date. The fields covered include the use of the space environment for understanding basic biological mechanisms, such as the role of gravity at the cellular, subcellular, and extracellular levels,

biological effects of the radiation field in space, survival factors in the upper boundary of Earth's biosphere, and application-oriented aspects, such as the use of microorganisms in bio-regenerative life support systems, the monitoring, characterization, and control of spacecraft microflora, and associated microbial crew health concerns.

Lectures: introduction(Differences between microorganisms (bacteria, fungi , viruses) importance and different habitat)- Microorganisms in the spacecraft environment- Earth's upper atmosphere- Effect of space and stations conditions on microbial growth- Microgravity- Role of the stratospheric ozone layer in protecting earth's biosphere from solar UV radiation- Interactions of microgravity and radiation in microorganisms- Carbon metabolism-Nitrogen metabolism - Vitamins and other organic growth factors-Correlation between antibiotic resistant and closed environment in stations- Applications of space microbiology.

Lab analyses: sterilization and microbiological media - isolation, purification and characterization of microorganisms- Effect of radiation on microbial growth - Effect of temperature on microbial growth - Effect of pH on microbial growth - Effect of different carbon sources on microbial growth - Effect of heavy metals and dyes on microbial growth - Effect of different nitrogen sources on microbial growth -Effect of growth inhibitors on microbial growth - Detection of drug production - Detection of antibiotic resistant - Detection of some enzymes produced by microorganisms.

ESS 401 Landfills and Waste Management 2 2 3

Waste Definition, Generation, Effects, Management Options (General and legal definitions- Sources and waste generation – physiochemical properties of municipal solid waste and hazardous waste)- Waste Compositions, quantities, and classifications- Effects of in-proper management -Relevant environmental regulations for waste disposal, Site Investigations. Landfills construction/design, base liner system and the leachate collection system, operation, aftercare, closure and re-cultivation, and the interaction of contaminants and the environment. Soil contaminant retention capacity - Geotechnical aspects. Water balance control of landfills. In situ stabilization (aeration, methane-oxidation, water balance control) of landfills. Facilities of landfills, the monitoring system.

General Siting and Design Criteria: Site investigations, Site Selection, Regulatory permitting process -siting and design requirements - Other federal and state legislation and regulation siting and design requirements -Siting criteria - Design criteria. **Transfer and Transport Facilities**: Objective of transfer stations - Types, siting and design criteria of transfer stations - Design cases. **Sanitary Landfills**: Landfilling methods - Design goals, basis, and variables - Design of landfill cover and drainage/liner systems. **Design of landfill gas migration control and recovery systems**: Design of leachate control and treatment systems - Design cases. **Material Recovery Facilities**: Types and objectives of material recovery systems - Principles, functions, equipment selection and comparisons, design criteria, and operation of different material recycling processes - Integrated and specific recycling plants - Design cases. **Principles and Design of Energy Recovery Facilities**: Types and principles of energy conversion processes - Incinerator design - Design of other thermal energy conversion systems
- Design cases. **Waste Minimization Facilities**: Principles and techniques of Waste minimization Examples of waste types and phase separation processes Design criteria and

examples. **Principles and Design of Hazardous Waste Landfills**: Design configurations and site selection - Design of final cover, intermediate cover and drain/liner systems - Design of gas and leachate control and treatment systems - Design cases. **Hazardous Waste Storage Facilities**: Types and design criteria - selection and design of storage facilities - Design of containment, run-on/run-off management systems - Design examples. **Thermal Treatment Facilities**: Status, types, principles, equipment used, application ranges, and comparisons of different thermal treatment technologies - Design of incinerators - Design of other thermal systems - Design cases. **Chemical/Physical/Biological Treatment Facilities**: Status, types, principles, equipment used, application ranges, and comparisons of different treatment facilities
- General design criteria and special requirements - Design cases. **Site remediation Facilities**: Status, types, principles, equipment used, application ranges, and comparisons of different site remediation technologies - Remedial investigations and feasibility studies - Soil remediation design examples - Groundwater remediation design examples Radioactive Waste Treatment/Site Remediation Facilities: Status, Types, technologies, principles, applications - Treatment Technologies - Site Remediation Technologies - Case Examples.
Waste Management: Recycling Waste – The 3 R concepts for recycling, Recycling for the Environment Protection, Human Health and Environment. Water, Sanitation, Hygiene, and Waste Management for the COVID-19 Virus. Covid-19 Biomedical Waste. Medical Hazardous Waste Disposal and Treatment Technologies. **Metallic and Rubber Wastes:** Understand the importance of metallic and rubber waste management for recovery of structural materials. Get acquainted with metallic and rubber waste material flows, compositions, and the possible recycling technologies. Technologies of processing and utilization of metal and rubber containing wastes. Main groups of introduced wastes: electronic wastes, end of life vehicle wastes, slugs. Mechanical, chemical and thermal processes of preparation. Knowledge of quality related to products. **Plastic and Paper Wastes:** Paper and plastics as material, their properties and their production methods and technologies, and their utilization as secondary raw material. Paper and plastic appearance in different waste streams, and their recycling technologies and unit operation level. Paper and plastic production. Properties of plastics, their production and utilization. Waste streams and major appearance of paper and plastic in these waste streams, quality and quantity. Properties of paper and plastics focusing the properties relevant to their recycling and separation. Technical solution of paper recycling. technical solution of plastic recycling, equipment and unit operation in paper and plastic recycling, energetic and as secondary raw material utilization of plastics and paper. **The Benefits of Waste Management:** Better Environment-Reduces Pollution-Conserves Energy-Creates – Employment-Helps Make a Difference-Various Methods of Waste Disposal-Landfills- Incineration/Combustion-Recovery and Recycling-Plasma gasification-Composting-Waste to Energy (Recover Energy)-Special Waste Disposal- Avoidance/Waste Minimization.

ESS 403 Waste Containment and Remediation Technology 2 2 3

Introduction to Remediation Technology - Hazardous Waste Regulations and Hazardous Materials - Contaminant Transport Mechanisms and Principles - Multi-phase Flow in Porous Media - NAPL Fate and Transport - Site Characterization. **Remediation Principles**: Source Control and Management of Migration Covers, Cut-off Walls, Solidification / Stabilization - Pump-and-Treat Systems - Solvent Vapor Extraction, Air Sparing, Soil Flushing - Funnel and Gate Systems, Permeable Treatment Walls- Bioremediation - Natural Attenuation- New Remediation Technologies- Remedy Selection and Risk Assessment. Introduction to Solid,

Hazardous, and Radioactive Waste Disposal and Containment - Design of Landfill- Leachate and Gas Production in Landfill- Landfill Hydrology- Compacted Soil Liners- Synthetic Clay Liners and Geomembranes - Landfill Construction QA, Monitoring, and Closure- Brownfields- Hazardous Waste Practice (Regulatory Practice, Expert Testimony, Risk Assessment)- Field Trip to Landfill in Alexandria Governorate.

ESS 405 Water Desalination and Purification 1 2 2

Water purification and desalination technology can be used to convert brackish ground water or seawater into drinking water. The challenge is to do so sustainably, with minimum cost and energy consumption, and with appropriately accessible technologies. The course will survey the state-of-the-art in water purification by desalination and filtration. Fundamental thermodynamic and transport processes which govern the creation of fresh water from seawater and brackish ground water will be developed. The technologies of existing desalination systems will be discussed and factors which limit the performance or the affordability of these systems will be highlighted. Energy efficiency will be a focus. Nanofiltration and emerging technologies for desalination will be considered. A student project in desalination will involve designing a well-water purification system for a village in surrounding Tanta City.

Desalination Overview (Introduction to water supplies-Why desalination?-Global drinking water shortage-What is water salinity?-Who are the potential users of the desalinated water?- Some examples of the existing desalination processes). Characteristics of seawater and fresh water (Salinity concentration-Molality and molarity). Fundamental of thermodynamics of desalination (Introduction to basic principles of thermodynamics-Free energy- Chemical potential-Principals of phase transfer). Separation Process (Fundamentals of separation process-Gibbs energy-Chemical activity-Membranes). Membranes (Ion-exchange-Osmosis- Reverse-osmosis-Nano-filtration-Electrodialysis).Desalination Process (Thermal desalination- Multistage flash-Multiple effect-Distillation-Vapor compression). Introduction to thermal desalination (What is GOR?-Basics of heat transfer-Enthalpy diagrams-Thermal process equations of MSF, MED, and VC). Electrodialysis: Concept, Designs, and Economics (Fundamentals of electrodialysis - Water-salts mass transfer equations-Transfer mechanism and kinetics-Design parameters and equations-Pre- and post-treatment-Potential problems-Costs and economics). Sustainability of desalination plants (Alternative energy sources: solar, wind, hydro-Link to power plants-Hybrid plants). Environmental impacts and economics of desalination plants (Costs analysis and economics-Environmental impacts).

ESS 407 Spacecraft Power Systems 1 2 2

Electrical Power System: Power Source- Energy Storage - Power Distribution - Power Regulation and Control. **Power Sources**: Primary Batteries- Secondary Battery- Fuel cell-Regenerative fuel cell- Chemical dynamic- Nuclear- Electrodynamics Tethers -Radioisotope - Thermionic converter- Thermoelectric converter -Photovoltaic -Solar dynamic- Flywheel Storage -Propulsion-charged tether**.** Power Source Applicability**. Primary Battery Types**: Silver zinc -Lithium sulfur dioxide- Lithium carbon monofluoride- Lithium thionyl chloride. Silver Zinc Cells. **Secondary Battery Types**: Silver zinc -Nickel cadmium -Nickel hydrogen**.** Lithium Ion Cells. Depth of Discharge-Fuel Cells and Characteristics-Radioisotope

Thermoelectric Generators-Thermoelectric Generator-Solar Cell and its physics-Solar Cell Operating Characteristics. Temperature Effects-Radiation Effects. **Alternate Solar Cell Technologie**s: Silicon -Thin sheet amorphous Si -Gallium Arsenide- Indium Phosphide-Multijunction GaInP/GaAs. Solar Array Construction. Cell Shadowing. Power Supply-Demand Profiling. Power Distribution Systems. DET Power Regulation Systems.PPT Power Distribution Systems.

ESS 409 Satellite Launch Systems 1 2 2

Launch systems characteristics-Launch systems selection process-Spacecraft design envelope and environments-Rocket Basics, Equation and Staging-Launch Vehicle Forces-Example Launch Systems-Example Orbit Transfer Vehicles-Launch Sites Criteria-Typical Launch Vehicle Integration Tasks-Launch Services – Scheduling-Payload Integration-Fairings- Structural and Electrical Interface-Acceleration Load Factors-Vibration Environments-Shock Loads-Acoustic Environments-Injection Accuracy-Launch System Cost Estimate.

ESS 411 Field Training 2 2 3

The student should spend 8 weeks devoted to training in the Egyptian Space Agency, NARSS - National Authority For Remote Sensing and Space Sciences, Factories, Companies, National Research Centers, Tanta University and other Universities Departments.

ESS 413 Space Nanotechnology 1 2 2

The course introduces the Nanotechnology in Space Exploration including the Nanomaterials-Nanosensors and Instrumentation- Microcraft- Micro/Nano-Robotics- Nano-Micro-Macro Integration and Nanomanufacturing. Advancements in nanomaterials make lightweight solar sails and a cable for the space elevator possible. By significantly reducing the amount of rocket fuel required, these advances could lower the cost of reaching orbit and traveling in space. In addition, new materials combined with nanosensors and nanorobots could improve the performance of spaceships, spacesuits, and the equipment used to explore planets and moons, making nanotechnology an important part of the ‘final frontier.’ **Nanoengineered Materials** (High strength/mass, smart materials for aerospace vehicles and large space structures - Materials with programmable optical/thermal/mechanical/other properties - Materials for high- efficiency energy conversion and for low temperature coolers - Materials with embedded sensing/compensating systems for reliability and safety). **Nano Electronics**(Devices for ultra high capability, low-power computing and communication systems - Low-power, integrable nano devices for miniature space systems - Bio-inspired adaptable, self-healing systems for extended missions - Quantum Devices and systems for ultrasensitive detection, analysis and communication). **Biomolecular nanotechnology** (Bio-geo-chem lab-on-a-chip for in situ science and life detection - Nanoscale sensing, assessment and therapeutics delivery for medical autonomy - Molecule-to-organism bio process modeling, digital human and cybermedicine - Tools for direct study of space-induced medical effects and countermeasures).

ESS 415 Space flight Dynamics and Orbital Mechanics 1 2 2

Physics of orbital motion and orbital elements -Coordinate systems and transformations-Kepler's equation and two-body propagation -Orbital maneuvering-Attitude dynamics-

Perturbations-Applications**.** Orbital Elements-Types of Orbits-Newton's Laws of Motion and Universal Gravitation-Uniform Circular Motion-Motions of Planets and Satellites-Launch of a Space Vehicle-Position in an Elliptical Orbit-Orbit Perturbations - Orbit Maneuvers - The Hyperbolic Orbit. Information on speed and direction of space objects, distances, mass and momentum.

ESS 417 Space Computing, Artificial Intelligence and Decision support Technology 1 2 2

Orbit Computation-Coordinates Computation-On Board Computer-Attitude and orbit control-Telecommands execution and dispatching-Housekeeping telemetry gathering and formatting-On board time synchronization and distribution-Failure detection-Isolation and recovery- DC/DC Power conversion and regulation-Ground Telecommand Decoding-Packet Telemetry Formatting-On Board time management-Autonomous Reconfiguration-Local Mass Memory function-Housekeeping telemetry-Interfacing with other Avionics subsystems-Satellite software development. Computing methods: Artificial intelligence- Search methodologies- Heuristic function construction- Machine learning- Machine learning approaches- Neural networks- Fuzzy Logic- Expert Systems- Evolutionary Computing- Intelligent Agents-Deep and Machine Learning-Information systems and applications**.** Fundamentals of Human Decision Making - Intelligent Decision Support Systems - Data warehousing. Data marts and mining. Contrast data, information, and knowledge- Computer-based inferencing -Applied computing-Operations research-Decision analysis. Evaluating Intelligent Decision Support Systems (Determining Evaluation Criteria, Multi-Criteria Model for IDSS Assessment).

ESS 402 Spacecraft Attitude Dynamics and Control 2 2 3

Rigid Body dynamics: Euler's angles- Quaternions vs Euler angles- Time derivative of vector quantities- Euler's equations of motion of a rigid body- Generalized Euler equation. Passive Stabilization of Rigid Spacecraft: Torque–free motion of axi–symmetric satellites- Torque–free motion of tri–inertial satellites- Nutation Damping- Attitude maneuvers of a spinning satellite-Gravity–gradient stabilization- Dual–spin satellites. **Active Stabilization and Control of Spacecraft**: Environmental torques and other disturbances- Attitude sensors (Infrared Earth sensors (IRES), Sun sensors, Star trackers, Rate and rate–integrating gyroscopes, Magnetometers)- Actuators- Linear model of rigid satellite attitude motion- Linear model of gyrostat attitude motion- Use of thrusters for attitude control- Momentum exchange devices for attitude control- Quaternion feedback control- Control Moment Gyroscopes.

ESS 404 Space Propulsion 1 2 2

Introduction -Fundamentals and Definitions -Mission Analysis -Review of Classical Astrodynamics-Analytical Approximations for Low Thrust Maneuvers -Sub-optimal Climb and Plane Change -Basic Electromagnetic Theory and Plasma Physics- Overview of the Physics in the Plasma Sheath- Electrostatic Thrusters (Kaufman Ion Engines)-Characterization of Space Propulsion Devices-Monopropellant Thrusters -Electrothermal Augmentation-Plasmas in Equilibrium- Arcjet Thrusters-Hall Thrusters Efficiency-- Fluid Model of the Discharge - Plasma Accelerators / Magneto Plasma Dynamic (MPD) Thrusters- Electrospray Propulsion - Cone-jet Electrosprays, or Colloid Thrusters-Ion Emission and the Pure Ionic

Regime- Electrodynamic Tethers.

ESS 406 Satellite Communications 1 2 2

Basics-Development- Communications satellite system- Introduction to satellite communications, services, and cost-Communications satellite system architecture- the concept of orbit and sub-systems of a satellite- The basics of digital communications and information transmission. **Communication techniques**: Advanced transmission concepts impacting the service performance (modulation and coding). **Hardware and equipment's**: the communication chain on ground and the performance. **Networking and services**: Provision of voice, television and Internet access. **Navigation systems and services**-Ground Segment- Space Segment-Tracking telemetry and control -Telecommunication and broadcasting-Satellite radio-Radio Regulations for orbit and spectrum resources-Network planning and link budget analysis-Earth station and VSAT system Radio Regulations for earth station coordination and registration-Earth station Technology-Modulation, multiplexing and multiple-access- Applications and Future trends in Sat-Communications. Satellite communications for development, education and training.

ESS 408 Space Mission Analysis and Design 1 2 2

The Space Missions Analysis and Design Process-Mission Characterization, Evaluation, Requirements Definition-Space Mission Geometry-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.

ESS 410 Space Medicine and Life Support 1 2 2

An overview of space medicine - Medical standards for spaceflight - Professional astronaut medical standards. **Effects of space flight on human body** (Loss of Blood Plasma leads to Temporary Anemia On Return to Earth fluid Redistribution causes Head Congestion and Puffy Face-Otoliths in inner Ear respond directly to motion changed sensory input confuses Brain, causing occasional Disorientation- Kidney Filtration Rate increase; Bone Loss may cause kidney stone- Fluid redistribution shrinks legs – Touch and Pressure Sensors register no downward force - Weight-bearing Bones and muscles deteriorate). Commercial spaceflight and 'space tourist' medical standards - **Physiological and medical effects of spaceflight** (Early effects of deployment in the space environment. Longer duration spaceflight-Radiation- Musculoskeletal system- Neurological system- Multisystem considerations- Re-entry, landing and post-flight considerations- Occupational health hazards- Extra-vehicular activity- Decompression sickness in the space environment). Medical planning, emergencies, anesthesia and surgery in space. Cardiopulmonary resuscitation in space. Spacecraft emergencies and Medical evacuation. Roles of a space medicine doctor. **Biomedical and Life Support** (Introduction, Humans in Space, Exploration in Extreme Environments, Bone Changes in Space, Muscle Mechanisms, Motor Control Optimization, Musculoskeletal

Dynamics and Control, Cardiovascular System, Control, and Simulation, countermeasures and Artificial Gravity, Extravehicular Activity (EVA)). The future of space medicine.

ESS 412 Graduation Project **2 2 3**

Students will work individually or in groups on producing bio-products, medical products, building and designing Spacecraft Models, Launching System, Power Systems, Electronic Circuits, Cameras, and Antennas or writing an essay and research on subjects devoted to the environment and/or space sciences.

ESS 414 Spacecraft Materials **2 - 2**

Materials are: Bulk materials such as metals and alloys and non-metallic materials such as glasses, polymers, ceramics and composites-Filler materials such as solder alloys-paints, lacquers, varnishes, adhesives, lubricants and coatings - Pottings, sealants and foams-Films, foils, tapes, inks**.** Properties are: Precautions-Processing and Assembly-Vendor information-Experience and equivalence-Physical properties-Elastic properties-Optical properties-Electrical properties-Thermal properties-Environmental properties relevant for space use, such as corrosion (general, stress, bimetallic), atomic oxygen, **machinability**, welding, outgassing, offgassing/toxicity, flammability, UV- radiation-Fluid compatibility-Special recommendations and lessons learned.

ESS 416 Environmental Law and Sustainable Development **2 - 2**

Common-Law Approaches to Environmental Problems-Property and the Environment-Environmental Impact Analysis and Endangered-Species Protection-Risk Analysis and Toxic Substances: Pesticides, Trade Disputes over Synthetic Hormones, and the Cleanup of Contaminated Sites-Environmental Justice, Water Pollution, Claims to a Human Right to Drinking Water, Fracking, and Insights from an Economic Model of Regulatory Cost-Effectiveness-Pollution, Climate Change and Course Conclusion-Environmental Protection Law-History-Pollution control-Resource sustainability-Principles-Theory. International environmental law- Laws around the World-International environmental agreements.
Environmental and energy policy-making; environmental ethics; the techniques of environmental analysis; and strategies for collaborative environmental decision-making. Theory of environmental planning practice. Growth vs. deep ecology, "command-and-control" vs. market-oriented approaches to regulation, and the importance of expertise vs. indigenous knowledge. **Environmental planning techniques and strategies**. The management of sustainability, the politics of ecosystem management, environmental governance and the changing role of civil society, ecological economics, integrated assessment (combining environmental impact assessment (EIA) and risk assessment).
Sustainable development, the realization and the problems, aspects, and the reasons of unsustainability. The global conventions, the international and the national programs concerned with sustainable development. The of sustainable development, - Sustainable development policy of the Egyptian Economic sectors- Society policy- Environmental policy and the sustainability - Energy and the sustainability -Sustainable production and consumption - Sustainable life -Environmentally sound technology in building- Environmental aspects around our house.

ESS 418 Space Law 2 -2

Space law is the body of law governing space-related activities, encompassing both international and domestic agreements, rules, and principles. Parameters of space law include space exploration, liability for damage, weapons use, rescue efforts, environmental preservation, information sharing, new technologies, and ethics. Other fields of law, such as administrative law, intellectual property law, arms control law, insurance law, environmental law, criminal law, and commercial law, are also integrated within space law. Basic concepts-Fundamental principles of space law-Outer Space Treaty-National regulation of space activities-International law for Remote sensing/GIS, satellite -meteorology and global climate activities-Satellite communications law-Global navigation satellite -systems (GNSS) law. Space traffic management-Sustainability of Space Activities-Planetary Protection-Space Tourism Regulations.