Faculty of Science
Department of Earth and Environmental Sciences

Study Plan for

Bachelor Degree in Earth and Environmental Sciences

2021

Mission

Our mission is to provide comprehensive integrated field and laboratory training (that will involve theoretical, scientific, and practical science approach, especially in the field of policy development, environmental management and protection**.**

Vision

The Vision of our department isto be a leader in Earth and Environmental sciences with emphasis on teaching, service, and industrial / community- based research, and to be distinguished on the local,regional, and global levels.

Goals

- Prepare students for professional positions in industry and government and for careers in academic research and teaching.
- Raise the awareness of Earth and Environmentalsciences in education and other major sciences.
- Attempt to become the center for research in Earth and Environmentalsciences.
- Develop a greater awareness of Earth and Environmental sciences in the general public (community) through outreach programs.

Accreditation Criteria in Earth and Environmental Sciences

according to the regulations of the Higher Education Accreditation and Quality Assurance Commission

A. Obligatory Theoretical Fields

Field of knowledge	Course Code	Course Name	Credits
Geology and Environment The minimum required credits (9 Credits)	EES104	Environmental Sciences	3
	EES 101	General Geology (1)	3
	EES 102	Environmental Geology	3
	Total Credits		**9**
Minerals and Rocks The minimum required credits (9Credits)	EES 220	Mineralogy	2
	EES 222	Optical Mineralogy	2
	EES 331	Igneous and Metamorphic Rocks	3
	EES 333	Sedimentary Rocks	2
	EES 350	Economic Geology (1)	2
	Total Credits		**11**
Hydrology and Soil The minimum required credits (9 Credits)	EES 361	Geology of Jordan	3
	EES 452	Applied Hydrogeology	2
	EES 211	Soil and its pollution	2
	EES 349	Remote Sensing in Geology	2
	EES 455	Engineering Geology	2
	Total Credits		**11**
Applied Geology (Geophysics, Geochemistry, Structural Geology, Petroleum Geology, Geographic Information Systems and Remote Sensing) The minimum required credits (9 Credits)	EES 340	Structural Geology (1)	2
	EES 348	Geographic Information Systems	2
	EES 453	Petroleum Geology	2
	EES 455	Engineering Geology	2
	EES 471	Applied Geophysics	2
	EES 475	Principles of Geochemistry	2
	Total Credits		**12**
Stratigraphy and Paleontology The minimum required credits (6 Credits)	EES 213	Stratigraphy and Historical Geology	2
	EES 210	Invertebrate Paleontology	2
	EES 311	Micropaleontology	2
	Total Credits		**6**

Study Plan for Bachelor Degreein
Earth and Environmental Sciences

The Department of Earth and Environmental Sciences at Yarmouk University offers a bachelor's degree upon the completion of the following requirements:

1. The fulfillment of the conditions stated in the regulations of awarding the bachelor's degree at Yarmouk University No. (2) for the year 1991 and its amendments issued in accordance with the bylaws of awarding academic degrees and diplomas at Yarmouk University No. 76 for the year 1976.
2. **University requirements** stated under the above regulations (27 Credit Hrs):
   a) Obligatory courses (12 Credit Hrs):

Table (1): Obligatory University requirements

Course code	Course Number	Course Name	Credit Hours
HUM	117	الريادة والابتكار	1
HUM	118	القيادة والمسؤولية الاجتماعية	1
HUM	119	المهارات الحياتية	1
HUM	120	مهارات الاتصال والتواصل (اللغة الإنجليزية)	3
HUM	121	مهارات الاتصال والتواصل (اللغة العربية)	3
PS	102	التربية الوطنية	3
MILT	100A	العلوم العسكريةوالمواطنة	3
EL	099	مهارات لغة إنجليزية – استدراكي	Remedial course
AL	099	لغة عربية – استدراكي	Remedial course
COMP	099	مهارات حاسوب – استدراكي	Remedial course
Total			**15**

b) Elective courses (12 Credit Hrs.) to be chosen from the following courses:

Table (2): Elective University requirements

HumanitiesCourses			
No.	Course Code	**Course Name**	**Credit Hours**
1.	HUM 101	الثقافة الاعلامية	3
2.	HUM102	المواطنة والانتماء	3

3.	HUM 103	الاسلام فكر وحضارة	3
4.	HUM 104	الفن والسلوك	3
5.	HUM 105	اسهام الاردن في الحضارة الانسانية	3
6.	HUM 106	مقدمة في دراسة الثقافات الانسانية	3
7.	HUM 107	حقوق الانسان	3
8.	HUM 108	مهارات التفكير	3
9.	HUM 109	النظم الاسلامية	3
10.	HUM 110	الثقافية السياحية والفندقية	3
11.	HUM 111	تاريخ القدس	3
12.	HUM 112	مقدمة في جغرافية الأردن	3
13.	HUM 113	الفكر التربوي الإسلامي	3
14.	HUM 114	الحاكمية الرشيدة والنزاهة	3
15.	HUM 115	التربية القانونية	3
16.	HUM 116	كتابات الأردن القديمة	3
17.	HUM 122	الاقتصاد والمجتمع	3
18.	HUM 123	الفنون الأدائية	3
المساقات العلمية			
1.	SCI 101	البيئة والصحة العامة	3
2.	SCI 102	تكنولوجيا المعلومات والمجتمع	3
3.	SCI 103	اللياقة البدنية للجميع	3
4.	SCI 104	مهارات التواصل الفعال	3
5.	SCI 105	الطاقة المتجددة	3
6.	SCI 106	الادارة وتنمية المجتمع	3
7.	SCI 107	البحث العلمي	3
8.	SCI 109	الثقافة الرقمية	3
9.	SCI 110	التنمية والبيئة	3
10.	SCI 110	مبادئ الوبائيات والمناعة المجتمعية	3

3. **Faculty of Science obligatoryrequirements** (21 Credit Hrs)**:**

Table (3): Faculty of Science Requirements

No.	Course Code	Course Name	Credit Hours
1.	Math101	Calculus(1)	3
2.	Phys101	General Physics(1)	3
3.	Chem101	General Chemistry(1)	3
4.	Bio101	General Biology	3
5.	Stat101	Principles of Statistics(1)	3
6.	EES101	General Geology(1)	3
7.	CS110	Selected Programming Langu	3
	Total		**21**

4. Department requirements:

I. Single Major (86 Credit Hrs.):

a) **Obligatory courses** (68 Credit Hrs.)	EES102, EES104, EES105, EES106, Chem.105, EES210, EES210L, EES 211, EES 211L, EES213, EES213L, EES220, EES220L, EES222, EES222L, EES311, EES311L, EES331, EES331L, EES333, EES333L, EES340, EES340L, EES346, EES348,EES348L,EES349,EES349L,EES350,EES350L, EES361, EES452, EES452L, EES453, EES453L, EES455, EES455L, EES471, EES471L, EES475, EES475L.
b**) Elective courses** (**18**Credit Hrs.) selected from the following courses	**a - 15 Credit hours chosen from department courses:** EES201, EES252, EES302, EES312, EES302L, EES334, EES385, EES412, EES432, EES444, EES474, EES474L, EES479, EES479L, EES482, EES484, EES492, EES491. **b - 3 Credit hours chosen from the following courses:** Phys.102, Phys.103, Phys.105, Phys.106, Stat.105, Stat.111, Chem.106, Chem.211, Bio.102, Bio.105, Bio.106, EES211, EES211L, EES251, CS130, CIS.103, MIS120.

Table (4): Single Major Credit Hours

Requirements	Obligatory	Elective	Total	Percentage
University	12	15	27	20%
Faculty	21	-	21	16%
Department	68	18	86	64%
Total	101	33	134	100%

II. **Major / Minor** (86 Credit Hrs.)

(1) **Major in Earth and Environment Sciences**(65 Credit Hrs.):

a) **Obligatory courses** (**65** Credit Hrs.)	EES102, EES104, EES105, EES106, Chem.105, EES210, EES210L, EES213,EES213L, EES220, EES220L, EES222, EES222L, EES311, EES311L, EES331, EES331L, EES333, EES333L, EES340, EES340L, EES346, EES348, EES348L, EES349, EES349L, EES350, EES350L, EES361, EES452, EES452L, EES453, EES453L, EES455, EES455L, EES471, EES471L, EES475, EES475L.
b) **Elective courses** (**0**Credit Hrs.) selected from the following courses	

(2) **Minor** (21 Credit hrs.)to be selected from any department of the following Faculties:Science (including the Environmental Sciences), and Information Technology and ComputerScience according to thelists of minor courses of the selected department.

Table (5): Major / Minor Credit Hours

Requirements	Obligatory	Elective	Total
University	12	15	27
Faculty	21	-	21
Department (Major)	65	0	65
Minor			21
Total			134

III. **Minor in Earth Sciences**(21 Credit Hrs)

a) **Obligatory courses** (14 Credit hrs.)	EES102, EES105, EES106, EES210, EES210L, EES220, EES220L, EES340, EES340L.
b) **Elective courses** (7Credit hrs.) selected from the following courses	EES201, EES213, EES213L, EES222, EES222L, EES252, EES302, EES302L, EES311, EES311L, EES385, EES491.

IV. **Minor in Environmental Sciences** (21 Credit hours):

a) **Obligatory courses** (15 Credit hrs.)	EES104, EES211, EES211L, EES251, EES 323, EES363
b) **Elective courses** (6Credit hrs.) selected from the following courses	EES255, EES312, EES316, EES325, EES328, EES351, EES357, EES362,EES 365, EES382, EES391, EES392, EES399.

*** Note:**For student majoring in Earth and Environmental Sciences and minoring in Environmental Sciences, he/she should take EES316 instead of EES104.

Table (6): The Significance of the Second Digit

Number	Title	Number	Title
0	General Geology	5	Applied Geology
1	Fossils and Stratigraphy	6	Regional Geology
2	Minerals	7	Geophysics and Geochemistry
3	Rocks	8	Special Topics
4	Structural and Field Geology	9	Special Studies

Table (7):ObligatoryCourses Offered by Departmentof Earth and Environmental Sciencesfor the Bachelor Degree in Earth and Environmental Sciences

No.	Course No.	Course Name	Cr. Hrs.	Weekly Hours		Prerequisites	Course equivalent	Course (OLD OR NEW)
				Theory	Lab			
1.	EES101	General Geology (1)	3	3	-	-	Geo.101	OLD
2.	EES 102	Environmental Geology	3	3	-	EES101	Geo.102	NEW
3.	EES104	Environmental Sciences	3	3	-	-	Env.101B	OLD
4.	EES105	General Geology lab (1)	1	-	3	EES101 or concurrent	Geo.105	OLD
5.	EES106	General Geology lab (2)	1	-	3	EES 102 or concurrent	Geo.106	OLD
6.	EES107	Introduction to Geology (for Geography Students)	3	3	-	-	Geo.107	OLD
7.	EES210	Invertebrate Paleontology	2	2	-	EES 102 *Synchronization with EES210L	Geo.210	NEW
8.	EES210L	Invertebrate Paleontology lab	1	-	3	*Synchronization with EES210		NEW
9.	EES211	Soil and its Pollution	2	2	-	−*Synchronization with EES211L	Env.211A	NEW
10.	EES211L	Soil and its Pollution lab	1	-	3	*Synchronization with EES211		NEW
11.	EES213	Stratigraphy and Historical Geology	2	2	-	EES210 *Synchronization with EES213L	Geo.213	NEW
12.	EES213L	Stratigraphy and Historical Geology lab	1	-	3	*Synchronization with EES213		NEW
13.	EES220	Mineralogy	2	2	-	EES105 *Synchronization with EES220L	Geo.220	NEW
14.	EES220L	Mineralogy lab	1	-	3	*Synchronization with EES220		NEW
15.	EES222	Optical Mineralogy	2	2	-	EES220 *Synchronization with EES222L	Geo.222	NEW
16.	EES222L	Optical Mineralogy lab	1	-	3	*Synchronization with EES222		NEW
17.	EES311	Micropaleontology	2	2	-	EES210 *Synchronization with EES311L	Geo.311	NEW
18.	EES311L	Micropaleontology lab	1	-	3	*Synchronization with EES311		NEW
19.	EES331	Igneous and Metamorphic Rocks	3	3	-	EES222 *Synchronization with EES331L	Geo.331	NEW
20.	EES331L	Igneous and Metamorphic Rocks lab	1	-	3	*Synchronization with EES331		NEW
21.	EES333	Sedimentary Rocks	2	2	-	EES331 *Synchronization with EES333L	Geo.333	NEW
22.	EES333L	Sedimentary Rocks lab	1	-	3	*Synchronization with EES333		NEW
23.	EES340	Structural Geology (1)	2	2	-	EES106,EES213 *Synchronization with EES340L	Geo.340	NEW
24.	EES340L	Structural Geology (1) lab	1	-	3	*Synchronization with EES340		NEW
25.	EES346	Field Geology	4	-	12	EES333,EES340	Geo.346	OLD

26.	**EES348**	**Geographic Information Systems**	**2**	**2**	**-**	**EES 340** *Synchronization with **EES 348L**	**Geo.348**	**NEW**
27.	**EES348L**	**Geographic Information Systems lab**	**1**	**-**	**3**	*Synchronization with **EES348**		**NEW**
28.	**EES349**	**Remote Sensing in Geology**	**2**	**2**	**-**	**EES348** *Synchronization with **EES349L**	**Geo.349**	**NEW**
29.	**EES349L**	**Remote Sensing in Geology lab**	**1**	**-**	**3**	*Synchronization with **EES349**		**NEW**
30.	**EES350**	**Economic Geology (1)**	**2**	**2**	**-**	**EES333** *Synchronization with **EES350L**	**Geo.350**	**NEW**
31.	**EES350L**	**Economic Geology (1) lab**	**1**	**-**	**3**	*Synchronization with **EES350**		**NEW**
32.	**EES361**	**Geology of Jordan**	**3**	**3**	**-**	**EES333**	**Geo.361**	**OLD**
33.	**EES452**	**Applied Hydrogeology**	**2**	**2**	**-**	**EES333** *Synchronization with **EES 452L**	**Geo.452**	**NEW**
34.	**EES452L**	**Applied Hydrogeology lab**	**1**	**-**	**3**	*Synchronization with **EES452**		**NEW**
35.	**EES453**	**Petroleum Geology**	**2**	**2**	**-**	**EES333 ,EES340** *Synchronization with **EES453L**	**Geo.453**	**NEW**
36.	**EES453L**	**Petroleum Geology lab**	**1**	**-**	**3**	*Synchronization with **EES453**		**NEW**
37.	**EES455**	**Engineering Geology**	**2**	**2**	**-**	**EES333** *Synchronization with **EES455L**	**Geo.455**	**NEW**
38.	**EES455L**	**Engineering Geology lab**	**1**	**-**	**3**	*Synchronization with **EES455**		**NEW**
39.	**EES471**	**Applied Geophysics**	**2**	**2**	**-**	**EES340** *Synchronization with **EES471L**	**Geo.471**	**NEW**
40.	**EES471L**	**Applied Geophysics lab**	**1**	**-**	**3**	*Synchronization with **EES 471**		**NEW**
41.	**EES475**	**Principles of Geochemistry**	**2**	**2**	**-**	**EES333** *Synchronization with **EES475L**	**Geo.475**	**NEW**
42.	**EES475L**	**Principles of Geochemistry lab**	**1**	**-**	**3**	*Synchronization with **EES475**		**NEW**

Synchronization for the first time

Table (8): Elective Courses Offered by the Department of Earth and Environmental Sciences for the bachelor's degree in Earth and Environmental Sciences

No.	Course No.	Course Name	Cr. Hrs.	Weekly Hours		Prerequisites	Course equivalent	Course (OLD OR NEW)
				Theory	Lab			
1.	**EES201**	**Astronomy in geology**	**3**	**3**	**-**	**EES102**		**NEW**
2.	**EES252**	**Hydrology**	**3**	**3**	**-**	**EES102**	**Geo.252**	**OLD**
3.	**EES302**	**Surveying**	**2**	**2**	**-**	**EES106** *Synchronization with **EES302L**	**Geo.302A Geo.302**	**NEW**
4.	**EES302L**	**Surveying lab**	**1**	**-**	**3**	*Synchronization with **EES302**		**NEW**
5.	**EES312**	**Climatology and Meteorology**	**3**	**3**	**-**	**Department approval**	**Env.311**	**NEW**

6.	**EES334**	**Carbonates and Evaporates**	**3**	**3**	**-**	**EES333**	**Geo.334**	**NEW**
7.	**EES385**	**Research Methods in Geology**	**3**	**3**	**-**	**EES333,EES340**	**Geo.385**	**NEW**
8.	**EES412**	**Palaeoecology**	**3**	**3**	**-**	**EES333**	**Geo.412**	**OLD**
9.	**EES432**	**Industrial Rocks and Minerals**	**3**	**3**	**-**	**EES350**	**Geo.432**	**OLD**
10	**EES444**	**Geotectonics**	**3**	**3**	**-**	**EES340**	**Geo.444**	**NEW**
11	**EES474**	**Engineering Geophysics**	**2**	**2**	**-**	**EES471** *****Synchronization with **EES474L**	**Geo.474**	**NEW**
12	**EES474L**	**Engineering Geophysics lab**	**1**	**-**	**3**	*****Synchronization with **EES474**		**NEW**
13	**EES479**	**Subsurface Geology and Well Logging**	**3**	**3**	**-**	**EES471** *****Synchronization with **EES479L**	**Geo.479**	**NEW**
14	**EES479L**	**Subsurface Geology and Well Logging lab**	**1**	**-**	**3**	*****Synchronization with **EES479**		**NEW**
15	**EES482**	**Marine Geology**	**3**	**3**	**-**	**EES333**	**Geo.482**	**OLD**
16	**EES484**	**Seismology**	**3**	**3**	**-**	**EES340**	**Geo.484**	**NEW**
17	**EES491**	**Seminar in Geology**	**1**	**1**	**-**	**EES346**	**Geo.491A**	**OLD**
18	**EES492**	**Special Topics in Geology**	**3**	**3**	**-**	**EES333**	**Geo.492T**	**OLD**

*****Synchronization for the first time*

*** NOTE:**

- requires synchronization between the theoretical and practical parts of the course for student who registers for the first time.

Table (9): Compulsory Courses Offered by the Department of Earth and Environmental Sciences in Environmental Sciences.

No.	Course No.	Course Name	Cr. hrs.	Weekly Hours		Prerequisites	Course equivalent	Course (OLD OR NEW)
				Theory	Lab			
1.	**EES104**	**Environmental Sciences**	**3**	**3**	**–**	**-**	**Env.101B**	**OLD**
2.	**EES211**	**Soil and its Pollution**	**2**	**2**	**-**	**-*Synchronization with EES211L**	**Env.211A**	**NEW**
3.	**EES211L**	**Soil and its Pollution lab**	**1**	**-**	**3**	***Synchronization with EES211**		**NEW**
4.	**EES251**	**Water Systems and its Pollution**	**3**	**3**	**–**	**-**	**Env.251A**	**OLD**
5.	**EES 323**	**Solid Wastes**	**3**	**3**	**–**	**Department approval**	**Env.323**	**NEW**
6.	**EES363**	**Management of Environmental Systems**	**3**	**3**	**–**	**Department - approval**	**Env.361**	**NEW**

*****Synchronization for the first time*

Table (10): Elective Courses Offered by the Department of Earth and Environmental Sciences in Environmental Sciences.

No.	Course No.	Course Name	Cr. hrs.	Weekly Hours		Prerequisites	Course equivalent	Course (OLD OR NEW)
				Theory	Lab			
1.	EES103	Environmental Sciences (1)	3	3	–	-	Env.101A	OLD
2.	EES255	Water chemistry lab	1	-	3	-	Env.255	OLD
3.	EES312	Climatology and Meteorology	3	3	–	Department approval	Env.311	NEW
4.	EES316	Environmental Impact Assessment	3	3	–	EES104	Env.316	OLD
5.	EES325	Air Pollution	3	3	–	Department approval	Env.325	OLD
6.	EES328	Radiation Pollution	3	3	–	Department approval	Env.328	OLD
7.	EES351	Marine Environment	3	3	–	Department approval	Env.351	OLD
8.	EES357	Water Reservoirs (Dams)	3	3	–	EES251	Env.357	OLD
9.	EES362	Environment Protection	3	3	–		Env.362	OLD
10.	EES 365	Sewage management	3	3	–	EES 104	Env.365	OLD
11.	EES 382	Energy sources and their environmental impacts	3	3	–	EES 104	Env.381	OLD
12.	EES391	Seminar in Environmental Sciences	1	1	–	Department approval	Env.391	OLD
13.	EES392	Special Topics in Environmental Sciences	3	3	–	Department approval	Env.392	OLD
14.	EES399	Research in Environmental Sciences	3	3	–	Department approval	Env.399	OLD

Table (11)Compulsory Courses Offered by the Department of Earth and Environmental Sciences for other departments

EES107	Introduction to geology for Geography Students	3

Table (12): Table of Equivalent Courses

Course Code and No. in the New Plan	Equivalent Course Code and No. in the Old Plan
EES103	**Env.101A**
EES104	**Env.101B**
EES 101	**Geo.101**
EES102	**Geo.102**
EES105	**Geo.105**
EES106	**Geo.106**
EES107	**Geo.107**
EES201	
EES210	**Geo.210**
EES210L	
EES211	**Env.211 A**
EES211L	
EES213	**Geo.213**
EES213L	
EES220	**Geo.220**
EES220L	
EES222	**Geo.222**
EES222L	
EES251	**Env.251 A**
EES252	**Geo.252**
EES255	**Env.255**
EES302	**Geo.302A, Geo.302**
EES302L	
EES311	**Geo.311**
EES311L	
EES312	**Env.311**
EES316	**Env.316**
EES323	**Env.323**
EES325	**Env.325**
EES328	**Env.328**
EES331	**Geo.331**
EES331L	
EES333	**Geo.333**
EES333L	
EES334	**Geo.334**
EES340	**Geo.340**
EES340L	
EES346	**Geo.346**
EES348	**Geo.348**

EES348L	
EES349	**Geo.349**
EES349L	
EES350	**Geo.350**
EES350L	
EES351	**Env.351**
EES357	**Env.357**
EES361	**Geo.361**
EES362	**Env.362**
EES363	**Env.361**
EES365	**Env.365**
EES 382	**Env.381**
EES385	**Geo.385**
EES391	**Env.391**
EES392	**Env.392**
EES399	**Env.399**
EES412	**Geo.412**
EES432	**Geo.432**
EES444	**Geo.444**
EES452	**Geo.452**
EES452L	
EES453	**Geo.453**
EES453L	
EES455	**Geo.455**
EES455L	
EES471	**Geo.471**
EES471L	
EES474	**Geo.474**
EES474L	
EES475	**Geo.475**
EES475L	
EES479	**Geo.479**
EES479L	
EES482	**Geo.482**
EES484	**Geo.484**
EES491	**Geo.491 A**
EES492	**Geo.492 T**

Suggested Courses Registration for Earth and Environmental Science Students

First Year

First Semester		Second Semester	
Course	**Credit hours**	**Course**	**Credit hours**
EES101	3	EES102	3
EES105	1	EES106	1
Chem.101	3	Bio101	3
Chem.105	1	CS101	3
Math.101	3	Elective course / University	3
EL.101	3	EES104	3
stat.101	3		
Sum	**17**	**Sum**	**16**

Second Year

First Semester		Second Semester	
Course	**Credit hours**	**Course**	**Credit hours**
EES210	2	EES213	2
EES210L	1	EES213L	1
EES220	2	EES222	2
EES220L	1	EES222L	1
AL101	3	MLT100	3
Phys.101	3	Elective course /University	3
Elective course /University	3	EES 211	2
		EES 211L	1
PS102	3	Elective course /Department	3
Sum	**18**	**Sum**	**18**

Third Year

First Semester		Second Semester	
Course	**Credit hours**	**Course**	**Credit hours**
EES311	2	EES348	2
EES311L	1	EES348L	1
EES331	2	EES333	2
EES331L	1	EES333L	1
EES340	2	Elective course /Department	3
EES340 L	1	Elective course /University	3
Elective course/ University	3	Elective course /Department	3
Elective course /Department	3		
Sum	**16**	**Sum**	**15**

Fourth Year

First Semester		Second Semester	
Course	**Credit hours**	**Course**	**Credit hours**
EES350	2	EES452	2
EES350L	1	EES452L	1
EES471	2	EES453	2
EES471L	1	EES453L	1
EES475	2	EES455	2
EES475L	1	EES455L	1
EES361	3	Elective course /Department	3
EES346	4	Elective course /Department	3
		EES349	2
		EES349L	1
Sum	**16**	**Sum**	**18**

Course Description of Earth and Environmental Sciences Major
Department of Earth and Environnemental Sciences

EES 101 - General Geology (1)(3 credit hours.)
This course aims to introduce students to the basic topics of geology, including an introduction to geology, the rock cycle, earth structure, minerals, igneous rocks and volcanic activity, weathering and soil, the geologic column, sedimentary rocks, metamorphic rocks, earthquakes, plate tectonics, and crustal deformation.
Upon completion of this course students should be able to:

1. Relate a general understanding of planet earth and the different earth spheres.
2. Differentiate the major mineral groups (silicates and nonsilicates).
3. Differentiate the different rock types (igneous, sedimentary, and metamorphic).
4. Understand the formation and distribution of earthquakes and volcanoes and their risks and the theory of plate tectonics and how it explains the formation and distribution of earthquakes and volcanoes.
5. Understand the different geological structures and their formation.

EES 102 - Environmental Geology(3 credit hours.)
This course aims to introduce the student to the fundamental concepts of environ-mental geology: environmental hazards (the internal structure of the earth and plate tectonics); natural hazards (earthquake phenomena, volcanic activity, rivers and flooding, and slope processes and landslides); natural resources and pollution (water resources and water pollution, mineral resources, energy resources, soil and the environment, waste as resources and waste management and air pollution); and environmental management (the global perspective and global climate change).
Upon completion of this course students should be able to:

1. Understand the fundamental concepts of environmental geology and the internal structure of the earth and plate tectonics.
2. Understand the natural hazards: earthquake phenomena, volcanic activity, rivers and flooding, and slope processes and landslides.
3. Understand the types of pollution: water pollution,air pollution, andsoil pollution.
4. Understand the renewable energy sources and the non-renewable sources, such as fossil fuels, and the resulting pollution and its impact on climate change.
5. Identify waste products and management methods.

EES 106 – Practical Geology (2)(1credit hour: 3 practical.)

This course aims to introduce students to the concepts of maps and mapping, including the following topics: how to draw contour maps and geological maps, interpret the horizontal layers in geological maps, draw cross sections and columnar sections, interpretation of the inclined layers in geological maps, drawing cross sections in different directions, and using three points problems in geological maps.

Upon completion of this course, students should be able to:

1. Understand how to draw contour maps and geological maps.
2. Understand how to draw cross sections in different directions for different layers, attitudes, dips, and geological columns.
3. Understand how to measure dip and strike for different layers.

EES 107 – Geology for the Geography Students(3 credit hours.)

This course aims to introduce the basic topics of geology and includes an introduction to geology, the rock cycle, earth's internal structure, minerals, igneous rocks, volcanoes, weathering, soil, geological columns, sedimentary rocks, metamorphic rocks, earthquakes, plate tectonics, crystal deformation, and sedimentary rocks.

Upon completion of this course, students will be able to:

1. Relate a short introduction about planet earth and the different earth spheres.
2. Differentiate the major mineral groups (silicates and nonsilicates).
3. Recognize the different types of rocks.
4. Understand the formation and distribution of earthquakes and volcanoes and their risks and understand the theory of plate tectonics and how it explains the formation and distribution of earthquakes and volcanoes.
5. Understand the different geological structures and their formation.

EES 201- Astronomy in geology(3 credit hours.)

This course aims to introduce the principles of astronomy, electromagnetic radiation, instruments of astronomical observation, the solar system, planets, and their moons, stars and galaxies, and the planetarium.

Upon completion of this course the students will be able to:

1. Understand general knowledge about the importance and evolution of astronomy.
2. Understand the basic laws in astronomy.
3. Understand the electromagnetic spectrum.
4. Relate the components of the solar system and descriptions of the sun and the planets and their moons.
5. Understand the properties of stars and galaxies and the basic concepts of the planetarium.

EES 210 - Invertebrate Paleontology (2 credit hours: 2 theoretical)

This course aims to introduce students to the beginning of life on earth; how life was created on earth and evidence of it; and how life evolved and/or diminished throughout geological time, supported by examples; what fossils are (invertebrates, invertebrate paleontology, and other closely-related subjects); how life was preserved in rocks and sediments and the requirements for that to

happen; the principles of taxonomy, the marine realms, and the divisions of marine fauna; the Eukarya and Prokarya, the life domains and different kingdoms of life and their basic characteristics, habits and habitats, and external and internal anatomy.
Upon completion of this course the students will be able to:

1. Identify of the invertebrate fossils and their ages and distribution in rock layers to assist in the reconstruction of earth's paleogeography.
2. Understand earth's paleoenvironmental settings.

EES 210 L - Invertebrate Paleontology Lab (1credit hours: 3 practical)
This course aims to provide an overview of the field of paleontology, including the classification, morphology, evolution, and ecology of invertebrates.
Upon completion of this course the students will be able to:

1. Become familiar with the major fossil groups.
2. Recognize major taxonomical parts of each fossil group.
3. Identify the major guide fossils.
4. Learn to identify fossils.
5. Use fossils as a key indicator of the depositional environment.

EES 211- Soil and Its pollution(2 credit hours: 2 theoretical)
This course aims to introduce soil concepts, compositions, forming processes, properties, and remediation measures, including the following topics: definition of soil science, the constituents of soil and the factors of soil formation including the physical, chemical, and biological properties, soil classification, soil erosion, and pollution and remediation measures.
Upon completion of this course the students will be able to:

1. Understand the physical, chemical, and biological characteristics of soil.
2. Understand the soil classification system.
3. Understand the measurement methods of soil properties.
4. Identify and remediate some major environmental problems affecting soil.

EES 211L- Soil and Its Pollution Lab (1 credit hour: 3 practical hours)
This course aims to familiarize students with conducting practical measurements pertaining to soil, including the following topics: minerals and rocks, moisture, sampling, density, permeability, grain size analysis, sieving, field capacity, saturation percentages, the content of organic matter, carbonate, pH, and dissolved salts, and the elemental concentration.
Upon completion of this course the students will be able to:

1. Identify the soil parent material.
2. Understand the physical properties of soil.
3. Understand the chemical properties of soil.
4. Classify soil samples.

EES 213 - Stratigraphy and Historical Geology (2 credit hours: 2 theoretical)
This course aims to introduce students to the historical development of geology as a scientific discipline and an overview of the methods used by geologist to reconstruct the earth's past history. The rock and fossil record will be studied in lectures, labs, and field outcrops to discover how our planet formed, how plate tectonic activity shaped ocean basins and continent, how geologic processes created economic resources, and how the history of life is recorded by ancient rock deposits. Field

trips will be required. The focus will be on the larger scale vertical and lateral relationships between units of sedimentary rocks that are defined on the basis of lithologic physical properties, paleontological characteristics, age, relationships, and geographic position and distribution as well as a paleontology review including extinctions and geological time significance.
Upon completion of this course the students will be able to:

1. Outline the earth's history in a geological time scale and the evolution process of organisms.
2. Apply proper lab techniques and knowledge of theoretical concepts in geology to acquire and interpret geological data and formulate new questions in a laboratory setting.
3. Determine the relative ages of rocks; construct facies maps, geological columnar sections, and three-dimensional panel diagrams; and apply litho- and bio-stratigraphic correlations.

EES 213 L - Stratigraphy and Historical Geology Lab. (1credit hour: 3 practical)
This course aims to introduce the general principles of historical geology with emphasis on the evolution of earth and life through time. Topics include an overview of rocks, with emphasis on stratigraphic principles, the fossil record, correlation, and paleogeographic map interpretation.
Upon completion of this course the students will be able to:

1. Interpret depositional environments based on observations of sedimentary rocks and fossils.
2. Determine the relative date of a rock unit to interpret the rock's record.
3. Identify and classify fossils (Index fossils) and apply them to interpret the age and environment of the strata.
4. Correlate stratigraphic successions from different locations.
5. Show an understanding of the bio-stratigraphic techniques and apply these techniques to specific examples.

EES 220 – Mineralogy (2 credit hours: 2 theoretical)
This course aims to introduce students to the following: external forms of crystals, including crystallization, crystal growth, internal orders in crystals, symmetry elements without translation, crystal morphology, crystal symmetry, crystal projections, and the thirty-two crystal classes; internal order and symmetry, including Bravais lattices and space groups, crystal chemistry, and X-ray crystallography; and systematic mineralogy, including native elements, sulfides, oxides, hydroxides, halides, carbonates, nitrates, borates, sulfates, chromates, tungstates, molybdates, phosphates, arsenates, vanadates, and silicates (nesosilicate, sorosilicate, cyclosilicates, inosilicates, phyllosilicates, and tectosilicates).
Upon completion of this course the students will be able to:

1. Distinguish between the minerals and the other materials.
2. Understand the crystal systems and crystal symmetry elements.
3. Understand the crystal structure of the minerals and what causes defects in the crystal structure.
4. Distinguish between the minerals based on the various physical properties.

EES 220L - Mineralogy Lab. (1credit hour: 3 practical)
This course aims to introduce practical study of mineral groups by extracting the physical properties, distinguishing the crystals systems and crystals symmetry for wood crystals specimens, and computing the mineral's formula using mineral chemical analysis.
Upon completion of this course the students will be able to:

1. Distinguish between the minerals and the other materials.

2. Calculate the mineral formula by knowing the chemical composition.
3. Distinguish the crystal systems.
4. Identify crystal symmetry.
5. Extract the most important physical properties of mineral hand samples.

EES 222 - Optical Mineralogy (2credit hours: 2 theoretical)

This course aims to introduce light and related phenomena, isotropic and anisotropic crystals, refraction and double refraction, optical indicatrices of uniaxial and biaxial crystals, the interference of light and interference colors, optical examinations of uniaxial crystals, optical examinations of biaxial crystals, and uniaxial and biaxial interference figures.

Upon completion of this course the students will be able to:

1. Differentiate between normal and polarized light.
2. Understand the interaction of minerals and polarized light.
3. Identify the plane polarized light mineral properties,
4. Identify the crossed-Nikons mineral properties.
5. Determine the rock-forming minerals.

EES 222L - Optical Mineralogy Lab. (1credit hour: 3 practical)

This course aims to study the optical properties for minerals using a polarized microscope; the properties of light; and the behavior of light in isotropic and anisotropic minerals, with detailed coverage of uniaxial and biaxial optics.

Upon completion of this course the students will be able to:

1. Distinguish the different parts of a polarized microscope.
2. Distinguish and identify the optical properties of minerals using plane polarized light.
3. Distinguish and identify the optical properties for minerals using cross polar light.
4. Distinguish and identify the optical properties for minerals using cross polar light with an accessory plate.
5. Distinguish and identify minerals using their optical properties for Bowen's reaction series.

EES 252 – Hydrology (3 credit hours.)

This course aims to introduce the basic principles of surface water: water importance; distribution; the water cycle; energy distribution during the water cycle and its environmental importance; the drainage basin concept and the water budget; evapotranspiration, humidity, and their measurements; condensation and cloud formation and cloud types; precipitation forms and measurement; infiltration and runoff factors that influence infiltration and runoff, and measurement of it; water movements in the vadose zone and water recharge; and the water situation in Jordan.

Upon completion of this course the students will be able to:

1. Understand the importance of energy transformation during the hydrologic cycle.
2. Understand drainage basin concept and elements.
3. Create a water budget for a drainage basin.
4. Measure humidity, evaporation, and evapotranspiration.
5. Understand the conditions for condensation and precipitation.

EES 302 – Surveying (2credit hours: 2 theoretical)

This course aims to introduce the principles of surveying, including its definition and importance; methods of surveying; calculations in surveying; leveling; aerial photographs; and the instruments of

surveying: tape, level, theodolite, total station, and GPS. Laboratory exercises include the use of different surveying instruments in the field.
Upon completion of this course the students will be able to:

1. Relate the basic concepts of surveying.
2. Understand the methods of surveying.
3. Perform surveying calculations.
4. Understand the basics of photogrammetry.
5. Understand the methods of leveling.

EES 302L – Surveying Lab. (1credit hour: 3 practical)
This course aims to introduce cadastral applications in different processes through the use of different spatial-purpose devices.
Upon completion of this course the students will be able to:

1. Work with various measurement units and map scales.
2. Calculate the area of irregular shapes.
3. Use different-purpose cadastral field measurements devices.

EES 311 – Microfossils (2 credit hours: 2 theoretical)
This course aims to offers a general introduction to the various groups of microfossils, including their morphology, classification, and distribution, and the use of microfossils to interpret the paleoenvironment and the relative age of rocks.
Upon completion of this course the students will be able to:

1. Understand the concept of microfossils and their application in geology.
2. Recognize and differentiate between the different groups of microfossils theoretically and practically.
3. Understand the practical importance of microfossils in geology.

EES 311 L – Microfossils Lab. (1credit hour: 3 practical)
This course aims to offers a general introduction to the various groups of microfossils, including their extraction and their use for solving geological problems and in industrial applications.
Upon completion of this course the students will be able to:

1. Assign a microfossil to its major taxonomic group.
2. Deduce paleoecological and/or paleogeographic interpretations from different groupings of microfossils.
3. Determine which microfossil groups are most applicable to the solution of a variety of particular geological problems.
4. Draw basic stratigraphic conclusions about microfossil assemblages (e.g., age of rock unit, correlation, etc.).

EES 331 - Igneous and Metamorphic Rocks (3 credit hours: 3 theoretical)
This course aims to introduce the principles of igneous and metamorphic rocks including thermodynamics, petrography, the composition of magmatic rocks including classical petrography, and descriptive petrochemistry; the origin and evolution of magmas; Calc-alkaline volcanic rock bodies; – calc – alkaline plutonic rock bodies; subalkaline basaltic and ultramatic rock bodies, and alkaline rock bodies; and the nature of metamorphism, the metamorphic record of the original rock,

the record of metamorphic processes, metamorphic grade, zones, and facies; petrography and the composition of metamorphic bodies; the composition, fabric, and classification of metamorphic rocks; descriptions of strongly foliated, weakly foliated, and non-foliated to weakly-foliated rocks; and composition diagrams.

Upon completion of this course the students will be able to:

1. Identify igneous and metamorphic rocks in hand samples.
2. Understand rocks classification.
3. Understand volcanoes and their types.
4. Understand the optical properties of Bowen's reaction series and Barrovian sequence.
5. Identify igneous and metamorphic rocks by using optical microscopy.
6. Identify the different types of igneous and metamorphic rocks in Jordan.

EES 331L - Igneous and Metamorphic Rocks Lab. (1credit hour: 3 practical)

This course aims to study the different types of igneous and metamorphic rocks, the different types of fabric, and the rock-forming minerals for igneous and metamorphic rocks.

Upon completion of this course the students will be able to:

1. Distinguish the different type of igneous and metamorphic rock.
2. Distinguish and classify the plutonic igneous rocks.
3. Distinguish and classify the foliated metamorphic rocks.
4. Distinguish and classify the non-foliate metamorphic rocks.
5. Distinguish and classify the volcanic igneous rocks.

EES 333 - Sedimentology and Sedimentary Petrology (2 credit hours: 2 theoretical)

This course aims to introduce the principles of sedimentology and sedimentary petrology, including how sediments are formed in nature (weathering processes, transport, and deposition); diagenesis and lithification; abundance and ranking of sedimentary rocks in crustal materials; general schemes of sedimentary rocks classification; the usefulness of studying sedimentary rocks; the facies and its geologic significance; Walther Law; and methods of studying sedimentary rocks and sediments, textural approaches of sediments, sedimentary structures, paleocurrents, conglomerates, sandstones, mudrocks, limestones, dolomites, chert, phosphates, and evaporites, with special regard to their textural properties, mineral composition, petrography, diagenesis, genesis, and depositional environments.

Upon completion of this course the students will be able to:

1. Identify sedimentary rocks and understand the necessary requirements to conduct any physical and chemical analyses that may be requested by a future employer.
2. Recognize the importance of depositional environments and their relation with the determination of the sediment and sedimentary facies types and how they distribute laterally and vertically in the sedimentation basins; and track the geometry of sedimentary body with the help of geological tools, such as paleocurrent analysis, to determine the volume of sedimentary bodies.
3. Recognize natural hazards and the relation of their causes with the type and geology of sedimentary rocks.
4. Describe the types of rock cuttings and the cores of drilled oil boreholes.

EES 333L – Sedimentology and Sedimentary Petrology Lab.(1credit hour: 3 practical)

This course aims to cover a range of exercises and applications that are in line with the theoretical course content (EES 333A) in terms of enabling the student to identify the basic mineral constituents of the sediment produced by the weathering of source rocks using the stereo-microscope; recognize the concepts of sedimentary rock facies, facies association, and facies succession; make correlations between different sedimentary facies; conduct volumetric and morphological analysis of sedimentary particles; analyze paleocurrents; describe sedimentary structures and identify the types of sedimentary rocks; and conduct thin-section study of clastic and nonclastic sedimentary rock.
Upon completion of this course the students will be able to:

1. Determine the type sedimentary rock and describe it and its sedimentary structures.
2. Absorb the concept of sedimentary facies and identify it in the field.
3. Analyze the grain size and grain morphology of loose sediment.
4. Analyze the paleocurrents.
5. Study thin sections of sedimentary rock.
6. Select the proper practical steps necessary for the study of sedimentary rocks and sediments.

EES 334 - Carbonates and Evaporites (3 credit hours)

The aim of this course is to introduce the student to the following topics: mineralogy and the mode of formation, crystal chemistry, the mechanisms of calcium carbonate equilibrium, classifications of carbonates, structure classification of evaporites, thermo and solution digenesis of salt minerals, chemical considerations and the mechanism of formation of dolomite, excessive dolomites as an indicator of the environment, the behavior of Sr, Zn, and Mn during carbonate digenesis, the behavior of Br, Sr, B, and F during the salt deposition, and silicate evaporates deposition in recent lakes.
Upon completion of this course the students will be able to:

1. Understand the concept of carbonate and evaporite minerals and rocks and their application in geology.
2. Recognize the environmental conditions and classifications of carbonate and evaporite minerals and rocks.
3. Understand the types and constitutes of the different carbonate and evaporites minerals and rocks.

EES 340 - Structural Geology (1) (2 credit hours: 2 theoretical)

This course aims to introduce students to the concepts of force, stress, and strain and their effects on rocks and the different geological structures. The course contents include an introduction to structural geology, the concepts of force, stress, and strain; rheology; joints and veins: (joint systems and their origin and economic importance); faults (description, recognition, system, and economic importance); and folds: description, systems, and origin.
Upon completion of this course the students will be able to:

1. Understand the concept of stress and strain and their application in structural geology.
2. Recognize the different geological structures both theoretically and in the field.
3. Understand the practical importance of structural geology.

EES 340L - Structural Geology (1) Lab. (1credit hour: 3 practical)

This course provides an introduction to structural geology in practice and addresses the following topics: attitude of lines and planes, compass measurements, structural maps and sections, rose diagrams, and stereographic projection. Field trips are required.
Upon completion of this course the students will be able to:

1. Understand the attitudes of structural planes (strike and dip) and lines (trend and plunge).
2. Use a geological compass in measuring beds and structures.
3. Draw and analyze geological and structural maps and sections.
4. Understand the techniques of projection in structural geology.
5. Recognize geological structures in the field.

EES 346 - Field Geology (4 credit hours: 12 practical)

The aim of this course is for students to learn how to conduct a geological survey of an area of about 10km2, including aerial photographs. Geological profiles of the mapped area and a report on the various field activities are required.

Upon completion of this course the students will be able to:

1. Use the materials and tools for conducting field work.
2. Determine the types of faults and folds.
3. Draw geological profiles and geological maps.
4. Write a field activities report.

EES 348 – Introduction to Geographic Information Systems(2 credit hours: 2 theoretical)

The aim of this course is to introduce the basics of geographic information systems (GIS) including the different models of GIS (vector and raster), the sources of GIS data, data preparation and processing, vector data analysis, and raster data analysis, as well as the applications of GIS in different disciplines, in particular the geosciences and environmental sciences. The course also covers the principles and uses of GIS software.

Upon completion of the course, students will be able to:

1. Comprehend the methods of data representation in GIS.
2. Possess the capabilities to analyze raster data.
3. Possess the capabilities to analyze vector data.
4. Understand the sources of GIS data.

EES 348L – Introduction to GIS Lab.(1credit hour: 3 practical)

This course aims to introduce students to the applications of GIS in geology and use ArcGIS for creating, managing, and processing geographic data.

Upon completion of the course, students will be able to:

1. Enter the software, work on its basics, and distinguish between various GIS data.
2. Convert and edit vectors to rasters and work on its applications.
3. Query data using different analysis methods.
4. Create new geographic shape files, using different symbolizing applications, and design shape files layouts.
5. Recognize and change coordinate systems.

EES 349 – Introduction to Remote Sensing(2 credit hours: 2 theoretical)

This course aims to introduce students to the basics of remote sensing, electromagnetic radiation and its characteristics, aerial photography and interpretation, the types and characteristics of remote sensors, and remote sensing applications in different disciplines. The course also covers the principles and uses of remote sensing software.

Upon completion of the course, students will be able to:

1. Comprehend the principles of remote sensing.

2. Understand the different types of aerial photos and satellite (space-borne) images.
3. Possess the ability to compute, analyze, identify, and interpret images collected from instruments on airborne and space borne platforms.
4. Use the different methods of image processing.

EES 349L – Introduction to Remote Sensing Lab.(1credit hour: 3 practical)
This course aims to introduce students to analyzing aerial photographs and satellite images and addresses the following topics: the principles of remote sensing science, electromagnetic radiation and its laws, studying and analyzing aerial photos and various satellite images; methods of processing satellite images and their use in different applications using ENVI software.
Upon completion of the course, students will be able to:

1. Perform calculations using the laws of electromagnetic radiation (Maxwell's Wave Theory, Quantum Theory, Stephan Boltzman Law, and Wien's Displacement Law) and recognize the relationships between them.
2. Measure and analyze reflected rays for target identification.
3. Use the ENVI software in terms of basic concepts, key features, and tools.
4. Combine multiple images into a single composite image (mosaicking).
5. Use remote sensing data to examine many applications in the fields of geosciences and environment science.

EES 350 - Economic Geology(1)(2 credit hours: 2 theoretical)
This course aims to differentiate the important factors in evaluating ores and addresses the following topics: a brief history of the use of minerals and the development of economic geology; geology of mineral deposits and ores: ore formation, early and late, magmatic ore deposits. Pegmatites; hydrothermal ore deposits; fissure veins; metasomatic and replacement deposits; metamorphism and metamorphic mineral deposits; sedimentary mineral deposits; genesis and forms of metallic minerals such as nickel, copper, lead, zinc, manganese, gold, and silver as well as non-metallic deposits such as phosphate and potash; and economic deposits from different parts of the world.
Upon completion of this course, the students will be able to:

1. Understand the history of the use of minerals and the development of economic geology, the geology of mineral deposits and ores (ore formation, early and late magmatic ore deposits), pegmatites, hydrothermal ore deposits, fissure veins, metasomatic and replacement deposits, metamorphism and metamorphic mineral deposits, and sedimentary mineral deposits.
2. Understand the genesis and forms of metallic minerals such as nickel, copper, lead, zinc, manganese, gold, and silver as well as non-metallic deposits such as phosphate and potash, Economic deposits from different parts of the world are discussed.

EES 350L - Economic Geology (1) Lab. (1credit hour: 3 practical)
This course aims to introduce the concept of economic geology and its application in geology. The following topics are addressed: understanding the concept of economic geology and its practical applications in geology, with a focus on the most important mathematical methods to calculate ore reserves and identify the ore minerals either by using the ore microscope or interpretation of X-ray diffraction.
Upon completion of this course the students will be able to:

1. Understand the role of a geologist in the various stages of economic ores exploration.

2. Calculate ore reserves by calculating the average grade, tonnage, and volume of the ore.
3. Understand the methods of sample collection in the field and the methods of ore separation.
4. Apply manual interpretation of the x-ray diffractionresults.

EES 361 - Geology of Jordan (3 credit hours.)

This course aims to introduce the geology of Jordan and addresses the following topics: geological studies in Jordan, the stratigraphy of Jordan (Precambrian, Paleozoic, Mesozoic, and Cenozoic), volcanic activity, structural geology, geomorphology, mineral resources, and water resources. Two field trips are required: one to south Jordan and one to north Jordan.

Upon completion of this course, the students will be able to:

1. Understand the geological natural resources of Jordan.
2. Understand the geological structures of Jordan.
3. Understand the stratigraphy and geomorphology of Jordan.

EES 385 – Research Methods in Geology(3 credit hours.)

This course aims to introduce undergraduate students to scientific research methods applied to modern geosciences. The course focuses on designing geologic field and laboratory-based studies, scientific writing skills, public presentation, citations, and professional ethics.

Upon completion of this course, the students will be able to:

1. Read and interpret data from previous literature.
2. Develop the skills to present and listen to a scientific presentation and to ask relevant questions regarding the material presented.
3. Use the scientific research writing skills learned.
4. Use the different methods of scientific citation.
5. Understand the ethics of scientific research and methods of scientific research design.

EES 412 – Paleoecology(3 credit hours.)

This course aims to define and explain the basic concept of paleoecology and addresses the following topics: depositional environments, classification of organisms, material structure of hard parts of organisms, importance and classification of trace fossils, trace fossils as indicators of depositional environment, paleoecology of different geological periods (marine environment parameters as paleo-temperature, paleo-salinity, and nature of marine substrate), and terrestrial environments: lakes and glacial and desert environments).

Upon completion of this course, the students will be able to:

1. Discuss the concepts and important questions in the paleoenvironment.
2. Identify marine-sediment components and their environmental significance.
3. Incorporate paleoecological questions and data into research.
4. Communicate research results orally and in writing.
5. Identify and interpret the most common macrofossils occurring in the Paleozoic, Mesozoic and Cenozoic eras in Jordan.

EES 432 - Industrial Rocks and Minerals(3 credit hours.)

This course aims to study the industrial minerals and rocks from the aspects of geology, mineralogy,

specification, uses, classification, and modern technological trends, including industrial rocks (granite, basalt, pumice, slate, marble, sand, and gravelly sandstone, clay minerals, limestone and dolomite, phosphate, gypsum and halite);industrial minerals (fluorspar, mica, beryl, asbestos, graphite, talc, sulfur, diamond, diatomite, potash, sodium minerals, and borates); and methods used to identify minerals and rocks using SEM, X-Ray (XRD and XRF).

Upon completion of this course, the students will be able to:

1. Discriminate between industrial rocks and industrial minerals.
2. Use the appropriate method of analysis to determine the industrial rock and minerals.
3. Understand the most important uses for each of the industrial rocks and minerals.

EES 444 - Tectonics of the Earth(3 credit hours.)

This course aims to introduce to students to the plate tectonics and major structures of the earth and addresses the following topics: the whole earth structures, plate tectonics, rifts, sea floor spreading, extension tectonics, fold-thrust belts, strike-slip tectonics, and active tectonics. Field trips are required to the Jordan Valley.

Upon completion of this course, the students will be able to:

1. Understand the major structures of the earth and the mechanism of plate tectonics.
2. Recognize the different features associated with active tectonic movements and examples from the Dead Sea fault.
3. Recognize the different stresses affecting the lithosphere (compression, tension, and shear) and examples of them (tensional faults, folds and thrusts, and strike-slip faults).

EES 452 – Applied Hydrogeology (2 credit hours: 2 theoretical)

This course aims to introduce the principles of hydrogeology and includes a description of water cycle elements, the watershed concept, and a water budget; aquifers and their properties (porosity, permeability, hydraulic conductivity; aquifer types); ground water movement and ground water movement to wells; and groundwater exploration (electrical resistivity); and ground water chemistry and quality.

Upon completion of this course the student should be able to:

1. Measure and calculate the elements of the hydrologic cycle.
2. Understand the concept of underground reservoirs, types, and characteristics.
3. Measure flow through porous medium and the hydraulic conductivity, transmissivity, and storativity of aquifers.
4. Differentiate between the various groundwater exploration techniques.
5. Measure groundwater major anions and cations.

EES 452L – Applied Hydrogeology Lab. (2 credit hours: 2 theoretical)

This course aims to introduce students to practical exercises to calculate water balance, average precipitation depth, evaporation, and surface run-off, infiltration and hydrological maps testing, porosity and permeability, and pumping.

Upon completion of this course student should be able to:

1. Recognize water quality representations.
2. Calculate water balance.
3. Determine the types of faults and folds.
4. Calculate porosity and permeability.

5. Draw hydrological maps.

EES 453 - Petroleum Geology (2 credit hours: 2 theoretical)

This course aims to introduce the student to the different types of hydrocarbon materials and its formations and includes an introduction to the origins of oil formation, the migration and accumulation of oil and gas and their physical and chemical properties, the environments of the subsurface, reservoir characteristics, methods of oil exploration in deep wells, drilling fluid and types and the problems associated with it and methods of treatment, electric well-logging and the processes associated with these operations, and the description of geological samples and writing various reports.

Upon completion of this course, the students will be able to:

1. Understand the basic information necessary to identify the different types of hydrocarbons and the methods of their formation, accumulation, and migration.
2. Understand the different methods used for oil and natural gas exploration and the different types of drilling and drilling fluids.
3. Identify the problems related to drilling deep wells and how to repair them.
4. Calculate the time necessary to bring the cutting from the bottom of the hole to the surface (lag-time).
5. Describe cuttings and cores and write daily, weekly, and final reports.

EES 453L - Petroleum Geology Lab. (1credit hour: 3 practical)

This course aims to introduce the students to the essential skills of correlation, sea transgression/ regression, use of geological maps, sample description, and the porosity and permeability of rocks.

Upon completion of this course, the students will be able to:

1. Use the acquired lithological, paleontological, and time correlation skills.
2. Interpret the depositional environments and changes in the position of shorelines (transgression/regression).
3. Determine the source land direction and use geological maps.
4. Determine the porosity and permeability of samples and the strike lines of the outcrops.
5. Locate exploration and production wells.

ES 455 - Engineering Geology (2 credit hours: 2 theoretical)

The aim of this course is to introduce the students to analyzing the effects of liquids on earth's materials, the geological processes (weathering, erosion, and tectonics), engineering geology, the alluvial process, the stability of slopes, earth subsidence, and disposal sites.

Upon completion of this course the students will be able to:

1. Understand the physical properties of soil.
2. Understand the effects of water on soil.
3. Conduct stress tests.
4. Identify the problems of soil constructions and the methods to solve them.

EES 455L - Engineering Geology Lab.(1credit hour: 3 practical)

This course aims to introduce the students to practical soil testing, such as moisture, porosity, permeability, density, stresses, and the effects of water.

Upon completion of this course the students will be able to:

1. Understand the physical properties of soil.

2. Understand the effects of water on soil.
3. Conduct stress testing.
4. Identify the problems of soil constructions and the methods to solve them.

EES 471 - Applied Geophysics(2credit hours: 2 theoretical)
This course provides an introduction to applied geophysical methods, focusing on the application of the various geophysical methods, data acquisition, processing and interpretation of subsurface structures, anomalies and exploration activities. This course has special interest in the following geophysical methods: Seismic (Refraction and Reflection), Gravity, Magnetic, and Direct electric (Electric Resistivity) methods. Additionally, it incorporates field data acquisition using available instruments and real data processing activities and interpretations.
Upon completion of this course the students will be able to:

1. Understand the basic physical concepts of different geophysical methods.
2. Measure and implement different geophysical surveys.
3. Use geophysical data (analysis and interpretation).

EES 471L - Applied Geophysics Lab.(1credit hour: 3 practical)
This course focuses on the application of geophysical methods using seismic refraction method in horizontal and multi horizontal case. Seismic refraction method (forward and reverse shooting & dipping interface). Seismic refraction (faulting and limitations. Seismic refraction. Field survey using different geophysical methods. Seismic reflection data interpretation. Gravity reduction (drift, latitude, free air, Bouguer correction).Gravity data interpretation and modeling simple shape sphere and horizontal cylinder. Magnetic reduction and interpretation. Resistivity field work and data interpretation (VES and horizontal variation Wenner method).
Upon completion of this course the students will be able to:

1. Understand the application of different geophysical methods in the field and deal with the correction and interpretation of the data.
2. Use the applied geophysical methods (seismic, gravity, and electric and their application and interpretation).

EES 474 - Engineering Geophysics(2 credit hours: 2 theoretical)
This course aims to introduce the students to the, physical properties of earth materials, engineering geophysical method (principles and applications, instrumentation, data analysis and processing techniques, electrical methods, applied seismic methods, and other methods); geological and geophysical controlling engineering projects (dams, channels, sinkholes, collapses, and earthquake engineering.
Upon completion of this course the students will be able to:

1. Understand the importance of geophysical methods in solving engineering problems.
2. Use scientific geophysical data and present a solution for different engineering problems.

EES 474 L- Engineering Geophysics lab(1credit hour: 3 practical)
This course focuses on the application shallow subsurface geophysical methods for environmental and engineering studies. It incorporates the introduction of the technical foundations, uses, limitations, data processing and interpretation of the following geophysical methods: Seismic Refraction Tomography, Seismic Surface Waves, Electrical Resistivity Tomography, Microgravity, Gradiometery, and Ground Penetrating Radar (GPR). The course includes field data acquisition using available instruments and real data processing activities, and/or case studies.

Upon completion of this course the students will be able to:

1. Understand the importance of geophysical methods in solving engineering problems.
2. Use scientific geophysical data and present a solution for different engineering problems.

EES 475 - Principles of Geochemistry(2 credit hours: 2 theoretical)

This course aims to introduce the student to the following topics: historical geochemistry: the composition, origin of earth, early and later geochemical history of the crust, history of atmosphere and sea water (Phase rule); geochemistry of igneous rocks (crystallization of magma, stages of magmatic crystallization, and volcanic gases); geochemistry of metamorphic rocks (conditions of metamorphism, equilibrium relations, and metamorphic differentiation); geochemistry of sedimentary rocks (chemical weathering, carbonate, and evaporate sediments); and the oxidation potentials and Eh-pH diagrams-metamorphic rocks.

Upon completion of this course the students will be able to:

1. Carry out appropriate mathematical strategies for solving geochemical problems.
2. Synthesize the results of their problem-solving with other work in the form of short, well-organized papers.
3. Understand the origins of the earth's atmosphere, oceans, and rocks.
4. Apply chemical concepts to predict the outcome of geologic processes.
5. Gather and interpret data independently by using the appropriate geochemical instrumentation.

EES 475 L- Principles of Geochemistry Lab.(1credit hour: 3 practical)

This course aims to introduce students to different geochemical experiments. Topics include the geochemical characteristics of geological earth samples through geochemical lab analysis and equipment, the thermodynamics of chemical reactions and the structure of silicate minerals, and the chemistry of isotopes and equations.

Upon completion of this course the students will be able to:

1. Conduct a geochemical procedure for calculating the percentage of water in a geological sample.
2. Determine the percentage of organic matter in a geological sample.
3. Determine the percentage of carbonate in a geological sample using the calciometer and titration.
4. Understand the structures of silicate minerals according to the ways Si-O Tetrahedra are related to each other.
5. Study and analyze phase-diagrams.

EES 479 - Subsurface Geology and Well Logging(2 credit hours: 2 theoretical)

This course provides the applied knowledge and hands-on experience required to generate subsurface accurate time/depth structure maps, fault surface maps, thickness, and net pay isopach and isochore maps, and subsurface cross-sections. It aims at introducing the students to the notion of interactive seismic interpretation of seismic reflection data, well log analysis and their integrated application to provide sound reservoir/formation evaluation and appraisal.

Upon completion of this course the students will be able to:

1. Understand the basic physical concepts of geophysical exploration methods and geophysical well logging.
2. Understand well logging methods and petrophysical analysis.

3. Interpret 2-D and 3-D seismic data and analysis.
4. Understand the basics of subsurface structural maps and sedimentary basin models.

EES 479L - Subsurface Geology and Well Logging Lab.(1credit hour: 3 practical)

This course aims to introduce the student to the basic physical concepts of exploration well logging geophysical methods. The topics include geophysical exploration methods, seismic stratigraphy, well logging and petrophysical analyses, subsurface facies analyses, drilling cores, seismic data and processing, 2-D and 3-D seismic data interpretation, set up and analysis of subsurface structural maps, preparing and analyzing subsurface structural maps, and setting up subsurface depositional basin models (problem and solution).

Upon completion of this course the students will be able to:

1. Understand the basic physical concepts of exploration geophysical methods and geophysical well logging.
2. Understand well logging methods and petrophysical analyses.
3. Interpret 2-D and 3-D seismic data and analyses.
4. Understand the basics of subsurface structural maps and depositional models.

EES 482 - Marine Geology(3 credit hours.)

This course aims to introduce the student to marine geology and the world distribution of oceans and addresses the following topics: distribution of the oceans, the origin of sea water, temperature, salinity, ocean currents, gases, continental slopes, factors affecting sedimentation on the continental slopes, the importance of the continental shelf as a source of minerals and petroleum, the continental rise, sedimentation and processes affecting the continental rise, manganese nodules, drowned valleys, warm currents, glaciation and fluctuation of sea level, and paleoenvironmental indicators.

Upon completion of this course the students will be able to:

1. Understand the history of oceanography and the origin of the earth and the oceans.
2. Understand the physical geography of the ocean basins and the evolution of ocean basins (tectonic).
3. Understand the types and classifications and mechanisms of the formation of the oceanic sediment transport.
4. Understand the physical properties of the ocean surface water and subsurface ocean water trading.
5. Understand the interactions between the oceans and the atmosphere including climate, monsoons, and hurricanes.

EES 484– Seismology(3 credit hours.)

This course provides an overview of earthquake seismology, earthquake physics, and mechanics, seismic waves and wave propagation, determine earthquake locations, depths and rupture mechanisms, instrumentation, application to the study Earth's interior structure and tectonics, earthquake hazard assessment and mitigate processes, and studying the seismicity of the Middle East region, with special focus on the Dead Sea Transform (DST) fault system.

Upon completion of this course the students will be able to:

1. Understand the basic concepts of seismology and be able to deal with seismological data and determinations of different seismic wave types and their arrival times.
2. Conduct a seismic hazards assessment for a defined region.
3. Differentiate between different seismic scales of magnitude and intensity.

4. Understand the importance of seismic data in tectonic studies.
5. Locate an earthquake and focal depth using different methods.
6. Define the seismic phases and understand their role in determining the earth's interior structures.

EES 491 – Seminar(1 credit hour.)
This one-hour course addresses topics not included in the program curricula. The topic is selected by the course instructor on condition of approval of course plan by department head prior to offering the course.

EES 492 - Special Topics(3 credit hours.)
This course addresses topics not included in the course study plan. The instructor will determine the subject of the course and provide a comprehensive plan of the course (three hours per week).

Course Descriptions
Environmental Sciences Minor

EES 103 - Environmental Sciences (1) (3 credit hours.)
This course intends to introduce students to the living and non-living components of the environment, major natural hazards, biomes, and the biogeochemical cycles. The following topics are addressed: the basic concepts of environment science, the components of ecosystems, the interactions between biotic and abiotic factors, the stability and disturbance of ecosystems, adaptation to environmental changes, the earth's composition and structure, natural hazards (causes, hazards, risks, and mitigation or prevention measures), biomes (terrestrial, aquatic, and wetlands), and biogeochemical cycles.
Upon completion of this course the students will be able to:

1. Identify the major concepts of environmental sciences and the human impacts on the environment.
2. Explain the science behind the biogeochemical cycle.
3. Understand global environmental issues.
4. Differentiate between the biotic and abiotic components of the ecosystems.

5. Understand the mechanism of natural hazards, differentiate between the primary and secondary hazards, and identify mitigation measures.

EES 104 - Environmental Sciences(3 credit hours.)
This course aims to introduce the basic principles of the environment, the ecosystems, ecological succession, and resources management and addresses the following topics: the definition of the environment and its branches, biotic and abiotic components, ecological succession, ecosystems, demography and human communities growth, earth biomes, natural resources and the environment, renewable and non-renewable resources, mineral resources, soil, the atmosphere and air pollution, water resources, and land use and land use planning.
Upon completion of this course the students will be able to:

1. Define the concepts and elements of the environment and the ecosystems.
2. Understand environmental problems and how to deal with them.
3. Understand the environmental resources and their sustainability.

EES 211- Soil and Its Pollution(2 credit hrs:2 theoretical)
This course aims to introduce the soil concept, its compositions, forming processes, and properties, and remediation measures. The following topics will be addressed: the definition of soil science; the constituents of soil and the factors of soil formation including physical, chemical, and biological properties; soil classification; soil erosion and pollution and remediation measures.
Upon completion of this course the students will be able to:

1. Understand the physical, chemical, and biological characteristics of soil.
2. Understand the soil classification system.
3. Understand the measurement method of soil properties.
4. Identify and address some major environmental problems affecting soil.

EES 211L- Soil and Its Pollution Lab.(1 credit hour: 3 practical hours)
This course aims to introduce the students to conducting practical measurements pertaining to soil and will address the following topics: minerals and rocks, moisture, sampling, density, permeability, grain size analysis, sieving, field capacity, saturation percentage, content of organic matter, carbonate, pH, dissolved salts, and the elemental concentration.
Upon completion of this course the students will be able to:

1. Identify the soil parent material.
2. Understand the physical properties of soil.
3. Understand the chemical properties of soil.
4. Classify the soil.

EES 251 - Aquatic Systems and their Pollution(3 credit hours.)
This course aims to introduce the students to the hydrological cycle and its importance, major aquatic systems, and sources and treatment of pollution. The following topics will be addressed: importance of water, water distribution in the earth water structure, the chemical, physical, and thermal properties of water, water cycle elements, fresh water systems (ponds and lakes, stream and rivers, and wetlands), marine systems (oceans and seas), ecological limiting factors in aquatic environments, pollution of aquatic systems, and the water situation in Jordan.
Upon completion of this course the students will be able to:

1. Understand the importance of the chemical structure of water and the water distribution on the earth.

2. Understand the chemical, physical, and thermal properties of water and their importance.
3. Understand the main characteristics of fresh water and marine and the major limiting factors in the aquatic environments.
4. Understand the concept of pollution and the main pollutants in the aquatic systems.
5. Understand the environmental situation of water in Jordan.

EES 255 – Water Chemistry Lab.(1 credit hr: 3 practical hours)
This course intends to train students to conduct water analyses. The course will consist of 10 laboratory sessions, during which student will be taught surface and groundwater sampling; laboratory safety measures; water quality and quality control and assurance; solution concentrations and measurement; water sample preparation and instruments; measuring water pH, electrical conductivity (EC), and total dissolved solids (TDS), major cations (Na, Ca, Mg, K), major anions (Cl, SO4, HCO3, CO3), nitrogen compounds, phosphorus, total alkalinity, hardness, turbidity, dissolved oxygen BOD (biological oxygen demand), COD (chemical oxygen demand), and some heavy metals in water.
Upon completion of this course the students will be able to:
1. Understand the importance and procedures of water quality analysis.
2. Identify the different devices used to analyze water samples.

EES 312 - Climatology and Meteorology(3 credit hours.)
This course is designed to familiarize students with the atmospheric layers, thermodynamics, and the impacts on the earth, as well as the methods of weather forecasting. It covers the basic concepts (gaseous thin layer, atmospheric layers, turbulent atmosphere, forces and causes of turbulence, the sun and the energy of the atmosphere, and a review of thermodynamics), observations and measurements (temperature, humidity, wind, pressure, deposition, and monitoring networks), the atmospheric system (the homogenous layer, diffusive and convective equilibriums, tropopause, dry air composition), state of the atmosphere, the physics of the clouds, the dynamics of the atmosphere, radiation in the atmosphere and its impact on the environment, and weather forecasting methods.
Upon completion of this course the students will be able to:
1. Identify the weather and climate elements.
2. Understand the formation and development of weather and climate conditions.
3. Understand the theory of climate change.
4. Understand weather forecasting and analysis.

EES 316 – Environmental Impact Assessment(3 credit hours.)
This course introduces the students to the principles and techniques of Environmental Impact Assessment (EIA) reporting and their application on case studies. The following topic are addressed: the principles of EIA and its origins and development; organizing an EIA; prediction of impacts and evaluating impact significance; mitigation; reporting and reviewing the EIA; decision-making, monitoring and follow up; and EIA examples.
Upon completion of this course the students will be able to:
1. Understand the principles of EIA.
2. Understand the origins and development of EIA.
3. Identify the steps for organizing an EIA.
4. Understand the methods of impacts prediction and evaluation of impact significance.
5. Understand the EIA reporting and review steps, the decision-making process, and the

methods of impacts prediction.

EES 323 – Integrated Solid Waste Management(3 credit hours.)
This course aims to familiarize students with the sources of solid waste and processes and techniques of disposal and re-use. The following topics are addressed: solid waste management, anthropogenic and natural ecosystems, sources of solid waste (domestic, industrial, hazardous, agricultural, and others), solid waste collection and transportation, treatment and disposal (on-site disposal, sea and ocean dumping, landfilling, composting and incineration), methods of resource recovery from waste (reuse, recycling, reprocessing and conversion waste, and recapturing heat energy), the steps of integrated solid waste management.
Upon completion of this course the students will be able to:

1. Identify and distinguish solid waste.
2. Understand the different sources of solid waste and methods of transportation, collection, treatment and disposal.
3. Understand the steps of integrated solid waste management.
4. Understand the methods of resource recovery from waste.

EES 325 - Air Pollution(3 credit hours.)
This course introduces students to the major air pollutants, its sources and environmental impacts, and monitoring and control methods. The following topics are addressed: air pollution (gaseous pollutants, aerosols, particulate matter, and mechanisms of transportation); sources of air pollution (industries, transportation sector, and agricultural activities), the effects of air pollution on human health and welfare, vegetation, animals, construction, and the climate; air pollution control (methods and monitoring of air pollution); and international and national quality standards and treatment techniques.
Upon successful completion of this course, students will be able to:

1. Understand the concepts related to air and its components and layers.
2. Understand the quality of air pollutants and their classifications and measurements.
3. Identify the reduction methods of air pollution.
4. Understand the methods of measuring air quality and the quantity of pollutants.
5. Understand Jordan's air quality conditions, control techniques, and responsible authorities.

EES 328 - Radiation Pollution(3 credit hours.)
This course aims to familiarize students with the principles of radioactivity, its sources and environmental impacts, and management of radioactive waste. The following topics are addressed: the principle concepts of radiation; dosimetry and determination of safe doses; sources of radiation (natural and man-made); uses of radioactive materials; radiation effects on humans and the environment; radioactive waste and its management, protection from radioactive waste, and cycling of radioisotopes in the environment.
Upon completion of this course the students will be able to:

1. Understand the principle concepts of radioactivity and its properties, types, and detection.
2. Identify the sources of radiation and the types of radioactive materials.
3. Understand the environmental effects of radiation.
4. Understand radiation protection techniques and radioactive waste disposal.

EES 351 - Marine Environment(3 credit hours.)
This course introduces students to marine ecosystems and their characteristics, marine pollution, and

protection techniques. The following topics are addressed: introduction to marine environments and their characteristics and importance; the physical, chemical, and geological aspects, of marine ecosystems (marshes, mangroves, coral reefs, grasslands, lagoons, and tidal flats); threats to marine environment, marine pollution and its types; climate change; and protection techniques for the marine environment.

Upon completion of this course the students will be able to:

1. Identify the marine ecosystems and their characteristics.
2. Understand the major threats to the marine environment and marine pollution.
3. Understand treatment methods and control of marine pollution

EES 357 – Dams (3 credit hours.)

This course introduces students to the types of dams, site selection, and the environmental and economic dimensions of dam construction. The following topics are addressed: dam types and their objectives, site selection, and construction materials; the hydrologic data required for quantification of water volume collected by the dam including precipitation (spatial and temporal distribution); water station measurements, evaporation, and infiltration; the geotechnical criteria for the suitability of foundations based on stratigraphy, geologic structures (weathering, landslides, faults, folds, joints, and exposed and subsurface rocks formations; the political, legislative, and economic aspects of dams; and the environmental impacts (sediment accumulation, rate of sedimentation, sources of sediment, and the impact of sediments on water quality). Examples of dams from Jordan are examined.

Upon completion of this course the students will be able to:

1. Identify the various types of dams.
2. Determine the type of dam to be constructed and the necessary building materials.
3. Identify the types of rocks, tectonic movements, and any seismic activity in the area.
4. Understand the solution techniques for geological and environmental problems and the stability of dams and calculating dam storage capacity.
5. Identify the types of sediment, rates of sedimentation, and the sources and impacts of sediments on water quality.

EES 362 – Environmental Protection(3 credit hours.)

This course aims to familiarize students with the techniques, strategies, and importance of environmental protection and addresses the following topics: the goals of environmental protection, natural and anthropogenic sources of pollution, concept of pollution, air pollution and control, human impacts on water (modification of rivers and dam construction, urbanization and its effects on water, human impacts on lake level, and deforestation and its effect on river and groundwater), major soil problems (pollution with agrochemicals such as fertilizers and pesticides), cleaner production, wildlife protection, and Jordan environmental law.

Upon completion of this course the students will be able to:

1. Distinguish between natural and anthropogenic sources of pollution and the concept of pollution.
2. Understand the air pollutants and their control methods and soil pollution with agrochemicals.
3. Understand the concept of wildlife protection.
4. Understand the concept of integrated pest control and the concept of cleaner production.
5. Understand the human impacts on water.

EES 363 - Management of Environmental Systems(3 credit hours.)

This course aims to introduce students to the steps and techniques of environmental management for a variety of environmental systems.

The course explores the fundamentals of environmental and ecosystem management (including sustainability and resources management). It introduces students to the basic knowledge of environmental management practices and provides a broad view of relevant concepts. In addition, the course illustrates application of these ideas and frameworks through a series of case studies. It primarily focuses on management of dryland systems, and students initially learn a variety of terminology, classifications of drylands, and drylands degradation with emphasis on desertification problem (causes, forms and mitigation). The students also are introduced to the marine and coastal environments, and the various aspects of coastal zone (terminology, types, processes, and human impacts) and integrated coastal zone management are explore The third part of this course focuses on management of forest and woodland systems (importance, threats, and management strategies).

Upon completion of this course the students will be able to:

1. Explain the physical and environmental characteristics of drylands and how drylands form.
2. Evaluate the natural and anthropogenic causes, processes, and consequences of degradation in dryland environments.
3. Provide a general view of the extent and character of the global forests and outline forest management implementation.
4. Diagnose problems and issues and implement coastal zone management strategies.
5. Outline the need for sustainable development in coastal zones.

EES 365 - Sewage Management(3 credit hours.)

This course intends to familiarize students with wastewater sources, characteristics, treatment, and re-use and address the following topics: water and wastewaters, sources and characteristics of wastewaters, centralized and decentralized sewage systems in domestic wastewater treatment, self-purification of water, treatment of wastewater, reuse of sewage effluent in artificial groundwater recharge, sludge treatment and its utilization in methane generation, and utilizing treated sewage sludge in agriculture.

Upon completion of this course the students will be able to:

1. Identify water and wastewater and the sources of wastewater.
2. Understand sludge treatment and its utilization in energy production and agriculture.
3. Understand the concept of self-purification of water and domestic wastewater treatment methods.
4. Understand the concept of reusing sewage effluent in agriculture and artificial groundwater recharge.
5. Understand the concept of centralized and decentralized sewage systems.

EES 382 - Energy Sources and their Environmental Impacts(3 credit hours.)

The course intends to familiarize students with the sources of energy and their environmental impacts and sustainability and addresses the following topics: energy demand and supply locally and globally, matter, energy and energy conversion, fossil energy sources and their environmental impacts, regenerative energy sources and their environmental impacts, uranium, nuclear and fusion energy and their environmental impacts, energy storage, and the energy laws in Jordan.

Upon completion of this course the students will be able to:

1. Identify energy demand and supply locally and globally and understand the concept of matter, energy and energy conversion.
2. Understand the energy laws in Jordan.
3. Understand uranium and nuclear energy and their environmental impacts.
4. Understand the different energy storage methods and regenerative energy sources and their environmental impacts.
5. Identifythe fossil energy sources and their environmental impacts.

EES 391 – Seminar (1 credit hr.)
This one-hour course covers 400-level environmental topics selected by the course instructor on condition of approval of course plan by department head prior to offering the course.

EES 392 - Special Topics(3 credit hrs.)
This course discusses topics not included in the courses of the study plan. The instructor will determine the subject of the course and provide a comprehensive plan of the course (three hours per week).

EES 399 – Research (3 credit hrs.)
This course defines natural sciences and introduces scientific research methods, information collection, types of articles, samples and types of sampling, data assessment, organizing a research paper, sections of a scientific research article, ethics of scientific research and research management.