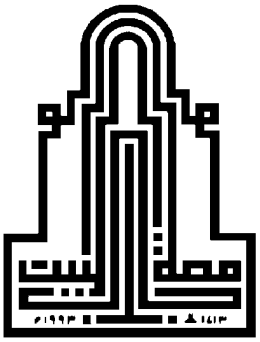

Al al-Bayt University

Faculty of Earth and Environmental Sciences

Advisory Plan for BSc. in Applied Earth and Environmental Sciences

2018-2019

Advisory plan for Applied Earth and Environmental Sciences

First Year					
First Semester			**Second Semester**		
Course No.	**Course Name**	**Credit Hours**	**Course No.**	**Course Name**	**Credit Hours**
-	Elective University Requirement	3	-	Compulsory University Requirement	3
-	Compulsory University Requirement	3	0403101	General Chemistry (1)	3
0401101	Calculus (1)	3	0801108	General Geology (2)	3
0801106	General Geology (1)	3	0801109	Practical General Geology (2)	1
0801107	Practical General Geology (1)	1	0801200	Crystallography and Mineralogy	2
-	-	-	0801201	Practical Crystallography and Mineralogy	1
-	-	-	0404101	General Biology (1)	3
-	-	-	0801161	Computer Applications in Geology	2
Total		**13**	**Total**		**18**

Second Year					
First Semester			**Second Semester**		
Course No.	**Course Name**	**Credit Hours**	**Course No.**	**Course Name**	**Credit Hours**
-	Compulsory University Requirement	3	-	Compulsory University Requirement	3
-	Elective University Requirement	3	0402102	General Physics (2)	3
0402101	General Physics (1)	3	0401218	Introduction to Geological & Environmental Statistics	2
0401102	Calculus (2)	3	0801241	Surveying	2
0801202	Optical Mineralogy	2	0801204	Petrology	2
0801203	Practical Optical Mineralogy	1	0801205	Practical Petrology	1
0801213	Sedimentary Rocks	2	0801253	Hydrology	3
0801214	Practical Sedimentary Rocks	1	-	-	-
Total		**18**	**Total**		**16**

Third Year					
First Semester			Second Semester		
Course No.	Course Name	Credit Hours	Course No.	Course Name	Credit Hours
-	Compulsory University Requirement	3	-	Elective Specialty Requirements	3
0801221	Applied Geochemistry	2	0801369	Remote Sensing and Geographic Information Systems	3
0801222	Practical Applied Geochemistry	1	0801310	Geology of Jordan	3
0801243	Structural Geology	2	0801318	Management of Arid and Semi-Arid Lands	2
0801244	Practical Structural Geology	1	0801362	Paleontology	2
0801303	Stratigraphy	2	0801363	Practical Paleontology	1
0801304	Practical Stratigraphy	1	-	-	-
0801309	Industrial Rocks and Minerals	3	-	-	-
0801354	Hydrogeology	3	-	-	-
Total		**18**	**Total**		**14**

Summer Semester

Course No.	Course Name	Credit Hours
0801366	Field Skills in Earth and Environmental sciences	3

Fourth Year					
First Semester			Second Semester		
Course No.	Course Name	Credit Hours	Course No.	Course Name	Credit Hours
-	Elective Specialty Requirements	3	0801453	Hydrochemistry	2
-	Elective Specialty Requirements	3	0801454	Practical Hydrochemistry	1
801337	Geophysics	3	-	Compulsory University Requirement	3
0801407	Engineering Geology	2	-	Elective Specialty Requirements	3
0801408	Practical Engineering Geology	1	-	Elective Specialty Requirements	3
0801410	Environmental Impact Assessment	2	-	Elective University Requirement	3
0801466	Petroleum Geology	3	-	-	-
Total		**17**	**Total**		**15**

Courses Description

0801105 Earth Sciences **3 Credit Hours**
Prerequisite: -

Definition of earth sciences, earth's spheres, crystals and minerals, type of rocks: igneous rocks, sedimentary rocks, metamorphic rocks, erosion, winds as a geological erosional agent, surface water, groundwater, volcanoes and volcanic activity, earthquakes, geological structures, plate tectonics, historical geology.

0801106 General Geology (1) **3 Credit Hours**
Prerequisite: -

Introduction to physical geology, Minerals, Rocks: plutonic and volcanic igneous rocks, sediments and sedimentary rocks; metamorphism and metamorphic rocks, Internal geological processes; earthquakes, volcanoes and plate tectonics, earth interior, crustal deformation and mountain building, and geological structures

0801107 Practical General Geology (1) **1 Credit Hour**
Prerequisite: 0801106 or simultaneous

Identify the crystals, Crystallographic Systems, Elements of Symmetry, Minerals properties and classification of minerals, study of the most important types of igneous, sedimentary, and metamorphic rocks and their properties and classifications

0801108 General Geology (2) **3 Credit Hours**
Prerequisite: 0801106

External geological processes acting on the Earth's surface including: weathering and soil formation, downslope movement of earth materials under the influence of gravity, groundwater and running water as geological factors. Effect of wind, glacial ice, shorelines, seas, lakes and oceans as external geological factors. Natural sources of energy

0801109 Practical General Geology (2) **1 Credit Hour**
Prerequisite: 0801108 or simultaneous

Basic principles of structural geology: completing outcrop pattern exposed on the ground, drawing contour maps, constructing cross sections and topographic profiles, building geological maps (horizontal and dipping strata), giving exercises show the main geological structures (Faults, Folds) and Relative dating (key principles and geologic time scale)

0801113 Energy Sources **3 Credit Hours**
Prerequisite: -

Global energy consumption through history, prediction and future of energy uses, non-renewable energy resources: oil, natural gas, coal, alternatives energy resources: solar energy, wind energy, hydropower, nuclear energy, geothermal energy and bio-energy, vehicles fuel alternatives: ethanol, hybrid and electric vehicles, energy in Jordan and their sources and forms,

0801115 Water Resources **3 Credit Hours**

Prerequisite: -

Water (hydrologic) cycle elements: precipitation, runoff, evaporation, infiltration, water storage in rivers and lakes. Conventional and non-conventional water resources and water demand, water quality, water resources in Jordan, current and future challenges.

0801117 Environment and Environmental Pollution **3 Credit Hours**

Prerequisite: -

Ecology concept, environmental change and its importance, bio-geochemical cycle, environmental systems, environmental quality and management, soil and its contamination: physical, chemical and biological processes, sediments as a source of pollution, industrial, biological, agricultural activities as a source of pollution, air pollution, long term effects on earth planet, environmental hazards and its evaluation: EIA, environmental situation in Jordan.

0801161 Computer Applications in Geology **2 Credit Hours**

Prerequisite: -

The knowledge about using different computer applications and software's for geological applications. Learning how to enter the geological data, data processing and analyzing, data filtering and sorting, and data visualizing as maps, tables and graphs using different software's (for example: Microsoft Excel software, SURFER software, and Google Earth software).

0801200 Crystallography & Mineralogy **2 Credit Hours**

Prerequisite: 0801106

Crystals and crystallization, crystal systems and its classification, physical properties, chemical classification of minerals, non-silicates; sulfides, oxides, hydroxides, halides carbonates, nitrates, sulphates, phosphate, chromate, tengestates, silicates, rock-forming minerals, crystallographic properties of minerals using diffraction x-rays.

0801201 Practical Crystallography & Mineralogy **1 Credit Hour**

Prerequisite: 0801200 or simultaneous

Practical identification of crystal systems, polarized microscope components identification and its operation mechanism, various mineral associations and eye - minerals identification

0801202 Optical Mineralogy **2 Credit Hours**

Prerequisite: 0801200

Study the Properties of light (Theories explaining light, Light waves, Reflection and Refraction light, Polariz and Unpolriz Light), Optical properties of Isotropic and anisotropic minerals (Optics of Minerals, Isotropic Indicatrix, Uniaxial and Biaxial, Retardation and birefringence, Monochromatic and Polychromatic Light), Optical Properties of Minerals under polarized microscope (color, cleaveg, relief, twining, extinction, Interferance color and Interference Figure).

0801203 Practical Optical Mineralogy **1 Credit Hour**
Prerequisite: 0801202 or simultaneous

Definition of Polarizing Microscope: Determination of the vibration direction of polarizer, Differentiation between opaque and transparent/ translucent minerals, Distinguish between isotropic and anisotropic minerals. Recognizing grains or crystal shape (form and habit). Study the properties of minerals under polarized Microscope, for plane polarizer light (PPL) such as cleavage, relief, extinction, and cross polarized light (XPL) such as Twining, interference color, Interference figure and alteration and zoning of minerals.

0801204 Petrology **2 Credit Hours**
Prerequisite: 0801202

Study earth structure, distribution of rocks on earth; igneous rocks; shapes and mineral composition of intrusive rocks, classification, magma (physical properties, physical chemistry, differentiation), Type of igneous rock formation, texture and structure of igneous rocks, tectonic setting related with generation of magma. Study of sedimentary rocks; mechanical and different type of rocks, (such as carbonates and evaporate), Metamorphic rocks; Metamorphism, Factors controlling metamorphism, metamorphic rocks classification, Metamorphic rocks formation at earth's crust, metamorphic rocks textures.

0801205 Practical Petrology **1 Credit Hour**
Prerequisite: 0801204 or simultaneous

Identification of the rock forming minerals under polarizing Microscope, study the (intrusive and extrusive) mineral igneous rocks, identify the rock names and classification under polarizer microscope for igneous, sedimentary and metamorphic rocks, by using mineral composition and the texture. Classification of igneous rocks by using mode analyses, study the alteration and diagenesis produce to secondary minerals of igneous rocks. Training to prepare thin sections for studying minerals under microscope.

0801213 Sedimentary rocks **2 Credit Hours**
Prerequisite: 0801202

Physical properties of grains, sedimentary cycles and weathering, silicate and non-silicate sedimentary materials, sedimentary processes, sedimentation basins, sedimentary environments, the sedimentary rock textures and their different characteristics, sedimentary structures, classification of sedimentary rock and sediments; types sedimentary rock.

0801214 Practical Sedimentary rocks **1 Credit Hour**
Prerequisite: 0801213 or simultaneous

Sedimentary rocks textures, sedimentary rocks structures, depositional environments, sedimentary rocks classifications, types and geo-structural interrelations, sedimentary rocks studying under microscope, naked eye identifications of sedimentary rocks, field study of sedimentary rocks, roundness and sorting, volumetric distribution for sediments, statististical parameters for sediment distributions.

0801215 Soil Science **3 Credit Hours**

Prerequisite: 0801106

Definition of soil science and fundamental relationships, origin of soil, soil formation factors, soil components, solid phase, fluid phase, water percolation in unsaturated and saturated soil, gaseous phase, physical, chemical and biological characteristics of soil, soil classification, local water cycle.

0801218 Introduction to Geological & Environmental Statistics **2 Credit Hours**

Prerequisite: -

Introduction to geo-statistics aims to define the geological and environmental statistics and its applications, defining the sampling, and calculating mean, median, variance, standard deviation of samples, construct frequency and histogram of samples, statistical analyses steps, sampling, data processing and analyses, hypotheses tests, the prediction and results, geological case studies.

0801221 Applied Geochemistry **2 Credit Hours**

Prerequisite: 0801204

Definition of Geochemistry, Geochemical composition and structure of the Earth, Mineral reactions and phase change; Earth interior and its structure; strata, density distribution, deep rocks; Magmatic behavior and igneous rocks; Geochemistry of sedimentation and sedimentary rocks, mineral composition and distribution in the different rocks, Geochemistry of Metamorphism and metamorphic rocks, Physiochemical factors in sedimentation.

0801222 Practical Applied Geochemistry **1 Credit Hour**

Prerequisite: 0801221 or simultaneous

Collection of geological samples, Preparation of samples for analysis (crushing, digenesis, heating), method analyses samples [Atomic Absorption Spectroscope (AAS) , XRF, RDD, Flam Photometer ,Ione Conductive Plasma ICP and titration] for major and trace elements, determination of humidity, organic matter, carbonate, phosphate in the geological samples.

0801241 Surveying **2 Credit Hours**

Prerequisite: -

Introduction (surveying branches and principles, fundamental definitions), measuring units and systems, The leveling, longitudinal and cross sections, The network balance and contouring line drawing, vertical and horizontal angles (directions, azimuths, deviations), areas and volumes (finding areas using straight lines and specified areas using curved lines), The using coordinates, universal coordinates systems (longitudes and latitudes), topographic surveys (fields data collection for preparing the topographic maps), water surveys and measuring streams fluxes, advanced survey equipments, computer applications.

0801243 Structural Geology **2 Credit Hours**
Prerequisite: 080109

Definition, classification, causes of geologic structures. Concepts of force and stress – normal and shear stress, stress states, strain and deformation. Mohr circles of stress, mean and deviatoric stress, and the stress tensor. Homogeneous strain, heterogeneous strain and strain ellipsoid. Rheology, Hooke's law, Poisson's ratio, elastic-plastic behavior. Joints and veins, classification, data collection in the field, Faults and faulting, terminology, types, net-slip components, fault breccias, Riedel shears, fault-related folding. Evidences for faults, fault systems. Folds and Folding, fold anatomy, fold classification, kinematic models of folding.

0801244 Practical Structural Geology **1 Credit Hour**
Prerequisite: 0801243
or simultaneous

Learning about the parts of the geological compass and how to use it, training students in measuring the attitudes of planes and lines in the laboratory and methods of representing readings of dip, strike, plunge and rake angles, training students in drawing cross sections of geological maps and methods of drawing layer outcrops on geological maps containing folds, faults and unconformities, stereographic projection (Schmidt's net) planes and lines, statistical analysis of fractures, methods for calculating and measuring stress and strain in rocks.

0801247 Geomorphology **3 Credit Hours**
Prerequisite: 0801106

Geomorphology and earth's structures: regional and in-situ relationships, debris movement on slopes, landforms produced by volcanic activity, landforms associated with rock types, landforms associated with erosion, The river erosion and the associated terrains, The coastal erosion and associated landforms. The human and his role in forming landscape.

0801253 Hydrology **3 Credit Hours**
Prerequisite: 0801108

Definition of hydrology; hydrological cycle; hydrological budget; types of precipitation, distribution, measuring; losses water: evaporation, transpiration, infiltration; river flow: Properties of water basins, water curves, groundwater superficial relationship, methods of measurement; and standard specifications.

Determination of water divide for catchment area using topographical maps and aerial photographs and satellite images, determination of geometrical and hydrological properties for water basins, contour mapping for elements of the hydrological cycle, ways to complete and correct records of precipitation, methods of calculating rates of evaporation and evaporation – transpiration, estimation of infiltration indices and values of surplus rain, coefficient runoff, identify discharge into waterways, methods of hydrograph separation, unit hydrograph, curves of rainfall intensity and the duration of recurrence, and methods of calculating volumes of flooding.

0801261 Earth Sciences and Information Technology **3 Credit Hours**

Prerequisite: 0801106

Definitions, introduction in the development of information technology systems, definition of problems, feasibility and systems analysis, methods of preparing systems for analysis purposes, introduction to information strategies, methods used in strategies.

0801302 Environmental Geology **3 Credit Hours**

Prerequisite: 0801106

Introduction, geological frameworks, earth structure and minerals; hazardous geological processes: estimate and identify geological hazards, earthquakes, lava, large sea waves, landslides and traffic blocks, flood risk, seas, climate, meteorites falling; nature earth's resources: introduction, types of land resources; human impact on the environment; climate change; medical geology.

0801303 Stratigraphy **2 Credit Hours**

Prerequisite: 080213

The laws/principles governing the stratigraphic and faunal successions, relative ages of rocks and sediments types, stratigraphic relationships: lateral and vertical, conformable and inconformable surfaces; The litho-stratigraphic units: the bases of their division, their various divisions with mention of the local examples, the bio-stratigraphic units: their different biozones, types, levels; the chrono-stratigraphic units: their concept, relationship to geological time units; the magneto-stratigraphic units, their concept, their subdivisions; Geological systems and the geological time scale, its different divisions, correlation, concept and different methods; Well records, their importance in stratigraphy, their various methods.

0801304 Practical Stratigraphy **1 Credit Hour**

Prerequisite: 0801303 or simultaneous

The vertical geological profiles, normal and closed litho-correlation, recognition of unconformity surfaces through correlation, identification of the pinch-out phenomena, weathering, and texture profiles through correlation, identification the areas of the sea transgression and regression through correlation and vertical sections, Well records and identification of subsurface layers through them, bio-correlation; Stratigraphical maps and others

0801309 Industrial Rocks and Minerals **3 Credit Hours**

Prerequisite: 0801205

Introduction, difference between ore deposits and industrial rocks & minerals, overview of the industrial minerals **(**characteristics of the industrial minerals sector**,** classification of industrial minerals and rocks, world distribution of industrial minerals deposits**,** international trade in industrial minerals, mine safety and health law environmental law for industrial minerals and rocks sustainable development and industrial minerals), markets and uses **(**absorbents and desiccants **,** construction uses, cosmetics, electronic and optical materials, environmental uses, fertilizers, refractories, nanomaterials, well drilling materials.. etc.)**,** industrial rocks & minerals in Jordan

0801310 Geology of Jordan **3 Credit Hours**

Prerequisite: 0801303

Knowing the regional geological setting of Jordan and the exposures of the Arabian-Nubian Shield rocks, the basement rocks, the geological sequences in the different Paleozoic, Mesozoic and Cenozoic Eras and their divisions into Groups and Formations, volcanic rocks, the structural setting of Jordan and the theories of the origin of the Dead Sea transform fault and the main structures in Jordan, a scientific trip to Aqaba and southern Jordan, and a scientific report on that..

0801318 Management of Arid and Semi-Arid Lands **2 Credit Hours**

Prerequisite: -

Introduction: definition and characteristics of arid and semi-arid lands global distribution and causes of dry lands: deserts and desertification, geologic processes in arid climates, landforms in arid and semi-arid environments, arid land resources management: water resources, livestock resources, vegetation and plant resources, energy resources. Industrial production in arid regions: resource extraction and mining strategy. Residents of arid regions (bedouin). Rainfed agriculture, irrigation, livestock. Urban centers and arid regions

0801337 Geophysics **3 Credit Hours**

Prerequisite: 0402101

Geophysics definition, Introduction, relationship of geophysics with geology and other sciences, Types of geophysical methods. Gravity method, Basic theory, Field measurements, gravity reduction and anomalies, data interpretation. Magnetic methods, Basic theory, earth magnetism, measurements and data interpretation. Seismic methods, Reflection and Refraction, fundamental principles, field measurements, data analyses and interpretation. Electrical and Electromagnetic methods, Their types, electrical resistivity, Basic theory, field measurements and data interpretation. Assignments and applications

0801338 Earthquake Geology **3 Credit Hours**

Prerequisite: 0801243

Introduction to seismology aiming at defining the seismology development and its uses. Earthquake causes and consequences, seismic waves, Seismometer and instrumentations, seismic monitoring and earthquake parameters, ray paths and gravity acceleration. Earth's interior structure using seismic data. Jordan transform fault seismicity and Arabian plate. Historical earthquakes. Pale-seismology and Dead Sea Transform fault.

0801354 Hydrogeology **3 Credit Hours**

Prerequisite: 0801106

Introduction to groundwater, the basic physical principles of the water cycle, geological formations and aquifers, types of aquifers, groundwater tables, groundwater contour maps and groundwater flow direction, wells and springs, physical properties of aquifers, Darcy's law, introduction karst aquifers, introduction to groundwater quality and main parameters affecting groundwater quality, introduction to pumping tests (concept and used methods), hydrogeology of Jordan.

801356 Solid Waste Management **3 Credit Hours**
Prerequisite: 0801106

Definition of solid waste, the emergence and development of solid wastes, factors affecting the rate of quantity and quality of solid waste, solid waste types and properties, history of solid waste management, the purpose of solid waste management, transport, sorting and treatment of wastes (incineration, direct disposal, recycling), landfills (how to choose landfill location, design, processing, landfill), and hazardous solid waste (sources, characteristics, storage, transportation and disposal).

0801357 Wastewater Treatment **3 Credit Hours**
Prerequisite: 801106

Definition of the concept of wastewater, types, components, physical, chemical and biological properties, sewage systems, factors on which the design of sewage systems, wastewater systems and their benefits, calculation of wastewater flow, wastewater treatment objectives, types of wastewater treatment (physical, chemical and Biological), pre-primary, secondary and advanced stages of wastewater treatment, activated sludge and disposal methods, sterilization, factors on which the design of treatment plants and the choice of appropriate treatment methods depend, wastewater management in Jordan, treatment plants in Jordan and treatment methods, water reuse Exhaust treatment in Jordan.

0801362 Paleontology **2 Credit Hours**
Prerequisite: 0801213

Defining the fossil, the importance of studying fossils, the relationship of fossils to the geological history, methods of fossil preservation, methods of classifying fossils into kingdoms, phylum, families, classes and orders, reaching to the genera and species, and clarifying the concept of each of them, identifying the common fossil groups, especially the following groups: trilobites, graptolites, brachiopods, gastropods, bivalves, cephalopods, and others.

0801363 Practical Paleontology **1 Credit Hour**
Prerequisite: 0801362
or simultaneous

The practical part includes identifying the different physical features of the fossils such as symmetry, size, morphology, and using them to identify some common fossils, the use of catalogues and descriptive tables prepared in an ideal and sequential manner to identify some fossils by comparison, classification processes and the assigned of some species to their phylum, families and genera, Collecting some fossils from sedimentary rocks in the field, separated the microscopic fossils in laboratory and photographed them using a Scanning Electron Microscope (SEM), using the various obtained information and data to identify and classify them.

0801360 Meteorology **3 Credit Hours**
Prerequisite: 0801253

Composition, measurement of atmospheric elements: heat, humidity, solar radiation, pressure, wind, rain, cloud physics, radiation in the atmosphere, basics of forecasting weather changes, optical phenomena in the atmosphere; radar and satellite meteorology.

0801365 Natural Resources and Environmental Economics **3 Credit Hours**

Prerequisite: -

Resources types, nature of resource markets, scarcity of standards and their impact on development, examples of natural and renewable resources, methods of investment of natural resources, natural resources in Arab countries and economic impacts, environmental pollution, role of economy in resources and environment study, natural and environmental conservation

0801366 Field Skills in Earth and Environmental sciences **3 Credit Hours**

Prerequisite: 0801310

Identify some of the outcrops of Groups and Formations that represent the different geological ages in northern Jordan. Training in using the geological compass to measure the dip and strike of different geological structures such as faults, joints, folds, and bedding planes; training in drawing horizontal and vertical geological sections; Training in the use of a GPS device for positioning, training in methods of taking rock samples (sedimentary and igneous) for various laboratory tests; Training in the geological mapping mechanism and producing geological maps by means of field surveys and aerial photos, and assigning students to make a scientific report and discuss it with them..

0801369 Remote Sensing and Geographic Information Systems **3 Credit Hours**

Prerequisite: 0801161

Introduction to Remote Sensing, electromagnetic radiation and its characteristics, the types and characteristics of remote sensors, elements of remote sensing and the remote sensing process, satellites, image processing and analysis, supervised and unsupervised classification, remote sensing applications in different disciplines. Introduction to Geographical Information System (GIS), GIS components, maps projections and coordinate systems, types of data in GIS, spatial data accuracy in GIS, data management in GIS, vector data analysis, data visualization.

0801405 Subsurface Geology and Well Logging **3 Credit Hours**

Prerequisite: 0801337

This course involves the geophysical exploration methods. Seismic layers, well logging and petro-physical analyses. Subsurface layering analyses. Core sample description. Seismic data processing. 2D and 3D seismic data interactive interpretation. Preparing and analyses subsurface structural map. Build subsurface models for sedimentary basins.

0801406 Selected Topics in Earth and Environmental Sciences **3 Credit Hours**

Prerequisite: 0801106

In this course a new and specific topics oriented to earth and environment field is selected according to the local and regional problems, the students must write a report and present the results.

0801407 Engineering Geology **2 Credit Hours**
Prerequisite: 0801243

Soil and Rocks: nature and engineering geological properties, effecting factors and variables, uses; Constructions: site investigations, foundations; Dams: types and structure, grouting and materials used, primary studies and investigations, reservoirs, problems; sedimentation engineering; landslides and solutions; Geophysical methods; Rocks and construction material; tunnels; Bridges and highways.

0801408 Practical Engineering Geology **1 Credit Hour**
Prerequisite: 0801407
or simultaneous

Evaluation of physical properties of rocks and soils, Pore space percent, Mechanical properties, Soil's engineering classification, Typical engineering names for rocks and soils, Calculations of slope stability, Force analysis on slopes, Safety factor, Projection of slopes, joints and faults on Schmidt's net

0801410 Environmental Impact Assessment **2 Credit Hour**
Prerequisite: 801354

Introduction and Principles: Processes: Preliminary Studies, Mitigation, Assessment and Environmental Impact Forecast, The Participation, The Submission and Review, Monitoring and Audit; After Decision, The Assessment and New Consolidations, Expectations: Improving the Impact of Projects, Environmental Assessment Strategy, Environmental Legislations, Definition, Source, Responsible Actors, Their Application, Assessment, Integrated Pollution Control, The Conservation of Nature, Environmental Policies and Legislation in Jordan.

0801416 Environmental Engineering **3 Credit Hours**
Prerequisite: 801410

Air pollution control, introduction, pollution measuring, General ideas of air pollution control, the control of preliminary pollutants, the control of volatile organic compounds and ferrous, nitrogen oxides, vehicles motor problems, the control of water pollution, water quality, biological and chemical variables, water treatment methods in natural systems, the role of runoff in organic residuals degradation, engineering systems for water treatment, wastewater treatment and its disposal, environmental and water engineering systems design, water pumping and wastewater.

0801417 Quaternary Environments **3 Credit Hours**
Prerequisite: 801303

The Quaternary record, the geomorphological characteristics, Lithological characteristics: introduction, glacial deposits, Paleo-soil, lakes, wind deposits and the carbonate rocks, deep deposits and ice, The biological characteristics, introduction, Analyses of pollen, algae, plants, mollusks and pryozoa (unit cell), geochronology, Stratigraphy and correlation, The last glacial and inter-glacial cycle.

0801426 Geochemical Exploration **3 Credit Hours**
Prerequisite: 0801221

Define Geochemical Exploration, Geochemical Environment) Syngenetic & Epigenetic Patterns(, Geochemical Survey, Geochemical Anomalies, Element of Geochemical Survey, Classification of Methods of Geochemical Survey, Type of Geochemical Survey, regional and detail, Methods of Geochemical Survey: Rock, Soil, Stream sediment, Heavy minerals and Statistical Treatments of Geochemical Data, How to Draw the Geochemical Maps, Geochemical interpretation and Geochemical right report.

0801437 Engineering Geophysics **3 Credit Hours**
Prerequisite: 0801337

Seismic refraction method and its field applications, subsurface and soil profile investigation for engineering and environmental applications using seismic methods. Cavity, slope stability and site selection studies. Electrical methods and their applications: Groundwater exploration, Karstification and old mines excavation. Exploring and follow up dam seepage. Investigating groundwater contamination and landfill plumes. Magnetic, electromagnetic and gravity methods and their environmental and engineering applications. Field work and writing reports.

0801445 Plate Tectonics **3 Credit Hour**
Prerequisite: 0801243

Introduction, Earth's interior, The geophysical techniques in tectonic studies, tectonic characteristics of the earth, plate tectonic theory, its movement, causes, Divergent boundaries and trenches, Transform faults, Convergent boundaries, geology and tectonic of Triple junction, collision, mountain building structures, neo-tectonics, regional mountain zones, scientific methods and plate tectonic revolution.

0801453 Hydrochemistry **2 Credit Hours**
Prerequisite: 0403101

Water cycle in nature, chemical composition of water, types of chemical bonds, the mole, chemical and physical properties of water, natural water components (rain, sea, oceans, rivers and groundwater, origin of water components, environmental problems resulting from water pollution, environmental isotopes and their benefits, chemical processes and chemical solutions and interpretation, chemical equilibrium.

0801454 Practical Hydrochemistry **1 Credit Hour**
Prerequisite: 0801453
or simultaneous

Sampling (sampling techniques, its maintain and transport means), physical characteristics test of samples (knowing the concentration of Ammonia, anion and cation in hydrous solution, error calculation, know the used instrumentation and its operation work, graphical representation of results and interpretation).

0801455 Well Drilling and Maintenance **3 Credit Hours**
Prerequisite: 0801354

Groundwater and aquifer characteristics, groundwater exploration, shallow and deep borehole drilling methods, fluids used in the drilling, filters and sediments volume, pumps and their types, experimental pumping processes and results evaluation, wells protection and sustainability, The groundwater table monitoring, alternatives utilities of wells and filters.

0801466 Petroleum Geology **3 Credit Hours**
Prerequisite: 0801354

The origin of petroleum sediments and the organic and inorganic theories. The genesis of petroleum and the thermal maturation processes of organic matter. The physical and chemical properties of the oil and the natural gas. Hydrocarbon groups and their chemical properties. Subsurface environments and their impact on the hydrocarbons matters in terms of formation and migration (subsurface water, subsurface heat, subsurface pressures, subsurface fluid dynamics). The reservoir and its physical properties (porosity and permeability). Cap or seal rocks. Migration and movement of the hydrocarbons compounds. Natural and industrial production methods. Hydrocarbon traps and their types. Deep well drilling. Drilling problems, properties of drilling fluid and methods of treatment. The tasks entrusted to the site geologist.

0801491 Seminar **1 Credit Hour**
Prerequisite:
Department Approval

Writing a scientific research in the subject related to the earth and environmental sciences under a direct supervision of the course instructor, to be presented to students in the presence of the supervisor and faculty members of the department.

0801492 Graduate project **2 Credit Hours**
Prerequisite:
Department Approval

Definition of the concept of graduation research, graduation research objectives, conditions of writing graduation research, identifying the methods of scientific research, the conditions of choosing the title of the graduation research, writing the graduation research plan, selecting the study area, preparing the required maps and collecting samples and analyzing them according to the subject outlinesof the research after the approval of the supervising professor.