Program: Geology
Degree Offered: M.Sc./ Thesis track

Plan No.	1/19	06	2005	M.Sc.

Study Plan

First: General Rules and Conditions
1. This plan conforms to the valid regulations of programs of graduate studies.
2. Specialities that can be accepted in this Program are:
a. Holders of the Bachelor's Degree in Geology, Earth and Environmental Sciences, and the Environmental and Applied Geology.
b. Holder's of Bachelor's Degree in Engineering Geology.
c. Holder's of Bachelor's Degree in Space Sciences and Remote Sensing.
d. Holders of Bachelor's Degree in Marine Geology.
e. Holders of Bachelor's Degree in Mining Engineering.
f. Holders of Bachelor's Degree in Physical Geography.

Second: Special Conditions
None

Third: This plan consists of (33) Credit Hours distributed as follows:
1. Obligatory courses (15) Credit Hours:

Course No.	Course Name	Credits	Prerequisite
0305701	Paleontology	3	-
0305721	Mineralogy	3	-
0305751	Geochemistry	3	-
0305761	Hydrogeology	3	-
0305771	Geophysics	3	

2. Elective Courses: 9 Credit Hours are selected from the following:

Course No.	Course Name	Credits	Prerequisite
0305711	Stratigraphy	3	-
0305722	Clay Minerals	3	0305721
0305731	Clastic Sedimentary Rocks	3	-
0305732	Igneous and Metamorphic Rocks	3	-
0305741	Field Geology	3	-
0305752	Isotope Geochemistry	3	-
0305762	Hydrological Modeling	3	-
0305772	Geophysical Exploration Methods	3	0305771

3. Submission of an approved thesis (9 Credit Hours) (0305797)

Course Description
M.Sc. Program in
Environmental and Applied Geology

0305701 Micropaleontology (3 Credit Hours)
Prerequisite:

A comprehensive course dealing with fossil micro-organisms such as: Foraminifera: structures, origin, shape, aperturers, wall composition, mode of life, selected families and genera for analyzing, history & Age. Ostracoda: Structures, classification, ecology, stratigraphic range, methods of study-post Paleozoic ostracodes. Pollen & Spores: general structures, classification, morphology, & stratigarphic palynology. Three days field trip to important stratigraphic sites in the Aqaba-Madawwara districts.

0305711 Stratigraphy (3 Credit Hours)
Prerequisite:

Detailed study of the International Stratigraphic Codes and their direct applications to Jordanian Stratigraphy. Quick revision of foraminiferal groups and its practical applications. Report on any rock sequence applying item the above code. Drawing lithofacies & isopachus maps. Construction of some basins for water & oil detection. Visiting stratigraphic sites for their successions, measuring sites, change of facies and fossil contents, around Jordan from north to south.

0305721 Mineralogy (3 Credit Hours)
Prerequisite:

Introduction, physical properties, crystallography, forms and symmetry operations, morphology, bravais lattices, Miller indices, crystal structures, X-ray crystallography, determining the unit cell structure, ionic radii, bonding, coordination, analytical calculations, Pauling's rules, substitution, systematic mineralogy: native elements, sulfides, oxides, hydroxides, halides, carbonates, borates, sulfates, phosphates, silicates, thermodynamics, binary phase diagrams, mineral assemblages and rocks.

0305722 Clay Minerals (3 Credit Hours)
Prerequisite: (030721)

Introduction, structure of clay minerals, classification of phyllosilicates, X-ray diffraction (theory and practice), identification of clay minerals, clay crystal chemistry, koalinite and serpentine, smectites, mixed-layer clays and illite, chlorites and vermiculites, quantitative clay analysis geochemistry, origin, and engineering properties of clays, zeolites, industrial rocks and clay minerals in Jordan, future research and problems on industrial rocks and minerals in Jordan.

0305731 Clastic Sedimentary Rocks (3 Credit Hours)
Prerequisite: (0305732)

Mineralogy of sandstones, heavy minerals, diagenetic and burial depth history, and the geochemistry of major, minor and trace elements, all provenance, tectonic setting, paleoclimate and depositional environments, determination of the recent and ancient depositional environments of the clastic sedimentary rocks.

0305732 Igneous and Metamorphic Petrology (3 Credit Hours)
Prerequisite: (None)

Introduction to thermodynamics, phase equilibria in igneous processes, magmatic processes, igneous rock associations of different tectonic settings, metamorphic reactions and facies, material transport during metamorphism, geothermometry and geobarometry, pressure-temperature-time paths in regional metamorphic rocks.

0305741 Field Geology (Credit Hours)
Prerequisite:

Geological maps and base maps. Methods of geological mapping. Preparing a field geological map at scale 1:10,000 for two different areas of simple and complicated geology. Writing a field report on the mapped areas including cross sections, structural analysis of faults, joints and folds.

0305751 Geochemistry (3 Credit Hours)
Prerequisite: (None)

An introduction to cosmochemistry including the origin of the universe, stars and solar system. Overview of the chemistry of geological processes in aqueous environments. Includes review of thermodynamics, chemical kinetics, phase equilibrium, mineral solubility, mineral stability diagrams. Introducing the concept of mixing and dilution. Overview of isotopes with geologic examples. Application of geochemistry to the solution of global problems. Geochemical cycles. Organic geochemistry

0305752 Isotope Geochemistry (3 Credit Hours)
Prerequisite: (None)

Radiogenic isotopes in geochronology, absolute dating methods: Rb-Sr, K-Ar, U-Pb-Th and Sm-Nd, sample treatment, measurement techniques, interpretation and modelling, petrogenetic implications of radiogenic and stable isotopes, environmental radioactive isotopes, and stable isotopes: modelling of atmospheric surface and groundwater isotopic composition, chemical and isotopic geothermometry.

0305761 Hydrogeology (3Credit Hours)
Prerequisite:

Groundwater aquifers systems, characteristics, movement, aquifers recharge, discharge and contamination processes, groundwater and urbanization, karst hydrogeology, and human activities, impacts, consequences and implications, artificial groundwater recharge and water harvesting principles, problems and development, mapping groundwater vulnerability, hydrogeology of mineral and thermal waters, salt water intrusion, management of hazardous waste and groundwater protection zones.

0305762 Hydrological Modeling (3Credit Hours)
Prerequisite:

Introduction, thermodynamic of the atmosphere, precipitation evaporation, runoff, maximization of storms, hydrograph analysis, unit hydrograph, synthetic unit hydrograph, reservoir routing, extreme events, flood design, flow regulation, catchment's yield, sediment yield, hydrological modeling and water resources systems.

0305771 Geophysics (3 Credit Hours)
Prerequisite:

Seismic methods and its importance in exploration, analysis and interpretation of seismic refraction data, constant and variable velocity models. Processing and interpretation of reflection data, preparation of seismic & geologic cross-sections. Gravity methods & its importance in exploration, Gravitational effect of subsurface bodies and models, separation of anomalies. Electrical methods and its importance in exploration, quantitative interpretation of resistivity data. Magnetic methods and its importance, qualitative & quantitative interpretation.

0305772 Geophysical Exploration Methods (3 Credit Hours)
Prerequisite:

Introduction, Geology of oil, Geophysical Exploration methods: gravity, Magnetic, Electrical and Electromagnetic, and Seismic Methods; Analyses and Interpretation of Geophysical Data; Recent developments in the processing and quantitative interpretation of geophysical Data; Geophysical Well-logging: Principles, Methods Land and offshore seismic exploration; deep reflection and refraction methods; spectral analysis; digital processing of seismic data; applications; seismic stratigraphy.