Al al-Bayt University

Faculty of Earth and Environmental Sciences

Master Study Plan Template

of Applied Geology

(Thesis Track)

2022 - 2023

Department: Applied Earth and Environmental Sciences
Faculty: Earth and Environmental Science
Al al-Bayt University

Master Study Plan of Applied Geology (Thesis Track)

Program Title (Arabic): الجيولوجيا التطبيقية

Program Title (English): M. Sc. in Applied Geology

A. General terms and conditions:

1- This plan shall adhere to the instructions of granting master degree at Al al-Bayt University.
2- The educational qualification accepted in this program shall be Bachelor degree in:

a. B.Sc. degree in Geology, Earth and Environmental Sciences, Applied and Environmental Geology
b. B.Sc. Degree in Geological Engineering
c. B.Sc. Degree in Environment and Environmental Sciences
d. B.Sc. Degree in Mining Engineering.
e. B.Sc. Degree in Geographic Information Systems and Remote Sensing
f. B.Sc. Degree in Civil Engineering, Chemical Engineering
g. B.Sc. Degree in Land and Water Management and Agricultural Engineering
h. B.Sc. Degree in Chemistry and Biology

B. Components of the Plan:

The master's degree study plan of Applied Geology consists of (33) credit hours distributed as follows:

Requirement Type	Credits
Specialty Requirements:	
a. Compulsory Requirements	18
b. Elective Requirements	6
c. Comprehensive Exam	9
Total	**33**

C. Numbering System

1- Code of the Faculty

Code	Faculty
08	Earth and Environmental Sciences

2- Codes of Department/Specialty

Code	Department/Specialty

01	Applied Earth and Environmental Sciences
02	Geographic Information System and Remote Sensing/Geographic Information Sciences
03	Water resources and Environment/Applied Geology

3- Codes of Courses

0-9	0-9	7	03	08
Serial	**Field**	**Level**	**Department**	**Faculty**

The Significance of the Ten Rank (Field) in the Course Numbers

Field Code	Specialty Field Title	Field Code	Specialty Field Title
0	Geology	5	-
1	Water resources	6	-
2	Environment	7	-
3	Assistant techniques	8	-
4	-	9	

D. Remedial Courses:
Shall be determined in accordance with the instructions of graduate studies at Al al-Bayt University.

First: Specialty Requirements: (33) credits distributed as follows:

A. Compulsory Courses: (18) credits include the following courses:

No.	Course No.	Course Title	Credits	Learning Type
1	0803701	Sedimentology	3	Face to Face
2	0803702	Advanced Geochemistry	3	Face to Face
3	0803703	Advanced Geophysics	3	Face to Face
4	0803704	Advanced Mineralogy	3	Face to Face
5	0803709	Advanced Structural Geology	3	Face to Face
6	*0803736*	Scientific Research Methodology	3	Face to Face
Total			18	

* Type of learning: indicates that the course will be educated by one of the following: (face-to-face, blended, online)

B. **Elective Courses**: (6) credits include the following courses:

No.	Course No.	Course Title	Credits	Learning Type

1	0803705	Advanced Clay Mineralogy	3	Blended
2	0803706	Clastic Sedimentary Rocks	3	Blended
3	0803707	Advanced Igneous and Metamorphic Rocks	3	Blended
4	0803708	Stratigraphy and Lithofacies	3	Blended
5	0803710	Ore Minerals Deposits	3	Blended
6	0803712	Applied Hydrogeology	3	Blended
7	0803716	Industrial Rocks and Minerals	3	Blended
8	0803717	Subsurface Geology	3	Blended
9	0803718	Special Topics in Geology	3	Blended
10	0803720	Environmental Systems & Environmental Impact Assessment	3	Blended
11	0803731	Applications of Remote Sensing and Geographic Information Systems	3	Blended

C. M.Sc. Thesis: (9) Credits divides as follow:

No.	Course No.	Course Title	Credits	Learning Type
1	0803799	M.Sc. Thesis	9	Blended (6) and Online (3)
2	9010797	M.Sc. Thesis	3	Online
3	9010798	M.Sc. Thesis	6	Blended

Courses offered by the Department of Applied Earth and Environmental Sciences/ Master Degree in Applied Geology

No.	Course No.	Course Title	Credits	Learning Type
1	0803701	Sedimentology	3	Face to Face
2	0803702	Advanced Geochemistry	3	Face to Face
3	0803703	Advanced Geophysics	3	Face to Face
4	0803704	Advanced Mineralogy	3	Face to Face
5	0803705	Advanced Clay Mineralogy	3	Blended
6	0803706	Clastic Sedimentary Rocks	3	Blended
7	0803707	Advanced Igneous and Metamorphic Rocks	3	Blended
8	0803708	Stratigraphy and Lithofacies	3	Blended
9	0803709	Advanced Structural Geology	3	Face to Face
10	0803710	Ore Minerals Deposits	3	Blended
11	0803712	Applied Hydrogeology	3	Blended
12	0803716	Industrial Rocks and Minerals	3	Blended

13	0803717	Subsurface Geology	3	Blended
14	0803718	Special Topics in Geology	3	Blended
15	0803720	Environmental Systems & Environmental Impact Assessment	3	Blended
16	0803731	Applications of Remote Sensing and Geographic Information Systems	3	Blended
17	0803736	Scientific Research Methodology		Face to Face

Second: Summary of Learning Types in the Study Plan

Learning Type	Online	Blended	Face-to-Face
No. of credit hours	3	12	18
Percentage	9.1%	36.4	54.5%

Guidance Plan for Master Students Specializing in Applied Geology (If any and in accordance with the decision of the department council)

First Year							
First Semester				Second Semester			
Course No.	Course Title	Credits	Learning Type	Course No.	Course Title	Credits	Learning Type
0803701	Sedimentology	3	Face to Face	0803709	Advanced Structural Geology	3	Face to Face
0803704	Advanced Mineralogy	3	Face to Face	0803703	Advanced Geophysics	3	Face to Face
-	Elective Course	3	Blended	0803736	Scientific Research Methodology	3	Face to Face
Total		**9**		**Total**		**9**	

Second Year							
First Semester				Second Semester			
Course No.	Course Title	Credits	Learning Type	Course No.	Course Title	Credits	Learning Type
0803702	Advanced Geochemistry	3	Face to Face	0803799	M.Sc. Thesis	9	
-	Elective Course	3	Blended				
Total		**6**		**Total**		**9**	

Description of Courses offered by the Department of Applied Earth and Environmental Sciences/ Master Degree in Applied Geology

Course No.	علم الرسوبيات	(3) Credits	Learning Type
0803701	Sedimentology	Pre-requisite: -	Face to Face
Sediments, their origin, formation and classification, depositional environments and microfacies, marine depositional environments and their characterization methods, petro-logical facies, depositional environments and their economic importance, weathering and depositional cycles, clastic and non-clastic sediments, sedimentary processes, sedimentary rocks textures and their various characteristics, sedimentary structures, sedimentary rocks classification, sedimentary rocks types.			

Course No.	الجيوكيمياء المتقدمة	(3) Credits	Learning Type
0803702	Advanced Geochemistry	Pre-requisite: -	Face to Face
Analysis of Geochemical Data, Geological processes and their geochemical signatures for Igneous rocks, Analytical methods in Geochemistry, Sources of error in Geochemical analysis, Using major elements, trace elements data for Rock classification, Variation, spider and vector diagrams. Geological controls on the distribution of trace elements (a-batch melting, b-fractional melting, c- in situ crystallization. Differentiation between tectonic environments using geochemical data. Thermodynamics, binary phase diagrams.			

Course No.	الجيوفيزياء المتقدمة	(3) Credits	Learning Type
0803703	Advanced Geophysics	Pre-requisite: -	Face to Face
Seismic methods and their importance in exploration, analyses and interpretation of seismic refraction data for geological models of constant and variation velocities. Analyses and interpretation of seismic reflection data and set up geological models. Gravity method and their importance in exploration, gravitational effects of various earth geometrical bodies. Gravitational anomalies isolation methods. Electrical methods and their importance in exploration, Analyses and interpretation electrical data quantitatively. Magnetic methods and their importance in exploration. Quantitative and Qualitative interpretation methods of magnetic data. Electromagnetic survey methods, data collection, data processing and interpretation. Advanced case studies in Geophysics.			

Course No.	علم المعادن المتقدمة	(3) Credits	Learning Type
0803704	Advanced Mineralogy	Pre-requisite: -	Face to Face
Introduction in advanced crystallography; [crystal morphology, crystal stability, unit cell, crystal lattice, crystal symmetry and crystal systems]. Mineral Chemistry; Atomic bonding, Coordination number, Pauling rules for ionic structure, Substitution ions [interstitial solid solution, omission solid solution]. Mineral (crystal) chemical and morphological analysis i.e.; XRD, XRF and SEM. Mineral physical properties. Non silicate mineral classification, native elements, sulfides, oxides, hydroxides, halides, carbonates, nitrates, borates, sulfates, chromates, phosphates, tungestates, molybdenate, arsenates. Silicate minerals: nesosilicates, sorosilicates, cyclosilicates, inosilicates, phyllosilicate, tectosilicate. Minerals Gems., Mineral assemblages and igneous, sedimentary and metamorphic rocks.			

Course No.	المعادن الطينية المتقدمة	(3) Credits	Learning Type
0803705	Advanced Clay Mineralogy	Pre-requisite: 0803704	Face to Face
Introduction, composition of clay minerals, classification of clay minerals, x-rays, identification of clay minerals, chemistry of clay minerals, kaolin groups, serpentine, smectite, illite, chlorite, vermiculite. Quantitative analysis of clay minerals, genesis of clay minerals, engineering properties of clays, clay minerals geochemistry, zeolite minerals, clay minerals in Jordan: occurrences, characteristics and origin.			

Course No.	الصخور الرسوبية الفتاتية	(3) Credits	Learning Type
0803706	Clastic Sedimentary Rocks	Pre-requisite: 0803701	Blended
Mineral composition of sandstone, heavy metals and post-deposition sequential. Burial depth, geochemistry, their relation with tectonic, paleo-climate and depositional environment. In addition, studying terrestrial, transitional and marine depositional environments to infer the paleo depositional environment in clastic sedimentary lithological record.			

Course No.	الصخور النارية والمتحولة المتقدمة	(3) Credits	Learning Type
0803707	Advanced Igneous and Metamorphic Rocks	Pre-requisite: 0803704	Blended
Igneous rocks genesis (magma generation), classification of igneous rocks mineralogy and chemistry. Thermodynamics, phase equilibria in igneous processes, magmatic processes, igneous rock assemblages at different tectonic settings. Thermochemical reactions and mineral facies in metamorphic rocks, material transport during metamorphism, geothermometry and geobarometry, pressure-temperature-time paths in regional metamorphic rocks.			

Course No.	علم الطبقات والسحنات الصخرية	(3) Credits	Learning Type
0803708	Stratigraphy and Lithofacies	Pre-requisite: 0803701	Blended
An introduction about the basic concepts of stratigraphy and lithostratigraphic, biostratigraphic and chronostratigraphic units, branches of stratigraphy and its subdivisions, litho and biocorrelation, direct application of the global stratification system to the stratigraphy of Jordan, preparation of a detailed report of lithostratigraphic and biostratigraphic units that are studied in the field and the separation of fossils, especially the foraminifera group, to determine the different facies, based on their fossil content; drawing maps of lithofacies to reconstruct the basins and ancient environments; visiting stratigraphic profiles to study the litho and biofacies changes and their fossil content.			

Course No.	الجيولوجيا التركيبية المتقدمة	(3) Credits	Learning Type
0803709	Advanced Structural Geology	Pre-requisite: 0803701	Face to Face
The different structural elements and their relationships with stress and strain, indications of stress and strain and methods of measuring and calculating them. Stereographic projection of planes and lines and their structural analysis, different field skills in the use of various geological compasses, methods of drawing geological cross sections and maps with different scales and locating structural information on them.			

Course No.	توضعات الخامات المعدنية	(3) Credits	Learning Type
0803710	Ore Minerals Deposits	Pre-requisite: -	Blended
Introduction to ore minerals, theories of ore minerals deposits, the hydrothermal deposits, hydrothermal bearing ore deposits migration and factors control that. Ore mineral deposits, the geological structures and their effect on ore mineral deposits, factors control ore deposition, the textures of ore deposits (replacement), classification and origin of ore minerals deposits.			

Course No.	علم المياه الجوفية التطبيقي	(3) Credits	Learning Type
0803712	Applied Hydrogeology	Pre-requisite: -	Blended
Introduction to groundwater, origin of groundwater, groundwater and the hydrologic cycle, vertical distribution of subsurface water, groundwater recharge and discharge, geological formations and aquifers, types of aquifers, groundwater levels in confined, unconfined and perched aquifers, groundwater contour maps, groundwater flow directions, determination of groundwater catchment area (groundwater contribution area), wells and springs, physical properties of aquifers (porosity, effective porosity, permeability, hydraulic conductivity, transmissivity, homogeneity, ...etc.), Darcy's law, Darcy velocity, karst aquifers, introduction to groundwater quality and main parameters affecting groundwater quality, groundwater protection against pollutants, wells pumping tests (concept and used methods), calculating the hydrogeological parameters using pumping tests analysis results, the hydrogeology of Jordan.			

Course No.	المعادن والصخور الصناعية	(3) Credits	Learning Type
0803716	Industrial Rocks and Minerals	Pre-requisite: 0803704	Blended
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			

Course No.	الجيولوجيا تحت السطحية	(3) Credits	Learning Type
0803717	**Subsurface Geology**	**Pre-requisite: -**	**Blended**
Geophysical exploration methods; seismic refraction and seismic reflection methods, seismic Stratigraphy, well logging, subsurface facies analysis, core cutting description, geophysical well logging, subsurface structural maps, basin analyses, reservoirs characteristics and evaluation, hydrocarbon traps. Reservoir modeling.			

Course No.	موضوعات خاصة في الجيولوجيا	(3) Credits	Learning Type
0803718	**Special Topics in Geology**	**Pre-requisite: -**	**Blended**
Advanced methods to study the newest theories, techniques and scientific research methodologies used in specified topic in one of the geological fields.			

Course No.	النظم البيئية وتقييم الاثر البيئي	(3) Credits	Learning Type
0803720	**Environmental Systems & Environmental Impact Assessment**	**Pre-requisite: -**	**Blended**
Introduction: Eco-systems, their definitions, importance, characteristics and different relationships. Environmental impact assessment (EIA), development of EIA such as " environmental assessment strategy" and "social impact assessment", principles and administrative procedures, audience contribution, EIA processes (Initial work, test, assessment, reduction management and impacts, report writing, reviewing, decision making, observing, conduction), methodology (lists, matrices, models, expert systems, etc), case studies.			

Course No.	تطبيقات الاستشعار عن بعد ونظام المعلومات الجغرافية	(3) Credits	Learning Type
0803731	**Applications of Remote Sensing and Geographic Information Systems**	**Pre-requisite: -**	**Blended**
Aerial imagery: introduction, use, hardware, geological phenomena recognition; remote sensing: concept, basic definitions; geometric correction of space images; Data processing: classification, filtering; uses for the environment and water resources; computer applications; GIS: Principles, components and management; collection and organization of information and data; modeling; results and computer applications. Remote sensing and GIS; applications in the environment and water resources; water surveys: Instruments, maps, interpretation; geophysical surveys: different methods, Hardware, interpretation.			

Course No.	منهجية البحث العلمي	(3) Credits	Learning Type
0803736	Scientific Research Methodology	Pre-requisite: -	Face to Face

The nature of the research projects required; research frameworks and overviews: management of development processes, focus on the study area, content, problem and objectives, problem selection and process; general framework for monitoring and evaluation of research projects and the selection of appropriate methods: definition, objectives, monitoring and evaluation projects, problems and challenges, realistic view, mechanical observation and evaluation methods, general indicators, evaluation system, reports, information retrieval, beneficiaries, project funding, capabilities and responsibilities.