

Department Of Geology

The department offers the degrees of Bachelor of Science in Applied Geology concentration and in Petroleum Geology concentration. The department also offers a minor in Geology for Non-Geology majors. The Geology department is committed to providing students with a comprehensive knowledge of modern theories in the Earth Sciences and a broad range of geotechnical skills in the petroleum and applied geology. Currently, 3 Professors, 5 Associate Professors, 3 Assistant Professors, 6 Instructors and 5 Technicians are associated to the department. Well-equipped educational labs in the department are available for different geological applications.

Graduation Requirements (BSc degree in Geology)

1. Common Requirements

36 Credit Hours

(1.1) University General Education Courses 27 Credit Hours

(1.2) College Compulsory Requirements 9 Credit Hours

The details about the above common requirements are given above in the college related section.

2. Major specialization and supporting courses requirement:

78 Credit Hours

(2.1) Major Compulsory Requirements 42 Credit Hours

(2.2) Major Elective Requirements 3 Credit Hours

(2.3) Supporting Compulsory Requirements 15 Credit Hours

(2.4) Supporting Elective Requirements 18 Credit Hours

3. Internship

6 Credit Hours

Total:

120 Credit Hours

First: Applied Geology Concentration:

A- Major Compulsory Requirements:

42 Credit Hours

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOL 105	Physical Geology	1 & 2	-	3
GEOA 250	Paleontology	1 & 2	GEOL 105	4
GEOA 290	Structural Geology and Tectonics	1 & 2	GEOL 105	4
GEOA 320	Mineralogy	1 & 2	GEOL 105+PHYS 105 + CHEM 111	4
GEOA 322	Igneous & Metamorphic Petrology	1 & 2	GEOA 320	4
GEOA 325	Sedimentary & Stratigraphy	1 & 2	GEOA 320	4
GEOA 358	Hydrogeology	1 & 2	GEOA 325+ PHYS 105 + CHEM 111+MATH 105	3
GEOA 372	Geophysics	1 & 2	GEOA 290 + PHYS 105 +MATH 105	3
GEOA 412	Remote Sensing and GIS	2	GEOA 290 + PHYS 105 +MATH 105	3
GEOA 458	Geology of the UAE	1 & 2	GEOA 325 + GEOA 290	3
GEOA 461	Geochemistry	1	GEOA 325 + GEOA 322 + CHEM 111	3
GEOL 499	Field Geology	1 & 2	GEOA 458	4

B. Major Elective Courses

3 Credit Hours

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOA 414	Environmental Geology	2	GEOA 325	3
GEOA 452	Economic Geology	1	GEOA 322	3
GEOA 462	Hydrogeochemistry	2	GEOA 358	3
GEOA 490	Mineral Exploration	2	GEOA 461 + GEOA 372+ GEOA 458	3
GEOA 495	Selected Topics	1 & 2	GEOA 372 + GEOA 290 +GEOA 325	3
GEOP 453	Petroleum and Subsurface Geology	1 & 2	GEOA 325 + + PHYS 110 +MATH 106	3

C. Supporting Compulsory Courses:

15 Credit Hours

Course No.	Course Title	Semester	Prerequisite	Credit Hours
BIOC 100	Basic Biology	1 & 2	-	3
CHEM 111	General Chemistry I	1 & 2	-	3
CHEM 112	General Chemistry II	1 & 2	CHEM 111	2
CHEM 115	General Chemistry Lab.	1 & 2	CHEM 112*	1
MATH 110	Calculus II	1 & 2	MATH 105	3
PHYS 110	General Physics II	1 & 2	PHYS 105	3

D. Supporting Elective Courses**18 Credit Hours**

The student may take 18 Credit Hours from the following courses with STAT 210 and BIOC 452 as a mandatory course. Otherwise, and upon the approval of the Department, the students select a total of 18 Credit Hours from one of the approved minors.

Course No.	Course Title	Semester	Prerequisite	Credit Hours
BIOC 205	Basic Biology II	1 & 2	BIOC 100	3
BIOC 250	Basic Ecology	1 & 2	BIOC 205	3
BIOE 452	Oceanography	1	BIOC 205	3
CHEM 241	Organic Chemistry I	1 & 2	CHEM 111	3
ENG 310	Rhetoric and Composition 3B	1&2	-	3
GEO 312	Geomorphology	2	-	3
MATH 110	Calculus II	1 & 2	MATH 105	3
ITBP 119	Algorithms & Problem Solving New	1 & 2		3
PHYS 110	General Physics II	1 & 2	PHYS 105	3
PSY 313	Educational Psychology*	1	-	3
STAT 210	Probability and Statistics	1 & 2	MATH 110	3

E. Professional Internship Program 6 Credit Hours

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOL 500	Internship	1&2	108 CH + GPA ≥ 2.00	6

Second: Petroleum Geology Concentration:**A- Major Compulsory Requirements:****42 Credit Hours**

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOL 105	Physical Geology	1 & 2	-	3
GEOA 290	Structural Geology and Tectonics	1 & 2	GEOL 105	4
GEOA 320	Mineralogy	1 & 2	GEOL 105+PHYS 105 + CHEM 111	4
GEOA 325	Sedimentary & Stratigraphy	1 & 2	GEOA 320	4
GEOA 372	Geophysics	1 & 2	GEOA 290 + PHYS 105 + MATH 105	3
GEOA 458	Geology of the UAE	1 & 2	GEOA 325 + GEOA 290	3
GEOP 413	Petrophysics	1	GEOA (325 + 372) + PHYS 110 + MATH 110	3
GEOP 420	Basin Analysis	1 & 2	GEOP 453+ CHEM 111	3
GEOP 453	Petroleum and Subsurface Geology	1 & 2	GEOA 325 + PHYS 110 + MATH 105	3
GEOP 463	Geophysical Exploration	2	GEOA 372 + PHYS 110 + MATH 110	3
GEOP 469	Petroleum Geochemistry	2	GEOA 325 + CHEM 111	3
GEOP 499	Research Project	1 & 2	GEOP (453 + 413 +420 + 463 + 469)	2
GEOL 499	Field Geology	1 & 2	GEOA 458	4

B. Elective Courses**3 Credit Hours**

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOP 322	Igneous & Metamorphic Petrology	2	GEOA 320	3
GEOA 414	Environmental Geology	2	GEOA 325	3
GEOP 431	Seismic Stratigraphy	1	GEOA 325 + GEOA 372	3
GEOA 495	Selected Topics	1 & 2	GEOP 453 + GEOP 413	3
PETE 403	Well Logging	1	PETE 300 or GEOA 372	3

C. Compulsory Courses**15 Credit Hours**

Course No.	Course Title	Semester	Prerequisite	Credit Hours
CHEM 111	General Chemistry I	1 & 2	-	3
CHEM 112	General Chemistry II	1 & 2	CHEM 111	2
CHEM 115	General Chemistry Lab.	1 & 2	CHEM 112*	1
CHEM 241	Organic Chemistry I	1 & 2	CHEM 111	3
MATH 110	Calculus II	1 & 2	MATH 105	3
PHYS 110	General Physics II	1 & 2	PHYS 105	3

D. Supporting Elective Courses**18 Credit Hours**

The student may take 18 Credit Hours from the following courses with STAT 210 and PETE 300 as mandatory courses. Otherwise, and upon the approval of the Department, the students select a total of 18 Credit Hours from one of the approved minors.

Course No.	Course Title	Semester	Prerequisite	Credit Hours
BIOC100	Basic Biology I	1 & 2	-	3
CHEM 242	Organic Chemistry II	1 & 2	CHEM 241	3
ECON 105	Fundamentals of Micro-economics	1 & 2	-	3
ECON 237	Energy Economics	1	ECON 105	3
ENG 310	Rhetoric and Composition 3B	1 & 2	-----	3
GEO 312	Geomorphology	2	---	3
ITBP 119	Algorithms & Problem Solving New	1 & 2		3
PETE 403	Well Logging	1	PETE 300 or GEOA 372	3
PETE 413	Applied Reservoir Geology	2	GEOL 1153 or GEOL 105	3
PHYS 215	Thermal Physics	1 & 2	PHYS 105	2
PSY 313	Educational Psychology*	1	-	3
STAT 210	Probability and Statistics	1 & 2	MATH 110	3

*Students of the College of Science who are planning to join the program of the professional diploma in teaching must study the course of Educational Psychology course number PSY 313, as it is a prerequisite for the curriculum of that diploma.

E. Professional Internship Program**6 Credit Hours**

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOL 500	Internship	1&2	≥ 108 CH + GPA ≥ 2.00	6

MINOR IN GEOLOGY

The Department offers a Minor in Geology for the students of other Departments and Colleges (18 Cr. H. for Non-Geology students).

Course No.	Course Title	Semester	Prerequisite	Credit Hours
GEOL 105	Physical Geology	1 & 2	-	3
GEOA 245	Paleontology	1 & 2	GEOL 105 + BIOC 100	4
GEOA 290	Structural Geology& Tectonics	1 & 2	GEOL 105	4
GEOA 320	Mineralogy	1 & 2	GEOL 105+ PHYS 105+ CHEM 111	4
GEOA 322	Igneous & Metamorphic Petrology	1 & 2	GEOA 320	4
GEOA 325	Sedimentology & Stratigraphy	1 & 2	GEOA 320	4
GEOA 358	Hydrogeology	1 & 2	GEOA 325 + PHYS 105 + MATH 105 + CHEM 111	3
GEOA 372	Geophysics	1 & 2	GEOA 290 + PHYS 105 + MATH 105	3
GEOA 412	Remote Sensing and GIS	2	GEOA 290 + MATH 105 + PHYS 105	3
GEOA 414	Environmental Geology	2	GEOA 325	3
GEOA 461	Geochemistry	1	GEOA 325 + GEOA 322 + CHEM 112	3
GEOA 462	Hydrogeochemistry	2	GEOA 358	3
GEOP 453	Petroleum and Subsurface Geology	1 & 2	GEOA 325 + PHYS 110 + MATH 105	3
GEOP 463	Geophysical Exploration	2	GEOA 372 + MATH 110 + PHYS 110	3
GEOP 468	Petroleum Geochemistry	2	GEOA 325 + CHEM 111	3

Courses Descriptions:

GEOL 105: Physical Geology

3 Credit Hours (2+3)

Origin of the Earth and its shells. Composition of the Earth's crust and oceans, and their Geological characteristics. Primary and secondary structures. Internal Geological processes. Plate Tectonics and the relation of Geological events to it. External Geological processes. Stratigraphic columns, details of the Geological Time Scale and case studies of Geological ages and their palaeogeographic distribution. Climate. Important biological aspects. **(Prerequisite: None)**

GEOA 250: Paleontology

4 Credit Hours (3+3)

The objectives of this course are the study of the main invertebrate fossils groups, their applications in stratigraphy, palaeoecology and their importance in the petroleum exploration especially in the United Arab Emirates. It concentrates on the study of major fossil groups (micro-and macrofossils) and selected fossils from the local outcrops including Foraminifera, Calcareous Nanofossils, Ostracodes, Conodonts, Palynomorphs, Porifera, Cnidaria, Bryozoa, Brachiopoda, Mollusca, Echinodermata, Trilobites, Graptolites and trace fossils. Study their characteristic morphology, microstructure, chemistry, mineralogy, geological time scale, their origins and systematic affinities, fossilization process, nomenclature, evolution, extinction and important role in the history of life on Earth. **(Prerequisite: GEOL 105)**

GEOA 290: Structural Geology and Tectonics

4 Credit Hours (3+3)

This course introduces the students to the principles of Structural geology, including the essential types of structural data, and how to measure and record them. It briefly treats primary structures before proceeding to explain the evolution of the important deformation (secondary) structures. The analysis of data to reveal the form and time relations of the largest crustal structures is then presented. The second half of the course deals with tectonics, particularly plate margins and their characteristic deformations. The significance of plate tectonics for resource exploration will also be mentioned. **(Pre-requisite: GEOL 105)**

GEOA 320: Mineralogy

4 Credit Hours (3+3)

This course aims to develop a clear understanding and basic knowledge of the properties and theories of light, the polarizing light microscope, mineral optics in ordinary light and in polarized light. Optical properties of minerals in crossed polars observations. Convergent light and interference figures. Uniaxial and biaxial minerals. Rock-forming minerals. Crystallography and crystallographic projection. **(Prerequisite: GEOL 105 + PHYS105 + CHEM111)**

GEOA 322: Igneous and Metamorphic Petrology

4 Credit Hours (3+3)

This course aims to develop a thorough knowledge of the characteristics and origins of igneous rocks, igneous processes, chemical patterns in igneous rocks, igneous rock associations: description, occurrence and origin. Lamprophyre dykes. Processes in metamorphic rocks. Description and origin of contact, regional and dynamic metamorphic rocks. Review of the origin of igneous and metamorphic rock associations. Ophiolites of the UAE. **(Prerequisite: GEOA 320)**

GEOA 325: Sedimentology and Stratigraphy

4 Credit Hours (3+3)

This course provides comprehensive and focused education in the fields of sedimentology and stratigraphy that will enable the student to understand and evaluate geological processes on the earth's surface and deeper. **(Prerequisite GEOA 320)**

GEOA 358: Hydrogeology

3 Credit Hours (2+3)

The course teaches the basic concepts of hydrogeology using examples from the UAE. Topics include: the hydrologic cycle, origin and age of groundwater, properties and kinds of aquifers, groundwater exploration, drilling, design, development and completion of water wells, principles of groundwater flow and pumping tests, physical and chemical properties of groundwater, recent developments in groundwater studies, and water resources in the UAE.

(Prerequisite: GEOA 325 +PHYS 105 + MATH 105 + CHEM111.)

GEOA 372: Geophysics

3 Credit Hours (2+3)

This course aims to develop a clear understanding of the principles of geophysics. It includes: reflection and refraction seismic waves, seismic data processing and interpretations, gravity measurement and applications of Newton's Law, gravity survey field procedures and interpretation. Magnetic parameters, field procedures and interpretations. Electrical properties of rocks, Ohm's Law, field resistivity measurements and geoelectrical interpretations. **(Prerequisite: GEOA 290+PHYS 105+MATH105.)**

GEOA 412: Remote Sensing and GIS

3 Credit Hours (2+3)

This course introduces the basic principles of remote sensing and fundamentals of GIS. This includes: introduction to electromagnetic radiation and targets; reflectance of terrain features; target signature; digital image structure; color composition. Data collection and data analysis. Photo Geological examples from the United Arab Emirates. Fundamental problem in GIS; geographic representation and data models. Geo-databases. Geo-spatial analysis; geo-visualization. **(Prerequisite: GEOA 290+PHYS 105+MATH 105)**

GEOA 414: Environmental Geology**3 Credit Hours (2+3)**

This course deals with the principles of environmental Geology as an integral part of the students' curriculum. It includes: renewable and non-renewable resources, minerals, fossil fuels and water, conservation measures. Natural hazards including volcanic activity, earthquakes, floods, regional subsidence and landslides. Mitigative measures. Pollution of air, surface and subsurface water, and soil. Waste disposal in a Geologic context. Man's modification of the physical environment. Environmental management. **(Prerequisite: GEOA 325)**

GEOA 452: Economic Geology**3 Credit Hours (2+3)**

This course covers the following topics: theories of ore genesis, different techniques used in the study of ore deposits: fluid inclusions, stable isotopes, chemical analyses and ore microscopy, ore-forming processes - magmatic, hydrothermal and sedimentary. Distribution of ore deposits in relation to plate tectonics and throughout Geologic time. Mineral resources of the UAE. **(Prerequisite: GEOA 322)**

GEOA 458: Geology of the UAE**3 Credit Hours (2+3)**

The course describes the essential features of the Geological setting and structural framework of the Arabian Peninsula. It includes: the sedimentary sequences Palaeozoic-Cenozoic and the effect of tectonic movements and water depth variation on sedimentary facies. Introduction to the Geology of the UAE, structural and tectonic setting, evolution of Rub Al Khali and Ras Al-Khaima basins. Evolution of the islands in UAE. Stratigraphic sequence facies and palaeogeography of the UAE. Oil exploration history, hydrocarbon characteristics, and oil fields. **(Prerequisite: GEOA 325 + GEOA 290)**

GEOA 461: Geochemistry**3 Credit Hours (2+3)**

This course presents an exposition of the impact of chemistry and its laws on the spatial distribution of elements in the various spheres of the Earth. It introduces theories on the origin of the elements which compose the Earth, and the Solar System. The geochemistry of isotopes and radionuclides. Geochemistry of the three types of rocks on the Earth's crust. Thermodynamics of elements. Geochemical exploration. Geochemical balance, and finally environmental geochemistry as a modern discipline. **(Prerequisite: GEOA 322 + GEOA 325 +CHEM 111)**

GEOA 462: Hydrogeochemistry**3 Credit Hours (2+3)**

The course aims at giving the students the basic principles of inorganic geochemistry and water hydrochemistry. The course contents cover chemical differentiation of the earth, metals and non-metals, geochemistry of sedimentary rocks, clay minerals, carbonate deposits, isotope geochemistry, geochemical equilibrium, environmental pollution and its sources, water chemistry, acidity- alkalinity, saltwater intrusion, rock-water interaction, hydrochemical evolution. **(Prerequisite: GEOA 358)**

GEOA 490: Mineral Exploration**3 Credit Hours (2+3)**

The course is intended to teach and improve the understanding of the minerals exploration issue. The basic elements of geological, geophysical and geochemical tools and data required for mineral explorations are described. The general techniques and procedures used in mineral prospecting are discussed. The types of mineral resources and/or industrial minerals occurring in the UAE and/or Gulf regions will be outlined with real examples enhance where possible. Field excursion to a practical site may also be included as an additional course tools. **(Prerequisite: GEOA 461+GEOA 372+GEOA 458)**

GEOA 495: Selected Topics**3 Credit Hours (3+0)**

Through this course, faculty members are given the chance to teach new or timely subjects that are not covered in other courses. **(Prerequisite: GEOA 290+GEOA 325+ GEOA 372)**

GEOL 499: Field Geology**4 Credit Hours**

The course aims to develop practical skills in field Geology and field surveying. It includes training in the use of a range of field instruments, field trips to selected areas, practical methods of Stratigraphy and facies analysis, ophiolite Stratigraphy, metamorphic rocks and metamorphism, structural Geology and regional tectonics, sabkha environments and salt domes. **(Prerequisite: GEOA 458)**

GEOL 500: Internship**6 Credit Hours**

The training programme is coordinated by both the Department, academic supervisor and the faculty training committee. The programme is continuously monitored and reviewed by a field supervisor staff member at one of the various geological organizations in the United Arab Emirates. **(Prerequisite: Min. GPA "2"+ at least 108 Credit Hours.)**

GEOP 322: Igneous & Metamorphic Petrology**3 Credit Hours (2+3)**

This course begins with a review of the classification of igneous rocks, followed by a study of the field occurrences, mineralogy, textures, compositions and origins for the major extrusive and intrusive rock associations. As the semester proceeds, experimental evidence is evaluated which can shed light on the origin and crystallization of magmas. During the second half of the term, metamorphic rocks, processes, and structures are considered from a field, laboratory, and experimental perspective. Igneous and metamorphic rocks and processes are considered at all scales, from global plates, mountain ranges, large outcrops, and hand-samples, through microscopic and submicroscopic observations. **(Prerequisite: GEOA 320)**

GEOP 413: Petrophysics**3 Credit Hours (2+3)**

This course aims to make the student aware of the different types of coring as well as the methods of obtaining, handling and storage of core samples. Also, it aims to teach him the methods of measuring the petrophysical characteristics of reservoir rocks such as porosity, permeability, density, resistivity...etc. **(Prerequisite: GEOA 325 + GEOA 372+MATH 110+PHYS 110)**

GEOP 420: Basin Analysis**3 Credit Hours (2+3)**

This course aims at giving the students the knowledge and clues about how much oil remains undiscovered in the sedimentary basins of the world? Where is it? and how do we find it? using crustal and global basin classification. This course identifies the key elements essential to a specific basin / play analysis that lead to oil and gas play definition. It includes a number of case studies about the petroleum basins in the world particularly the Arabian Gulf region. **(Prerequisite: GEOP 453+CHEM111)**

GEOP 431: Seismic Stratigraphy**3 Credit Hours (2+3)**

The aim of this course is to identify the key elements of seismic reflection patterns, amplitudes and frequencies essential to a specific basin stratigraphic and facies analysis that lead to oil and gas play definition. It gives clues about the methods of analyzing environments of deposition, type of rocks, Sedimentary sequences, fluid content and contacts, palaeo-sea level change and the Geologic history. **(Prerequisite: GEOA 325 + GEOA 372)**

GEOP 453: Petroleum and Subsurface Geology**3 Credit Hours (2+3)**

The course introduces all the processes which contribute to the transformation of organic matter to petroleum. All types of petroleum systems and their relation to global tectonics are discussed. All analytical techniques and geophysical methods used for exploration and exploitation are briefly covered. Various kinds of subsurface maps and illustrations are also accomplished. Examples from the UAE are presented throughout the course. **(Prerequisite: GEOA 325+PHYS 110+ MATH 105)**

GEOP 463: Geophysical Exploration**3 Credit Hours (2+3)**

This course aims at delineating subsurface Geology including layer succession, types of structures, petrophysical parameters of different layers, types of fluids and their quantity, buried ores, etc. The most important type of these methods is the seismic methods, especially the reflection seismic. A precise determination of the attitude of subsurface layers, structures, water tables, bearing capacity of different soil materials for civil engineering purposes, and the fluid zonation in oil traps is the main duties of the surface and borehole seismic surveys. Gravity, magnetic and electric methods play a secondary role in geophysical exploration for oil, groundwater and other land-resources. **(Prerequisite: GEOA 372+MATH 110+PHYS 110)**

GEOP 469: Petroleum Geochemistry**3 Credit Hours (2+3)**

The main objectives of this course is to introduce many of the basic concepts used by geochemists in obtaining information on the origin and history of crude oil, bitumen, petroleum and natural gas, to evaluate the source rocks of oil, to develop the concept of biomarkers and to interpret GC and GC/MS chromatograms. **(Prerequisite: GEOA 325 + CHEM 111)**

GEOP 499: Research Project**2 Credit Hours**

This course is designed to enhance the student's research capability in an area of petroleum geosciences. This course also may involve field and laboratory activities as well as literature survey. Final report is required.

(Pre-requisite: GEOP 453 + GEOP 413 + GEOP 420 + GEOP 463 + GEOP 469)

Courses offered to other colleges and departments:**GEOL 100: Planet Earth (for Non-Geology Students)****3 Credit Hours (3+0)**

The course is designed to all university students in order to provide them with general education knowledge about our planet; its past, present and future changes. The course will include three main sections; the first focusing on Earth evolution in time and space, the second covers the Earth materials and Earth shaping processes and the third deals with natural hazards and the future of earth sciences. The course will be based on lectures, computer assisted exercises, multimedia presentations and seminars.

(Prerequisite: None)

GEOL 1153: Physical Geology for Petroleum Engineers**3 Credit Hours (2+2)**

This subject presents the fundamental principles of geology and their context in the evolution of the Earth. It introduces the main concepts in the foundational disciplines of mineralogy, sedimentary petrology, stratigraphy, paleontology, structural geology and tectonics, with some reference to igneous and metamorphic petrology, geomorphology, resource geology and engineering geology. **(Prerequisite: None)**