

قسم الجيولوجيا - الدراسية لبرامج الدراسات العليا.

E		E	
Diploma		G500	استكشاف الثروات الطبيعية البتروال والغاز الطبيعي
M.Sc.	ماجستير	G600	الصخور الصلبة والجيوكيمياء الصخور الرخوة والحفريات الجيوفيزياء
Ph.D.		G700	صخور الصلبة والجيوكيمياء الصخور الرخوة والحفريات الجيوفيزياء

الخطة الدراسية :

		E	
		G500	
	إختياري		

ساعات إجبارية: يدرس الطالب ساعات معتمدة موزعة على فصلين دراسيين بواقع

الساعات الاختيارية: يختار الطالب ساعات معتمدة موزعة على فصلين دراسيين بواقع

الدراسية استكشاف الثروات الطبيعية.

إختياري					
-		-			
-		-		التنقيب الجيوكيميائي	
-		-		التنقيب الجيوفيزيائي	
	-	-		التكتونية والتمعدنات	
	-	-			
	-	-		الأحجار الكريمة	
	-	-		جيولوجيا الفحم والأخطار البيئية للمناجم	
-		-		الثروات الطبيعية:	
-		-		بتروجرافية الصخور	
	-	-		جيولوجيا النظائر	
	-	-		تطبيقات الاستشعار عن بعد ونظم المعلومات الجغرافية	
	-	-		المعادن الصناعية والإشعاعية	
	-	-		تركيز الخامات	

الدراسية البترول والغاز الطبيعي.

اختياري						
-					السحنات والبيئات الترسيبية	
-			-		اصفات الغاز الطبيعي	
-			-		حفریات تطبيقية	
	-		-		مقدمة بتروفيزياء وتسجيل آبار	
	-				جيوكيمياء البترول	
-			-		طرق الاستكشاف السيزمية	
-			-		الغاز الطبيعي دراسة	
	-		-		جيولوجيا البترول متقدم	
	-				الطباقية التتابعية والسيزمية	
	-		-		تفسيرات البيانات السيزمية ثلاثية الأبعاد	
	-		-			

### المحتوى العلمي للمقررات الدراسية

#### G501: Advanced Mineralogy

:

This course will focus on understanding and knowledge of crystallography and crystal symmetry; understanding of fundamental chemical principles that dictate the structure and composition of minerals; the relationships between the chemical, and structural aspects of minerals (a topic called "Systematic Mineralogy"); the variety of minerals that occur in various mineral groups (e.g. the pyroxenes, the amphiboles), and gain a better understanding of the genetic and environmental implications that various species of minerals have; a number of advanced techniques for identifying minerals and/or better understanding their structure and/or composition.

#### G502: Natural Resource: Case Study

: الثروات الطبيعية:

Ore mineralogy; classification of commercial earth materials; geochemical cycle of various elements; geology, distribution, characteristics, formation, enrichment and localization of various economic mineral and industrial deposits, relationship of mineral and industrial deposits to global tectonics. Principles and relationships of economics and politics to the utilization of mineral and industrial deposits with emphasis to Arabian Nubian Shield.

#### G503: Geochemical Prospecting

: التنقيب الجيوكيميائي

Dispersion of trace metals from mineral deposits. The distribution of elements in rocks, soils, and sediments; application of geochemical techniques to mineral exploration; the application of geochemical principles techniques to environmental problem solving; petrophysical exploration methods; minerals economy, and deposit evaluation.

#### G504: Petrography

: بتروجرافية الصخور

Petrographic study of igneous and metamorphic rocks using transmitted and reflected light. Major families of volcanic and plutonic igneous rocks with emphasis on tectonic setting, models of their origin and evolution throughout geologic time. Mineralogy, comparative study and fundamental observations of sedimentary rocks in hand specimens and under the petrographic microscope, with emphasis on paragenetic, paleographic, tectonic, and Environmental interpretation.

#### **G505: Prospecting Geophysical**

: التنقيب الجيوفيزيائي

Introduction to theory and practice of seismic, gravity, magnetic, electrical, and electromagnetic methods of exploration for natural resources. Application of refraction and reflection techniques to exploration. The gravity method is studied in detail with regard to its application to exploration for hydrocarbons, minerals, geothermal sources, groundwater, and geotechnical studies, including surveying, processing, analysis, and modeling of gravity data.

#### **G506: Isotopes Geology**

: جيولوجيا النظائر

Stable and radioactive isotopes and the applications of isotopic studies to igneous and metamorphic petrology, ore deposits, sedimentology, surface processes, geothermometry, and geochronology. Zirconology and crustal evolution, Applications of stable isotopes O, C, H and Sr isotopes in earth systems, noble gas geochemistry and terrestrial evolution, Introduction to isotopic techniques and mass spectroscopy.

#### **G507: Tectonic and Mineralization**

: التكتونية والتمعدنات

Definition, tectonic control of mineralization, mineralization along subduction zone, mineralization along mid-ocean ridge, mineralization along forearc setting, island-arc root mineralization, within plate mineralization, sea-floor mineralization, mineralization along tectonic contact, mineralization along intrusive or thermal contact, plate tectonics and mineralization in the Tethyan region, Tectonics and Mineralization in the Arabian Shield and its extension, plate tectonic and petroleum accumulation, structural control of mineralizations. Tectonics and mineralization of copper, gold, chromitists, magnetite ... etc.

#### **G508: Gemstone**

: الاحجار الكريمة

Definition of Gemstone, Nomenclature and classification, difference between gemstone and other stones, origin of gemstone, the host-rock of gemstone, mineralogy and chemistry, treatment of Gemstone, geologic distribution (location) in Egypt, gemstone applications, gemstone and medicine, economic importance of gemstone, synthetic of gemstone.

#### **G509: Advanced mineral Deposits**

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Mineral deposits in the principal plate tectonic regims- Continental interior basins-Ocean basins and rises- passive continental margins-Subduction-related setting –Strike-slip setting-Collision-related settings- Ore Mineralization through Geological Time- The Archaean-The early to mid-Proterozoic-Mid to Late Proterozoic-The Phanerozoic.

#### **G510: Industrial and radioactive minerals**

: المعادن الصناعية والإشعاعية

The relative importance of ore and industrial minerals-Aggregates and constructional materials- Cement and concrete-Building stones-Glass-Gypsum- Refractory clay-Industrial sand and gravel - Graphite deposit types- Deposits of gypsum and anhydrite.Uranium and thorium ore deposit types- Geochemistry of Uranium and thorium- Supergene enrichment uranium deposits-Hydrothermal vein deposits of uranium- Unconformity uranium deposits.

**G511: Remote Sensing and GIS Applications** : تطبيقات الاستشعار عن بعد ونظم المعلومات الجغرافية

Remote sensing for mineral exploration (Uranium, Gold, copper...etc), Gold prospecting using Remote Sensing 'A case study of Egypt. Mapping of Pb-Zn SEDEX mineralization using remote sensing, Remote sensing technology for mineralizing alteration, Mineralization Information Extraction Using ETM Remote Sensing Image, Integration of Geological Mapping for Discovery of Iron-Ore Mineralization, Remote sensing: Principles and Application. Remote Sensing Based Technology for the Evaluation of ores. Remote sensing interpretation and prospecting.Integration of Satellite Remote Sensing Data for deposits Prospecting. Hyperspectral Remote Sensing Data and a Multi-proxy Investigation.Remote sensing and GIS-based prediction and assessment of copper.

**G512: Ore Dressing** : تركيز الخامات

What is the ore dressing? advantages of ore dressing, Different method of ore dressing, Beneficiations of minerals, separation of stream deposits, separation of heavy metals, ore dressing of Gold, ore dressing of phosphate, ore dressing of iron, ore processing, treatment types and processes.

**G513: Coal Geology and Environmental aspects of Mining** : جيولوجيا الفحم والأخطار البيئية للمناجم

Coal types- petrography of coal-The chemical composition of coal- Peat formation environment - Dimensions of coal seams-Concordant and discordant clastic sediments in coal seams- Host rocks of coal- Coal formation in geological space and time-Coal mining geology-Environmental aspects of coal mining.

**G514: Seismic Exploration Methods** : طرق الاستكشاف السيزمية

Uses of artificially generated elastic waves to locate hydrocarbon deposits, geothermal reservoirs, groundwater, archeological sites, and to obtain geological information for engineering.Land and marine acquisition techniques and instrumentation.Seismic reflection processing methodology. Exploration seismology provides data that, when used in conjunction with other geophysical, borehole and geological data, and with concepts of physics and geology, can provide information about the structure and distribution of rock types.

**G515: Sedimentary Environments & Facies** : السحنات والبيئات الترسيبية

Analysis of sedimentary facies and Environments of deposition. The processes, characteristics, and relationships among depositional systems; depositional basin analysis.Principles, of sedimentation and modeling. Mechanical, chemogenic and biogenic sedimentation, and diagenetic processes discussed in detail. Emphasis on the study of the recent Environments of sediments deposition. The products of sedimentary processes will be related to their analogs in the stratigraphic record.

**G516: Natural Gas: Case study****: الغاز الطبيعي :**

Regional geology of Egypt and Middle East - Geology of local basins - Gas resources Reservoir seals - Structural control of some different fields - Gas in place versus recoverable gas - Gas exploration and production - Reserves assessment - Global availability versus demand Future of hydrocarbon exploration.

**G517: Reservoir Properties****:**

Description of elastic and carbonate reservoirs using sedimentological, petrological, petrophysical, and petroleum engineering data to formulate realistic models of primary and enhanced recovery in various depositional systems that contain oil and gas reserves. Reservoir heterogeneity resulting from depositional and diagenetic processes reservoir modeling.

**G518: Advance Petroleum Geology****: جيولوجيا البترول متقدم**

Sedimentary basins, reservoir, seal, trap, timing, maturation, migration and accumulation of hydrocarbon, analysis of source rocks, analysis of reservoir, analysis of petroleum statistics.

**G519: Natural Gas Properties and Characterization****: خصائص ومواصفات الغاز الطبيعي**

Natural Gas - Classification - Components and composition (gases, liquids, fluids, solids) - General overview of their properties - Pure component properties - Ideal gas law - Boyle's law - Charles law - Avogadro's principle - An overview of phase equilibria - Water content of gas - Hydrate formation - Sweet gas and sour gas - acid gas properties -  $H_2S$  and  $CO_2$ .

**G520: Seismic and sequence stratigraphy****: الطباقية التتابعية والسيزمية**

Definition of seismic and sequence stratigraphy, difference between lithostratigraphy and chronostratigraphy. Mention the types of seismic reflection patterns, reflection and geological boundaries. Discuss the sedimentary bodies in 3D seismic records, classification and stratification patterns in seismic record. In the final, discuss the sequence stratigraphy in siliciclastic and carbonate systems, as well as, the applications of sequence stratigraphy in some Egyptian regions.

**G521: Applied Paleontology****: حفريات تطبيقية**

The most important groups of microfossils, their systematics, ecology and distribution throughout earth's history (evolution and stratigraphy). Applications of micropaleontology to interdisciplinary research in biostratigraphy, paleoecology, paleoceanography, paleoclimatology and environmental sciences. Understanding applied micropaleontology as well as the value of foraminifera, calcareous nannoplankton, ostracods, pollen and spores in oil exploration.

**G522: Three Dimensional (3D) Seismic Interpretation****: تفسيرات البيانات السيزمية ثلاثية الأبعاد**

Review of acquisition of 3D seismic data on land and water-covered areas - Review of processing of 3D seismic data - Two dimensional (2D) seismic interpretations against 3D seismic interpretation - Basic concepts of 3D seismic interpretation; 3D seismic volume, inline vertical sections, cross line vertical sections and horizontal slices - Direct hydrocarbon indicators (DHI<sub>s</sub>), bright spot, flat spot,

dim spots, AVO (etc..) - Seismic well tie and synthetic seismogram, convolutional model - Seismic resolution; horizontal resolution and vertical resolution - Structural interpretation, picking faults and horizons, time structure maps, stratigraphic interpretation - pitfalls of seismic interpretation.

### **G523: Petrophysics and well logging**

: مقدمة بتروفيزياء وتسجيل آبار

Physical Properties of rocks, porosity, saturation, permeability, conductivity, effect of salinity and temperature on formation of waters, mud filtrate, mud resistivity, formation factor and its dependence on porosity and saturation. Gamma ray logging, Physical concept, Tools, Spectral Gamma ray logging and Clay-volume calculation. Spontaneous Potential logging, Physical concept, Tools, and their applications. Caliper log and borehole diameter determination. Resistivity logs, physical concept, tools configuration, conventional resistivity logs, Microresistivity logs and Induction resistivity logs. Porosity logs, Physical concepts, Neutron logs, Density logs, Neutron-Density combination, Nuclear Magnetic Resonance and Sonic logs. Dip meter and Borehole image. Interpretation of well logs and flow chart for interpretation of well logs. Petrophysical parameters estimation, porosity, permeability, water saturation, hydrocarbon saturation. Cross plots for determination of porosity and lithology.

### **G524: Exploration and drilling**

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Study the geology and geophysics exploration methods. Study the drilling activities, agreements and contracts, as well as site preparation. Study the types of wells and different drilling methods. Study the modern rotary drilling and its main components, besides study the drilling fluid cycle. Study the problems and risks of the wells drilling, as well as drilling techniques. In final the course, study the general view on safety and environment in petroleum field.

### **G525: Computer and Exploration**

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Use of computers to compile and assemble geologic data in to a coherent "map" of the underground. Study of the three main types of computer assisted exploration models: 2-dimensional, 3-d, and most recently, 4-d. Incorporate the data obtained from different types of tests, such as logging, production information, and gravimetric testing which can all be combined to create a 'visualization' of the underground formation. Uses an interactive computer generated visualization of 3-D seismic data to explore the subsurface layers.

### **G527: Geochemistry of Petroleum**

: جيوكيمياء البترول

Study the basic organic geochemistry, Production, preservation and degradation of organic matter. Identification on fats of organic matter - Conditions of accumulation of organic rich sediments. Also, study the formation of humic material, coal and kerogen. Discuss the generation, composition and classification of petroleum, as well as Organic geochemistry of Sulphur. Study the environmental behaviour of organic compounds, source rock quality, maturity, and potential - Rock-Eval pyrolysis. Biomarkers - Geochemical correlation: oil-to-oil, oil-to-source rock.

ثانياً: الخطة الدراسية الماجستير.



	-		-		جيولوجيا النظائر	
-			-		حفریات لا فقارية (كبيرة ودقيقة)	
-			-		السحنات الصخرية والبيئات الترسيبية	
	-		-		الخواص الفيزيائية للصخور	
	-		-		الجيولوجيا الهندسية وميكانيكا الصخور	
	-		-		الصخور الجيرية والمتبخرات	
	-		-		جيولوجيا البترول والمياه المتقدم	

## ٦ درجة الماجستير الجيوفيزياء.

اختياري						
-			-		طرق الجاذبية والمغناطيسية المتقدمة	
-			-		تفسيرات البيانات السيزمية ثلاثية الأبعاد	
-			-		انص السيزمية لخزانات البترول	
	-		-		الطرق الكهربية والكهرومغناطيسية	
	-		-		احصاء جيولوجي	
	-		-		جيوفيزياء منجمية	
	-		-		مخاطر جيولوجية	
-			-		تسجيلات الابار وبتروفيزياء	
-			-		موجرافيا السيزمية	
	-		-		تطبيقات الاستشعار عن بعد ونظم المعلومات الجغرافية	
	-		-		جيوفيزياء هندسية وبيئية	
	-		-		جيوفيزياء بحرية	
	-		-		جيومورفولوجيا وجيولوجيا المياه التطبيقية	
	-		-		قراءات موجهة في الجيوفيزياء	

## المحتوى العلمي للمقررات الدراسية

### G601: Advanced Mineralogy (1)

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This course will focus on understanding and knowledge of crystallography and crystal symmetry; understanding of fundamental chemical principles that dictate the structure and composition of minerals; the relationships between the chemical, and structural aspects of minerals (a topic called "Systematic Mineralogy"); the variety of minerals that occur in various mineral groups (e.g. the pyroxenes, the amphiboles), and gain a better understanding of the genetic and environmental implications that various species of minerals have; a number of advanced techniques for identifying minerals and/or better understanding their structure and/or composition.

### G602: Advanced igneous and metamorphic rocks (1)

: صخور نارية ومتحولة متقدم ( )

Igneous Petrology: Field observations of igneous rocks: large and small scale features, types of intrusions and extrusions, methods of emplacement of igneous rocks. Magmatic evolution. Recent classification of igneous rocks, Petrogenesis and tectonic setting of major igneous rock types and suites.



Metamorphic Petrology: Pressure, Temperature and Composition of metamorphic rocks. Metamorphic processes. Metamorphic reactions. Metamorphic isograds. Metamorphic facies. Influence of tectonics on metamorphic P-T-t Paths.

**G603: Advanced Structural Geology**

**: جيولوجيا تركيبية متقدم**

Different types of structures. Stress: Definition – Types. Strain: Definition – Types. Structural elements, classification, methods of representation. Joints, classification, kinematics of jointing. Faults, definition, classification, kinematics of faulting, criteria of faults recognition, fault mechanics solution. Folds: Definitions - Classifications, Fold mechanisms - Criteria of fold recognitions, superimposed folding. Shear zones and shear sense indicators. Thrust system. Geometry and kinematics of inversion tectonics. Structural characteristics and tectonic evolution of north Sinai fold belt. Cretaceous tectonic in Egypt. Some geometrical characteristics of inversion.

**G604: Advanced Geochemistry (1)**

**: جيوكيمياء متقدم ( )**

Definitions, classification, distribution and rules of distribution of trace elements. Geochemistry of magma and igneous rocks in different tectonic settings. Geochemistry of sedimentary rocks and geochemical factors affecting formation of sedimentary rocks. Geochemistry of rare earth elements REE and its distribution. Estimation of melting and crystallization degrees from chemistry of rock-forming minerals. Fluid chemistry and rock-fluid interaction. Stable isotope fractionations and source of fluids. Geochemistry of Nobel metals. Analytical methods for elements in whole-rocks (XRF, NNA, ICP, LA-ICP) and minerals (EMPA, IMPA).

**G605: Advanced Economic Geology**

**: جيولوجيا اقتصادية متقدم**

Orthomagmatic ore formation- Ore deposits at mid-ocean ridges and in ophiolites- Ore formation related to alkaline magmatic rocks, carbonatite and kimberlites- granitoids and ore formation processes. Hydrothermal ore formation- source and origin of hydrothermal solutions- Skarn and contact metasomatic ore deposits. Residual ore deposits- Sedimentary ore formation systems. Diagenetic ore formation system.

**G606: Industrial and radioactive minerals**

**: المعادن الصناعية و الإشعاعية**

The relative importance of ore and industrial minerals- Aggregates and constructional materials- Cement and concrete- Building stones- Glass- Gypsum- Refractory clay- Industrial sand and gravel - Graphite deposit types- Deposits of gypsum and anhydrite. Uranium and thorium ore deposit types- Geochemistry of Uranium and thorium- Supergene enrichment uranium deposits- Hydrothermal vein deposits of uranium- Unconformity uranium deposits.

**G607: Advanced Geotectonic**

**: جيولوجيا تكتونية متقدم**

Geodynamics applied to plate tectonics: mantle composition and rheology, deformation of the lithosphere, structural characteristics of plate margins, stability of triple junctions. Types of plate boundaries. Driving forces of plate motion. Current plates. The interpretation of orogenic zones, African example of a continental craton. Structure of constructive boundaries, including the development of rifting. Examples of continental passive margins and their structural levels. Andean

and cordilleran belts. The Alpine-Himalayas Fold belts and its Afro- European and near East sub regions. Structure of conservative boundaries.

**G608: Coal Geology and Environmental Aspects of Mining** : جيولوجيا الفحم و الاخطار البيئية للمناجم

Coal types- petrography of coal-The chemical composition of coal- Peat formation environment - Dimensions of coal seams-Concordant and discordant clastic sediments in coal seams- Host rocks of coal- Coal formation in geological space and time-Coal mining geology-Environmental aspects of coal mining.

**G609: Advanced mineral Deposits** :

Mineral deposits in the principal plate tectonic regims- Continental interior basins-Ocean basins and rises- passive continental margins-Subduction-related setting –Strike-slip setting-Collision-related settings- Ore Mineralization through Geological Time- The Archaean-The early to mid-Proterozoic-Mid to Late Proterozoic-The Phanerozoic.

**G610: Volcanology**

: علم البركانيات

Geologic settings of volcanos, geophysical and geochemical constraints on the origin of magmas, energetics and periodicity.Pre-eruption, and post-eruption processes. Examines triggers of magma ascent, controls on volatile build-up and loss, magma fragmentation, magma-groundwater interaction, eruption column dynamics, gravity-controlled eruptive phenomena.Volcanos and earthquakes, volcanic hazards and prediction, geothermal power and volcanogenic ore deposits.

**G611: Advanced Sedimentary Petrology**

: علم الصخور الرسوبية المتقدم

Siliciclastic sediments: Detailed petrographic, texture relations and mineralogy, provenance, modal composition, heavy minerals, and classification. Diagenesis: compaction, porosity, authigenesis, cement types, diagenetic environments. Carbonates: mineralogy, specific sedimentary structures, grain types (Folk 1962), structural classification (Dunham 1962), sedimentary environments. dolomitization, dedolomitization, porosity changes. Diagenesis: cement types, diagenetic environments. Evaporites, cherts, black shales, coal, oil, glauconite, phosphates.Paleosols (humid, semiarid, arid; calcretes, silcretes, dolocretes).

**G612: Applications of Remote Sensing and GIS**

: تطبيقات الاستشعار عن بعد ونظم المعلومات الجغرافية

Remote sensing processing, and interpreting images and related data from aircraft and satellites.Remote Sensing and Geophysical surveys.Using Remote Sensing and GIS techniques for mineral exploration. How to read and use remote sensing images for identification of geological structures, mapping, ore deposits, and different rock types....etc. Hyperspectral remote sensing and prospectivity modelling.recognize hydrothermally altered rocks by their spectral signatures such as Landsat thematic mapper (TM) satellite images. Recognizable in multispectral thermal IR images.Using Landsats 1, 2, 3, 4, 5, 6 and 7), Landsat 4, 5 thematic mapper (TM), Landsat 7 enhanced TM, SPOT multispectral scanner\_XS, SPOT panchromatic, AVIRIS hyperspectral scanner. Using Color composite ratio images.Using GIS and modelling systems to interpret data from satellite and airborne sensors. Application in geophysics– geology – regional geology –

geological formations – rock types and discriminations – lithology – groundwater potential and movements – geomorphology – mineralization zones – drainage patterns – tectonics – marine resource evaluation.

### **G613: Geology of Egypt: Case Study (1)**

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: جيولوجية مصر:

This course include the following topics: Geography and geomorphology of main Egyptian provinces; geologic, structural and tectonic history of Egypt; distribution and ages of rocks in Egypt; description the different stratigraphic successions in type localities and their lateral relationships, analyze different facies; and correlation the litho-and biostratigraphic rock units with emphasis the major tectonic events related to Red Sea rifting and River Nile and associated volcanicity.

### **G614: Advanced Isotope Geology**

: جيولوجيا النظائر المتقدمة

Stable and radioactive isotopes and the applications of isotopic studies to igneous and metamorphic petrology, ore deposits, sedimentology, surface processes, geothermometry, and geochronology. Zirconology and crustal evolution, Applications of stable isotopes O, C, H and Sr isotopes in earth systems, noble gas geochemistry and terrestrial evolution, Introduction to isotopic techniques and mass spectroscopy.

### **G615 Sequence Stratigraphy & Basin Analysis**

التحليل الحوضي

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Systematic study of stratified rocks and space-time implications. Principles of stratigraphy, including biostratigraphy, magnetostratigraphy, seismic stratigraphy, isotop stratigraphy and surface analysis. Basin analysis, evolution of sedimentary basins and continental margins. Characterizing and predicting of the vertical and lateral distribution of sedimentary rocks. Correlation methods, use of facies models, facies delineation, impact of tectonics and changes in relative sea level on sedimentary record, transgressions and regressions, concept and construction of stratigraphic framework and sequence stratigraphy.

### **G616: Advanced (Mega & Micro) Invertebrate Fossils**

: حفريات لا فقارية (كبيرة ودقيقة)

Micropaleontology and invertebrate Paleontology: Study of microscopic fossils, especially of plants, animals, and protists, including calcareous, siliceous, phosphatic and organic-walled types (foraminifera, ostracodes, pteropods, calcareous nannofossils, radiolaria, diatoms, pollen grains, spores, dinoflagellates, conodonts, etc.). Application of paleontology: to interdisciplinary research in biostratigraphy, paleoecology, paleoceanography, paleoclimatology and environmental science. Foraminiferal biozones, pollens and spores, ostracoda, diatoms and radiolarian. Evolutionary trends of invertebrates as interpreted from fossil evidence. What the fossil record can tell us about the evolutionary process. Emphasis is laid on groups of geological importance by elucidating their application for dating, correlation and facies interpretation of sedimentary successions. Statistical studies of fossils especially related to zonal distribution and age determination.

### **G617: Applied Micro Paleontology**

: علم الحفريات الدقيقة التطبيقي

The most important groups of microfossils, their systematics, ecology and distribution throughout earth's history (evolution and stratigraphy). Applications of micropaleontology to interdisciplinary research in biostratigraphy, paleoecology, paleoceanography, paleoclimatology and environmental sciences. Understanding applied micropaleontology as well as the value of foraminifera, calcareous nannoplankton, ostracods, pollen and spores in oil exploration.

**G618: Sedimentary Environments & Facies**

**: السحنات الصخرية والبيئات الترسيبية**

Updated definitions of terms facies and depositional environments and their sequential processes in geology. Facies associations in various depositional environments and sedimentary rock sequences. The chemical, physical and biological processes, products and characteristics of various associated lithofacies. Sedimentary environments and related facies for detrital, carbonate and evaporite sequences. Basics of defining the different depositional systems (applied cases on Egyptian sedimentary column). Applications of facies variations on the economic potential resources.

**G619: Siliciclastic Sedimentary Rocks & Petroleum**

**: الصخور الرسوبية الفتاتية والبتترول**

This course focuses on the origin, composition and diagenesis of clastic rocks. Lectures covers: clastic sediments and depositional environments, facies models, petrographic and geochemical analysis of clastic rocks; reservoir developments, origin and maturation of petroleum. Field exercises emphasizing depositional systems at a variety of scales, laboratory work emphasizing the petrology and diagenesis of clastic rocks and petroleum. Seminars and reports are required

**G620: Petrophysics**

**: الخواص الفيزيائية للصخور**

This course provides an understanding of the physical phenomena and processes that determine properties of rocks and soils. Topics include porosity and permeability; surface energy, roughness, absorption, and percolation, fractures and heterogeneous media; problems of scale; mechanical behavior of dry and fluid saturated rocks; elasticity; visco-elasticity, and plasticity; acoustic, electric, dielectric, thermal, and magnetic properties.

**G621: Advanced Gravity and Magnetic Methods**

**: طرق الجاذبية والمغناطيسية المتقدمة**

Gravity method, the Geoid, GPS and the Geoid, the gravitational Potential and attraction of mass distributions, attraction of a spherical shell. Gravity calculation for simple geometries , sphere, vertical cylinder of infinite depth extent, vertical prism of finite depth extent. Anomaly separation, Spectral analysis, Upward continuation, Downward continuation, First vertical derivative, Second vertical derivative, Analytic signal, Matched filtering, Tilt-derivative. Magnetic effects from buried magnetic bodies, Analytical methods of computation and vertical intensities from vertical Polarized bodies: Vertical bar magnet, Sphere, Horizontal cylinder, Vertical cylinder. Interpretation of magnetic data Qualitative interpretation of magnetic data. significance of magnetic Contours, Use of magnetic data in mapping surface geology, effect of flight elevation on observed fields. effect of orientation of axis of body on anomaly obtained when flying perpendicular to axis.

**G622: Engineering Geology & Rock Mechanics**

**: الجيولوجيا الهندسية وميكانيكا الصخور**

Emphasis will be on engineering geology mapping methods, and geologic hazards assessment applied to site selection and site assessment for a variety of human activities. Application of geological principles and analytical techniques to solve complex engineering problems related to geology, such as mitigation of natural hazards, stabilization of earth materials, and optimization of construction options. Physical Properties of Rock, Stresses and Strains, Rock Discontinuities. Seminars and reports are required.

**G623: Three Dimensional (3D) Seismic Interpretation** : تفسيرات البيانات السيزمية ثلاثية الأبعاد

Review of acquisition of 3D seismic data on land and water-covered areas - Review of processing of 3D seismic data - Two dimensional (2D) seismic interpretations against 3D seismic interpretation - Basic concepts of 3D seismic interpretation; 3D seismic volume, inline vertical sections, cross line vertical sections and horizontal slices - Direct hydrocarbon indicators (DHI<sub>s</sub>), bright spot, flat spot, dim spots, AVO (etc..) - Seismic well tie and synthetic seismogram, convolutional model - Seismic resolution; horizontal resolution and vertical resolution - Structural interpretation, picking faults and horizons, time structure maps, stratigraphic interpretation - pitfalls of seismic interpretation.

**G624: Limestones & Evaporites** : الصخور الجيرية والمتبخرات

Carbonate Rocks: Types, Textures, Structures, Depositional Processes and Composition, Depositional Environments. Evaporites: Definition, Types, Depositional Environments, Economic Importance, and Paleoclimatic Indications.

**G625: Seismic reservoir characterization** : الخصائص السيزمية لخزانات البترول

Amplitude Variation with Offset (AVO), Reflection amplitude at normal incidence, Reflection amplitude at oblique incidence - Zoeppritz equations, Aki and Richards (1980) approximation of Zoeppritz equation, Shuey (1985) approximation - Basic concepts of AVO technique; Intercept, Gradient, Intercept-Times-Gradient, Fluid Factor and Classification of AVO - Seismic Inversion definition, Post-stack inversion methods; Simple integration of seismic trace, Colored inversion, Sparse spike inversion, Model-driven inversion, Stochastic inversion - Pre-stack inversion methods; Elastic inversion, Simultaneous inversion - Hybride techniques, Linearized Bayesian approach - Reservoir modeling and fluid substitution, Estimation of rock physical parameters - Qualitative seismic attributes and Quantitative seismic attributes for reservoir characterization.

**G626: Advanced Petroleum Geology & Hydrology** : جيولوجيا البترول والمياه

Chemical and physical characteristics of hydrocarbons. Generation of petroleum and natural gas. Source and reservoir rocks. Migration of hydrocarbons. Entrapment of hydrocarbons: Anticlinal, fault and stratigraphic traps. World oil and gas deposits. Hydrocarbons exploration. Drilling of oil and gas wells. The logging of boreholes. Recovery techniques. The course will also concentrate on: groundwater occurrence and evolution; types of aquifers and their properties; and general groundwater flow equations. Laboratory exercises on seismic, well log, and core interpretation.

**G627: Electrical and Electromagnetic Methods** : الطرق الكهربائية والكهرومغناطيسية

Principle of electrical methods of prospecting, electrical properties and conduction in rocks, dielectric constant, electrochemical properties, true and apparent resistivity, various electrode configuration and geometrical factors, investigation, exploration and penetration depth, Spontaneous Potential, Induced Polarization, and Charged body methods their principle, applications and interpretations. Various Electromagnetic methods, classification on the basis of measured parameters, Dip angle, fixed transmitter inline and broad side arrays, Moving source and receiver (Slingram) method. Airborne and transient EM methods, Type curves and phasor diagram in interpretation. EM scale modeling, Magnetotelluric methods, origin, theory and interpretation for 1-D, 2-D and 3-D.

### **G628: Well Logging and Petrophysics**

### **: تسجيلات الابار وبتروفيزياء**

Physical Properties of rocks, porosity, saturation, permeability, conductivity, effect of salinity and temperature on formation of waters, mud filtrate, mud resistivity, formation factor and its dependence on porosity and saturation. Gamma ray logging, Physical concept, Tools, Spectral Gamma ray logging and Clay-volume calculation. Spontaneous Potential logging, Physical concept, Tools, and their applications. Caliper log and borehole diameter determination. Resistivity logs, physical concept, tools configuration, conventional resistivity logs, Microresistivity logs and Induction resistivity logs. Porosity logs, Physical concepts, Neutron logs, Density logs, Neutron-Density combination, Nuclear Magnetic Resonance and Sonic logs. Dip meter and Borehole image. Interpretation of well logs and flow chart for interpretation of well logs. Petrophysical parameters estimation, porosity, permeability, water saturation, hydrocarbon saturation. Cross plots for determination of porosity and lithology.

### **G629: Geostatistics**

### **: احصاء جيولوجي**

This module aims to provide M. Sc. students in geology with basic concepts of study design and data analysis suitable for laboratory and field research. Introduction: Variables and distributions. Summarizing data. Sampling variability of a mean. Analysis of quantitative data: Comparing means: comparing two samples. Measures of dispersion (variation). ANOVA: Comparing more than two samples. Sampling variability of proportions. Analysis of categorical data; comparing two proportions. Regression and correlation. Comparing correlations and regression. Multiple regressions. Computer applications.

### **G630: Earthquake Seismology and Seismic Tomography**

### **: الزلازل والتوموجرافيا السيزمية**

Basic concepts of Earthquake terminology; Earthquake definition, focus (hypocenter), epicenter and fault plane - Seismic body waves and surface waves, their characters and passage through the earth - Seismographs and travel time curves - Locating the epicenter of an earthquakes - Origin of earthquakes, Elastic Rebound Theory, Hook's law, elasticity, deformation rupture, Stress and strain - Global distribution of earthquakes - Earthquakes and plate tectonics - Focal mechanism (First motion studies) - Intensity and magnitude of earthquakes; Modified Mercali scale, Richter's magnitude - Earthquakes damage; primary and secondary effects of earthquakes - Seismic risk maps - Prediction of earthquakes - Induced seismicity - Internal structure of the Earth using seismic waves - Seismic tomographic studies.



**G631: Mining Geophysics****: جيوفيزياء منجمية**

Mining geophysics uses many different instruments to locate minerals. The subject informs of utilization of geophysical methods in mining. On the basis of Earth physics knowledge there are given the main principles of geophysical methods, which can help in solving problems joined with mining (seismic, electrical, thermic, magnetic, gravimetric methods etc.). For reconnaissance work, instruments such as airborne magnetometers, various electromagnetic sensors and radioactivity detectors are flown from planes. Detailed work is generally done with ground-based instruments, measuring the same properties as airborne instruments plus several others. Magnetic and electrical methods are applied to explore iron and sulphides ores. Seismic method is used for coal and potash exploration. The seismic method has value in detecting breaks in these deposits to help determine the extent of the mineral.

**G632: Engineering and Environmental Geophysics****: جيوفيزياء هندسية وبيئية**

Geophysical imaging methods provide solutions to a wide variety of engineering and environmental problems; Location of cavities, location of fractures, location of buried and hidden targets, protection of soil and groundwater from contamination, disposal of chemical and nuclear waste, geotechnical site testing, landslide and ground subsidence hazard detection; location of archaeological artifacts. The student will identify which geophysical methods are used to solve environmental problems, and be able to associate seismic, potential field, electrical and electromagnetic methods with the particular problems to which the methods are best suited. The student will analyze and integrate the physical theory, field methodology, and interpretation of each method with geologic and engineering information.

**G633: Geohazards****: مخاطر جيولوجية**

This course emphasized on natural phenomena that cause major problems all over the world. Evaluate the different geological hazards, predict their origin and mode of formation and calculate the risk from these hazards on lives and property, as well as on the surrounding environment.: Submarine Landslides, Debris flows, Shallow gas accumulation, Overpressured zones (including gas and shallow water flows), Naturally occurring gas hydrates and their climate-controlled meta-stability, Mud flows, diapirism and volcanism/volcanoes, Flood basalt, Loess Soil, Sand Dunes, Salt Domes, Earthquakes and seismicity, Tsunamis from tectonics and landslides, Rock falls and landslides.

**G634: Marine Geophysics****: جيوفيزياء بحرية**

Ocean and Seas; Classification, growth and decline of ocean basins, turbidity currents, submarine sedimentation and stratigraphy, physiography and divisions of the sea floor, continental shelves, slopes, aprons and abyssal planes, occurrence of mineral deposits and hydrocarbon in offshore - Gravity and Magnetic Surveys; Types of magnetometers used in a survey ship, towing cable and fish, data collection, reduction and interpretation - Underwater gravity measurements, ship borne gravimeters, Graf sea gravimeter, vibrating string accelerometer, Lacoste Romberg gravimeter, problems with shipborne gravity measurements, survey procedure, data reduction and interpretation - Seismic Surveys; Marine seismic data acquisition, marine energy sources, finger, boomer, sparker,

airgun, vapour cook etc. - hydrophones active section and streamer towing gear, shooting methods near offshore and offshore exploration techniques, recording of signals by digital system, analysis of seismic data their processing and interpretations, refraction survey with Sonobuoy's and interpretation – Radio Positioning System; Short range and long range Doppler Sonar, satellite navigation, GPS and GIS.

**G636: Geomorphology and Applied Hydrogeology** : جيومورفولوجيا وجيولوجيا المياه التطبيقية

It covers the hydrologic cycle, fluvial geomorphologic cycle, fluvial erosion and deposition, analysis of drainage morphometric characteristics, human intervention, time related evolution of river networks, ground- water movement and geomorphologic features, hydrogeological behavior of geological formations, groundwater flow system, water drilling Hydrochemistry, and computer software applications in hydrogeology.

**G638: Directed Reading in Geophysics** : قراءات موجهة في الجيوفيزياء

Instructor or professor of geophysics will assign and direct Master's students to read particular papers and articles about advanced topics related to the Master's thesis. Instructor may also ask his students to write a paper or an essay about specific topics in geophysics related to their master research. Instructor will discuss the students about assignment and evaluate the essay written by them. Students will also summarize and critique recent publications in different fields of geophysics.

**: الخطة الدراسية**

			E	
	إختياري		G700	

الإجبارية. الساعات الإجبارية: يدرس الطالب  
 الإختيارية. الساعات الإختيارية: يختار الطالب  
 يبدأ بعد الانتهاء من إجراءات (G700 – )  
 التسجيل لدرجة دكتوراه الفلسفة.

**: ية لدرجة دكتوراه الفلسفة تخصص الصخور الصلبة والجيوكيمياء.**

إختياري					
-			-		( )
-			-		رواسب الخامات الفلزية
-			-		جيوكيمياء متقدم ( )
	-		-		صخور نارية ومتحولة متقدم ( )



	-		-		رواسب الخامات اللافلزية
	-		-		صخور الأوفبوليت

ية . دكتوراه الفلسفة تخصص الصخور الرخوة والحفريات.

اختياري					
-			-		أحافير الدياتومات والطحالب الجيرية
-			-		قيقة للصخور الجيرية
-			-		
	-		-		أحافير فقارية متقدمة
	-		-		تحليل سحنات
	-		-		الصخور الطينية والطفلة
	-		-		تطبيقات طباقية حيوية

ية . الجيوفيزياء.

اختياري					
-			-		معالجة البيانات السيزمية
-			-		مغناطيسية قديمة
-			-		جيوفيزياء الآبار
	-		-		تفسيرات البيانات السيزمية المتقدمة
	-		-		طباقية سيزمية
	-		-		علم الزلازل وتطبيقاته

المحتوى العلمي للمقررات الدراسية

**G701: Advanced Mineralogy (2)**

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Crystal structure, chemistry, origin and paragenesis of major rock-forming and ore minerals. Point groups, Space groups, Diffraction techniques, Spectroscopic methods, Classification schemes, Structure stabilities, XRD and DTA of minerals identification. Use the computer programs in mineral calculations.

**G702: Metallic Resources**

: رواسب الخامات الفلزية

The economic geology of Iron ore deposits- Chromium ore deposit types-Geochemical properties of copper deposits-Orthomagmatic to magmatic hydrothermal copper sulphide ore in carbonatite-Porphyry Cu-(Mo-Au) deposits- Plutonic, metamorphic and placer gold deposits- Rare earth ore deposits types. Properties of tantalum and niobium metal ore deposits. The most common antimony ore minerals.Geochemical concentration of antimony.

**G703: Advanced Geochemistry (2)**

: جيوكيمياء متقدم ( )

Using geochemical data for geothermometry, geobarometry and thermodynamic models of minerals, rocks and magmas. Stable and radioactive Isotope Geochemistry: Recent Perspectives and using recent program such as Isoplot for age determination. Archaeological applications of isotopic and elemental geochemistry. Geochemistry and secular geochemical evolution of the Earth's mantle and crust. Recent analytical methods and instruments in geochemical prospecting. Microbial geochemistry: at the intersection of disciplines. Nanogeochemistry: Nanostructures and their reactivity in Natural Systems. Urban geochemistry (such as environmental chemistry, toxicology for As, Pb and Cd, pollution of water and groundwater and air by toxic minerals or elements from minerals and rocks). Pollution of groundwater by As and Cd from chemical weathering of rocks and minerals.

**G704: Advanced Igneous and Metamorphic Rocks (2)**

: صخور نارية و متحولة متقدم ( )

Binary and Ternary system applications. Oxygen fugacity and its application. Processes which modify the composition of primary magmas. magma generation and its relation with plate tectonics. Basalt magma generation and basaltic magmatism. Volcanism and the upper mantle: investigations in the Kurile Island Arc. Origin of granite and related rocks in different tectonic settings. Metamorphic rocks at different tectonic settings. The Contact Aureole and Its Rocks, Interactions between the Intrusion and the Contact Aureole. Metamorphic phase diagram and modeling for various rocks. Compositional groups of metamorphic rocks. Environments and processes of metamorphism. Prograde and retrograde metamorphism, Replacement and overgrowth in prograde and retrograde metamorphism. Metamorphism of Ultramafic-mafic Rocks in Mg-Si-Ca system. A Key to determine metamorphic grades and major reaction-isograds or isograds in common rocks.

**G705: Non-Metlic Resources**

: رواسب الخامات اللافلزية

Talc and pyrophyllite- Vermiculite- Muscovite and phlogopite- Kaoline deposit types- Source and formation of diamond deposits- Mineralogy and Geochemistry of phosphate deposits- Fluorite deposit types- Salt minerals and salt rocks- Salt formation today- salt lakes- sabkha- marine salt lagoons- shallow water evaporites. Seawater in the geological past.

**G706: Ophiolitic rocks**

: صخور الأوفيوليت

Definition of ophiolites. Plate tectonics and ophiolites. General discussion of ophiolite assemblages. classification of ophiolites and ophiolitic rocks. Metamorphism of ophiolitic rocks. Ore Deposits in Ophiolite. Emplacement Tectonics. Geologic, tectonic, and petrologic nature of ophiolites (Bay of Islands Ophiolite in Newfoundland, Semail ophiolite in Oman, Troodos ophiolites in Cyprus, Coast Range ophiolite in California, Papua ophiolite in New Guinea , Egyptian ophiolites).

**G707: Diatomite & Calcareous Algae**

: أحافير الدياتومات والطحالب الجيرية

Morphology, systematic and evolution of calcareous nanofossils. Paleoenvironmental and paleogeographic applications of calcareous nanofossils. Biostratigraphic application. Standard

Mesozoic and Cenozoic of calcareous nanofossils zonation. Morphology of diatoms, Ecology/palaeoecology of diatoms and their Evolutionary history (Range).

**G708: Limestone Micro Facies**

: السحنات الدقيقة للصخور الجيرية

The Microfacies concept. Methods of facies analysis. Recent carbonate sedimentation. Carbonate mineralogy and sedimentation in marine environments, Lacustrine and terrestrial carbonate sedimentation. Carbonate diagenetic processes and diagenetic environments. Microfacies types and characteristics. Facies diagnosis and facies models.

**G709: Sand & Sandstones**

:

The Fundamental Properties of Sandstones: Mineral and Chemical composition, Texture, Sedimentary structures and bedding. The Petrography and Classification of Sandstones. Formation processes and provenance of sands. Diagenesis. Sand deposition and Environments. Seminars and reports are required.

**G710: Advanced Vertebrate Fossils**

: أحافير فقارية متقدمة

Definitions; Subphylum: Vertebrata contains Superclass: Pisces and Superclass: Tetrapoda (Amphibia, Reptila, Aves and Mammalia). Dinosaur paleobiology and the origin of birds. Major mammalian lineages and Primate origins. Importance of Fayoum province in Egypt as a famous locality for vertebrate fossils. Wadi El-Hitan as a world heritage protectorate in Egypt. Also the study includes examples of each class in the laboratory.

**G711: Facies Analysis**

: تحليل سحنات

Identification of depositional processes on land and in the sea based on the textural and structural characteristics of sedimentary deposits. Facies Model Concepts for Siliciclastic and Carbonate Successions. Application of facies analysis in interpreting sedimentary successions. Seminars and reports are required.

**G712: Mud rocks & Clays**

: الصخور الطينية والطفلة

Nomenclature and definitions. Importance of mudrocks. Creation of Mud and Mudrocks. Depositional environments of Mudrocks. The mudrock cycle. Important properties of mudrocks. Composition of mudrocks. Major clay minerals and provenance. Seminars and reports are required.

**G713: Biostratigraphic Applications**

: تطبيقات طباقية حيوية

Biostratigraphic models and its economic applications. The industrial utility of microfossil types and assemblages. Biostratigraphic geological settings relevant to the hydrocarbon exploration.

**G714: Seismic Data Processing**

: معالجة البيانات السيزمية

Review of seismic data acquisition, recording of seismic data, analog recording, digital recording, analog to digital convertor- Seismic data processing – Seismic signal, definition of signal and noise,

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 Analog and Digital signals, Sampling theorem, Nyquist frequency and Aliasing, multiplexing and demultiplexing, correlation, convolution and filtering operations, Static Correction: Elevation correction, weathered layer (datum) correction, Normal Moveout (NMO), Dip Moveout (DMO), stacking, velocity determination, velocity analysis, time sections, migration; manual migration, automated migration, pre-stack migration, post-stack migration, time to depth conversion, depth imaging.

### **G715: Paleomagnetism**

**: مغناطيسية قديمة**

Fundamentals of rock magnetism and paleomagnetism, origin of the Earth's magnetic field, geomagnetism and dynamo current in core, the physics of magnetism, rock magnetism, magnetic susceptibility, magnetic domains, induced and remanent magnetism, Paleomagnetism, Remanent magnetism of rocks, Thermoremanent magnetization, Detrital remanent magnetization, Chemical remanent magnetization, Isothermal remanent magnetization, Viscous remanent magnetization, Paleomagnetic procedure, Collecting samples, laboratory procedures for isolating various components of magnetic remanence and data analysis, geomagnetic polarity, secular variations and magnetic reversals, magnetic lineation of the sea floor, Poles and apparent polar wander, Plate tectonic reconstructions, Application in Paleogeography.

### **G716: Boreholes Geophysics**

**: جيوفيزياء الآبار**

The course will cover three geophysical fields in an integrated approach for optimizing interpretation of petrophysical parameters and rock physics. (1) Well logging techniques; Caliper logs, Gamma ray logs, Spontaneous potential, Resistivity logs, Sonic logs, Dipmeter, Borehole image and Porosity logs. (2) Vertical seismic profile (VSP), check shot, different configuration of shot and receivers, seismic well tie, synthetic seismograms, recognizing of horizons of interest and improving the vertical resolution.

### **G717: Advanced Seismic Data Interpretation**

**: تفسيرات البيانات السيزمية المتقدمة**

Review of 3D seismic interpretation concepts, inline sections, crossline sections, horizontal sections. Picking faults, horizons and geobodies, manual picking against automated picking (2D & 3D Autotracking). Generating surfaces, stratal slices, phantom slices, time structure maps, horizons and surfaces seismic attributes, dip, dip azimuth, etc., Classification of seismic attributes, amplitude, frequency, time and attenuation attributes. Seismic inversion techniques, post-stack seismic inversions, pre-stack inversions. Four Dimensional (4D) seismic techniques for reservoir monitoring and recovery enhancement.

### **G718: SEISMIC STRATIGRAPHY**

**: طباقية سيزمية**

Definition and scope of Seismic Stratigraphy: Tectonic control on eustatic sea level changes. Sea level changes and offlap, onlap, downlap surfaces. The concept of depositional sequence. Theories related to relative changes in coastal onlap and the construction of depositional sequences. Seismic

sequence analysis. Seismic facies analysis and mapping of reef patterns. Relationship between seismic facies and depositional energy, reflection patterns. Parasequences. Lowstand, transgressive and highstand system tracts. Seismic Prospecting revisited: Review of seismic reflection data acquisition and processing for stratigraphy: Wavelet processing; Bandwidth and temporal resolution. Vertical seismic profiling (VSP). Seismic modeling for Stratigraphy.

**G719: Earthquakes and its Applications**

**: علم الزلازل وتطبيقاته**

Introduction, Internal structure of the Earth, Elasticity theory, Seismic waves and propagation, Earthquake seismology, Conditions for Earthquake Generation, Earthquakes Focal Mechanisms Solutions, Travel Time Curves , Low-Velocity Zones, Earthquake Hazard, Historical Seismicity, Recent Seismicity, Earthquake and Plate tectonics, Global Seismicity, Faulting Dynamics and Siesmotectonics. Locating Earthquake epicenters.