Geological Study Plan

Geology and Geophysical Department

2016 – 1438H

King Saud University
College of Science
Vice Dean Academic Affairs
Study Plans

Geological Stud Plan

1st Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
CI 140	Learning, Thinking and Research Skills	-	-	3 (3+0+0)
CHS 150	Health and Fitness	-	-	1 (1+0+0)
ENG 140	English Language (1) **(E)**	-	-	8 (8+0+0)
MATH 140	Introduction to Mathematics **(E)**	-	-	2(1+1+0)
Total of Credit Hours				**14**

2nd Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
CT 140	Computer Skills **(E)**	-	-	3 (0+0+3)
MC 140	Communication Skills	-	-	2 (2+0+0)
ENG 150	English Language (2) **(E)**	ENG 140	-	8 (8+0+0)
MATH 150	Differential Calculus **(E)**	MATH 140	-	3(2+1+0)
ENT 101	Entrepreunership	-	-	1(1+0+0)
Total of Credit Hours				**17**

3rd Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer.. –Pract.)**
GEO 101	Physical Geology (E)	-	-	4 (3+0+1)
CHEM 101	General Chemistry (1)	-	-	4 (3+0+1)
PHYS 101	General Physics (1)	-	-	4 (3+0+1)
STAT 100	Introduction to Statistics	MATH 150	-	3 (2+1+0)
Elective course from University Requirement				2 (2+0+0)
Total units				**17**

4th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer. – Pract.)**
CHEM 253	Analytical chemistry	-	-	2 (1+0+1)
GEO 221	Mineralogy	GEO 101	-	3 (2+0+1)
GEO 106	Historical Geology (E)		-	3 (2+0+1)
GPH 201	Principles of Geophysics (E)	-	-	3 (2+0+1)
Elective course from University Requirement				2 (2+0+0)
Elective course				3 (2+0+1)
Total units				**16**

5th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer. –Pract.)**
GEO 236	Stratigraphy & Sedimentology (E)	GEO 221	-	3 (2+0+1)
GEO 243	Invertbrate Paleontology (E)	GEO 106	-	3 (2+0+1)
GEO 262	Environmental Geology (E)	GEO 221	-	2 (2+0+0)
GEO 381	Structural Geology (E)	-	GEO 236	3 (2+0+1)
GEO 323	Igneous & Metamorphic Petrology (E)	GEO 221	-	3 (2+0+1)
Elective course				3
Total Units				**17**

6th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer. – Pract.)**
GEO 334	Sedimentary Petrology (E)	GEO 236	-	3 (2+0+1)
GEO 392	Geological Reports (E)		-	1 (1+0+0)
GEO 383	Remote Sensing (E)		-	3 (2+0+1)
GEO 380	Plate tectonics (E)		-	2 (2+0+0)
GEO 386	Geology of the Arabian Shield (E)	GEO 323	-	2 (1+0+1)
Elective course from University Requirement				2 (2+0+0)
Elective course				3
Total Units				**16**

Summer semester				
Course code	**Course title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer. – Pract.)**
GEO 393	Field Geology	GEO 323, GEO381, GEO 392	-	6 (0+0+6)
Total Units				**6**

7th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer. –Pract.)**
GEO 478	Spatial Information System (E)	GEO 381	-	2 (1+0+1)
GEO 450	Ore Geology (E)	GEO 323	-	3 (2+0+1)
GEO 406	Data Analysis in Geology (E)	GEO 383, STAT 100	-	2 (1+0+1)
GEO 497	Graduation Project (1)	GEO 393	-	3 (0+0+3)
Elective course from University Requirement				2 (2+0+0)
Elective course				2
Total Units				**14**

8th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exer. – Pract.)**
GPH 301	Geophysical Exploration (E)	-	-	3 (2+0+1)
GEO 452	Petroleum Geology	GEO 236, GEO 381	-	3 (2+0+1)
GEO 455	Hydrogeology		-	3 (2+0+1)
GEO 482	Sedimentary Geology of Saudi Arabia	GEO 334	-	3 (2+0+1)
GEO 498	Graduation Project (2)	GEO 497	-	3 (0+0+3)
Elective course				2
Elective course				2
Total Units				**19**

(Lect - Exer – Pract) = (Lecture – Exercise – Practical)

(E) = Courses in English

List of the Elective Courses of the University Requirements (Student elects 8 credit hours)

Course Code	Course Title	Pre-requisite	Credits (Lect. – Exer. - Pract.)
IC 100	Studies in the Biography of the Prophet	-	2 (2+0+0)
IC 101	Introduction of Islamic Culture	-	2 (2+0+0)
IC 102	Islam and Building up the Society	-	2 (2+0+0)
IC 103	Economic System in Islam	-	2 (2+0+0)
IC 104	Political system in Islam	-	2 (2+0+0)
IC 105	Human Rights	-	2 (2+0+0)
IC 106	Islamic Jurisprudence	-	2 (2+0+0)
IC 107	Ethics of Occupation	-	2 (2+0+0)
IC 108	Contemporary Issues	-	2 (2+0+0)
IC 109	Woman and Her Developmental Role	-	2 (2+0+0)

List of the Elective Courses (Student elects 15 credit hours)

Course Code	Course Title	Pre-requisite	Credits (Lect. – Exer. – Pract.)
GEO 242	Micropaleontology	GEO 106	3 (2+0+1)
GEO 301	Geomorphology	GEO 101	3 (2+0+1)
GEO 341	Paleobotany	GEO 106	2 (1+0+1)
GEO 342	Paleoecology	GEO 236, GEO 243	3 (2+0+1)
GEO 361	Principles of Geochemistry	CHEM 101, GEO 221	3 (2+0+1)
GEO 421	Volcanology	GEO 323	3 (2+0+1)
GEO 431	Carbonate Rocks	GEO 334	3 (2+0+1)
GEO 432	Quaternary Geology	GEO 236	3 (2+0+1)
GEO 435	Oceanography		2 (2+0+0)
GEO 441	Vertebrate Paleontology	GEO 243	2 (1+0+1)
GEO 445	Sedimentary Basin Analysis	GEO 334	2 (1+0+1)
GEO 454	Mining Geology	GEO 450	2 (1+0+1)
GEO 456	Applications in Petroleum Geology	GEO 452	2 (2+0+0)
GEO 483	Regional Geology of the Middle East	GEO 482	2 (2+0+0)
GEO 495	Historical Geology	GEO 106	1 (1+0+0)
GEO 496	Specialized Topics	GEO 392	1 (1+0+0)
GPH 341	Geophysical Well Logging	-	3 (2+0+1)
ASTR 101	Introduction to Solar and Stellar System	-	3 (2+0+1)
BOT 102	General Botany	-	3 (2+0+1)
ZOOL 103	Principles of General Zoology	-	3 (2+0+1)
BUS 101	Principles of Business Administration	-	3 (3+0+0)
MIS 101	Management of Information System	-	3 (3+0+0)
ECON 101	Principles of Microeconomics	-	3 (3+0+0)

List of service courses to other Specialization.

Course Code	Course Title	Credits (Lect. – Exer. - Pract.)	Pre-Req.	Department/College of
GEO 101	Physical Geology	4 (3+0+1)	-	GPH
GEO 105	Introduction to Geology	2 (2+0+0)	-	ZOOL
GEO 221	Mineralogy	4 (3+0+1)	GEO 101	GPH
GEO 236	Stratigraphy and Sedimentology	3 (2+0+1)	GEO 221	GPH
GEO 320	Petrology	3 (2+0+1)		GPH
GEO 262	Geoecology	2 (2+0+0)	-	BOT
GEO 381	Structural Geology	3 (2+0+1)	GEO 236	GPH
GEO 452	Petroleum Geology	3 (2+0+1)	GEO 381	GPH
GEO 478	GIS	3 (2+0+1)	GEO 236 GEO 381	GPH

Short Courses Description

I- Compulsory courses *from* the Specialization [credit hours (Lect. – Exer. – Pract.)]

GEO 101: Physical Geology (E) 4 (3+0+1)

Introduction to physical Geology and minerals – volcanism and intrusive igneous rocks – weathering, soil, sediments and sedimentary rocks – metamorphism and metamorphic rocks – water courses and groundwater – glaciers and glaciations – deserts and coasts – Geological structures – earthquakes – plate tectonics – mountain belts and continental growth – earth resources.
(Three days field trip).

GEO 106: Historical Geology (E) 3 (2+0+1)

Essentials of earth history – uniformitarianism – the law of superposition – unconformities – mountain building – stratigraphic units – fossils and fossilization – correlation – absolute time and radiometric ages – plate tectonics – evolution of the lithosphere and biosphere through Geologic time.
(Three days field trip).

GEO 221: Mineralogy (E) 3 (2+0+1)

Crystallization in solutions and magma – crystal symmetry – crystal forms and habits – crystallographic systems – crystal lattices – chemical and physical properties of minerals – classification and nomenclature of minerals – origin and distribution of minerals - physics of light and its interaction with crystalline matter – the polarizing microscope – thin section preparation – refraction indices – optical indicatrix – optical sign determination – mineral identification – qualitative and quantitative analysis of minerals.
(Two days field trip).

GEO 236: Stratigraphy & Sedimentology (E) 3 (2+0+1)

Erosion, transport and sedimentation – grain morphology – porosity, permeability and diagenesis – classification of sedimentary rocks – sedimentary structures – stratigraphic units and correlation – seismic stratigraphy – sequence Stratigraphy – use and interpretation of stratigraphic maps and sections
(Two day field trip).

GEO 243: Invertbrate Paleontology (E)	3 (2+0+1)
Introduction – conditions and processes of fossilization – types of preservation – the fossil record – index fossils – biological classification – study of the most important invertebrate phyla: sponges, corals, coelenterates, mollusks, echinoderms, brachiopods, annelids, arthropods and graptolites – trace fossils. (Three days field trip).	

GEO 262: Environmental Geology (E)	2 (2+0+0)
Geologic factors influencing the environment – air, water and soil pollution – radioactive waste disposal – Geohazards including: earthquakes, volcanoes, floods, soil erosion and landslides – desertification – population expansion and depletion natural resources – pollution associated with the extractive industries. (Two days field trip).	

GEO 323: Igneous and Metamorphic Petrology	3 (2+0+1)
Origin and composition of magma – magmatic differentiation – volcanism and its products – emplacement mechanisms of plutonic rocks – geochemistry of igneous rocks and its relationship with their tectonic settings – types of metamorphism- field relations – metamorphic textures – metamorphic zones – metamorphic reactions and P-T-t paths. (Three days field trip).	

GEO 334: Sedimentary Petrology (E)	3 (2+0+1)
Grain morphologies and statistical distribution of grain size – classification of sedimentary rocks - mineral composition of detrital rocks and its relationship to the tectonic setting – diagenesis – carbonate rocks and evaporites – phosphorites – ironstones – siliceous rocks – coal and coalification processes. (Two days field trip).	

GEO 380: Plate Tectonics (E)	2 (2+0+0)
Geophysical and Geological observations related to plate tectonic theory - marine magnetic and paleomagnetic measurements - seismicity and volcanism of plate boundaries - reference frames and absolute plate motions - Interpretations of Geologic phenomena in the context of plate tectonics – ocean trenches and island arcs - plate tectonic evolution of the ocean basins and continents. (**Three days** field trip).	

GEO 381: Structural Geology (E)	3 (2+0+1)
Stress, strain and rock deformation - kinematic analysis – interpretation of Geologic maps – stereographic projections - joints – strike-slip faults – dip-slip faults – Geometry of folds – foliation and lineation – balanced cross-sections - rheology – microscopic structures – orogenic belts and plate tectonics. (Three days field trip).	

GEO 383: Remote Sensing	3 (2+0+1)
Basics of remote sensing – electromagnetic spectrum –types of sensors and platforms – acquiring and processing primary data – spatial corrections – types of filters - image enhancement - interpretation – classification methods – principal component analysis – thermal and radar imaging - Geologic applications. (Two days field trip).	

GEO 386: Geology of the Arabian Shield (E)	2 (1+0+1)
Origin of the Arabian Shield – stratigraphic schemes – igneous and tectonic activity – island arc and microcontinents - allochthonous terranes – ophiolites and sutures – correlation with the Nubian Shield – the Pan-African episode – Archean terranes in the Arabian Shield – ore deposits in the Arabian Shield. (Three days field trip).	

GEO 392: Geological Reports (E)	1 (1+0+0)
Using terms and expressions in their proper Geologic context – organizing data - stratigraphic and Geographic names - maps and drawings – references and appendices – training on selected local examples.	

GEO 393: Field Geology (E)	6 (0+0+6)
A 45 day summer field camp devoted to training on mapping and exploration techniques including: field relation of igneous and metamorphic rocks – making stratigraphic sections and traverses – measurement of structures – using global positioning systems – making topographic and Geologic maps – report writing. (45 days field trip)	

GEO 406: data Analysis in Geology (E)	2 (1+0+1)
Sampling methods – data distributions - precision and accuracy - confidence intervals - least squares methods - correlation - time series analysis - multivariate techniques - cluster analysis – principal component analysis – kriging - using statistical software packages - Geologic modeling.	

GEO 450: Ore Geology (E)	3 (2+0+1)
Basic definitions – morphology of ore bodies – ore textures – theories of ore genesis – classification of ore deposits – orthomagmatic deposits – diamonds and kimberlites – the carbonatite environment – volcanogenic massive sulphides - greisen and skarn – hydrothermal deposits – strata-bound deposits – sedimentary Fe and Mn deposits – metamorphic ores - supergene enrichment – industrial minerals. (Three days field trip).	

GEO 452: Petroleum Geology (E)	3 (2+0+1)
Physical properties of oil, gas and connate water – porosity and permeability and the effect of diagenesis – origin, migration and accumulation of oil – oil traps and seals – drilling methods - oil exploration – formation evaluation – chemistry and grades of crude oil – reserve estimation - oil in Saudi Arabia. (Three days field trip).	

GEO 455: Hydrogeology (E)	3 (2+0+1)
Geologic factors controlling the flow of groundwater – porosity and permeability – groundwater flow - types of aquifers – Darcy's law – groundwater wells – chemistry of groundwater – groundwater exploration – seawater encroachment – groundwater pollution - groundwater resources in Saudi Arabia. (Three days field trip).	

GEO 478: Spatial Information System (E)	2 (1+0+1)
The concept of GIS – maps and spatial analysis – data entry, storage and retrieval – computer-based processing of Geologic data – vector and raster data models and analysis – linking digital maps and attribute information - spatial interpolation - practical application through a real-life GIS project.	

GEO 482: Sedimentary Geology of Saudi Arabia (E)	3 (2+0+1)
Sedimentary basins of Saudi Arabia – Phanerozoic stratigraphic units – sedimentary cycles – intra-basin stratigraphic correlations – biostratigraphy – major structural trends – economic Geology of the cover rocks. (Three days field trip).	

GEO 497: Graduation Project (1) (E)	3 (0+0+3)
Training on geologic research methods through an integrated field and laboratory study of an area or topic chosen by the student and his supervisor. (Three days field trip).	

GEO 498: Graduation Project (2) (E)	3 (0+0+3)
Completing the laboratory work (Lab work) and a written report must be submitted and oral presentation made for evaluation by a committee appointed by the department.	

III- Compulsory courses *from outside* the Specialization [credit hours (Lect. – Exer. – Pract.)]

STAT 100: Introduction to Statistics (E)	3 (2+1+0)
Key features of data, present the data graphically and numerically, Calculation and interpretation of mean, median, mode, ranges, variance, standard deviation, Preparation and apply tables, graphs and charts such as histograms, using of computer statistical software to carry out all the calculations.	

CHEM 101: General Chemistry 1 (E)	4 (3+0+1)
Theoretical Part: **Stoichiometry**: SI units, chemical formulas, the mole, methods of expressing concentration, calculations based on chemical equations. **Gases**: Laws, kinetic theory, deviation and van der Waals equation. **Thermo chemistry**: Types of enthalpy changes, Hess Law and its applications,, first law of thermodynamics. **Solutions**: Type of solutions and laws related, colligative properties. **Chemical Kinetics**: Law of reaction rate, reaction order, factors affecting the reaction. *Chemical* **Equilibrium**: Reaction between K_c & K_p, Le Chatelier's principle and factor affecting equilibrium. Ionic equilibrium: Acid and base concepts, pH calculations of acid, base and buffer solutions. **Practical Part:** Eleven experiments including: Physical properties of mater, Hess's law, chemical kinetics, volumetric analysis.	

PHYS 101: General Physics (E)	4 (3+0+1)
Reflection and refraction of light, lenses, optical instruments, wave theory of light. interference, and diffraction of light. Electrostatics, electric current, DC circuits, electrical instruments, electromagnetism and AC circuits. Introduction to quantum theory, atomic spectra, X-rays. Properties of nuclei, radioactivity, decay of alpha, beta and gamma, nuclear fission and nuclear power.	

GPH 201: Principles of Geophysics (E)	3 (2+0+1)
Physical and mathematical laws and its relation to the Earth's properties. Elasticity theory and properties of wave propagation in seismic reflections, refractions, wave equations, seismic wave characteristics, and potential field theories. Principles of different exploration techniques. Interpretation of the Earth's structures by Geophysical data.	

CHEM 253: Fundamental of analytical chemistry (for none major) (E)	2 (1+0+1)
Theoretical Part: Introduction to quantitative analysis, concentration units, chemical equilibria and its application on acid base reaction. Solubility, factors affecting solubility, solubility products. Acid-base, precipitation, complexation and redox titrations. **Practical Part:** Qualitative analysis, including identification of anions and cations. Volumetric analysis, e.g. Acid base titration, precipitation titration, complexation titration and redox titration.	

GPH 301: Geophysical Exploration (E)	3 (2+0+1)
Magnetic and gravity exploration; Geoelectrical Methods; Electrical resistivity, Self-Potential and Induced Polarization; electromagnetic Methods; Seismic methods; Seismic Reflection and refraction methods; seismology; Ground Penetrating Radar, Radioactive and thermal methods. Application of these methods for natural resources exploration. Qualitative and quantitative interpretation of the Geophysical data. (Two days field trip).	

V- Elective courses *from* the Specialization [credit hours (Lect. – Exer. – Pract.)]

GEO 242: Micropaleontology (E)	3 (2+0+1)
Marine ecology and zoning- classification of marine organisms- collection and preparation of samples- study of the most important microfossils including: Foraminifera, Radiolaria, Ostracods and Conodonts in terms of soft tissue, shell morphology, ecology and evolution. (Two days field trip).	

GEO 301: Geomorphology (E)	3 (2+0+1)
Natural processes that create landforms and landscapes - physics and chemistry of weathering and soil formation - dynamics of mass wasting - streams and glaciers - karst processes - topographic response to tectonic and climatic forces - terrain analysis utilizing geomorphic field data, remote sensing imagery, and numerical models - natural hazards. (Two days field trip).	

GEO 341: Paleobotany (E)	3 (2+0+1)
Fossil record of the plant kingdom – ancient environments and plant diversity through the Geologic record – origin of life in the Archean – cyanobacteria – emergence and diversity of fungi – appearance of ferns and mosses – vascular plants – dominance of angiosperms in the Mesozoic and Cenozoic. (One day field trip).	

GEO 342: Paleoecology (E)	3 (2+0+1)
The nature and classification of environments – comparison with living representatives –evidence of biological activity and associated sediments – lateral and vertical variations –geographical distribution of assemblages – trace fossils – biodiversity – environmental changes through Geologic time. (One day field trip).	

GEO 361: Principles of Geochemistry (E)	3 (2+0+1)
Meteorites and origin of the solar system - distribution of elements – isotope Geology and radiometric age determination – basic thermodynamics – reaction kinetics - crystal chemistry – water chemistry – organic geochemistry – oxidation and reduction – chemical evolution of magma – metamorphic reactions - hydrothermal processes and ore genesis.	

GEO 421: Volcanology (E)	3 (2+0+1)
Internal structure of the Earth and magma genesis – distribution of active volcanoes and their relationship to plate tectonics – internal structure of volcanoes – volcanic ejecta – types of eruptions - classification of volcanoes – mid-ocean ridge volcanism – island arcs – intra-plate volcanism – hot spots – volcanic activity in Saudi Arabia. (Three days field trip).	

GEO 431: Carbonate Rocks (E)	3 (2+0+1)
Types of carbonate rocks - carbonate minerals - classifications of limestones - limestone diagenesis – depositional environments and facies – lacustrine deposits – coral reefs – pelagic sediments - dissolution and transformation – cementation – silicification - dolomitization – evaporites and sabkhas – Geologic record of carbonate rocks. (One day field trip). (Three days field trip).	

GEO 432: Quaternary Geology (E)	3 (2+0+1)
Characteristics, distribution, and origin of recent deposits - stratigraphy and chronology - paleosols - formation of landforms – glacial and inter-glacial periods – glacial deposits and landforms - changes in sea level – biodiversity and extinction – appearance of man. (Three days field trip).	

GEO 435: Oceanography	2 (2+0+0)
Physical processes in the oceans – waves, currents and tides – formation of ocean basins – turbidity currents and deep sediment transport – earthquakes and tsunamis – marine chemistry – coastal processes – life in the oceans – ocean mineral resources - changes in the oceanic ecosystem.	

GEO 441: Vertebrate Paleontology (E)	3 (2+0+1)
Origin and classification of chordates – extraction and study of vertebrate fossils – the main vertebrate classes and the appearance in the Geologic record – fish and amphibians – age of the dinosaurs – birds – appearance of mammals – primates and hominoids – mass extinction.	

GEO 445: Sedimentary Basin Analysis (E)	2 (1+0+1)
Stratigraphic and facies analysis – sub-surface methods – stratigraphic correlations – biostratigraphy and biozones – sequence stratigraphy - basin maps – paleocurrent analysis - subsidence and burial history – basin models – basin classification – processes generating oil, gas and coal. (Two days field trip).	

GEO 454: Mining Geology (E)	2 (1+0+1)
Reconnaissance exploration – remote sensing – Geochemical exploration – Geophysical exploration – drilling methods - evaluation techniques – feasibility studies mine mapping – surface and underground mining methods – mineral processing and metallurgy – mining in Saudi Arabia. **(Three days field trip).**	

GEO 456: Application in Petroleum Geology (E)	2 (2+0+0)
Geologic and seismic exploration – methods and problems of production – tectonic settings of oil-producing basins – depositional environments and oil and gas quality – detailed study of hydrocarbon field in and outside the Kingdom. (Two days field trip).	

GEO 483: Regional Geology of the Middle East (E)	2 (2+0+0)
Pre-Cambrian relationships in the Arabian-Nubian Shield – the Arabian Shelf and its northerly extension – tectonic movements related to the opening of the Red Sea – Arabian Plate movement and the creation of Zagros and Taurus belts – oil and mineral resources of the Middle East.	

GEO 495: History of Geology (E)	1 (1+0+0)
Beginnings of earth sciences and the contribution of Arab and Muslim scholars – evolution of modern concepts in Geology – emergence of the main disciplines of earth sciences - catastrophism and uniformitarianism – plutonists and neptunists – Geologic controversies on the ice age, granitization and age of the Earth – continental drift and the theory of plate tectonics. **(One day field trip).**	

GEO 496: Specialized Topics (E)	1 (1+0+0)
Advanced study of detailed aspects of certain Geological problems chosen by the student, which is summarized in a brief report.	

VI- Elective courses *from outside* the Specialization [credit hours (Lect. – Exer. – Pract.)]

GPH 341: Geophysical Well Logging (E)	3 (2+0+1)
A review of rocks (sedimentary, igneous and metamorphic), Physical properties of rocks and fluids that affect the distribution and movement of fluids such as oil, gas, water, or contaminants in porous media including porosity, permeability, capillary pressure, surface and interfacial tension, Wettability, and viscosity. Darcy's law for anisotropic porous media. (Three days field trip).	

ASTR 102: Introduction to Solar and Stellar System	3 (2+0+1)
Modern concept of astronomy – The Solar System -Units of astronomical distances - Astronomy in Islamic culture-Telescopes- Kepler's laws - Earth and Moon-The Terrestrial planets - The Jovian Planets –Asteroids and Comets. Origin of the solar system - The Sun – stars: apparent and absolute magnitude, color index, distances and velocities of stars.	

BOT 102: General Botany	3 (2+0+1)
Plant and their importance. Chemical and fine structures of the plant cell. Metabolism. Anatomy.Plant tissues, Plant water relations. Heredity and its applications. Levels of structural organization and evolution in plants (structure, taxonomy, economical and biological importance). Plant morphological and anatomical adaptation to environment Environmental pollution.	

ZOO 103: Principles of General Zoology (E)	3 (2+0+1)
Study of structure of animal cell. Tissues, General characters of animal Kingdom. Classification of animal Kingdom. Study of Protozoa with selected examples. General characters and classification of different phyla of animal Kingdom with selected examples. Introduction of physiology : Nutrition, digestion and metabolism, blood (structure and function).	

BUS 101	Principles of Business Administration	3 (3+0+0)
The student must review the department concerned for decisions that taught outside the college.		

MIS 101	Management of Information System	3 (3+0+0)
The student must review the department concerned for decisions that taught outside the college.		

ECON 101	Principles of Microeconomics	3 (3+0+0)
The student must review the department concerned for decisions that taught outside the college.		

I- **IV- Service Courses to other Specialization** **[credit hours (Lect. – Exer. – Pract.)]**

GEO 101: Physical Geology (E)	4 (3+0+1)
Introduction to physical Geology and minerals – volcanism and intrusive igneous rocks – weathering, soil, sediments and sedimentary rocks – metamorphism and metamorphic rocks – water courses and groundwater – glaciers and glaciations – deserts and coasts – Geological structures – earthquakes – plate tectonics – mountain belts and continental growth – earth resources. (Two days field trip).	

GEO 105: Introduction to Geology (E)	2 (2+0+0)
Origin of planet Earth and the solar system - age of the Earth and geologic periods - crystals and minerals-magma and igneous rocks - soil and weathering -sediment transport and sedimentary rocks - metamorphism and metamorphic rocks – groundwater - geologic structures - earthquakes and volcanoes - plate tectonics - origin and diversification of life on Earth – stratigraphic units – fossils and fossilization – correlation – absolute time in geology – mass extinction and its causes. **(Two days field trip).**	

GEO 221: Mineralogy (E)	3 (2+0+1)
Crystallization in solutions and magma – crystal symmetry – crystal forms and habits – crystallographic systems – crystal lattices – chemical and physical properties of minerals – classification and nomenclature of minerals – origin and distribution of minerals - physics of light and its interaction with crystalline matter – the polarizing microscope – thin section preparation – refraction indices – optical indicatrix – optical sign determination – mineral identification – qualitative and quantitative analysis of minerals. (One day field trip).	

GEO 236: Stratigraphy & Sedimentology (E)	3 (2+0+1)
Erosion, transport and sedimentation – grain morphology – porosity, permeability and diagenesis – classification of sedimentary rocks – sedimentary structures – stratigraphic units and correlation – seismic stratigraphy – sequence Stratigraphy – use and interpretation of stratigraphic maps and sections. (One day field trip).	

GEO 262: Geoecology	2 (1+0+1)
Geologic factors influence the environment – air, water and soil pollution – radioactive waste disposal – geohazards including: earthquakes, volcanoes, floods, soil erosion and landslides – desertification – population expansion and depletion natural resources – pollution associated with the extractive industries. (One day field trip).	

GEO 320: Sedimentary Petrology (E)	3 (2+0+1)
Extrusive and intrusive igneous rocks – classification and field relations of igneous rocks - weathering – clastic sedimentary rocks – carbonates and evaporites – metamorphism and metamorphic rocks – metamorphic zones and facies – a brief summary on the Arabian Shield and the sedimentary cover in Saudi Arabia. (Two days field trip).	

GEO 381: Structural Geology (E)	3 (2+0+1)
Stress, strain and rock deformation - kinematic analysis – interpretation of Geologic maps – stereographic projections - joints – strike-slip faults – dip-slip faults – Geometry of folds – foliation and lineation – balanced cross-sections - rheology – microscopic structures – orogenic belts and plate tectonics. (Three days field trip).	

GEO 452: Petroleum Geology (E)	3 (2+0+1)
Physical properties of oil, gas and connate water – porosity and permeability and the effect of diagenesis – origin, migration and accumulation of oil – oil traps and seals – drilling methods - oil exploration – formation evaluation – chemistry and grades of crude oil – reserve estimation - oil in Saudi Arabia. (Three days field trip).	

GEO 478: Spatial Information System (E)	2 (1+0+1)
The concept of GIS – maps and spatial analysis – data entry, storage and retrieval – computer-based processing of Geologic data – vector and raster data models and analysis – linking digital maps and attribute information - spatial interpolation - practical application through a real-life GIS project.	

Important Note: The student must review the department concerned for decisions that taught outside the college (Compulsory and Elective).