INTERIM JOINT MATRICULATION BOARD

GEOLOGY

SYLLABUS

GEOLOGY SYLLABUS (REVISED 2012)

I. Introduction

The word "geology" comes from the Greek word geo meaning the Earth and logos a discourse. Geology, therefore, might be described as the science that deals with the description and understanding of the Earth from its creation to present day.

Geology is essentially an observational field science, which should be taught mainly in the classroom and in the laboratory with supporting fieldwork. The study of geology involves the knowledge and application of the natural sciences (Chemistry, Physics, Biology and Mathematics).

This syllabus is designed to provide an overall knowledge of the subject, i.e. geology. It presents the students the opportunity to note and appreciate the economic significance of naturally occurring local materials. It also provides an understanding of geological principles and processes relevant to the application of the knowledge to aspects of human endeavours.

The scope includes the following:

- General geological principles and processes;
- Identification and use of minerals, rocks and fossils;
- Simple geological field measurements, description and map preparation.
- Interpretation of simple geological maps.

The contents of this syllabus are expected to be taught in one academic year
(twelve calendar months)

II. Objective(s):

By the end of the course, students should be able to:

- Define Physical Geology, mineralogy, petrology, etc.
- Understand the origin of the universe and the position of the Earth in the solar system,
- Understand the internal structures and composition of the Earth.
- Describe how the various landforms originated.

- Understand how geological ages of formations and events are determined.
- Know the basis for correlation of strata.
- Know the environments of sedimentation.
- Know basic units in stratigraphy.
- Distinguish between a mineral and rock and describe different types of common rocks in terms of their mineralogical composition, texture and structures; to classify these rocks into the three major groups (i.e. Igneous, Metamorphic and Sedimentary) and state their uses.
- Determine the origin and mode of occurrence of igneous, metamorphic and sedimentary rocks.
- Describe the physical properties of a mineral with a view to its identification.
- Identify a mineral in common mineral assemblage.
- Determine its origin, and modes of occurrence.
- State its uses.
- Identify the economic minerals and economic deposits and their association within host rocks; their geographical locations within Nigeria; the geological conditions for their formation or accumulations.
- Make crystallographic observations, which will enable them to describe correctly and identify minerals, and to relate mineralogical properties to crystallographic features.
- Describe the major invertebrate phyla; morphology, geological history and the relationship between them.
- Understand their applications in relative age determination.
- Learn to use geological tools like topographical maps, geological hammer, hand-lens, geological compass, etc.; make field observations on rock outcrops, vegetation, drainages, soils, geological structures; locate the observed features appropriately on the topo-map of a selected area and give detailed descriptions in a field notebook; make a geological interpretation of the observed features, prepare a geological map at a given scale based on the observed features; and give a brief geological history of the area.

III. Examination Structure:

Assessment of the subject shall be in two main parts, namely:
Continuous Assessment and Examination

(a) Continuous Assessment (C.A)

Continuous assessment component shall be based on the performance of the candidates in the following:

- Terminal tests and assignments
- Practical
- Field school reports.
- Attendance

C.A. shall constitute 20% of the total mark. The C.A. marks are to be submitted under four (4) headings, viz: attendance, terminal tests and assignments, practical, and field school reports, where field school reportcarries08%, practical 05%, tests and assignments 05% and attendance 02%. Students' graded fieldwork reports should be submitted, along with the C.A. reports, to the Chief Examiner.

(b) Examination

The examination will consist of two theory papers and a practical paper made up as follows:

PAPER I	(Physical Geology, Palaeontology and Stratigraphy)
PAPER II	(Mineralogy, Crystallography, Petrology and Economic Geology)
PAPER III	(Practical)

The three papers shall contribute 80% towards the total mark and shall be equally weighted. Each of the theory papers shall contain SEVEN questions out of which candidates will be expected to answer FIVE. In each of these papers there shall be ONE compulsory question consisting of at least THREE sub-questions covering the main areas for the paper. Thereafter candidates shall be required to attempt any FOUR questions.

Paper III shall consist of FIVE compulsory questions with at least one question each on

- Simple geological map interpretation
- Mineralogy
- Crystallography
- Petrology
- Palaeontology

Each examination paper will be for duration of three (3) hours. Candidates will be expected to use their experience in the field when answering any relevant

questions in any paper. Questions will be set which will test the candidate's knowledge of field techniques and the ability to apply them in relevant situations.

DETAILED SYLLABUS

FIRST SEMESTER SYLLABUS

S/NO	TOPICS / CONTENTS	ACTIVITIES/ PRACTICAL GUIDE	INSTRUCTIONAL MATERIALS	DURATION
1.	PHYSICAL GEOLOGY (i) A brief introduction to the origin of the universe; solar system. (ii) Concept of the layered structure of the Earth (Core, mantle and crust); the nature of the evidence for the existence and characteristics of the layers. (iii) The nature and origin of earthquakes and vulcanicity; the relationship of earthquakes and igneous activity to major earth structure. (iv) The theories of continental drift, seafloor spreading and plate tectonics and an outline of the evidence for them. The form and structure of the ocean floor. (v) The descriptions of the main types of folding and faulting; the nature of cleavage and its relationship to other structures; jointing. (vi) Types and processes	Interactions between tutors and students, tutorials, tests	Models of: * Layered structure of the earth * Folding * Faulting	7weeks/42hrs

	of weathering; soil formation; erosion (natural and man-made erosion); transportation and deposition of materials by mass movement, water, (marine and fluvial), wind (Aeolian) and ice and their resultant landform.			
2.	MINEROLOGY (i) Definition and general processes of formation of minerals; Atomic bonding. (ii) The composition of minerals. A simple classification of minerals based on chemical composition into native elements, sulphides, oxides, halides, carbonates, sulphates, phosphates and silicates. (iii) Forms of occurrence e.g. crystals, crystal aggregates, aggregations such as fibrous, lamellar, botryoidal, etc. (iv) Physical properties e.g. colour, streak; luster; hardness; fracture; cleavage; magnetism, density. (v) Modes of occurrence and mineral assemblages.	Determination of the physical properties of minerals (e.g. colour, streak, luster, hardness, cleavage, etc) from the following common groups with a view to naming them: Native elements: Copper, graphite, sulphur, etc. Oxides: Haematite, magnetite, cassiterite, limonite, corundum etc. Halides: Fluorite, halite, etc. Carbonates: Calcite, Dolomite Malachite, Azurite, etc. Sulphates: Gypsum, Barytes etc. Sulphides: Pyrite, Chalcopyrite, Galena, sphalerite.	1. Streak plates 2. Pen knife 3. Mineral specimens 4. Standard minerals for hardness determination.	4weeks/24hrs

		Silicates – Silica Group–quartz, chalcedony feldspars – Orthoclase, Plagioclase Micas – Muscovite, Biotite Pyroxenes – Augite Amphiboles - Asbestoses, Hornblende Other Silicates – Olivine Garnets Tourmaline.		
3.	**CRYSTALLOGRAPHY** (i) Definition of "crystals", "crystalline" and "amorphous". (ii) Atomic structure of minerals, including the concepts of crystal lattice, unit cell, crystal forms etc. Atomic bond types. (iii) Crystallographic axes; interfacial and solid angels (coigns); law of constancy of interfacial angels. (iv) Elements of symmetry in crystals; planes of symmetry; centre of symmetry; axes of symmetry.	Drawing and describing crystal models or natural crystals; inserting and labeling crystallographic axes; measuring interfacial angles; recognizing symmetry elements in the crystal models; assigning a crystal to its crystal system.	1. Crystal models/ Natural crystals 2. Contact goniometer	4weeks/24hrs

	(v) Classification of crystals based on the six crystal systems; examples of natural minerals in each system are to be given.			
4.	**PETROLOGY I** **Sub-topic I: Igneous Rocks** (i) The origin and occurrence of common igneous rocks. (ii)Mineralogicalcompositi on, textures and structures of igneous rocks. (iii) Classification of igneous rocks based on simple mineralogical composition, texture / structure. **Sub-topic II: Metamorphic Rocks** (i) Metamorphism: major types of metamorphism (thermal / contact, dynamic	Candidates will be required to describe specimen of the rocks listed below in terms of mineralogy and texture/structure, to give names or positioninabroad classification and to assign a specimen to its major rock group; igneous, metamorphic or sedimentary. Igneous: Coarse –grained: Pegmatite, granite, gabbro, granodiorite, etc.Medium – grained: Microgranite (including quartz porphyry), dolerite, etc. Fine – grained and glassy: rhyolite, obsidian, pitchstone, andesite, basalt, etc Pyroclastic: Pumice, tuffs, Agglomerate Metamorphic: Slate, phyllite, Schist, gneiss, migmatite,quartzite, marble	1. Samples of common rocks as listed above	6 weeks/36hrs

	and regional). (ii) Metamorphic factors; metamorphic zoning (iii)Mineralogicalcompositi on of common metamorphic rocks. (iv) Metamorphic textures and structures, e.g. foliation, schistocity, banding, porphyroblastic, augen, etc.		2. Simple magnifying glass or hand lens 3. Pen knife	3Weeks/18hrs

Total 144hrs

SECOND SEMESTER SYLLABUS

5	**PETROLOGY II** **Sub-topic III: Sedimentary Rocks** (i) Origin of the components of a sedimentary rock (Refers to physical geology. Weathering, erosion, transportation and deposition / chemical precipitation). (ii) Diagenetic processes (iii) Primary sedimentary structures and textures. (iv) A simple classification of sedimentary rocks into broad groups (clastic, organic and	Sedimentary: Conglomerate, breccia, sandstones (including arkose, greywacke, quartzose sandstone, glauconitic sandstone, micaceous flags, grits); shale, marl, mudstone,		4weeks/24hrs

	chemical).	limestones (including oolitic and organic types, chalk, dolomitic limestone) simple evaporites (gypsum, halite dolomite), chert and flint, coals.		
6.	ECONOMIC GEOLOGY (i) The origin and distribution of the main types of economic mineral deposits with emphasis on Nigerian examples. (ii) Fuels: Nature, origin and occurrence of coals; petroleum and natural gas. (iii) Water: Geological factors governing the accumulation of groundwater and the storage of surface water; hydrological cycle, permeability and porosity. Artesian structures; springs and wells. Water quality (chemical, physical and biological). Water treatment (filtration, boiling, chlorination, etc.). Water pollution and water protection. Water borne and water-related diseases. (iv) Rocks as raw materials: In the construction industries (roads, dams, houses, etc), manufacturing industries			4weeks/24hrs

	(cement, glass, clay bricks, fertilizers, etc.)			
7.	PALAEONTOLOGY (i) Fossil; nature, types and processes of fossilization. (ii) Outline of the distribution in time and space, the morphological features and geological history of the following main groups of invertebrate fossils. Trilobite, scleractinian (Hexacorals), and rugose corals; crinoids, regular and irregular echinoids; articulate brachiopods, inarticulate brachiopods (Lingula and orbiculoidea only); examples of fixed, active and burrowing types of bivalves (pelecypods); gastropods; nautiloids, goniatites, ammonites, belemnites; and graptolites. (iii) Brief outline of the history of life, including plants and vertebrates.	Students are to: - Draw, label, and describe morphological features of the main groups of invertebrate fossils listed above; -Place a specimen in its fossil group; -Give approximate age range of its existence -Give application in dating and correlation - State their distribution in space and time in rock formations in Nigeria.	1. Fossil and model specimens of the main groups listed above. 2. Drawing materials	5weeks/30hrs
8.	STRATIGRAPHY (i) The geological column and time scale; geochronology – radiometric dating. (ii) The geological systems, their broad characters and distribution in the international type localities, treated so as to illustrate general stratigraphical concepts and principles rather than successional details. (iii) Events stratigraphy: Orogenic movements; marine transgression and regression,	Interactions, tutorials, assignments, tests		5weeks/30hrs

	unconformities, cyclic sedimentation, geo-synclinal, shelf sea and vertical changes of facies; the problems and methods of classification and correlation of strata. (iv) An outline Geology of Nigeria.			
9.	FIELD GEOLOGY Use of compass, G.P.S., topographical maps; scales; drawing of sketches; drawing of cross-sections; interpretation of simple geological maps. (ii) Field study of examples of weathering, soil formation, erosion and sedimentation processes. (iii) Examination in the field of igneous, metamorphic and sedimentary rocks, associated structural and other features including landforms; preparation of field notes and reports. (iv) Preparation of simple field geology map of a small selected area (on scale 1: 1000).	Problems are to be given to students to solve in map reading, scale, compass reading, etc.	1.Topographical maps 2.Compass/clino meter 3.G.P.S.(Global Positioning System) 4.Geological hammers (1 kg type) 5. Hand-lenses	5weeks/30hrs of field work
10	Revision			1week/6hrs

Total 144hrs

Recommended Texts / Reference Materials:

Basic:

1. Holme's Principles of Physical Geology, 4th Edition, edited by M. Mcl. Duff, Published by Chapman & Hull.

2. Rutleys's Elements of Mineralogy by C.D. Gribble, 27th Edition, CBS Publishers and Distributors London.

3. Petrology for students by S.R. Nockolds, R.W. O'B. Knox and G.A. Chinner, Published by Cambridge University Press, Cambridge.

4. Paleontology: An Introduction by Nield and Tucker.

5. Stratigraphy: An introduction to Principles by D.T. Donovan, Publ. By Wiley – Inter. Science.

6. Dictionary of Geology (Penguin).

Recommended Further Reading Texts

1. Petrology of the Igneous Rocks by F.H. Hatch, A.K. Wells and M.K. Wells. Thomas Murby & Co., London.

2. Geology of Nigeria, edited by Kogbe, C.A. Published by Rock View (Nig.) Ltd, Jos. Nigeria, 2nd Revised Edition 1989.

3. Principles of Paleontology by Raup and Stanley.

4. Invertebrate Paleontology and Evolution, 2nd Edition by E.N.K. Clarkson, Publ. George Allen & Unwin Ltd.

5. Stratigraphy and Sedimentology by Krumbein and Sloss, 2nd Ed., Publ. by Freeman & Co., San Francisco.

6. Sedimentology (Process and Products) by M. Leeder.

7. Principles of Stratigraphy by Dunbar and Roger.

8. Field Geology by F.H. Lahee, Publ.: McGraw-Hill Book Company, New York.

9. Simple Geological Structures and Maps: A Laboratory Manual by E.A. Bala, A.B.U., Press Ltd., Zaria, Nigeria.

10. Sedimentary Rocks by E.J. Pettijohn. Harper and Row, Publishers, New York.

11. Hydrogeology by Davis, S.N. and De Wiest, R.J.M. John Wiley and Sons, New York.