

COURSE UNIT STUDY GUIDE

Course Unit: MATERIALS OF THE EARTH; **Course Code:** SGL 101

Year 2013: First Semester

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Introduction to the course unit

The **Materials of the Earth** course unit is one of the three core courses in Geology at level 1 (First year). The other two core courses are **SGL 102 – Earth Processes** and **SGL 103 - Introduction to Paleontology**. Geology is a science of the study of the earth with reference to its evolution, composition and processes that have prevailed from the time of its evolution to the present time. It is the study of rocks and minerals in the context of the Earth we live on.

Aims: This course unit aims to introduce students to the basic concepts that are important to the understanding of the formation of the earth, its rocks and minerals. It integrates theoretical studies with essential practical skills in the identification of crystals systems, minerals and rocks in the laboratory.

Objectives: At the end of this course unit, students should be able to:

1. Demonstrate a basic understanding of the natural materials of the Earth.
2. Explain the various concepts advanced for the origin of the solar system, and the techniques used in understanding the formation of the earth, its structure and composition.
3. Identify and distinguish various earth materials (minerals and rocks) and explain their uses and contribution to economic development.
4. Describe the nature, mode of formation and associated structures and textures of the three major rock types constituting the earth – igneous, sedimentary and metamorphic rocks.
5. Explain how fossils are preserved, their uses and application in the tracing of plant and animal development throughout the geological history.

Programme of Lectures and Practicals:

Lectures for this course unit are held on Wednesdays from 8 – 10 am and a 3-hr practical on the same day in the afternoon from 2.00 - 4:50 pm. The lectures and practicals are held in the Mineralogy Laboratory 1 of Wing A in the Department of Geology.

Course Unit content

The course consists of 8 key lectures that are subdivided into four sections: Section I, II, III and IV.

- **Section I** of the unit starts by examining the theories advanced for the origin of the earth as part of the larger solar system and then progresses to examine the scientific evidence relating to its structure and composition.
- **Section II** begins by examining the basic applied concepts of elementary crystallography and mineralogy. Emphasis is made in learning the basic techniques employed in the derivation of the symmetry elements in crystals and the physical properties used in identification of minerals. Skills gained from this section of the course form a vital component in the understanding of the various ways in which crystalline materials can be put into use.
- **Section III** examines the nature and mode of formation of the igneous, sedimentary and metamorphic rocks. In this section, the student will acquire skills that will enable him to describe and explain the mode of occurrence of the three rock types and associated structures, and be able to distinguish them on the basis of their mode of formation, characteristic textures and compositional differences.
- **Section IV** introduces you to the study of past life forms and methods used in their preservation. An introduction to the study of fossils and principles of elementary Stratigraphy will enable you to grasp the important uses of fossils in providing the relevant information regarding the trace and development of plants and animals in our planet earth.

Lecture program

Lecture/ No	MAIN SUBJECT	SUBJECT COMPONENTS
1	ORIGIN, STRUCTURE AND COMPOSITION OF THE EARTH	<ul style="list-style-type: none">• The origin of the Earth• Theories Advanced for the origin of the solar system• Structure and composition of the Earth
2	ELEMENTS OF CRYSTALLOGRAPHY AND MINERALOGY	<ul style="list-style-type: none">• What is crystallography?• Crystals, crystalline solids and their formation• Properties of crystals• Classification of Crystals

		<ul style="list-style-type: none"> • Crystals faces • Parametral plane, Axial length and Axial ratios • Miller Indices
3	PHYSICAL PROPERTIES OF MINERALS	<ul style="list-style-type: none"> • Minerals Defined • Identifying characteristics of Minerals • Physical Properties of Minerals
4	COMMON ROCK FORMING AND ECONOMIC MINERALS	<ul style="list-style-type: none"> • Common rock forming minerals • Silicate minerals • Structure and classification of the silicate minerals • Non-silicate minerals
5	NATURE AND CLASSIFICATION OF IGNEOUS ROCKS	<ul style="list-style-type: none"> • Igneous rocks defined. • Textures of Igneous rocks • Pyroclastic rocks • Xenoliths • Lava flows and sills • Occurrence of Igneous rocks : Plutonic and volcanic rocks • Forms of Igneous Intrusions • Classification of igneous rocks
6	NATURE AND CLASSIFICATION OF SEDIMENTARY ROCKS	<ul style="list-style-type: none"> • Sedimentary rocks defined • Methods of sediment erosion and transport • Sediment grain size, sorting and rounding • Diagenesis and lithification • Classification of sedimentary rocks • Structures in sedimentary rocks
7	NATURE AND CLASSIFICATION OF METAMORPHIC ROCKS	<ul style="list-style-type: none"> • Metamorphism defined • Agents of metamorphism • Movement and action of fluids • The types of Metamorphism and associated rocks • Effects of composition on metamorphic mineralogy • Common metamorphic rocks and textures • Nature of metamorphic textures • Tectonic history

		<ul style="list-style-type: none"> • Time relations between metamorphic minerals and Deformation.
8	PAST LIFE AND PRESERVATION OF FOSSILS	<ul style="list-style-type: none"> • Paleontology defined • Fossils • Requirements for fossilization • The different kinds of fossil preservation • Fossils and the Geological Time Scale • The importance and uses of fossils

Laboratory work (Practicals)

Practicals are compulsory in this course unit and a separate practical manual will be availed to all students.

Each student is expected to work independently and submit his/her practical work every Wednesday of the week before 5pm for individual assessment.

Tutorials

Tutorials will be held once a week for at least one hour on Wednesdays just before practicals commence. The tutorials are meant to review the previous practical where any student may have had any difficulties. In total there will be 12 tutorials per semester.

Assessment

The overall assessment for this course unit will be comprised of practicals, continuous assessment tests (C.A.T) and end of semester examination. There shall be two continuous assessment tests. Each C.A.T will carry a total of 40% and the final mark for C.A.T will be averaged from these two C.A.Ts.

The final assessment for the course unit will comprise of Practical – 20%; C.A.T. – 10% and End of semester examination – 70% (TOTAL = 100%).

Recommended Reading:

1. **Nyamai C.M., 2003.** SGL 101: Materials of the Earth Lecture series. Nairobi University Press.
2. **Plummer, C.C., McGeary, D. and Carlson, D.H., 2002.** Physical Geology. McGraw-Hill Science /Engineering/Math; 9th edition.
3. **Pettijohn, F.J. 2002.** Sedimentary rocks. 3rd Ed. Harper & Row Publishers, Inc., USA.
4. **Blyth, F.G.H. and de Freitas, M.H., 1988.** Geology for Engineers. English Language Book Society/Edward Arnold, London. 7th Ed. ISBN-10: **0713128828** | ISBN-13: **978-0713128826**.
5. **Open University press., 1988.** Earth Materials and Processes.

6. **Bonewitz, R.L., 2008.** Rocks and Minerals: The definitive visual guide. Dorling Kindersley Ltd, London. ISBN **978 1 4053 28319**.
7. **Frank, P. and Raymond, S., 1986.** Earth. W.H. Freeman and Company, New York.
8. **Cox, K.G., Price N.B., and Harte, B., 1967.** A Practical study of Crystals, Minerals, and Rocks.
9. **Holmes, D.L., 1969.** Elements of Physical Geology. Fletcher and Son Ltd, Norwich, Great Britain.
10. **Middlemost, E.A.K., 1985.** Magmas and magmatic rocks, An introduction to igneous petrology. Longman Scientific and Technical, United Kingdom.
11. **Battey, M.H. (1972).** Mineralogy for students. Oliver and Boyd, Edinburg.
12. **Yardley, B.W.D., 1989.** An Introduction to Metamorphic Petrology. Longman Scientific & Technical Publishers, England.