COURSE OUTLINE

GGY3020

MINERALOGY AND PETROLOGY

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Office#: 109

GGY3020: PETROLOGY

1. **Igneous Rocks**: Origin, minerals in igneous rocks; composition and viscosity of magma; crystallization of magma; magma differentiation; Chemical composition of igneous rocks; mineralogical composition of igneous rocks; Textures of igneous rocks; Classification of igneous rocks.
2. **Sedimentary rocks:** Origin; Processes involved in the formation, transportation and transformation of sediments after deposition; sedimentary structures; sedimentary minerals; classification of sedimentary rocks
3. **Metamorphic rocks:** Origin; The role of pressure and temperature conditions in metamorphism; types of metamorphism; fabrics of metamorphic rocks; metamorphic minerals; metamorphic grade; Classification of metamorphic rocks

GGY3020: Learning outcomes

On completion of the course, students will be expected to be able to:

a) Demonstrate understanding of basic concepts of crystallography

b) Describe crystals systematically and classify them

c) Plot crystals on a stereonet for visualization of 3D crystals in 2D

d) Demonstrate understanding of basic concepts of minerals and how they form

e) Use a polarizing microscope in studying minerals

f) Identify common rock-forming and accessory minerals and describe them systematically under the microscope

g) Understand the basic concepts of rock formation

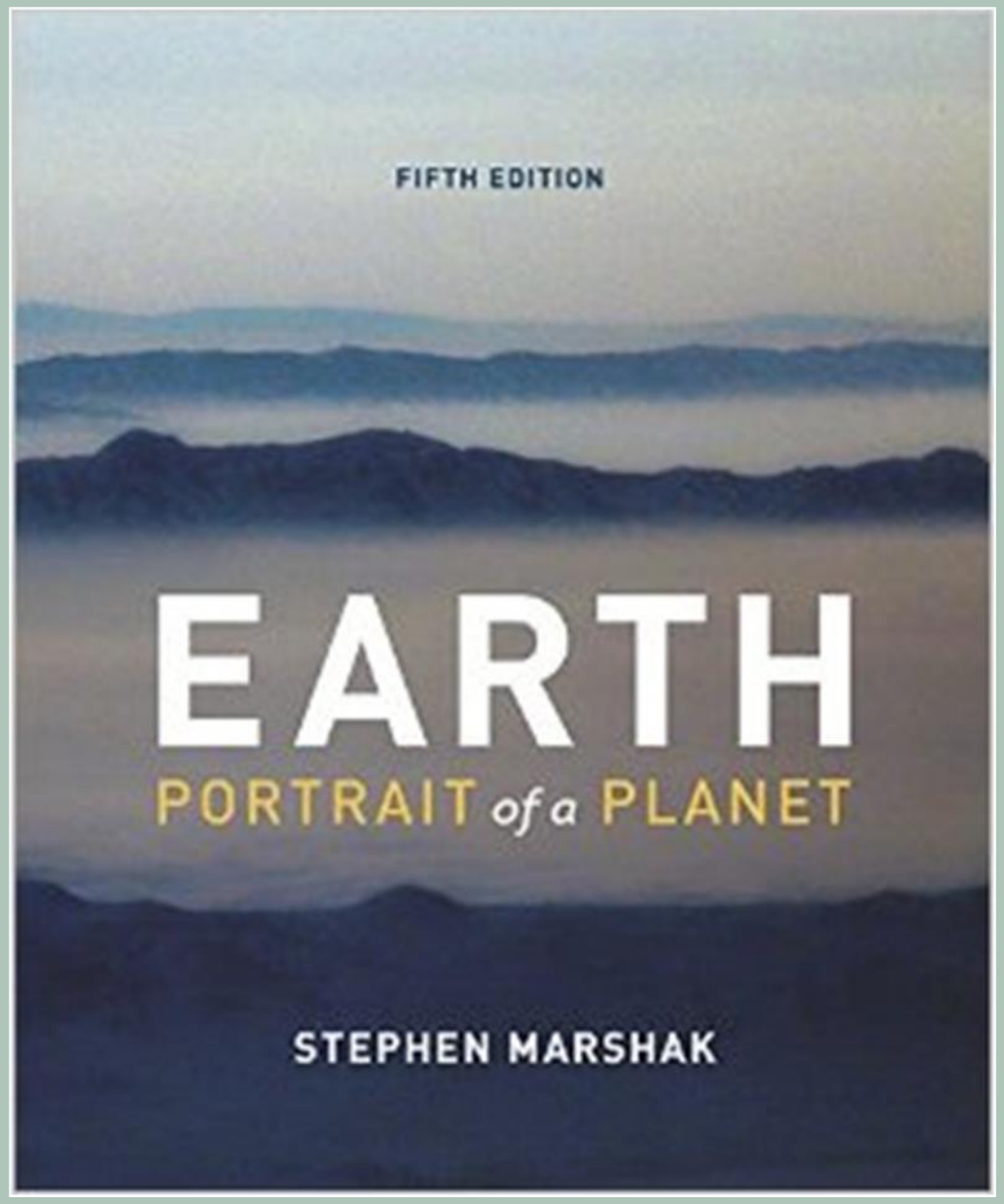
h) Identify, describe and classify the major rocks both in hand specimen and under a microscope

i) Recognize, identify and describe textures of various rocks

j) Interpret how the rocks originated

k) Relate the various rocks to tectonic settings

TEXTBOOK:



1:

Our Planet: a perspective from the Space (Pg. 15 – 36)

TOPICS:

- The Universe: Where we are … now …
- Formation of the planets
- The Solar System

2:

The Earth System (Pg. 36 – 53)

TOPICS:

- The structure of the Earth:
  - Earth’s materials
  - The layered structure of the Earth

3:

Volcanic eruptions (Pg. 249 – 285)

TOPICS:

- Products
- Eruptive style of volcanoes
- Volcanism occurrences

4:
Igneous Petrology: Magma and Igneous rocks (Pg. 139 – 167)

1. Concepts of magma formation and crystallization
2. Magma composition
3. Igneous textures and processes
4. Classification of igneous rocks

5: Sedimentary Petrology

Sedimentary Rocks (Pg. 185 – 211)

TOPICS:

- Classes of sediments and sedimentary rocks
- Sedimentary structures and processes
- Depositional environments
- Concepts of weathering, erosion and lithification

6:

Metamorphic Petrology:(Pg. 213 – 237)

1. Concept of metamorphism
2. Metamorphic textures and processes
3. Classification of metamorphic rocks
4. Environments of metamorphism

7. Mineralogy

1. Introduction
2. Internal structure of crystals and their properties
3. Chemical and physical properties of minerals
4. Polymorphism and isomorphism
5. Overview of the main rock-forming minerals
6. Optical Mineralogy i.e. transmitted light microscopy

8. Crystallography: Earth materials: MINERALS (Pg. 105 – 127)

Chapter content

1. Crystal structure
2. Crystallographic notation
3. Crystal lattices and unit cell
4. Elements of crystal symmetry
5. The crystal systems and classes
6. Twinning
7. Stereographic representation of principal crystal forms

PRACTICAL TEST

TOPICS:

- Igneous rocks
- Metamorphic rocks
- Sedimentary rocks

Extra materials 1:

Crustal deformations (Pg. 349 – 383)

TOPICS:

- Rock deformation and fracture
- Faults
- Mountain building
- Cratons

Extra materials 2:

The Continental Drift (Pg. 56 – 75)

TOPICS:

- Evidences for continental drift
- Evidence for spreading seas

Extra materials 3:

Plate Tectonics (Pg. 78 – 100)

TOPICS:

- Principles
- Divergent plates
- Convergent plates
- Transform plate boundaries
- Special locations
- The puzzle of tectonic plates
- What drives plate motion?

FINAL EXAM

ALL THE TOPICS COVERED IN THE COURSE!!!!

Good luck!

TRANSFERABLE SKILLS

In addition to subject training, other skills training include self-reliance during:

- Laboratory work,
- Analysis & interpretation of data, time management,
- Graphical presentation of data,
- Working with others,
- Basic research skills
- Written & oral communication

Teaching and Learning Methods

- Lectures: 4 hours/ week
- Laboratory sessions: 3 hours/ week
- Fieldwork sessions: 1-2

Course Assessment Components

Component of assessment	Number	Contribution to overall grading (%)
Continuous assessment		40%
Assignments	4	5
Laboratory sessions	6	5
Fieldwork sessions	1-2	5
Tests	2	20
Attendance/ Seminars		5
Final examination	-	60%

Prescribed Readings

1. Walter Borchardt-Ott, 2012, Crystallography: An Introduction (3rd Edition). Springer-Verlag Berlin Heidelberg. ISBN: 978-3-642-16451-4.
2. Battey, M. H., 1981, Minerology for Students (2nd edition). Longman.
3. Verhoog. B. J., 1991, Manual of Optical Mineralogy. UNZA.
4. C.S. Hurlbut, and W. Edwin Sharp, 1998, Dana´s Minerals and How to study them (4thedition), John Wiley & Sons, NY, 328pp.
5. Myron Best, 2002, Igneous and Metamorphic Petrology. Blackwell, **832pp**. ISBN: 1405105887.

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Recommended Readings

1. William D. Nesse, 2012, Introduction to Optical Mineralogy (2nd Edition). Oxford University Press.
2. William Nesse, 2000, *Introduction to Mineralogy*. New York, Oxford University Press. ISBN: 0 19 510691 1.
3. W.A. Deer, R.A. Howie & J. Zussman, 1996, An Introduction to the rock-forming minerals, 2nd Ed. Prentice Hall, 712pp. ISBN: 0582300940.
4. Fander, H. W.,1985, Mineralogy for Metallurgists: an Illustrated Guide. London (Institution of Mining and Metallurgy). ISBN: 9780900488795.
5. Shelley, D., 1985, Optical Mineralogy (2nd edition). Amsterdam, Oxford, and New York (Elsevier).
6. M.E, Tcker, 2003, Sedimentary rocks in the field. John Wiley & Sons, 244pp. ISBN: 0470851236.
7. Yardley, B.W.D. 1989. An introduction to metamorphic petrology. ELBS.

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