

GENERIC ELECTIVES (GE-2): Physics & Chemistry of Earth

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
GE-2 Physics & Chemistry of Earth (L3, T1)	4	3	1	0	12th pass	-

Learning Objectives

This course on physics and chemistry of earth is intended to provide students with basic knowledge and understanding of the surface and internal structure of the Earth and its mineralogy and chemistry. This will equip the students about the present and past processes operative in shaping the physical and chemical make-up of the planet Earth.

Learning outcomes

After completion of this course students will acquire knowledge about the major surface features and the subsurface processes of the earth. Students will learn about the physical, mineralogical and chemical structure of the earth. They will be able to correlate how different geological processes produce different rock types and different landforms. Students will learn about the concepts of geological time and they will learn to calculate the age of the different rocks. They will develop understanding of the Earth's magnetic field and its variation through time. After completing the course, students will be able to analyse different types of geophysical data and how they can be applied to unravel the different subsurface geological structures.

SYLLABUS OF GE-2

Credits 4

Theory (45 hours)

UNIT – I (9 hours)

Detailed contents

Earth: surface features: Continents, continental margins, oceans

Earth's materials: Rocks and Minerals

UNIT – II (9 hours)

Detailed contents

Earth's interior - variation of physical parameters and seismic wave velocity inside the earth, major sub divisions and discontinuities. Depth-wise mineralogical variation in the Earth. Concepts of Isostasy; Airy and Pratt Model. Core and Mantle: Seismological and other geophysical constraints. The geodynamo - Convection in the mantle. Plate Tectonics. Types of plate margins and their Dynamics.

UNIT – III (9 hours)

Detailed contents

Elements of Earth's magnetism: Secular variation and westward drift. Solar activity and magnetic disturbance. Paleomagnetism

UNIT – IV (9 hours)

Detailed contents

Elements: Origin of elements/nucleosynthesis. Abundance of the elements in the solar system/planet Earth. Geochemical classification of elements. Earth accretion and early differentiation. Isotopes and their applications in understanding Earth processes.

UNIT – V (9 hours)

Detailed contents

Isotopes: Radiogenic and Stable. Radiogenic isotopes and their applications

Stable isotope fractionation. Oxygen isotopes. Sublithospheric Mantle (Mineralogy/phase transitions) Concept of mantle heterogeneity. Low-temperature geochemistry; surface and near-surface processes

Tutorial (30 hours)

Students in small batches or groups will be given assignments about the critical aspects related to physics and chemistry of Earth and understand how to resolve important issues.

Essential/recommended readings

Holmes, A. (1992). Principles of Physical Geology, 1992, Chapman and Hall.

Anderson, G. M. (1996). Thermodynamics of natural systems. John Wiley & Sons Inc.

Condie, K.C. (2016) Earth as an evolving planetary system (3rd Edn.) Elsevier

Suggestive readings

Krauskopf, K. B., & Dennis, K. Bird, 1995, Introduction to Geochemistry. McGraw-Hill

Faure, G. Principles and Applications of Geochemistry, 2/e (1998), Prentice Hall, 600 pp.

Anderson, G. M. (1996). Thermodynamics of natural systems. John Wiley & Sons Inc.

Steiner, E. (2008). The chemistry maths book. Oxford University Press.

Yates, P. (2007) Chemical calculations. 2nd Ed. CRC Press.