

**3 Yr. Degree Course
(Minor)
based on NEP-2020
GEOLOGY**



**(Effective from Session 2024-25)
(Batch: 2024-2027)**



SAMBALPUR UNIVERSITY
JYOTI-VIHAR, BURLA, SAMBALPUR, ODISHA-768019

COURSE AT A GLANCE (NEP-UG)

SUBJECT -GEOLOGY

ACADEMIC SESSION: 2024-27

CORE-I COURSE

Course Number	Semester	Course Title	Type of Paper P-Practical NP-Non-practical	Credit Hour	Maximum Weightage of Marks
Paper-I	I	GENERAL GEOLOGY	P	4	100
Paper-II		HISTORICAL GEOLOGY	P	4	100
Paper-III	II	CRYSTALLOGRAPHY	P	4	100
Paper-IV		MINERALOGY AND MINERALOPTICS	P	4	100
Paper-V	III	GEOCHEMISTRY AND ELEMENTRY PETROLOGY	P	4	100
Paper-VI		ELEMENTRY ECONOMIC GEOLOGY	P	4	100
Paper-VII		PALENTOLOGY	P	4	100
Paper-VIII	IV	STRATIGRAPHY	P	4	100
Paper-IX		IGNEOUSSPETROLOGY	P	4	100
Paper-X		SEDIMENTRYPETROLOGY	P	4	100
Paper-XI	V	METAMORPHICPETROLOGY	P	4	100
Paper-XII		REMOTESENSING AND GIS	P	4	100
Paper-XIII		STRUCTURAL GEOLOGY AND TECTONICS	P	4	100
Paper-XIV	VI	ENGINNERING GEOLOGY AND ROCK MECHANICS	P	4	100
Paper-XV		HYDROGEOLOGY	P	4	100
Paper-XVI	VII	EXPLORATION AND MINING GEOLOGY	P	4	100
Paper-XVII		ECONOMIC MINERALS OF INDIA	P	4	100
Paper-XVIII		LABORATARY INSTRUMENTATION AND ANALYSIS	P	4	100
Paper-XIX		GEOLOGY AND MINERALS RESOURCES OF ODISHA	P	4	100

Paper-XX	VIII	FUEL GEOLOGY	P	4	100
Paper-XXI		ENVIRONMENTAL GEOLOGY	P	4	100
Paper-XXII		ORE MICROSCOPY	P	4	100
Paper-XXIII		INTRODUCTION TO GEOSTATISTICS	P	4	100

CORE-II/CORE-III COURSE

Course Number	Semester Core-II/ Core-III	Course Title	Type of Paper P-Practical NP-Non-practical	Credit Hour	Maximum Weightage of Marks
Paper-I	I/II	GENERAL GEOLOGY	P	4	100
Paper-II	III/IV	GEOCHEMISTRY AND ENVIRONMENTAL PETEROLOGY	P	4	100
Paper-III	V/VI	ELEMNRTRY ECONOMIC GEOLOGY	P	4	100
Paper-IV	VII	ENGINNERING GEOLOGY AND ROCK MECHANICS	P	4	100
Paper-V	VIII		P	4	100

CORE COURSE II/ III
Minor (Paper-I) Semester I/II
(General Geology)

(ORIGIN OF EARTH, IT'S EVOLUTION AND LANDFORMS)

Course Objectives:

- To introduce fundamental aspects of Earth and Planetary system and Geological time-scale
- To introduce the Internal Structure and processes of Earth.
- To associate with the naturally occurring landforms with erosive and depositional action of the rivers, wind, glaciers and oceans.

Learning Outcomes:

- Understand the scientific theories and evidence supporting the origin of the Earth and the Solar system
- Analyze the processes involved in the early evolution of the Earth including differentiation, accretion, and the formation of the Earth's internal structure and processes.
- Understand the internal structure and processes within the earth which impacts surface processes like volcanism and earthquakes.
- Evaluate the surface processes and agents like water, wind, glacier and oceans in shaping the various landforms.

Unit-I: Earth as a planet

Geology - its perspective, scope and subdivisions; Solar System and its planets. The terrestrial and Jovian planets. Origin of Earth in the solar system. About Earth (size, shape, mass, density, rotational and revolution parameters). Radioactivity and age of the earth.

Unit-II: Internal structure of the Earth

Seismology and internal structure of the earth, Formation of core, mantle, crust, Convection in Earth's core and its magnetic field. Volcanoes: Types, products and distribution. Earthquakes - intensity, causes and distribution.

Unit-III: Denudation and Geological Action of water

Weathering and Erosion, Mass wasting; Geological works of river. Types of drainage pattern. Geological action of underground water.

Unit-IV: Geological action of Wind, Glaciers & Ocean

Geological action of glacier, wind and ocean and landforms produced by them. Wave erosion and beach processes.

Suggested Practical:

- Topographic Maps and Interpretation.
- Contour Patterns and Drawing of Profiles
- Volcanoes and their Occurrences
- Earthquakes and Seismic Zones.

Text Book:

- ✓ Steven Earle(2015)*Physical Geology* (available online at <https://opentextbc.ca/geology/>)
- ✓ G.B. Mohapatra (2018)*Text book of Physical Geology*, CBS Publishers

Semester-III/IV

Paper-II**(Geochemistry and Elementary Petrology)****Course Objectives:**

- To introduce the chemical characteristics and cosmic abundance of elements
- To explain the geochemistry of water and sediments
- To classify and name of the rocks based on their mineral composition and properties
- To explain the petrographic characteristics and petrographic features, such as mineral assemblages, textures, and structures, exhibited by rocks.

Learning Outcomes

- Explain the geochemistry of water and sediments
- Classify elements based on their geochemistry and mode of affinity.
- Elaborate on the cosmic abundance of elements
- Explain the petrographic characteristics and petrographic features of rocks.

Unit-I: Elements of Geochemistry

Chemical bonding, states of matter and atomic environment of elements. Cosmic abundance of elements; composition of planets and meteorites. Structure and composition of earth. Conservation of mass, isotopic and elemental fractionation. Concept of radiogenic isotopes in geochronology and isotopic tracers.

Unit-II: Geochemical Classification of Elements

Geochemical classification of elements, Primary geochemical differentiation; Atomic substitution. Advection and diffusion; Solid solution, Chromatography; Elements of marine chemistry; Mineral reactions- diagenesis and hydrothermal reactions.

Unit-III: Cosmic Abundance of Elements

Distribution of elements in solar system; Chemical differentiation and composition of the Earth; General concepts about geochemical cycles and mass balance; Geo-chemical behavior of major elements.

Unit-IV: Elements of Petrology

Types of rocks, Physical properties, genesis, evolution and types of magma. Processes of

formation of sedimentary rocks; origin of metamorphic rocks.

Practical:

- Geochemical data analysis and interpretation of common geochemical plots.
- Geochemical phase variation diagrams and its interpretations.
- Rock classification and Megascopic identification of rocks

Text book:

- ✓ *Principles of Geochemistry, Brian Mason*
- ✓ *Principles of Petrology: An Introduction to the Science of Rocks, Tyrrell, G.W.*

Suggested Readings:

- ✓ *Essentials of geochemistry, John V Walther*
- ✓ *Petrology of Igneous, Sedimentary and Metamorphic Rocks, Sachin Changotra*
- ✓ *Petrography, An Introduction to the Study of Rocks. Williams, H., F.J. Turner, and C.M. Gilbert.*

SEMESTER-V/VI (Elementary Economic Geology)

Course Objective

- To explain the process of formation of ore deposits.
- To discourse on Indian distribution of metallic and non-metallic ore minerals
- To provide an understanding of the various economic minerals found in India.

Learning Outcomes:

- Understand the primary and secondary processes of ore formation
- Apply principles of ore-genesis and geo-thermometry
- Appreciate the distribution of various metallic and non-metallic ores in India.

Unit-I: Ore Minerals & Primary Processes

Process of formation of ore bodies: Magmatic concentration, Hydrothermal processes, Wall rock alteration and Paragenesis, Zoning.

Unit-II: Secondary Processes

Residual and mechanical concentration, Oxidation and Supergene enrichment, Sedimentation, Evaporation & Metamorphism.

Unit-III: Ore-Genesis

Ore genesis, Syngenetic & Epigenetic Ores, Formation of Magmatic, Hydrothermal, Metamorphic Fluids and their concentration. Geo-thermometry, definition, classification, methods for preparation of geological thermometry.

Unit-IV: Economic Minerals of India

Metallic and Non-metallic ores of India: Metallic ores, Non-metallic and industrial rocks and minerals, atomic minerals, Gem & Gemstones.

Practical:

- Distribution of Economic Minerals by type in India and the world
- Problems in geo-thermometry.

Textbooks:

- ✓ *Tiwari, S.K.(2010)Ore Geology, Economic Minerals and Mineral Economics, Atlantic Publishers & Distributors (P) Limited*
- ✓ *Laurence Robb.(2005)Introduction to ore forming processes. Wiley.*

Suggested Reading:

- ✓ *Guilbert, John M. and Charles Frederick Park (2007) The Geology of Ore Deposits, Waveland Press 4.*
- ✓ *Arogyaswamy R.N.P. (2017) Courses in mining geology, Oxford and IBH publishers*
- ✓ *Evans, A.M.(1993) Ore Geology and Industrial minerals. Wiley*
- ✓ *Ridley,J.(2013):Ore Deposit Geology. Cambridge University Press,UK.P398.*
- ✓ *Guilbert, J.M. and Park Jr.,C.F.(1986) The Geology of Ore deposits. Freeman & Co.*

SEMESTER-VII

(Engineering Geology & Rock Mechanics)

Course Objectives

- To introduce the mechanical properties of rocks
- To expose students to the geological problems related to foundation, dam, tunnel, roads and bridges.
- To evaluate rock mass and building materials and stability of slopes.

Learning Outcome:

- Define the mechanical properties of rocks
- Solve the geological problems related to foundation, dam, tunnel, roads and bridge.
- Characterize rock mass and building materials
- Address issues related to stability of slopes.

Unit-I: Engineering Properties and Classification

Engineering properties of Rock and Soil. Rock strength and failure, Mohr circle. Building materials. Rock mass classification – Rock Quality Designation (RQD).

Unit-II: Slopes and Slope Stability

Soil-classification, erosion and conservation. Slopes and Slope failure, Geological factors, Slope history and examples of Slope failure. Landslides and its type.

Unit-III: Geology of Tunnels and Bridges

Tunnels and its types, Bridges and its types, Geological considerations of tunnel alignment and bridge site selection. Earthquake resistant structures.

Unit-IV: Dams & Reservoirs

Types of dams; Geological considerations of Dam site and reservoir site selection. Case studies of Dams (e.g. Hirakud dam, Rengali dam).

Practical:

- Engineering properties of rocks.
- Structural maps and tunnel Alignment
- Topographic maps and dam / bridge site selection
- Rock Quality Designation (RQD) calculation and determination of foundation condition

Textbooks:

- ✓ *N Chena Kesavulu, Engineering geology*
- ✓ *SPGarg, Physical and Engineering Geology*

Suggested Readings:

- ✓ *Blyth & Frieta s (1984) A Geology for Engineers.7thEdition, Elsevier*
- Verma,B.P.(2017).Engineering Geology and Rock mechanics.4thEdition.Khanna Publishers.*