# GEOLOGY

## PAPER I

### 1. General Geology:

The Solar System, meteorites, origin, and interior of the earth and age of the earth; Volcanoes—causes and products.

Volcanic belts. Earthquakes—causes, effects, seismic zones of India.

Island arcs, trenches, and mid-oceanic ridges; Continental drift; Seafloor spreading; Plate tectonics. Isostasy.

### 2. Geomorphology and Remote Sensing:

Basic concepts of geomorphology. Weathering and soil formations; Landforms, slopes, and drainage.

Geomorphic cycles and their interpretation. Morphology and its relation to structures and lithology; Coastal geomorphology; Applications of geomorphology in mineral prospecting, civil engineering; hydrology, and environmental studies; Geomorphology of the Indian subcontinent.

Aerial photographs and their interpretation—merits and limitations; The Electromagnetic spectrum.

Orbiting Satellites and Sensor Systems. Indian Remote Sensing Satellites.

Satellite data products; Applications of remote sensing in geology; The Geographic Information System (GIS) and Global Positioning System (GPS)—its applications.

### 3. Structural Geology:

Principles of geologic mapping and map reading, projection diagrams, Stress and strain ellipsoid, and stress-strain relationships of elastic, plastic, and viscous materials.

Strain markers in deformed rocks.

Behaviour of minerals and rocks under deformation conditions.

Folds and faults classification and mechanics; Structural analysis of folds, foliations, lineations, joints, and faults, unconformities; Time-relationship between crystallization and deformation.

### 4. Paleontology:

Species—definition and nomenclature; Megafossils and Microfossils.

Modes of preservation of fossils; Different kinds of microfossils; Application of microfossils in correlation, petroleum exploration, paleoclimatic and paleoceanographic studies; Evolutionary trend in Hominidae, Equidae, and Proboscidea.

Siwalik fauna.

Gondwana flora and fauna and its importance; Index fossils and their significance.

**5. Indian Stratigraphy:**

Classification of stratigraphic sequences: lithostratigraphic, biostratigraphic, chrono-stratigraphic, and magnetostratigraphic and their interrelationships;

Distribution and classification of Precambrian rocks of India;

Study of stratigraphic distribution and lithology of Phanerozoic rocks of India with reference to fauna, flora, and economic importance.

Major boundary problems—Cambrian/Precambrian, Permian/Triassic, Cretaceous/Tertiary, and Pliocene/Pleistocene;

Study of climatic conditions, paleogeography, and igneous activity during the Indian sub-continent in the geological past.

Tectonic framework of India. Evolution of the Himalayas.

**6. Hydrogeology and Engineering Geology:**

Hydrologic cycle and genetic classification of water; Movement of subsurface water; Springs; Porosity, permeability, hydraulic conductivity, transmissivity, and storage coefficient; Classification of aquifers; Water-bearing characteristics of rocks; Groundwater chemistry.

Saltwater intrusion. Types of wells. Drainage basin morphometry; Exploration for groundwater; Groundwater recharge; Problems and management of groundwater; Rainwater harvesting; Engineering properties of rocks; Geological investigations for dams, tunnels, highways, railway, and bridges; Rock as construction material; Landslides causes, prevention, and rehabilitation; Earthquake-resistant structures.

## PAPER II

**Mineralogy:**

Classification of crystals into systems and classes of symmetry.

International system of crystallographic notation.

Use of projection diagrams to represent crystal symmetry.

Elements of X-ray crystallography.

Physical and chemical characters of rock-forming silicate mineral groups.

Structural classification of silicates.

Common minerals of igneous and metamorphic rocks.

Minerals of the carbonate, phosphate, sulphide, and halide groups.

Clay minerals.

**Economic Geology:**

Properties of common economic minerals and ores, including their physical and chemical characteristics.

Geologic setting, mode of occurrence, and origin of metallic mineral deposits.

Classification of ore deposits, processes of mineralization, and control of ore localization.

Study of Indian occurrences of economic minerals.

Origin and distribution of coal and petroleum in India.

Gas hydrates and CBM (Coal Bed Methane).

**Atomic minerals**: Resources of uranium and thorium in India.

Mineral exploration and its techniques: Prospecting, Geological Surveys, Geophysical and Geochemical Exploration methods.

Mining Geology and Environmental Geology:

**Mining methods:** Open-cast and underground mining.

Sampling, ore reserve estimation, and grade calculation.

Impact of mining on the environment.

Remedial measures for mining-induced environmental issues.

Geological aspects of environmental management, including landslide mitigation, seismic hazards, and land subsidence.

**Engineering Geology:**

Geological considerations for the construction of engineering structures such as dams, reservoirs, and tunnels.

Rock mechanics and ground stability in civil engineering projects.

Site investigations and foundation problems.

Earthquake engineering and seismic zoning.

**Mining Geology**

Methods of prospecting—geological, geophysical, geochemical, and geobotanical; Techniques of sampling;

Estimation of reserves of ore; Methods of exploration and mining—metallic ores, industrial minerals, marine mineral resources, and building stones.

Mineral beneficiation and ore dressing.

**Geochemistry and Environmental Geology**

Cosmic abundance of elements; Composition of the planets and meteorites.

Structure and composition of earth and distribution of elements.

Trace elements.

Elements of crystal chemistry—types of chemical bonds, coordination number.

Isomorphism and polymorphism.

Elementary thermodynamics.

Natural hazards—floods, mass wasting, coastal hazards, earthquakes, and volcanic activity and mitigation;

Environmental impact of urbanisation, mining, industrial and radioactive waste disposal, use of fertilisers, dumping of mine waste and fly-ash.

Pollution of ground and surface water, marine pollution.

Environment protection—legislative measures in India;

Sea level changes: causes and impact.