

# **GG Geology and Geophysics**

## **Part A : Common Section**

Earth and Planetary system - size, shape, internal structure and composition of the earth; concept of isostasy; elements of seismology – body and surface waves, propagation of body waves in the earth's interior; Gravitational field of the Earth; geomagnetism and paleomagnetism; continental drift; plate tectonics – relationship with earthquakes, volcanism and mountain building; continental and oceanic crust – composition, structure and thickness.

Weathering and soil formation; landforms created by river, wind, glacier, ocean and volcanoes. Basic structural geology - stress, strain and material response; brittle and ductile deformation; nomenclature and classification of folds and faults. Crystallography – basic crystal symmetry and concept of point groups. Mineralogy – silicate crystal structure and determinative mineralogy of common rock forming minerals. Petrology – mineralogy and classification of common igneous, sedimentary and metamorphic rocks. Geological time scale - geochronology and absolute time. Stratigraphic principles; major stratigraphic divisions of India. Geological and geographical distribution of mineral, coal and petroleum resources of India

Introduction to remote sensing. Engineering properties of rocks and soils. Ground water geology. Principles and applications of gravity, magnetic, electrical, electromagnetic, seismic and radiometric methods of prospecting for oil, mineral and groundwater; introductory well logging.

## **Part B (Section-1): Geology**

Geomorphic processes and agents; development and evolution of landforms; slope and drainage; processes in deep oceanic and near-shore regions; quantitative and applied geomorphology.

Mechanism of rock deformation; primary and secondary structures; geometry and genesis of folds, faults, joints and unconformities; cleavage, schistosity and lineation; methods of projection; tectonites and their significance; shear zones; superposed folding; basement-cover relationship.

Crystallography - symmetry, forms and twinning; crystal chemistry; optical mineralogy, classification of minerals, diagnostic physical and optical properties of rock - forming minerals.

Cosmic abundance of elements; meteorites; geochemical evolution of the earth; geochemical cycles; distribution of major, minor and trace elements in crust and mantle; elements of geochemical thermodynamics; isotope geochemistry; geochemistry of waters including solution equilibria and water-rock interaction.

Igneous rocks – classification, forms and textures; magmatic differentiation; binary and ternary phase diagrams; major and trace elements as monitors of partial melting and magma evolutionary processes. Sedimentary rocks – texture and structure; sedimentary processes and environments, sedimentary facies, provenance and basin analysis. Metamorphic rocks – structures and textures.

Physico-chemical conditions of metamorphism and concept of metamorphic facies, grade and baric types; metamorphism of pelitic, mafic and impure carbonate rocks; role of fluids in metamorphism; metamorphic P-T-t paths and their tectonic significance. Association of igneous, sedimentary and metamorphic rocks with tectonic setting. Igneous and metamorphic provinces and important sedimentary basins of India.

Morphology, classification and geological significance of important invertebrates, vertebrates, plant fossils and microfossils.

Principles of Stratigraphy and concepts of correlation – lithostratigraphy, biostratigraphy and chronostratigraphy. Indian stratigraphy – Precambrian and Phanerozoic. Overview of Himalayan Geology.

Ore-mineralogy and optical properties of ore minerals; ore forming processes vis-à-vis ore-rock association (magmatic, hydrothermal, sedimentary, supergene and meta morphogenic ores); fluid inclusions as an ore genetic tool. Coal and petroleum geology; marine mineral resources. Prospecting and exploration of economic mineral deposits - sampling, ore reserve estimation, geostatistics, mining methods. Ore dressing and mineral economics. Origin and distribution of mineral, fossil and nuclear fuel deposits in India.

Engineering properties of rocks and soils; rocks as construction materials; role of geology in the construction of engineering structures including dams, tunnels and excavation sites; natural hazards. Ground water geology – exploration, well hydraulics and water quality. Basic principles of remote sensing – energy sources and radiation principles, atmospheric absorption, interaction of energy with earth's surface, aerial-photo interpretation, multispectral remote sensing in visible, infrared, thermal IR and microwave regions, digital processing of satellite images. GIS – basic concepts, raster and vector mode operations.