

# UPSC CSE Mains Geology Syllabus

## Paper - I

**1. General Geology:** The Solar System, Meteorites, Origin and interior of the earth and age of earth; Volcanoes- causes and products, Volcanic belts; Earthquakes-causes, effects, Seismic zones of India; Island arcs, trenches and mid-ocean ridges; Continental drifts; 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 Indian subcontinent. Aerial photographs and their interpretation-merits and limitations; The Electromagnetic spectrum; Orbiting satellites and sensor systems; Indian Remote Sensing Satellites; Satellites data products; Applications of remote sensing in geology; The Geographic Information Systems (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; Behavior of minerals and rocks under deformation conditions; Folds and faults classification and mechanics; Structural analysis of folds, foliations, lineation's, 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 Proboscidae; Siwalik fauna; Gondwana flora and fauna and its importance; Index fossils and their significance.

**5. Indian Stratigraphy:** Classification of stratigraphic sequences: lithostratigraphic, biostratigraphic, chronostratigraphic 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 in the Indian subcontinent 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; Ground-water chemistry; Salt water 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

**1. 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. Optical properties of common rock forming minerals; Pleochroism, extinction angle, double refraction, birefringence, twinning and dispersion in minerals.

**2. Igneous and Metamorphic Petrology:** Generation and crystallization of magmas; Crystallization of albite-anorthite, diopside-anorthite and diopside-wollastonite-silica systems; Bowen's Reaction Principle; Magmatic differentiation and assimilation; Petrogenetic significance of the textures and structures of igneous rocks; Petrography and petrogenesis of granite, syenite, diorite, basic and ultrabasic groups, charnockite, anorthosite and alkaline rocks; Carbonatites; Deccan volcanic province. Types and agents of metamorphism; Metamorphic grades and zones; Phase rule; Facies of regional and contact metamorphism; ACF and AKF diagrams; Textures and structures of metamorphic rocks; Metamorphism of arenaceous, argillaceous and basic rocks; Minerals assemblages Retrograde metamorphism; Metasomatism and granitisation, migmatites, Granulite terrains of India.

**3. Sedimentary Petrology:** Sediments and Sedimentary rocks: Processes of formation; diagenesis and lithification; Clastic and non-clastic rocks their classification, petrography and depositional

environment; Sedimentary facies and provenance; Sedimentary structures and their significance; Heavy minerals and their significance; Sedimentary basins of India.

**4. Economic Geology:** Ore, ore minerals and gangue, tenor of ore, classification of ore deposits; Process of formation of minerals deposits; Controls of ore localization; Ore textures and structures; Metallogenic epochs and provinces; Geology of the important Indian deposits of aluminium, chromium, copper, gold, iron, lead zinc, manganese, titanium, uranium and thorium and industrial minerals; Deposits of coal and petroleum in India; National Mineral Policy; Conservation and utilization of mineral resources; Marine mineral resources and Law of Sea.

**5. Mining Geology:** Methods of prospecting-geological, geophysical, geochemical and geobotanical; Techniques of sampling; Estimation of reserves or ore; Methods of exploration and mining metallic ores, industrial minerals, marine mineral resources and building stones; Mineral beneficiation and ore dressing.

**6. 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 chemistrytypes of chemical bonds, coordination number; Isomorphism and polymorphism; Elementary thermodynamics. Natural hazards-floods, mass wasting, costal hazards, earthquakes and volcanic activity and mitigation; Environmental impact of urbanization, mining, industrial and radioactive waste disposal, use of fertilizers, 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.