

13. GEOLOGY

PAPER-I

Unit – I

Geomorphology and Remote Sensing: Weathering and erosion, Geological action of River, wind and glacier. Physiography of India, Application of geomorphology. Principles of aerial photography, photogrammetry and satellite remote sensing – data products, their interpretation and application. Geographic Information System (GIS) – Principles and application.

Unit – II

Mineralogy: Physical, chemical and optical characteristics of common rock forming silicate mineral groups. Structural classification of silicates. Minerals of Carbonate, Phosphate and sulphide groups. Atomic substitution, isomorphism, polymorphism. Principles of X-Ray Diffraction.

Unit – III

Structural Geology: Concept of stress, strain and rock deformation. Structural analysis of folds, joints and faults, Lineation and foliation. Unconformities and basement cover relation. Superposed deformations.

Unit – IV

Igneous and Metamorphic Petrology: Form, texture and structure of igneous rocks. Silicate melt equilibria, binary and ternary phase diagrams, magmatic differentiation, assimilation. Petrology and geotectonic evolution of granites, basalts, anorthosites, ophiolite, kimberlite. Texture and structure of metamorphic rocks, regional and contact metamorphism. Characteristics of different grades and facies of metamorphism. Plate tectonics and metamorphic zones. Metasomatism, granitisation, migmatites and paired metamorphic belts.

Unit – V

Sedimentology and Geochemistry: Sedimentary structures and textures. Provenance and diagenesis. Sedimentary environment and facies. Tectonics and sedimentation. Classification of sedimentary rocks. Sedimentary basins of India. Earth in relation to solar system, structure and composition of Earth. Geochemical cycle, meteorites. Concept and application of stable isotopes in sedimentology.

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PAPER-II

Unit – I

Palaeontology: Morphology and time ranges of fossil groups. Evolutionary changes in mollusks and mammals in geological time. Siwalik vertebrate fauna, Gondwana flora. Evidence of life in Precambrians. Different microfossil groups and uses in biostratigraphic correlation.

Unit – II

Stratigraphy: Stratigraphic code and nomenclature, Geological time scale, Stratigraphic correlation, Precambrian stratigraphy of India. Stratigraphy of the Palaeozoic, Mesozoic and Cenozoic formations of India, Gondwana system and Deccan traps. Palaeoclimate and palaeogeography. Concept of seismic and sequence stratigraphy.

Unit – III

Geophysics and Fuel Geology: Geophysical techniques: gravity, electrical, magnetic and seismic. Origin and classification of coal, Indian coal deposits: Gondwana, Tertiary and lignite. Coal Bed Methane (CBM). Origin, migration and entrapment of natural hydrocarbons, structural, stratigraphic and mixed traps. Geographical and Geological distribution of onshore and offshore petroliferous basins of India.

Unit – IV

Economic Geology: Process of mineralization: magmatic, hydrothermal, supergene, sedimentary exhalation (SEDEX). Mineralogy, mode of occurrence and distribution of iron, manganese, aluminium, chromium, base metals and gold. Indian deposits of non-metals: mica, asbestos, graphite, placer deposits, gemstones, limestones, evaporites. Strategic, critical and essential minerals. Metallogenic epochs and provinces. Surface and subsurface exploration and prospecting.

Unit – V

Hydrogeology and Environmental Geology: Natural hazards – preventive / precautionary measures of floods, landslides, earthquakes, tsunami, coastal erosion. Impact assessment of anthropogenic activities: opencast mining, river valley projects, solid and radioactive waste disposal, excess withdrawal of groundwater, oil spill. Concept of global warming, sea level rise. Vertical distribution of groundwater, classification of aquifers, hydrologic cycle. Hydrological properties: porosity, permeability, Darcy's law and its application. Groundwater provinces of India. Groundwater quality and contamination, groundwater recharge, rainwater harvesting. Engineering properties of rocks, geological investigation for dams and reservoirs. Tunnels: type, method and problems.