

Geology

Unit - I: Physical Geology, Remote Sensing and Structural Geology

1. Internal structure and composition of Earth; Origin of Earth, Weathering and Erosion; Geological action of River, Wind and Glacier and their landforms; Physiography of India; Application of geomorphology.
2. Theory of Isostasy, Continental drift, Plate tectonics, Mid-Oceanic Ridges, Island arc.
3. Principles of Aerial Photography; Satellite Remote Sensing - Data products, their interpretation and application; Geographic Information System (GIS) - Principles and application.
4. Concept of stress, strain and rock deformation; Attitude of beds, Classification and mechanism of folds, joints, faults; Lineation and Foliation; Types of Unconformities.

Unit - II: Mineralogy and Petrology

1. Crystallography: Six systems (Normal Class); Structural classification of silicates; Physical, chemical and optical characteristics of common rock forming silicate mineral groups (Garnet, Olivine, Pyroxene, Amphibole, Mica, Feldspar, Feldspathoid, and Quartz); Minerals of Carbonate, Phosphate and sulphide groups; Atomic substitution, isomorphism, polymorphism; X-Ray analysis of crystal structures.
2. Form, texture, structure and classification of igneous rocks; Binary (Eutectic, Solid Solution) and Ternary phase diagrams; Magmatic differentiation, assimilation;
3. Sedimentary structures and textures; Provenance and diagenesis. Sedimentary environment and facies. Classification of sedimentary rocks. Heavy minerals and their significance; Sedimentary basins of India.
4. Texture and structure of metamorphic rocks, regional and contact metamorphism of argillaceous, basic and calcareous rocks. Characteristics of different grades and facies of metamorphism. Metasomatism, granitisation and paired metamorphic belts.
5. Petrography of Granites, Basalts, Dunite, Anorthosites, Gabbro, Peridotite, Quartzite, Marble, Khondalite, Charnockite, Sandstone, Conglomerate, Limestone.

Unit -III: Economic Geology

1. Classification of mineral deposits, Process of formation of mineral deposits; magmatic, hydrothermal (cavity filling and replacement), oxidation and supergene enrichment, sedimentary exhalation (SEDEX) processes; mechanical and residual concentration; Metallogenic epochs and provinces.
2. Geophysical exploration: gravity, electrical, magnetic and seismic; Geological and Geochemical exploration; Controls of ore localization, Mineral beneficiation, Drilling and Mining. Conservation of minerals, Strategic, Critical and Essential minerals.
3. Mineralogy, mode of occurrence and distribution of Iron, Manganese, Aluminum, Chromite, Base metals and Gold.
4. Indian deposits of mica, asbestos, graphite, beach placer, gemstones, lime stones, gypsum;
5. Coal and Petroleum deposits: Their occurrence, genesis and Indian distribution.

Unit - IV: Stratigraphy and Paleontology

1. Geological Time Scale, Principles of Stratigraphy, Stratigraphic correlation, Code of Stratigraphic nomenclature;
2. Precambrian Stratigraphy: Dharwars, Eastern Ghats, Iron Ore Group, Sausar Group, Aravallis, Cuddapahs and Vindhya;
3. Detailed study of type area of Triassic of Spiti; Jurassic of Kutch; Cretaceous of Trichinopoly, Tertiary of Assam and Siwaliks; Gondwana Super Group; Deccan Traps; Geology of Odisha.
4. Study of morphology, classification and evolution of Brachiopods, Lamellibranchs, Gastropods, Cephalopods, Trilobites, Echinoids, Corals and Graptolites;
5. Elementary idea on Paleobotany and Palynology, Gondwana flora and its significance;
6. Types of microfossils; Study of morphology and classification of foraminifers and Ostracods.
7. Evolution of horse and man;

**Unit - V: Geochemistry, Environmental Geology, Engineering Geology,
Hydrogeology, and Marine Geology**

1. Cosmic abundance of the elements, Primary geochemical differentiation of the earth, Geochemical classification of elements, Geochemical cycle, Meteorites
2. Natural hazards and their mitigation measures-floods, landslides, earthquakes, tsunami, coastal erosion.
3. 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.
4. Engineering properties of rocks and soil; geological investigation for dams, reservoirs and Tunnels.
5. Vertical distribution of groundwater, classification of aquifers, hydrologic cycle; Hydrological properties, Darcy's law and its application; Groundwater quality and contamination; groundwater recharge, rainwater harvesting; Groundwater provinces of India and Odisha.
6. Relief of Ocean floor, Marine Sediments, Marine mineral resources.