

## **Syllabus Geology\***

Origin, size, shape and internal structure of the Earth; Composition and characteristics of continental and oceanic crust; Concept of isostasy; Heat flow within the Earth; Geomagnetism and paleomagnetism; Geological time scale and absolute age dating; Weathering, erosion and soil formation; Plate tectonics, earthquakes and volcanism

Geomorphic processes and agents; Development and evolution of landforms; Fluvial, aeolian, glacial, marine and volcanic landforms; Structural and tectonic geomorphology

Stress, strain and rock deformation; Brittle and ductile deformation; Primary and secondary structures; Folds, faults, joints and unconformities; Shear zones and thrusts; Basement–cover relationships; Stereographic projection

Interpretation of geological maps and cross-sections; Stratigraphic correlation; Structural and lithological interpretation; Coal seam disposition and fault analysis

Crystal symmetry, crystal systems and point groups; Crystal chemistry and bonding; Physical and optical properties of minerals; Silicate structures; Identification of common rock-forming minerals

Classification, textures and structures of igneous rocks; Magmatic differentiation; Binary and ternary phase diagrams; Texture, structure and classification of sedimentary rocks; Sedimentary processes and environments; Sedimentary facies and basin analysis; Coal-bearing sedimentary environments; Metamorphic textures and structures; Metamorphic facies, grade and types; Metamorphism of pelitic, mafic and carbonate rocks

Principles of stratigraphy; Lithostratigraphy, biostratigraphy and chronostratigraphy; Concepts of sequence stratigraphy; Stratigraphy of Peninsular and Extra-Peninsular India; Gondwana stratigraphy and coal measures; Boundary problems in Indian stratigraphy

Fossilization and taphonomy; Invertebrate fossils (bivalves, brachiopods, gastropods, ammonites, etc.); Vertebrate fossils (introductory); Paleobotany: fossil plants, spores and pollen; Application of fossils in stratigraphic correlation and paleo-environmental interpretation

Origin and classification of coal; Coal petrology (macerals and microlithotypes); Coal rank and coalification processes; Indian coalfields: distribution and characteristics; Coal seam correlation; Coal quality parameters; Basics of Coal Bed Methane (CBM); Coal Gasification- Surface, UCG; Global Coal Scenario

Ore minerals and ore textures; Ore-forming processes; Mineral, coal and petroleum resources of India and Global Scenario; Prospecting and exploration of economic mineral deposits- sampling, ore reserve estimation and basic geostatistics; Mining methods (surface and underground – overview); Mineral economics (introductory)

Physical and mechanical properties of rocks; Rock mass classification systems (RMR, Q-system); Rock Failure Criteria; Shear strength of rock discontinuities, in-situ stresses; Rock slope stability;

Geological considerations in opencast and underground mining; Subsidence and mine hazards; Geological aspects of dams, tunnels and excavation works

Occurrence and movement of groundwater; Aquifers and aquitards; Groundwater exploration techniques; Well hydraulics; Mine water problems and drainage

Basic principles and applications: Gravity method, Magnetic method, Electrical resistivity method' Electromagnetic Methods, Seismic refraction and reflection methods- 2D, 3D, 4D seismic data acquisition, processing and interpretation

Borehole geophysics and well logging- Principles and applications of well logging relevant to coal exploration and mine planning, including SP, resistivity, induction, gamma ray, density, neutron and sonic logs for coal seam identification, thickness, quality and continuity; Use of caliper and temperature logs for borehole condition; Limited use of NMR, dipmeter and micro-logs for fracture/cleat analysis; Quantitative interpretation for lithology, coal–shale discrimination, porosity, moisture and permeability; Logging while drilling and application of borehole geophysics in coal exploration, mine development and groundwater assessment in coalfields; Applications in coal exploration and mining; Geophysical Inversion- Basic concepts

Principles of remote sensing; Interpretation of satellite imagery; Application of remote sensing in geological and coal exploration; Basic concepts of GIS

Environmental impact of mining; Mine reclamation and rehabilitation; Natural hazards: flood, landslides and earthquakes; Basic concepts of climate change

**\*Note:** *The above syllabus is indicative and not exhaustive.*