

Syllabus for Level-10 Post Code: NCB/CME-04

Common Section

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 of common igneous, sedimentary and metamorphic rocks.

Geological time scale; Geochronology and absolute time. Stratigraphic principles; major stratigraphic divisions of India.

Mineral, coal and petroleum resources of India.

Introduction to remote sensing. Engineering properties of rocks and soils. Elements of hydrogeology.

Principles and applications of gravity, magnetic, electrical, electromagnetic, seismic and radiometric methods of prospecting for oil, mineral and ground water; introductory well logging.

Geology

Crystallography and Mineralogy: Elements of crystal symmetry, form and twinning; crystallographic projection; crystal chemistry; classification of minerals, physical and optical properties of rock-forming minerals.

Geochemistry: 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 high temperature and low temperature geochemical thermodynamics; isotopic evolution of the crust and the mantle, mantle reservoirs; geochemistry of water and water-rock interaction.

Igneous Petrology: Classification, forms, textures and genesis of common igneous rocks; magmatic differentiation; binary and ternary phase diagrams; major and trace elements as monitors of partial melting and magma evolutionary processes. Mantle plumes, hotspots and large igneous provinces.

Sedimentology: Texture, structure and sedimentary processes; petrology of common sedimentary rocks; Sedimentary facies and environments, cyclicities in sedimentary succession; provenance and basin analysis. Important sedimentary basins of India.

Metamorphic Petrology: Structures and textures of metamorphic rocks. Physico-chemical conditions of metamorphism and concept of metamorphic facies, grade and baric types; chemographic projections; metamorphism of pelitic, mafic and impure carbonate rocks; role of

bulk composition including fluids in metamorphism; thermobarometry and metamorphic P- T-t paths, and their tectonic significance.

Stratigraphy: Principles of stratigraphy and concepts of correlation; Lithostratigraphy, biostratigraphy and chronostratigraphy. Principles of sequence stratigraphy and applications. Stratigraphy of peninsular and extra-peninsular India. Boundary problems in Indian stratigraphy.

Resource Geology: Ore-mineralogy; ore forming processes vis-à-vis ore-rock association (magmatic, hydrothermal, sedimentary, supergene and metamorphogenic ores); fluid inclusions as ore genetic tools. 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. Distribution of mineral, fossil and nuclear fuel deposits in India.

Applied Geology: Physico-mechanical properties of rocks and soils; rock index tests; Rock failure criteria (Mohr-Coulomb, Griffith and Hoek-Brown criteria); shear strength of rock discontinuities; rock mass classifications (RMR and Q Systems); in-situ stresses; rocks as construction materials; geological factors in the construction of engineering structures including dams, tunnels and excavation sites. Analysis of slope stability.

Natural hazards (landslide, volcanic, seismogenic, coastal) and mitigation. Principles of climate change.

Hydrogeology: Groundwater flow and 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.

Methods of Geological Prospecting and Exploration

Principles and concepts of mineral exploration, methods of Prospecting and Exploration. Different stages of mineral exploration. Radiometric survey. Remote sensing in mineral exploration.

Sampling and Subsurface Exploration

Sampling theory, objectives and methods. Exploration drilling technique, planning, drill core logging and sampling. Planning of geological plans and sections for ore body evaluation.

Reserve Estimation

Cut-off grade concepts and applications, reserve estimation—principles, practices and different

conventional methods.

Principles of Geochemical Exploration

Geochemical cycle, geochemical mobility and association of elements. Primary and secondary dispersions of elements; determination of background and geochemical anomalies; pathfinder and target elements for geochemical exploration.

Geochemical Methods of Mineral Exploration

Methods of geochemical explorations, procedures for geochemical sampling; interpretation of geochemical surveys.

Mineral Economics: World resources of minerals

Classification of mineral resources with special reference to UNFC and JORC schemes. Mineral markets, import-export policies and international trade. Demand analysis of minerals, royalty and taxes. India's status in mineral production.

Mineral Policies and Regulations:

International and national mineral policies. Mines and Mineral policies. Mines and Minerals (Development and Regulation) Act. Marine and mineral resources and laws of sea.

Economics of Deposit:

Economic evaluation of mineral deposit.

Mineral Conservation:

Methods of mineral conservation and substitution.