

Syllabus of Ph.D. Entrance Examination

19. GEOLOGY

- 1. Igneous Petrology:** Forms, textures and structures of the igneous rocks. Silicate melt equilibria, binary and ternary phase diagrams. Behaviour of major, minor trace and Rare Earth elements during magmatic crystallization. Igneous rock suites and complexes and their tectonics settings. Mafic and ultramafic suites, including anorthosite, granite, syenite and alkaline suites, carbonitite, charnokite.
- 2. Geochemistry:** Earth in relation to the solar system and universe, cosmic abundance of elements; Composition of the planets and meteorites. Structure and composition of earth and distribution of elements. Trace elements, Introduction to Isotopes geochemistry. Geochemical cycle and principals of geochemical prospecting.
- 3. Geodynamics:** Earth and the solar system, planetary evolution of the earth and its internal structure Major tectonic features of the Oceanic and Continental crust. Continental breakup and drifting of continents. Sea-floor spreading and plate tectonics- concept and evidence Palaeomagnetism. Seismicity and plate movements. Island arc, Oceanic Island and volcanics arc. Isostasy Earthquake and volcanics. Tectonic subdivision, structure and evolution of Himalaya.. Active and passive marginal basins.
- 4. Stratigraphy:** Standard Stratigraphic Scale, Code of Stratigraphic Nomenclature, Different Boundary Problems. Lithostratigraphic & Chronostratigraphic Classification. Precambrian Formation of the World along with Archean Proterozoic, Paleozoic, Mesozoic and Cenozoic Formation

of India, Different Tectonic Division and elements of Himalaya.

5. **Paleontology:** Origin of Life, Precambrian Life with special reference to microbiota, Ediacaran assemblage, Stromatolites and trace fossils International code of Zoological nomenclature. Biostratigraphic Classification. Critical evaluation of Indian Phanerozoic Fossil record with special emphasis on their evolution, Classification and significance of Brachiopoda, Mollusca, Trilobita, Graptolites and Echinoderms. Uses and application of different microfossil groups- Calcareous, Phosphatic and Siliceous. Evolution of Plants and Vertebrates – Man , Horse, Elephant and Dinosaurs.
6. **Crystallography and Mineralogy:** Elementary idea of space lattice and symmetry of internal structures. 14 Bravais Lattices. Systematic description of 32 classes of symmetry. Twinning in crystals. X- ray crystallography. Laue and oscillation methods. Rotation of crystals and Powder methods. Detailed study of silicate structures. Study of important groups of rock- forming minerals, with reference to their crystal structure, physical & optical properties, chemical composition and occurrences such as olivine, pyroxene, amphibole, mica, chlorite, talc feldspars, feldspathoids, zeolites and spinel. General principles of optical mineralogy, pleochroism, indicatrix, interference figures and determination of optical sign, $2V$, $2E$ and dispersion. Universal Stage.
7. **Geomorphology and Remote Sensing:** Geomorphic processes and agents; development and evolution of landforms; slope and drainage; processes on deep oceanic and near-shore regions; quantitative and applied

geomorphology. Types of remote sensing (aerial and space borne; aerial photography, multispectral scanning including thermal infra-red sensing, RADAR remote sensing).

Elements of visual image interpretation. Fundamentals of Digital image processing. Application of remote sensing data in geological investigations, resource exploration, geohazard monitoring and environmental monitoring. India's remote sensing programme.

- 8. Sedimentology:** Granulometric properties and texture. Characters of various clastic and non-clastic rocks. Sedimentary structures. Palaeocurrent and sediment dispersal patterns. Provenance. Concept of sedimentary facies and facies analysis. Modern and ancient sedimentary environments. Sedimentary basins in different tectonic settings.
- 9. Environmental Geology, Engineering Geology and Hydrogeology:** Landuse pattern and land capability mapping. Engineering properties of rocks and soils. Geological conditions for the suitability of dam foundation and reservoir. Problems of hill slope instability and remedial measures. Buildings, their types and foundation problems. Geological considerations for the safe alignment of tunnels. Buildings and their types. Bridges and causes of their failure. Distribution of ground water. Porosity, Permeability. Aquifers and their types. Impacts of excessive withdrawal of ground water. Pollution of ground waters, rivers and lakes.
- 10. Structural Geology:** Concept of deformation, mechanical principles, Stress and strain status in rocks; folds, faults their definition, classification and mechanism, thrust geometry; Joints, fractures, rock cleavages, lineation and foliation, tectonites and microtectonics, shear zone, application of

stereographic projection; crystallization and deformation;
determination of structures in field.