Department of Earth Sciences

Syllabus for the Post of Lab Assistant

Unit-1 Structural Geology

Mechanical properties of rocks and rock failure. Concept of stress and strain and their geological significance. Mechanics of folding and buckling. Faults and dynamics of faulting. Planer and linear fabrics in deformed rocks. Concept of petro-fabrics and symmetry. Interpretation of fabric data on microscopic and mesoscopic scale. Geometrical analysis of simple and complex structures on macroscopic scale.

Unit-2 Paleontology and Stratigraphy

Modern concepts of origin of life. Precambrian fossil record and origin of Metazoa. Taphonomy and fossil communities. Principles of biostratigraphy. Methods and techniques in palaeontology. Morphology and evolutionary trends in Ammonoids, Brachiopods, Graptolites and Trilobites. Morphology, classification, and evolutionary trends of Foraminifera, Ostracodes and Conodonts, their ecological and geological significance. Sequence of plant life through geological time. An account of Gondwana plant fossils of India with respect to paleoclimatic conditions. Landmarks in the evolution of vertebrates. Extinction of Dinosaurs, Siwalik vertebrates.

Principals of stratigraphy. Stratigraphic classification. International code of stratigraphic nomenclature. Concept of stratigraphic facies, stratigraphic correlation. Seismic stratigraphy, magnetostratigraphy. Precambrian-Cambrian, Permian-Triassic, Cretaceous-Tertiary, and Pliocene-Pleistocene boundary problems in stratigraphy.

Unit-3 Sedimentology

Sedimentary processes. Sedimentary structures and textures. Use of textures and structures in sediment dispersal and basin studies. Classification, environment of deposition, provenance and diagenesis of sandstones, carbonates and mudstones.

Sedimentary environments and classification of environments, lithologies, structures and vertical sequences formed in alluvial, deltaic and glacial and aeolian environments. Concept of sedimentary facies, Walters law of facies and application. Sedimentary cycles and cyclothems. Scalar properties and paleocurrents. Paleogeographic reconstruction and basin analysis.

Unit-4 Mineralogy and Geochemistry

Silicate mineral groups, Pauling's rule, ionic substitution and crystalline solutions. Polymorphism and pseudomorphism. Exsolution and non-crystalline minerals (mineraloids). Concept and application of optical indicatrix and interference phenomenon. Orthoscopic and conoscopic study of minerals. Optic figure, optic sign, dispersion, pleochroism and absorption. Determinative methods of Refractive Index. Pleochroic scheme and 2V microscopic methods. Axiality and optic sign. Geochemical classification of elements. Trace element geochemistry and concepts of partitioning and distribution coefficients of trace elements between solid and liquid phases vis-à-vis partial melting and magma generation. Distribution of REE in the Earth's mantle and crust. Isotope geochemistry, decay mechanism and growth of isotopes; Geochronological applications of Rb-Sr, and U-Th-Pb systematics.

Unit-5 Crystallography

Bravais Lattices, Parallel growth, crystal form, crystal habit. Twining-types, causes and laws. External & Internal symmetry in crystals; Symmetry elements; Improper axis; Combination of symmetry elements.

Crystal Systems: Normal classes of crystals, spherical and stereographic projections. Crystal structure of minerals.

Unit-6 Igneous and Metamorphic Petrology

Magma; nature and cooling behaviour. Volatiles in silicate melts. Classification schemes of igneous rocks.

Phase equilibria: Unary, binary and ternary systems. Genesis and tectonic setting of different Magma types. Application of major and trace elements (including REE) and Sr-, Pb-, and Nd-isotopes studies in deciphering magma generation, mantle-crust interactions and tectonic environments.

Metamorphism and metamorphic processes. Metamorphic differentiation. Metamorphic facies and systematic description of regional and thermal metamorphism of pelitic, basic-ultra-basic and calcareous rocks. Metamorphic reactions and their implications to geothermo-barometry. Metasomatism and Anataxis. Regional metamorphism and paired metamorphic belts in reference to plate tectonics. P-T-t- paths.

Unit-7 Ore, Fuel & Exploration Geology

Principal mechanisms of formation of the igneous, sedimentary and metamorphic mineral deposits. Weathering and placer deposits. Ore deposits and plate tectonics. Mineral economics and national mineral policy in relation to strategic, critical and essential minerals. Ore Microscopy and quantitative methods in ore microscopy. Microchemical studies of ore minerals. Fluid inclusions and their importance in ore geology.

Origin and occurrence of petroleum. Migration and accumulation of petroleum. Reservoir rocks and traps. Petroliferous basins of India. Rank and grade of coal; origin of kerogen and coal. Geological and geographical distribution of coal deposits in India with emphasis on Gondwana coal fields. Atomic minerals and mode of occurrence of atomic minerals in nature. Atomic minerals as source of energy and productive atomic mineral geological horizons in India.

Unit-8 Tectonic Geomorphology

Geomorphological cycle, Morphometric analysis of drainage basins. Tectonic Geomorphology; Active Tectonics & Models of landscape development. Geomorphic markers, landform dating techniques. Geomorphic expression of Faults. Palaeoseismology and field techniques in paleoseismology. Direct and

indirect observations of paleoseismic displacements. Paleoseismic landforms; use of liquefaction-induced features and landslides for paleoseismic analysis.

Unit-9 Hydrogeology

Groundwater table and Groundwater table fluctuations and controlling factors. Elementary theory of groundwater flow, Darcy's law and its range of validity. Steady and unsteady flow. Porosity and permeability transmissivity, storage coefficient and methods of determination. Steady, unsteady and radial flow into a well. Determination of aquifer characteristics from pump-tests. Groundwater exploration using geological, resistivity and seismic methods. Groundwater basin management methods. Water logging and artificial recharge. Fresh and saltwater relationship in coastal areas. Groundwater quality analysis.

Unit-10 Engineering Geology

Engineering properties and classification of rocks. Factors affecting engineering services of rocks. Engineering properties of soils. Geological considerations for evaluation of bridges, dams, reservoir and tunnels. Influence of geological conditions on foundation and design of buildings.

****