MINERALOLOGY

Concept of point group, space group, reciprocal lattice, diffraction and imaging. Concepts of crystal field theory and mineralogical spectroscopy. TEM and SEM applications. Lattice defects (point, line and planar). Physical, Electrical, magnetic and optical properties of minerals. Bonding and crystal structures of common oxides, sulphides, and silicates. Transformation of minerals - polymorphism, polytypism, and polysomatism. Solid solution and exsolution.

IGNEOUS AND METAMORPHIC PETROLOGY


STRUCTURAL GEOLOGY AND GEOTECTONICS


APPLIED PALEONTOLOGY

SEDIMENTOLOGY

PHYSICAL GEOLOGY

Development in geomorphology. Historical and process Geomorphology. Landforms in relation to climate, rock type, structure and tectonics. Processes - weathering, pedogenesis, mass movement, erosion, transportation and deposition. Geomorphic processes and landforms - fluvial, glacial, eolian, coastal and karst. River forms and processes - stream flow, stage-
discharge relationship; hydrographs and flood frequency analysis. Submarine relief. Geomorphology and topographic analysis including DEM, Environmental change - causes, effects on processes and landforms. Extra-terrestrial geomorphology

**OCEANOGRAPHY AND METEOROLOGY**

**GEOCHEMISTRY AND GEOPHYSICS**
Structure and atomic properties of elements, the Periodic Table; ionic substitution in minerals; Phase rule and its applications in petrology, thermodynamics of reactions involving pure phases, ideal and non-ideal solutions, and fluids; equilibrium and distribution coefficients. Nucleation and diffusion processes in igneous, metamorphic and sedimentary environments, redox reactions and Eh-pH diagrams and their applications. Mineral assemblages as 'sensors' of ambient environments. Geochemical studies of aerosols, surface-, marine-, and ground waters. Radioactive decay schemes and their application to geochronology and petrogenesis. Stable isotopes and their application to earth system processes. Geochemical cycles.
Signal Processing, Field theory, Numerical analysis and inversion, Gravity and Magnetic fields of the earth, Plate Tectonics and Geodynamics, Seismology & Tomography, Gravity and Magnetic Methods, Electrical and Electromagnetic Methods, Seismic Methods, Well logging and other methods

**ECONOMIC GEOLOGY:**
Magmatic, hydrothermal and surface processes of ore formation. Metallogeny and its relation to crustal evolution; Active ore-forming systems, methods of mineral deposit studies including ore microscopy, fluid inclusion and isotopic systematics; ores and metamorphism - cause and effect relationships. Geological setting, characteristics, and genesis of ferrous, base and noble metals. Origin, migration and entrapment of petroleum; properties of source and reservoir rocks; structural, stratigraphic and combination traps. Methods of petroleum exploration. Petroliferous basins of India. Origin of peat, lignite, bitumen and anthracite. Classification, rank and grading
of coal; coal petrography, coal resources of India. Gas hydrates an methane. Nuclear and non-conventional energy resources.

**PRE - AND POST- CAMBRIAN GEOLOGY**


**APPLIED GEOLOGY**


(iii) Mineral Exploration: Geological,geophysical, Geochemical and geobotanical metho of surface and sub-surface exploration on different scales, sampling, assaying and evaluation of
(iv) Hydrogeology; hydrogeology of Rajasthan, hydrogeology of arid zones and wetlands preparation of hydrographs. Flownets, water table contour maps; Hydrostatigraphic units. Groundwater quality, various estimation and treatment methods for its use for different purposes (drinking, agricultural, industrial) Groundwater quality map of India, water contaminants and pollutants, Problems of Arsenic and fluoride; Calculation of groundwater velocity, amount of inflow and outflow, permeability (hydraulic conductivity), transmissivity and storage coefficient.