

Faculty of Science

M.Sc. (Applied Geology)

Earth in the solar system : origin, size, shape, mass, density, rotational and revolution parameters. Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere and elemental abundance in each constituent. Radioactivity and age of the Earth. Seafloor spreading, plate tectonics, and continental drift.

Volcanoes : Type and distribution. Atmospheric circulation. Earth's heat budget.

Rock Weather : Type, Controlling factors and products of weathering. Soil formation, soil profile and soil types. Erosional and depositional landforms produced by running water, wind and glaciers. Physiographic subdivisions of Indian subcontinent – their physical, structural and geological features. Stream patterns.

Elementary Ideas about crystal structure. Silicate structure and their classification. Concept and theories of isostasy. Island arcs and trenches. Cycles in earth system : carbon energy cycle, biogeochemical cycle, rock cycle, geochemical cycle. Landslides : slope stability, causes of landslides, prevention and mitigation.

Floods : causes, impact and mitigation. Earthquakes : causes, impact and mitigation.

Bowen's reaction series magmatic differentiation and assimilation. Magmatic processes : fractional crystallization, magma mixing, crystal setting, liquid immiscibility, assimilation, differentiation. Binary system – Albite – Anorthite, Diopside – anorthite, Nepheline- silica. Ternary systems – Albite – Anorthite – Diopside, Nepheline – Kalsilite – Silica. Forms and structures of extrusive and intrusive igneous rocks. Igneous textures. Bases of classification and types of igneous rocks. General characteristics of the Precambrian igneous rock assemblages :

- a) Komatiites (b) Anorthosites (c) Tonalite – trondhjemite – granodiorite (TTG) Mineralogical characteristics and origin of the following rock types :
(I) Granite, granodiorite, diorite, rhyolite, (II) Basalt, dolerite, gabbro
(III) Syenite, nepheline – syenite, trachyte, (IV) Peridotites.

Introduction to Metamorphic rock and their significance. Classification of Metamorphic rocks. Basic concepts of types of metamorphism. Concepts of isograds and zones and metamorphism. Physical properties of magma, volatile contents . Metamorphic processes, agents and their role in metamorphism. Types of metamorphism contact, regional, cataclastic and metasomatism. Textures and structures of metamorphic rocks and their significance. Barrovian zones of regional metamorphism and principles of isograd mapping. Concept of metamorphic facies and facies series. Cataclastic metamorphism and its products. Contact metamorphism of mafic, pelitic and carbonate rocks. Regional metamorphism of mafic, pelitic rocks. Petrology, origin and distribution (in India) of charnockites, khondalites, granulites and eclogites.

Zingg's and Folk's shape classes. Concept of sedimentary facies. Basic Morphology and occurrence of bedding plane structures, internal structures, soft sediment deformational structures, biogenic structures and significance of ichno fossils. Sandstone : Classification and origin. Conglomerates : origin and classification. Shale, types, their bedding characteristics and mineralogy. Classification and origin of carbonates with special reference of Folk's classification. Classification of sedimentary rocks : terrigenous and chemical sedimentary rocks. Important primary sedimentary structure bedding, ripple marks, cross bedding and mud cracks.

Principles of nomenclature and classification of lithostratigraphic, chronostratigraphic, biostratigraphic and tectonic / genetic facies. Various geological divisions of Peninsular Shield : Cratons – Dharwar, Baster, Singhbhum, Bundelkhand and Aravalli. Mobile belts : Eastern Ghats, Southern Granulite Terrain, Satpura. Delhi supergroup, Vindhyan Supergroup, Cudappah Supergroup. Aravali supergroup, Gondwana Supergroup, Deccan Traps./ Siwalik system. Evolution of Himalayas.

Basic ideas about the method of mineral exploration and mining, Renewable and non renewable energy resources. Distribution of mineral deposits in space and time. Geological setting, mineralogical characteristics and Indian distribution of non metallic mineral deposits i.e. Iron, manganese, Copper, Lead and Zinc, Chromite, Bauxite etcv. Systematic classification of minerals, Silicates, Carbonates, Oxides, Sulfides, Sulfates, Halides. Ore deposits related to magmatic activity. Hydrothermal and skarn deposits. Ore deposits formed by sedimentation, oxidation and supergene enrichment, replacement, Method of Mineral exploration. Physiographics, mineralogical, stratigraphic, lithologic and structural guides to ore.

Methods of mineral exploitation – open pit and underground mining. Microfossils : definition, significance and a brief account of important groups. Morphology and geological distribution, of brachiopods, Trilobita, Gastropoda. Cephalopoda. Evolutionary History of Equidae. Morphology, Classification and Geological range of important Gondwana flora.

Definition of force, stress and strain, stages of rock deformation, stress strain diagram. Unconformalities, their types of recognition in the fields and on geological maps. Geometric and genetic classification of folds. Synforms and antiforms. Mechanics and causes of folding. Description and classification of faults. Planar structures, their identification and description. Type of cleavage and schistosity and their origin. Types of lineations, their origin and their relation to major structures. Joints, their classification and significance.

Basics of remote sensing, EMR, platforms, sensors. Types of aerial photographs. Framing and Scanning Systems. Types of Satellites and images. IRS, LANDSAT AND SPOT Satellites. EMR interaction with atmosphere and earth surface spectral signatures of soil, water and vegetation. Basic drainage pattern and their recognition on images / aerial photos. Identification and characteristics of common rock types on aerial; photographs / satellite images. Concept of datum and coordinate system. Map projections : Conical, cylindrical and azimuthal. Basic concepts and applications of GIS in geosciences, functions of GIS, data structure, data input and analysis in

GIS. Global positioning system (GPS) : components, operating principle, application and limitations.

Hydrologic cycle and its component. Rock properties affecting ground water. Classification of aquifers.

Darcy's Law and its validity permeability. Ground water provinces of India. Vertical distribution of Ground water, concept of water shed management, chemical quality of ground water. Ground water pollution. Petrology of coal, types, classification and ranks. Origin of Coal. Gondwana and Tertiary coalfields of India. Origin, migration and entrapment of natural hydrocarbons. Structural stratigraphic and mixed oil traps. Hydrocarbon exploration techniques – geological and geophysical methods. Onshore and off shore distribution of petroliferous basins in India.

Radioactive minerals : mineralogy, geochemistry, origin and distribution of uranium and thorium deposits in India. Detection and measurement of radioactivity. Surface and subsurface methods of mineral exploration. Geophysical methods of mineral exploration – air borne versus ground surveys. Gravity, electrical, magnetic and seismic methods. Methods of drilling, assaying and reserve estimation.

Basics of Geotechnical Engineering. Geological considerations in site selection for dams & tunnels.