

13. GEOLOGY

DETAILS OF SYLLABUS

1. General Geology

Origin of the Earth, Geospheres. Features of continents and ocean basins- their distribution, structure and evolution, Interior of the Earth. Geochronology. Age of the Earth.

2. Geomorphology

Geomorphic processes and landforms. Evolution of landforms. Models of Davis, Penk, King, Gilbert and Hack. Fluvial geomorphology: Processes. Morphometric analysis of river basins and fluvial landforms. Hillslope processes and evolution. Coastal geomorphology- Processes and associated landforms. Classification of coasts. Wind action and arid landforms and Glaciers and glacial processes . Glacial landforms. Glaciation. Coral reefs.

3. Remote Sensing

Aerial photography: Types of aerial photographs, principles and methods, geometrical properties, stereoscopy, interpretation. Instruments for measuring and plotting. Geological application.

Satellite Remote Sensing: Electromagnetic spectrum, methods of acquisition and instruments. Microwave remote sensing. Different types of satellites used for natural resource evaluation.

4. Geo Informatics

Fundamentals of GIS: Basic concepts, Spatial data and non-spatial data, components of GIS.

Spatial data: Spatial entities, Spatial referencing, Topology, Raster and Vector data

Data input and editing: Data sources, Scanning, Digitizing, Geo referencing, GCPs, coordinate conversion, Data Editing – Detecting and correcting errors, transformation and generalization, Edge matching and rubber sheeting.

Global Positioning System: Over view of GPS and its applications.

5. Structural Geology

Deformation of rocks: Isotropy, Anisotropy. Competency and incompetency. Elastic, plastic and rupture stages. Classification of Joints, Folds , and Faults. Tectonites: Foliation and Lineation. Petrofabric analysis. Primary and secondary structures. Unconformities. Geological field mapping.

6. Geotectonics

Continental Drift. Plate Tectonics. Sea-floor Spreading. Polar Wandering and Polar Reversals. Mid-oceanic Ridge System. Island Arcs. Subduction Zones. Trenches. Orogeny.

7. Stratigraphy

Principles of stratigraphy. Modern stratigraphic classification and nomenclature. Correlation. Stratigraphy of shield areas. Greenstone Belts and Granulites.

8. Indian Geology

Precambrian, Palaeozoic, Mesozoic and Cenozoic stratigraphic units of India and their distribution. Age problems in Indian stratigraphy. Stratigraphy of Kerala.

9. Palaeontology

Kinds of fossils and fossilization. Origin of life. Precambrian life. Geological history of major invertebrate phyla. Evolution of elephants, horse and man. Plant fossils of Gondwana Supergroup. Micropalaeontology: Foraminifers, ostracodes and conodonts. Palynology.

10. Crystallography

Symmetry elements and classification of crystals. 32 crystal classes and forms of crystal systems.

Crystal projections: Spherical, Stereographic and gnomonic

11. Optical Mineralogy

General principles of mineral optics. Optical accessories. Optical properties of minerals of all crystal systems. Optical anomalies in minerals

12. Descriptive Mineralogy

Physical and chemical properties of minerals. Classification of minerals. Classification of Silicate minerals. Olivine, Pyroxene, Amphibole, Mica, Feldspar, Feldspathoid, Zeolite, Garnet, Epidote and aluminosilicate group of minerals. Oxides, Hydroxides, Carbonates, Phosphates, Halides, Sulphides, and other common rock forming minerals.

13. Geochemistry

Cosmic abundance of elements. Primary geochemical differentiation of the Earth . Geochemical classification of elements. Geochemical dispersion. Geochemical cycles. pH, Eh, Eh-pH diagrams. Dox potential. Entropy. Enthalpy. Trace elements and their importance.

Isotope geology: Applications of isotopes - stable isotopes of Carbon, Oxygen, Hydrogen and Sulphur.

14. Igneous Petrology

Forms of igneous bodies. Structures of igneous rocks. Textures: Description and origin of Granite, Granodiorite, Diorite, Granophyre, Syenite, Gabbro, Peridotite, Dunite, Dolerite, Lamprophyre, Pegmatite, Aplite, Kimberlite, Carbonatite, Rhyolite, Trachyte, Dacite, Andesite, Basalt, Anorthosite, Ophiolite, Komatite.

Phase rule and equilibrium in silicate systems. Unary, binary and ternary systems. Order of crystallization of magmatic minerals. Reaction principle. Variation diagrams.

15. Sedimentary and Metamorphic Petrology

Classification of sedimentary depositional environments. Origin of sediments. Textures and structures of sedimentary rocks. Provenance. Heavy minerals and their significance. Lithification and diagenesis. Description of sandstones, limestones, mudstones, evaporates and phosphorites.

Agents of metamorphism. Types and controls. Structures . Mineral paragenesis. Facies and grade of metamorphism. Graphical representation of mineral paragenesis. Acf, AKF and AFM diagrams. Anatexis and palingenesis. Petrography and petrogenesis of schists, gneisses, charnockites, granulites, Amphibolites, Khondalites, marbles, Eclogites, and Migmatites. Retrograde metamorphism.

16. Economic Geology

Processes of formation and characteristics features of various types mineral deposits. Controls of localization of ore mineralization. Theories of ore genesis. Metallogenic epochs and metallogenic provinces.

Genesis, geological settings, mode of occurrence and distribution of deposits of iron, copper, lead, zinc, aluminium, magnesium, manganese, chromium, uranium and titanium in India . Major Indian occurrences of mica, asbestos, barites, graphite, gypsum, precious and semi-precious minerals. Indian occurrence of refractory minerals, abrasive minerals, and minerals used in ceramic, glass, fertilizer, cement, paint, pigment industries.

Distribution and nature of occurrence of coal, petroleum , natural gas and atomic minerals in India

17. Exploration Geology

Methods of surface and subsurface exploration. Field equipments and field tests used in exploration. Guides for locating ore deposits. Various methods of geological, geophysical, geochemical, geobotanical exploration methods. Principles of sampling and assaying and estimation of ore reserves. Methods and types of drilling . Reserve and resource.

18. Hydrogeology

Hydrologic cycle. Origin of ground water. Hydrogeological properties of rocks: Porosity, permeability, void ratio, transmissivity, storativity, specific yield, specific retention. Classification of rock bodies on the basis of water bearing properties: aquifer, aquifuge, aquiclude and aquitard. Types of aquifers. Coastal aquifers and sea water intrusion. Laws of ground water movement. Water Table, Darcy's Law. Piezometric surface. Aquifer tests and pumping tests. Chemistry of ground water and methods of plotting of chemical data. Ground water provinces of India. Exploration method for groundwater.

Recharging aquifers, Methods and techniques of rainwater harvesting.

19. Engineering Geology

Engineering properties of rocks. Criteria for the selection of dam sites, tunnel sites, and reservoir sites. Landslides, types, causes and mitigation.

20. Mining Geology

Terminology. Methods of mining – alluvial, open cast and underground. Coal mining methods. Ore beneficiation. Mining and beneficiation of beach placers of Kerala

21. Environmental Geology

Natural resources- their conservation, management and sustainable development. Impact of mining on environment. Pollution of air, water . Biochemical oxygen demand and chemical oxygen demand. Global warming and ozone depletion. Environmental impact of earthquakes, and volcanoes. Environmental Impact Assessment (EIA) models. Disaster management.