

## INTRODUCTION TO GEOLOGY – PART I

- UNIT-I
- i) Geology and its perspectives. Earth in the solar system: origin, size, shape, mass density rotational and revolution – parameters.
  - ii) Internal structure, formation, and chemical composition of crust, mantle and core.
  - iii) Formation of atmosphere, hydrosphere, and biosphere.
  - iv) Age of the earth. Radioactivity. Production of magnetic field.
  - v) Origin of the solar system and universe with Indian perspective.
- UNIT-II
- i) Elementary ideas of continents drift and plate Tectonics.
  - ii) Origin of oceans, continents and mountains.
  - iii) Earthquake and earthquake belts , measure of earthquake, Volcanoes-types and distribution
  - iv) Rock Weathering, Erosion and transportation by rivers.
  - v) Erosion and transportation by wind, glaciers.
- UNIT-III
- i) Wave erosion and beach processes.
  - ii) Map Scale, Slope, Dip, Strike, definition and measurement.
  - iii) Unconformity: Definition and classification.
  - iv) Forms of igneous bodies.
  - v) Elements of deformational structures.
- UNIT-IV
- i) Elementary idea about crystal structure, crystal faces, edges, solid angles and zone.
  - ii) Crystallographic axes and axial angles. Axial parameters and indices.
  - iii) Crystal symmetry, plane, axis and centre of symmetry.
  - iv) Classification of crystals: Symmetry elements of normal classes of Cubic , Tetragonal and Hexagonal systems.
  - v) Classification of crystals: Symmetry elements of normal classes of Orthorhombic, Monoclinic and Triclinic systems.
- UNIT-V
- i) Definition and classification of minerals. Physical properties of minerals
  - ii) Optical mineralogy – Refractive indices, twinkling, birefringence, pleochroism, interference colors,
  - iii) Physical and optical properties of Quartz and Feldspar.
  - iv) Physical and optical properties of Hypersthene, Augite, Hornblende.
  - iv) Physical and optical properties of Muscovite, Biotite, Garnet.

## INTRODUCTION TO GEOLOGY – PART II

- UNIT-I
- i) Magma : definition and composition.
  - ii) Tabular classification of igneous rocks.
  - iii) Definition and agents of metamorphism.
  - iv) Textures and classification of metamorphic rocks.
  - v) Structures of metamorphic rocks.
- UNIT-II
- i) Origin, transportation and deposition of sediments. Consolidation and diagenesis.
  - ii) Sedimentary texture.

- iii) Classification of sedimentary rocks: Terrigenous and chemical sedimentary rocks.
- iv) Definition and scope of paleobiology, process of fossilization and preservation.
- v) Elementary ideas about origin of life, evolution and fossil record.

- UNIT-III
- i) Morphology, environmental factors and geological distribution of Mollusca.
  - ii) Morphology, environmental factors and geological distribution of Brachiopoda
  - iii) Gondwana plant fossils and their significance.
  - iv) Principles of Stratigraphy. Geological time scale.
  - v) Stratigraphic correlation.

- UNIT-IV
- i) Physical and structural subdivisions of Indian sub continents and their characteristics.
  - ii) Classification and distribution of Dharwars.
  - iii) Classification and distribution of Aravallis.
  - iv) Sausar group and Sakoli group.
  - v) Cuddapah group.

- UNIT-V
- i) Brief account of geology and distribution of Vindhyan and Chhattisgarh.
  - ii) Classification and geographic distribution of Gondwana in India.
  - iii) Geology and age of Deccan Traps, inter-trappeans and infra-trappean.
  - iv) Classification and distribution of Siwalik.
  - v) Evolution of Himalayas.

### GEODYNAMICS AND STRUCTURAL GEOLOGY

- UNIT-I
- i) Concept and theory of Isostasy, Gravity, Magnetism & Palaeomagnetism.
  - ii) Orogeny, Epierogeny, Mountain building.
  - iii) Theory of continental drift and sea/ocean floor spreading.
  - iv) Theory of Plate tectonics, Types and nature of Plate Boundaries
  - v) Mid oceanic ridges, Trenches, Origin of island arcs, distribution and importance.

- UNIT-II
- i) Island arcs and trenches, their distribution and importance.
  - ii) Tectonics of continental boundaries: continental shelf, slopes and abyssal sea.
  - iii) Concept of neotectonics and their parameters.  
( Active fault, Geomorphic indicators, River course change, Recurrent seismicity)
  - iv) Unconformities, Recognition and its geological importance. Overlap and off lap, Outlier and inlier.
  - v) Morphology of folds and its Geometrical classification.

- UNIT-III
- i) Genetic classification of folds.
  - ii) Causes and Mechanics of folding.
  - iii) Recognition of folds in maps and topography. Effects of folds on outcrops.
  - iv) Genetic and Geometrical classification of faults.
  - v) Effects of fault on outcrop.

- UNIT-IV
- i) Genetic and Geometrical classification of Joints.

- ii) Salt domes.
- iii) Foliation : Description, origin and relationship with mega structures.
- iv) Lineation: Description, Type, Origin & relationship with mega structures.
- v) Top and Bottom criteria on the basis of primary igneous and sedimentary structures.

- UNIT-V
- i) Concept of stress and strain. Stress and Strain ellipsoid.
  - ii) Stages of rock deformation.
  - iii) Basic concepts of mechanics of faulting.
  - iv) Stereographic projections and its application in structural geology.
  - v) Tectonic structure of India.

### PETROLOGY, STRATIGRAPHY AND EARTH'S HISTORY

- UNIT-I
- i) Classification of Igneous rocks. Concept of rock series.
  - ii) Basic principles of equilibrium thermodynamics. Phase equilibria in two and three component silicate system: (Albite – Anorthite), (Diopside – Anorthite) (Diopside - Albite – Anorthite).
  - iii) Mineralogical petrological characteristics of acid igneous rocks: Granite, Pegmatites, Rhyolites.
  - iv) Mineralogical petrological characteristics of Alkaline and basic igneous rocks: Syenite, Nephelene syenite, Carbonatite, Basalt, Dolerite, Gabbro.
  - v) Mineralogical petrological characteristics of ultramafic rocks: Dunite, Peridotite, Kimberlite, Komatite.
- UNIT-II
- i) Metamorphic facies and Isogrades.
  - ii) Evolution of pelitic rocks with reference to pressure – temperature composition.
  - iii) Evolution of basic and calcareous rocks with reference to pressure – temperature condition.
  - iv) Paragenetic diagrams : projective analysis ACF and AKF diagram.
  - v) Chemistry of weathering processes – Diagenesis of terrigenous and chemical sediments.
- UNIT-III
- i) Concept of sediment depositional environment: fluvial, lacustrine, deltaic, deep sea environments.
  - ii) Concept of sedimentary and stratigraphic facies.
  - iii) Parameters of palaeoclimate, Palaeoenvironment studies.
  - iv) Stratigraphic classification and correlation.
  - v) Methods of collecting stratigraphic data – identification of stratigraphic contacts and unconformities.
- UNIT-IV
- Study of classification, geographical distribution, petrological characteristics, accumulated fossils and economic importance of the following stratigraphic basins:

- i) Dharwar, Singhbhum, Sausar, Bastar and Pre Cambrian rocks of Aravalli Supergroup.
- ii) Cuddapah, Vindhyan and Pre Cambrian rocks of Chhattisgarh Super group.
- iii) Palaeozoic rocks of salt range and Gondwana Supergroup.
- iv) Mesozoic rocks of Spiti, Kutch and Trichnapalli, Deccan Traps and Intertrappean beds.
- v) Tertiary rocks of Assam and Siwalik Group. Glacial periods : Causes of glacial ages and glacial-eustasy.

**UNIT-V Earth's History:**

- i) Ontogeny and variation in fossil assemblage. Identification of fossils, methods of description and illustration, taxonomic categories and codes of systematic nomenclature.
- ii) Application of palaeontologic data in palaeoecology, evolution, stratigraphy and palaeogeographic reconstructions.
- iii) Morphology, environment and geological distribution of mollusca and Brachiopoda.
- iv) Morphology, environment and geological distribution of echinodermata, arthropoda and anthozoa.
- v) Basic ideas about micropalaentology and microfossils. A brief study of vertebrates and plant fossils.

**ORE FORMING PROCESSES AND MINERAL RESOURCES**

- UNIT-I**
  - i) Distribution of mineral deposits in space and time.
  - ii) Conventional and non-conventional energy resources: solar energy, water, wind, hot springs and sea waves.
  - iii) Ore forming minerals – Metallic and non-metallic. Process of formation of ores – magmatic concentration.
  - iv) Hydrothermal processes, skarns.
  - v) Weathering products and residual deposits. Oxidation and supergene sulphide enrichment.
  
- UNIT-II**
  - i) Sedimentation as a process of ore formation.
  - ii) Replacement and bacterial precipitation. Colloidal deposition, Evaporation of Brine.
  - iii) Metamorphism as ore forming process.
  - iv) Indian tectonics and metallogeny through geological times.
  - v) Geological setting, mineralogical characters and Indian distribution of Iron-manganese - chromium.
  
- UNIT-III**
  - i) Geological setting, mineralogical characters and Indian distribution of copper – Lead - Zinc.
  - ii) Geological setting, mineralogical and characters and Indian distribution of Gold - Aluminium.
  - iii) Geological setting, mineralogical characters and Indian distribution of refractory, fertilizer minerals.

- iv) Geological setting, mineralogical characters and Indian distribution of non metallic deposits used in cement, chemical industry including building stones.
- v) Geological setting, mineralogical characters and Indian distribution of Gem stones.

- UNIT-IV**
- i) Process of ore beneficiation: Primary and secondary methods.
  - ii) Environmental implications of exploitation of mineral resources.
  - iii) Origin of coal deposits, definition and stratigraphy.
  - iv) Basic concepts of coal petrology: Peat, lignite Bituminous and Anthracite.
  - v) Indian coal deposits with special reference to Chhattisgarh.

- UNIT-V**
- i) Origin of natural hydrocarbon, transportation and accumulation, sources and factors.
  - ii) Types of Oil traps – structural, stratigraphic and mixed type.
  - iii) Indian offshore and onshore petroleum deposits.
  - iv) Radioactive minerals – Mineralogical, geochemical survey techniques.
  - v) Distribution of radioactive minerals in India.

## **NATURAL ENVIRONMENT, REMOTE SENSING, GROUNDWATER AND MINERAL EXPLORATION**

- UNIT-I**
- i) Concept of Environmental Geology and definition.
  - ii) Soil formation – Soil types.
  - iii) Soil erosion and its causes.
  - iv) Landslides and floods, causes and prevention.
  - v) Global warming, causes and prevention.

- UNIT-II**
- i) Dams and Tunnels: Types, terminology, Site selection criteria.
  - ii) Study of environmental impact in connection with construction of large Dams, Reservoir and Tunnels.
  - iii) Preliminary studies of Aerial photographs and Satellite Imageries.
  - iv) Application of Remote Sensing Techniques in planning Urban development and Large engineering structures.
  - v) Construction of Photogeological maps.


- UNIT-III**
- i) Water cycle, concept of watershed.
  - ii) Water Bearing Rocks: Aquifer, aquiclude, aquitard, acquifuse.
  - iii) Types of aquifers: Confined, unconfined, perched.
  - iv) Darcy Law and its validity.  
Hydrogeological properties of rocks, Ground water provinces of India.

- UNIT-IV**
- i) Fundamentals of prospecting and exploration: sampling, drilling, and assaying, borehole logging.
  - ii) Gravity, Electrical and magnetic methods of mineral survey.
  - iii) Aerial and Seismic method of mineral survey.

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- iv) Geobotanical and Geochemical prospecting.
- v) Groundwater exploration: Geological and Electrical methods.

- UNIT-V**
- i) Changing scenario of mineral consumption.
  - ii) National Mineral Policy.
  - iii) Mineral concession rules.
  - iv) Marine Mineral resources and Law related to them.
  - v) Mineral resources of Chhattisgah.

  
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