

**FURTHER DETAILS REGARDING MAIN TOPICS OF  
PROGRAMME NO. 05 / 2010**

**JUNIOR HYDRO GEOLOGIST**

**GROUND WATER DEPT.**

**CATEGORY NO. 9/2009**

**1. Crystallography & Mineralogy**

Crystalline state. Translation periodicity of crystals. 32 crystal classes and stereographic projection of crystal. Study of the important rock forming minerals. Isotropic and anisotropic minerals. Petrological microscope. Pleochroism and scheme of pleochroism. Interference colours. Uniaxial and biaxial indicatrices. Vibration direction and sign of elongation in minerals.

**2. Geomorphology**

Geomorphic principles and processes. Drainage basin. Morphometric analysis of drainage basins. Open channel hydraulics. Fluvial landforms. Concept of rejuvenation and interruptions in the evolution of landforms. Models of landscape evolution. Coastal geomorphology. Shoreline processes and associated landforms. Wet lands. Geomorphology of Kerala.

**3. Petrology**

Magma and its differentiation. Significance of isotopic studies in igneous petrology. Textures and structures of igneous rocks, Classification of igneous rocks. Crystallization of magma, Magmatic differentiation, and Assimilation, Role of volatiles, Study of binary and ternary systems: Albite-Anorthite system, Forsterite-Silica system, Feldspathoid-silica system, Diopside-Albite-Anorthite system.

Concept of metamorphic zones, grades and facies. Types of metamorphism and their controlling factors. Textures and structures of metamorphic rocks. Retrograde metamorphism. Metasomatism. Regional and thermal metamorphism of pelitic rocks, basic igneous rocks and carbonate rocks. Mineral paragenesis.

Origin of sediments. Parent rocks and their products. Sediment transport mechanism; Deposition by fluids, Lithification and Diagenesis. Sedimentary Textures and structures. Classification of sedimentary rocks.

#### **4. Structural Geology**

Concept of stress and strain, stress strain relationship of elastic, plastic and viscous materials. Theory of rock failure, Behaviour of rocks and minerals with respect to stress and strain. Measurement of strain in deformed rocks. Mechanics of folding, Classification of folds. Folding in shear zones. Faults: Classifications and Genesis. Thrust belts and Nappes. Joints: Classification and Genesis. Origin and significance. Rock cleavages, foliation and lineation. Structural Analysis: Principles, phases, Scale, homogeneity and symmetry of structural analysis. Structural analysis on microscopic, mesoscopic and megascopic scales.

#### **5. Hydro geology**

Hydrogeological properties of rocks. Porosity, void ratio, permeability, transmissivity, storativity, specific yield and safe yield. Aquifers, Aquiclude, Aquitard, Aquifuge. Movement of ground water - Darcy's law and its application in hydrology. Hydraulic conductivity of geologic materials. Determination of Hydraulic conductivity - Formula, laboratory methods and field tests. Ground water exploration techniques. Uses of satellite imageries in groundwater studies. Quality of ground water. Saline water intrusion in coastal aquifers. Artificial recharge of ground water. Ground water development and management. Rainwater harvesting.

#### **6. Indian Stratigraphy**

Stratigraphic principles and evolution. Distribution, lithology, tectonic history and correlation of Archaeans and Proterozoics of India. Phanerozoic stratigraphy of India with world equivalence. Gondwanas. Deccan traps and Tertiaries of East coast. Cenozoic formations.

#### **7. Paleontology**

Evidence of life in Precambrian times. Origin and evolution of life. Brief study of morphology, classification, evolutionary trends and distribution of Invertebrate phyla: Mollusca, Brachiopoda, Echinodermata, and Corals. A brief account of the vertebrate sequence through geological time. Study of evolution of Fishes, Elephant, Horse and Man. Micropaleontology and its applications in geology. Foraminiferal studies. General morphology of spores and pollens.

#### **8. Marine Geology**

History of Marine geological studies. Physical and chemical properties of sea water. Coastal processes. Coastal geomorphology. Coastal regulatory zone. Sea bottom topography. Marine mineral resources. Polymetallic nodules. Eustatic changes of sea level. Distribution and classification of marine sediments. Coastal protection measures.

#### **9. Economic Geology**

Classification of mineral deposits. Mode of occurrence of mineral deposits, their morphology and relationship with host rocks. Controls of localization of minerals. Study of the following ore deposits with reference to their geological and tectonic setting, genesis and distribution: Cu, Pb, Zn, Mn, Fe, Cr, Al and Au. Atomic minerals. Coal- origin of peat, lignite, bitumen and anthracite. Petroleum and natural gas- origin, migration and entrapment of petroleum, properties of source and reservoir rocks, structural; stratigraphic and combination traps, petroliferous basins of India. Significance of minerals in national economy.

## **10. Mining Geology**

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Alluvial mining, Open cast mining, Underground mining Coal mining, Sea bed mining  
Fundamentals of ore dressing:- Crushing, grinding, sizing. Concentration by washing, scrubbing, jigging, tabling, floatation, magnetic and electrostatic separation.

## **11. Remote sensing and GIS**

History of aerial photography. Satellite Remote Sensing, Image interpretation and Digital Processing Techniques. Principles of Terrain Analysis. Interpretation of topographic and tectonic features. Rock type identification. Uses of remote sensing in resource exploration, applications in environmental studies, natural hazards and groundwater potential evaluation. Indian space missions.

Fundamental of GIS. Spatial data, mapping concepts and co-ordinate system, projections, Global positioning systems, spatial data structure- Raster and Vector, Topology, spatial data modeling and analysis- digital terrain model- digital elevation model- application of GIS in geology, urban planning, forestry, agriculture and natural resource management.

## **12. Engineering geology**

Engineering properties of rocks and soils. Rocks as building material. Engineering seismology, earthquake resistant design. Geological investigations for major civil engineering projects. Decorative stones. Dams : classification, foundation, abutment and reservoir problem. Geological aspects of dam site investigation. Tunnels: Geological factors in tunneling. Landslides: types, causes and prevention. Stability of slopes.

## **13. Environmental Geology**

The physical environment of the earth. Ecological perspective of environment. 1 Conservation and preservation of natural resources. Concept of sustainable development of natural resources. Natural hazards Earthquakes, landslides and Floods. Hazard Zonation maps. Wastes and their disposal: solid, liquid, gaseous and radioactive wastes. Problems of pollution of geospheres. Urban development.

## **14. Exploration Geology.**

Surface and subsurface explorations. Selection of areas for prospecting . Nature and extent of overburden. Sequence of exploration. Exploratory drillers. Preparation of level plane and profiles. Ore reserve calculation. Exploratory mining. Principles, chief methods, and applications of Geophysical surveys. Programming application in the analysis of ore- reserve estimation and statistical calculation pertaining to Geological data.

**NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.**