Maharashtra Public Service Commission

Civil Services Exam – Mains Optional

Geology

(Code No : 603)

Paper - I

Standard : Degree **Total Marks** : 200
Nature of Paper : Conventional Type **Duration** : 3 Hours

Note : 1) Answers to this paper must be written in English only
2) This paper will test the candidate's ability to comprehend, to analyse, to interpret, to criticise and to appraise subject matter related to the topics/sub topics mentioned below.
3) It is expected from candidates to study the latest and recent developments and happenings pertaining to the topics/sub topics mentioned below.

Section - A (Marks : 50)

1) General Geology :

.01) **(i)** Universe, components of the universe. Solar system, theories of origin of solar system. Meteorites and their classification. Age of the earth. Origin of continents and ocean basins.

(ii) Internal structure of the earth. Earthquakes, their distribution and causative factors. Volcanoes, volcanic belts of the world and their relation to evolution of the earth.

.02) **Continental drift :** Concept, evidences and objections. Sea floor-spreading- mid oceanic ridges, trenches and arcs. Plate Tectonics - concept, types of plate boundaries, plumes and hot spots. Mountain building processes.

.03) Geological work of water, wind and glaciers.

Section - B (Marks : 50)

2) Geomorphology :

Basic concepts in geomorphology. Geomorphic cycles. Weathering and soil formation. Erosion. Landforms, slopes and drainage patterns. Relation between landforms and geology. Geomorphology of the Indian Subcontinent. Geomorphic features of Maharashtra.

3) Remote Sensing :

.01) Concept of remote sensing. The electromagnetic spectrum. Aerial photography. Interpretation of aerial photographs. Indian Remote Sensing (IRS) satellites. Imageries- IRS products, MSS bands- blue, green, red and near infra red, False Colour Composite (FCC).

.02) Application of remote sensing in geology and natural resources. Introduction to Geographical Information System (GIS) and Global Positioning System (GPS). Computer applications in remote sensing.

4) Structural Geology :

Stratification. Attitude of beds. Outcrops and Outcrop patterns. Joints - classification. Faults - classification and recognition. Folds- classification and recognition. Unconformities - classification and recognition. Concept of foliation and lineation. Introduction to petro-fabric analysis.

Section - C (Marks : 50)

5) Principles of Stratigraphy :

Principles of stratigraphy. Geologic Time Scale. Stratigraphic units-Lithostratigraphic, Biostratigraphic, Chronostratigraphic and Magnetostratigraphic. Methods of correlation.

6) Stratigraphy of India :

Introduction to Precambrian and Phanerozoic sequences of India. Gondwana Supergroup. Deccan Traps. Study of climatic conditions and palaeogeography of Indian Subcontinent. Stratigraphy of Maharashtra.

7) Palaeontology :

.01) Conditions of fossilisation. Modes of preservation of fossils. Types of fossils. Morphology and geological distribution of Lamellibranchs, Gasteropods, Cephalopods, Brachiopods, Echinoderms and Trilobites.

.02) Evolution of Man and Horse. Microfossils and their importance in petroleum exploration. Plant fossils from Gondwana Supergroup.

Section - D (Marks : 50)

8) Hydrogeology :

.01) Hydrologic cycle. Vertical distribution of subsurface water. Movement of groundwater. Rock properties affecting groundwater- porosity, permeability, hydraulic conductivity, transmissivity, specific retention, specific yield and storage coefficient. Aquifers and their types. Different rocks types as aquifers. Water quality.

.02) Exploration for groundwater. Groundwater recharge. Methods of artificial groundwater recharge. Conventional and non-conventional methods of rainwater harvesting. Groundwater management-technical and social aspects. Concept of watershed management.

9) Engineering Geology :

.01) Engineering properties of rocks and soils. Building stones. Geological investigations for dams, tunnels, bridges, highways, railways and stability of slopes.

.02) Engineering geological aspects related to mitigation of natural hazards like coastal erosion, floods, landslides, earthquakes, tsunamis and volcanic activity.

Paper - II

Standard : Degree **Total Marks** : 200

Nature of Paper : Conventional Type **Duration** : 3 Hours

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Section - A (Marks : 50)

1) Mineralogy :

.01) Crystal Elements. Classification of crystals into systems. Normal classes of symmetry. Crystallographic notations.

.02) Physical properties of minerals. Isomorphism, Polymorphism and Pseudomorphism. Physical properties, chemical composition and occurrences of following rock forming mineral groups- Silica, Feldspars, Olivine, Pyroxene, Amphibole, Mica, Chlorite, Garnet and Alumino-silicates. Physical properties, chemical composition and occurrences of ore minerals, industrial minerals and gemstones.

.03) Petrological microscope and its accessories. Following optical properties of the above (1.02) rock forming minerals- form, colour, pleochroism, cleavage, isotropism, extinction, and interference colours. Common minerals in igneous rocks, sedimentary rocks and metamorphic rocks.

2) Petrology :

.01) **Igneous Petrology :** Origin of magma. Primary magma. Crystallisation of magma- unicomponent, binary and ternary . Reaction principle. Intrusive and extrusive forms of igneous rocks. Petrogenetic significance of textures and structures of igneous rocks. Tabular classification of igneous rocks. Petrography of granite, pegmatite, diorite, andesite, syenite, trachyte, gabbro, dolerite, basalt, anorthosite, dunite, peridotite and lamprophyres. Magmatic differentiation and assimilation.

.02) **Sedimentary Petrology :** Origin of sediments. Diagenesis and lithification. Clastic and non-clastic rocks and their classification. Provenance. Depositional environments. Petrogenetic significance of sedimentary textures and structures.

.03) **Metamorphic Petrology :** Agents and types of metamorphism. Depth zones. Metamorphism of quartzo-feldspathic, argillaceous and basic igneous rocks. Metamorphic grades and zones. Retrograde metamorphism. Metasomatism. Migmatites. Petrogenetic significance of metamorphic textures and structures.

Section - B (Marks : 50)

3) Economic Geology :

.01) Ore, ore minerals and gangue, tenor. Processes of formation of mineral deposits- magmatic concentration, contact metasomatism, hydrothermal, oxidation and supergene enrichment, residual concentration, mechanical concentration and evaporation.

.02) Economic mineral deposits of Maharashtra. National Mineral Policy - basic objectives and salient features. Strategic, critical and essential minerals. Conservation and utilization of mineral resources.

4) Mineral Fuels :

.01) Origin and entrapment of petroleum. Petroleum traps. Petroliferous basins of India, particularly of Maharashtra.

.02) Origin and classification of coal. Coal deposits of India, particularly of Maharashtra. Atomic mineral deposits of India.

Section - C (Marks : 50)

5) Mineral Exploration :

.01) **(i)** Methods of prospecting for mineral deposits-Geological, Geobotanical, Geochemical

and Geophysical – remote sensing, gravity, magnetic, seismic and electrical methods.

(ii) Introduction to drilling methods. Sampling and assaying. Borehole logging.

.02) Modes of occurrence of ore bodies. Morphology of ore bodies and their relationship with host rocks. Structural, stratigraphic and physico-chemical controls of ore localization.

6) Mining Geology :

Methods of mining-Open cast mining, Underground mining-shaft sinking, drifting, crosscutting, winzing, stopping, room and pillaring, top slicing, sublevel caving and block caving. Ocean bottom mining.

Section - D (Marks : 50)

7) Geochemistry :

Abundance of elements : Atomic structure of elements. The periodic table. Ionic substitution in minerals. Geochemical classification and distribution of elements in the earth. Principles of geochemical cycling.

8) Environmental Geology :

.01) Concept of ecosystem-biotic communities, food chain and ecologic pyramids. Impact of anthropogenic activities on air, water and soil resources. Problems of pollution and hazardous waste.

.02) **(i) Natural Hazards :** Causative factors and mitigation measures. Floods, earthquakes, tsunamis, landslides and volcanoes. Pollution due to mining, mining hazards and their mitigation. Conservation of energy and alternative sources of energy- geothermal, solar, wind, tidal and biomass.

(ii) Sustainable development and environment protection - industrial, agricultural and mining. Role of geologist in disaster management.

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