

**SYLLABUS FOR WRITTEN TEST FOR THE POSTS OF GEOLOGICAL ASSISTANTS
IN JKSPDC**

S. No	Examination Type	Subjects	No. of Questions	Marks	Duration
1	Multiple Choice Questions	General Intelligence and Reasoning General Awareness (Common to all disciplines)	20	20	2 hours
2		Discipline oriented	80	80	

As per the Official JKSPDC Geological Assistants Syllabus, you are supposed to have decent reasoning and knowledge of Current affairs and General Knowledge.

GENERAL INTELLIGENCE & REASONING:

15 Marks

Marks Questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem-solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the your ability to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

GENERAL AWARENESS:

05 Marks

Marks Questions will be aimed at testing your general awareness of the environment around you and its application to society. Questions will also test your knowledge of current events and of matters of everyday observations and experiences in their scientific aspect. The test will also include questions relating to India and its neighboring countries especially pertaining to History, Culture, Geography, Economic Science, General Polity.

GEOLOGY- 80 Marks

1. Geomorphology, Remote sensing and Geographic Information System:

05 Marks

Geomorphological processes, elements-physical, chemical and biological. Landform evolution by various agencies: river, glaciers, wind, mass movements, and in soluble terrain etc. Landforms in relation to lithology and structure. Drainage basin morphometry. Classification of slopes, forms, slope regression, slope maps and slope evolution. Geomorphic and neotectonic features of Himalayan Region. Morphotectonic evolution of Himalaya and Tibetan Plateau.

Fundamental concepts of remote sensing; general idea about electromagnetic spectrum; spectral bands, resolutions and reflectance curves; interaction of EMR with atmosphere, rocks, minerals and soils; aerial photographs and their geometry; recognition of photo-elements; recent advancement and application.

Satellite remote sensing; global and Indian space missions; different satellite exploration programs and their characteristics:

Imageries and IRS products LANDSAT, METEOSAT, SEASAT, SPOT and IRS; visual interpretation of satellite images; computer application in Remote sensing. Use of satellite images in monitoring natural hazards and environment. Application of remote sensing in engineering geology, groundwater and petroleum exploration. Concept of Geographic Information System and its application in Geological mapping.

2. Mineralogy

05 Marks

Silicate structures of minerals; physical and chemical properties of minerals. Classification of minerals: native elements, silicates and non silicates, structure and classification of silicates. Structure, distinguishing features and paragenesis of major oxide, sulphate, sulphide and carbonate minerals. Structure, classification, distinguishing features and paragenesis of various groups namely Olivine, Garnet, Pyroxene and Pyroxenoid, Amphibole, Silica, Feldspar-alkali feldspar & Feldspathoid, plagioclase feldspar, Mica and Epidote.

Elements of optics: Nature of light, electromagnetic spectrum, total internal reflection and critical angle, wave and wave front. Linear, circular and elliptical polarized light; Methods of obtaining plane polarized light. Phase difference, retardation, interference of light. Optical accessories and their uses, interference colours, abnormal interference colours. Extinction and its categories, measurement of extinction angle, uses of extinction angle. Optical indicatrix: uniaxial and biaxial indicatrix and their principal sections, optic orientation of biaxial indicatrix. Conoscopic illumination, formation of isogyres and isochromes in uniaxial minerals, optic axis and off centered optic axis interference figures, determination of optic sign. Biaxial interference figures: acute and obtuse bisectrix figures, determination of optic sign. Pleochroism and determination of pleochroic schemes for uniaxial and biaxial minerals; dispersion in biaxial minerals, anomalous dispersion. Optic angle determination by various methods.

3. Petrology

15 Marks

Igneous Petrology: Definition, nature, constitution, generation/evolution of magmas, generations of magmas and source rock composition: upper mantle and lower crust. Phase equilibrium of uni-component, binary, ternary and quaternary silicate systems; its relation to magma genesis and crystallization in the light of modern experimental works. Criteria for classification of the igneous rocks; CIPW- norms, Niggli values, IUGS classification. Petrology, geochemistry and genesis of major igneous rocks types of mafic, ultramafic, alkaline rocks, ophiolites, carbonatites, lamprolite, kimberlites, pegmatites and lamprophyres. Crystallization of basaltic and granitic magmas; mid oceanic ridge volcanism, continental flood basalts, Deccan basalt, basalt magmatism associated with subduction zone. Textures and classification of various igneous rocks.

Metamorphic Petrology: Types of metamorphism; Depth zones, metamorphic grades; mineralogical phase rule of closed and open systems; application of phase rule. Role of temperature, pressure and fluids in metamorphism; a detailed description of each facies of low

pressure, medium to high pressure and very high pressure with special reference to characteristic metamorphic zones and subfacies. Progressive, contact and regional metamorphism of quartzofelspathic, argillaceous and basic igneous rocks. Metamorphic differentiation, metasomatism; anatexis and origin of migmatites; regional metamorphism and pair metamorphic belts in reference to plate tectonics. Ocean floor metamorphism, metamorphism related to ophiolites, metamorphism and continental collision. Textures and structures of various metamorphic rocks

Sedimentary Petrology: Processes of transport and formation of sedimentary rocks; classification of sedimentary rocks; sedimentary textures and structures. Concept of grain size, grade-scale, phi-scale; Techniques of size analysis: sieve and pipette analysis. Particle morphology; shape forms, sphericity, roundness; Primary grain fabric: orientation of sand grains, gravels and fossils. Graphic presentation of grain size data; Textural parameters and their significance. Basic properties of fluids, laminar and turbulent flows, rapid and tranquil flows. Streamlines, flow regimes, flow separation. Sediment transport modes; sediment gravity flows: mud flows, grain flow, liquefied flows, turbidity flows. Porosity and permeability, pore morphology, effect of texture on porosity and permeability. Sedimentary environments and facies; continental environments - alluvial, lacustrine, desert- aeolian and glacial sedimentary systems. Marginal marine environments – deltaic, beach and barrier-islands, estuarine and lagoonal, tidal –flat system. Grain size, Textural Parameters and their Significance. Textural and compositional maturity. Petrography and Diagenesis origin of Sandstones, Limestones and Mudrocks. Evolution of sedimentary basins- tectonics and sedimentation. Heavy Minerals and their Importance in determination of Provenance. Deep sea basins; clastic petrofacies; palaeoclimate and palaeoenvironment analysis. Major diagenetic processes; diagenetic environments. Petrogenetic significance of textures and structures, Major Carbonate Minerals; Carbonate Grains of Biological origin.

4. Stratigraphy and Palaeontology

10Marks

Approaches to measurements of Geological time. Concepts of Sequence stratigraphy; brief ideas of quantitative-, magneto-, seismic-, chemo- and event stratigraphy. Approaches to palaeogeography. Stratigraphic correlations. stratigraphic code.

Precambrian stratigraphy ,Precambrian geochronology. Chronostratigraphy of the Precambrian of Dharwar Craton, Eastern Ghats Belt, Southern Granulite Belt and Singhbhum-Chhotanagpur-Orissa Belt. Proterozoic stratigraphy of Son Valley, Cuddapah-Kurnool and Chatisgarh basins. Precambrian-Cambrian boundary.

Stratigraphy and correlation of the Gondwana rocks; Mesozoics of Peninsular India; Cenozoic stratigraphy ,Problems of Cretaceous- Eocene boundary of India; Tertiary rocks of India and their correlation; Quaternary stratigraphy of India; Neogene- Quaternary boundary problem. Cretaceous-Tertiary boundary. Palaeogene and Neogene systems, Epoch boundaries of the Cenozoic in India.Stratigraphy, facies, and fossil contents of the Palaeozoic rock formations of India. Palaeozoic of Himalayas Permian-Triassic boundary.

Origin and evolution of fossils, Collection, preparation, preservation and maintenance of palaeontological record; microfossils; types of microfossils-foramenifera, calcareous, nanno , silicious, phosphatic, organic walled , application of micropaleontology in ocean science, palynology and its application.

Modern Taxonomy, Identification of fossils, Describing a fossil specimen, Ontogenic variation. Trace fossils: Kinds and classification; their significance in palaeoenvironmental reconstruction. Classification of Brachiopoda, Bivalvia, Ammonoidea and Cnidaria (corals) Evolutionary trends and Geological history of Brachiopoda, Bivalvia, Gastropoda, Ammonoidea, Trilobita, Echinoidea and Cnidaria (corals). Palaeoecology/Functional Morphology of Bivalves and Brachiopods. Evolution of fishes, equade, elephant, dinosaur and man.

5. Structural Geology and Tectonics

15 Marks

Mechanical principles and properties of rocks and their controlling factors; theory of rock failure; concept of stress and strain; two dimensional strain and stress analysis; types of stress and strain ellipses and ellipsoids, their properties and geological significance; strain marks in naturally deformed rocks. Translations, rotation, dilation and distortion, measurement of strain, displacement. Strain analysis by Mohr Circle Technique and Wellman Diagram.

Folds- Geometric classification of folds; mechanics of folding and buckling; folding in shear zones; distribution of strains in folds; structural analysis in terrain with multiple deformations.

Faults- Causes and dynamics of faulting; strike- slip faults; normal faults; overthrust and nappe. Fractures and joints- their nomenclature; age relationship; origin and significance.

Concept of petrofabric and the role of symmetry, indicator minerals and fabric diagrams. Rock fabric field relations, planar and linear fabric elements (foliation and lineation), and tectonic significance.

Fundamental concepts of geotectonic; recent advances, pros and cons; dynamic evolution of continental and oceanic crust; tectonics of Precambrian orogenic belts of India; tectonic framework of India; seismicity in India. Formation of mountain roots; anatomy of the orogenic belts; structure and origin of the Himalayan belt.

6. Geophysical Exploration

5Marks

Variation of gravity over the surface of the earth; principles of gravimeters; gravity field surveys; various types of corrections applied to gravity data; preparation of gravity anomaly maps and their interpretation in terms of shape, size and depth.

Geomagnetic field of the earth; magnetic properties of rocks; working principles of magnetometers; field surveys and data reductions; quantitative interpretation; magnetic anomalies due to single pole, dipole; introduction to aeromagnetic surveys.

Geophysical Surveying: Basic Principles of Seismic method, Resistivity method, magnetic method and gravity method.

Resistivity methods- various types of electrode configurations; field procedure profiling and sounding.

Seismic methods; fundamental principles of wave propagation; refraction and refraction surveys; concept of seismic channels and multi- channel recoding of seismic data; End- on and split spread shooting techniques; CDP method of data acquisition; sorting; gather; stacking and record section; seismic velocity and interpretation of seismic data.

Application in engineering geology, mineral and petroleum exploration; description of bore-hole environment; brief outline of various well- logging techniques; principles of electrical logging and its application in petroleum; groundwater and mineral exploration; prospecting for radioactive minerals.

Drilling: types of drilling methods. Sampling methods and assaying. Geochronology and its application in Geology, Radioactive dating Methods: K-Ar, C-14 and U-Pb methods

7. Hydrogeology

10 Marks

Precipitation – process, causes, types and measurements. Computation of average rainfall. Evapotranspiration – process, causes, factors influencing and measurements in the field and of empirical equations. Infiltration – process, factors affecting, measurements, relation to runoff and computation of runoff. Hydrographs. Elements of snow hydrology-factors influencing snow melt and determination of runoff (snow melt).

Ground water: origin, types, importance, occurrence, movement and reservoirs; renewable and non- renewable groundwater resources; hydrologic properties of rocks: porosity; permeability; specific yield; specific retention, hydraulic conductivity, transmissivity, and storage coefficient . Genetic and hydrologic classification of reservoir rocks and boundary conditions.

Darcy's law-assumptions, derivation, applications and limitations. Differential equation governing groundwater flow. Surface indicators of groundwater, fracture trace analysis. Unconfined, confined, steady, unsteady and radial flow to the well. Thies equation. Evaluation of aquifer parameters using Theim's, Thies, Cooper-Jacob and Walton methods. Pump tests methods data analysis and interpretation of hydrogeologic boundaries. Determination of aquifer parameters-Pump test; Step-draw down test (SDT), formation and well characteristics; Slug test. Partially penetrating well, well interference and criteria for spacing of wells. Aquifer-well relationships. Volume elasticity of confined aquifer. Different drilling methods used in the construction of shallow and deep wells. Various groundwater structures. Different well development and completion methods.

Hydrostratigraphic units, water table contour maps and flow net analysis. Concept of drainage basin and groundwater basin. Hot water springs, their origin, distribution and economic importance. Mode of occurrence of groundwater in unconsolidated and semi-consolidated formations.

Methods of artificial groundwater recharge; method of rainwater harvesting, problem of over exploitation of groundwater; groundwater legislation; water management in rural and urban areas, salt water intrusion in coastal aquifers; remedial measures.

Surface and sub surface geophysical and geological methods of groundwater exploration; hydrogeomorphic mapping using various Remote Sensing techniques; radioisotopes in hydrogeological studies, concept of watershed management, ground water management technical and social aspects.

Physical and chemical properties of water. Quality criteria for domestic, irrigation and industrial use. Graphic presentation of water quality data. Groundwater quality in different provinces of India.

8. Engineering Geology

15 Marks

Engineering properties of rocks: specific gravity, porosity, sorption, absorption value, compressive strength, poisson's ratio etc.

Physical and Engineering properties of soil: structure, texture, colour, density, porosity, permeability, void ratio, etc.

Rock as Engineering Material: Requirement of good building stone, selection criteria for mass concrete works. Quarry and borrow site identification and investigations/studies. Coarse and fine aggregates: Wearing and Non Wearing Surfaces.

Laboratory investigations for coarse aggregates: Physical Tests- Specific Gravity, Water Absorption, Aggregate Impact Value, Aggregate Crushing Value, Aggregate Abrasion Value (by Los-Angeles), Soundness Loss and Crushing Strength; Chemical Tests- Aggregate Reactivity Test (alkali-aggregate, alkali-carbonate), and also by Mortar Bar Method; and Petrographic Tests- Petrographic Examination of coarse samples.

Laboratory investigations for fine aggregates: Physical Tests- Sieve Analysis, Organic Impurities, Grading and Fineness Modulus, Soundness Loss, Specific Gravity, Mica Contents, Compressive Strength of Cement; Chemical Tests- Acc. Alkali Aggregate Reactivity Test, also by Mortar Bar Method ; and Petrographic Tests- Petrographic Examination of fines.

Methods of geological investigations for civil engineering projects: surface investigations, sub-surface investigations, objectives.

Rock Mass Classifications: Rock Quality Designation (RQD); Rock Structuring Rating (RSR). Geomechanics Classification: Rock Mass Rating (RMR); Geotechnical Classification-Q-System; Slope Mass Rating: SMR; Support Measures; Modified SMR Approach.

Dams: terminology and classification, geological investigation and requirement of a dam site. Reservoirs. Influence of various geological structures on dam, silting problem in dams, various causes of dam failures.

Tunnels: classification of tunnels, lining in tunnels, influence of various geological factors.
Methods of tunneling: Fore poling method, Needle beam method, English method, Belgian method, heading and bench method, full face method, NATM

Bridges: terminology of bridge, types of bridges, stability of bridges, design of bridges, foundation of bridges

Roads: constructions in hilly regions & in permafrost regions. Geotechnical measures adopted for road stability.

Mass movements; landslides; stability of slopes; causes of slides; creep movement; earth flow and subsidence - precautionary measures and mitigations of hazards.

Earthquake and seismicity; seismic zones of India; aseismic design of building; engineering problems related to precautionary measures and mitigations of hazards.