

**लोक सेवा आयोग**  
नेपाल इन्जिनियरिङ्ग सेवा, जियोलोजी समूह, इन्जिनियरिङ्ग जियोलोजी, हाइड्रोजियोलोजी, जनरल जियोलोजी  
उपसमूहको राजपत्राङ्कित तृतीय श्रेणीको खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रूपरेखा :- यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिइने छ :

प्रथम चरण :- लिखित परीक्षा पूर्णाङ्क :- २००  
द्वितीय चरण :- सामूहिक परीक्षण र अन्तर्वार्ता पूर्णाङ्क :- ४०

**प्रथम चरण – लिखित परीक्षा योजना (Examination Scheme)**

| पत्र    | विषय            | पूर्णाङ्क | उत्तीर्णाङ्क | परीक्षा प्रणाली            | प्रश्न संख्या X अङ्कभार | समय              |
|---------|-----------------|-----------|--------------|----------------------------|-------------------------|------------------|
| प्रथम   | जियोलोजी        | १००       | ४०           | वस्तुगत बहुवैकल्पिक (MCQs) | १००X१ = १००             | १ घण्टा १५ मिनेट |
| द्वितीय | उपसमूह सम्बन्धी | १००       | ४०           | विषयगत (Subjective)        | १०X१० = १००             | ३ घण्टा          |

**द्वितीय चरण**

| विषय                         | पूर्णाङ्क | परीक्षा प्रणाली                 | समय      |
|------------------------------|-----------|---------------------------------|----------|
| सामूहिक परीक्षण (Group Test) | १०        | सामूहिक छलफल (Group Discussion) | ३० मिनेट |
| व्यक्तिगत अन्तर्वार्ता       | ३०        | मौखिक                           | -        |

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।
- पाठ्यक्रमको प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछन् ।
- माथि उल्लिखित उपसमूहको पाठ्यक्रमको प्रथमपत्रको विषयवस्तु एउटै हुनेछ । द्वितीयपत्रका विषयवस्तु उपसमूह अनुसार फरक फरक हुनेछन् ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- प्रथम पत्रका पाठ्यक्रमका एकाईहरूबाट सोधिने प्रश्नहरूको संख्या निम्नानुसार हुनेछ । द्वितीय पत्रको पाठ्यक्रमका एकाईहरूबाट सोधिने प्रश्नहरूको संख्या द्वितीयपत्रको पाठ्यक्रम उल्लेख भए अनुसार हुनेछ ।

| प्रथमपत्रका एकाई | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
|------------------|----|----|----|----|----|----|----|----|----|----|
| प्रश्न संख्या    | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नका लागि तोकिएका १० अङ्कका प्रश्नहरूको हकमा १० अङ्कको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- द्वितीय पत्रमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
- प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको अन्तर्वार्तामा सम्मिलित गराइनेछ ।
- पाठ्यक्रम लागू मिति :- २०६३/२ / २५ देखि (२०७२/०७/२४ को निर्णय अनुसार सामूहिक परीक्षण समावेश)

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### प्रथम पत्र :- जियोलोजी

- 1. Crystallography And Mineralogy: 10%**
  - 1.1 Crystallography: Crystal system and classes, Symmetry elements, Crystal notations, Crystal morphology, Measurement of crystal angles, Spherical and stereographic projection, determination of axial ratios. Intergrowth of crystals, causes, effects and origin of twinning
  - 1.2 Optical mineralogy: Principal and application of Beck method. Uniaxial and biaxial crystals, their Indicatrices and interference pattern. Accessory plates and Berek compensator. Crystal in the convergent light and determination of their optic signs
  - 1.3 Descriptive mineralogy, naming of minerals, and their important physical properties. Native elements, sulphides, chromates, sulphates, halites, borates, tungstet, molybdates, phosphates, arsenats, and vanadates, carbonates, oxides and hydroxides. Study of rock forming minerals. Silica and silicates, nesosilicates, sorosilicates, cyclosilicates, phyllosilicates and tectosilicates
- 2. Regional Geology 10%**
  - 2.1 Overview of the Geology of the Himalaya
  - 2.2 Physiographic and geological division of Nepal
  - 2.3 Description of Terai Region, Siwalik, Lesser Himalaya, Higher Himalaya and Tibetan Tethys zones
  - 2.4 Main characteristics of the Main frontal Thrust, Main Boundary Thrust, Main Central Thrust and the South Tibetan Detachment System
  - 2.5 Magmatism, metamorphism, and mineral deposits of the Nepal Himalaya
  - 2.6 Detail Geological account of Eastern, Central Western, Mid western and Farwestern Nepal
- 3. Igneous and Metamorphic Rocks 10%**
  - 3.1 Classification of igneous rocks, mineralogical classification, chemical classification, geological occurrences and associations. Nomenclature of Igneous rocks
  - 3.2 Characteristic of Magma: Temperature, pressure, density. Constitution of magma. Kinetics of magma: Viscosity, diffusion, formation of crystals
  - 3.3 Crystallization o magma: Crystallization and melting as changes in state. Crystallization an melting intervals of different magma composition, sequential segregation during crystallization, crystal melt equilibria in magmatic systems. Role of volatiles in the phase equilibria of magmatic system. Convective meteoric water system around magmatic intrusions. Changes in phase relationships with pressure. The effect of pressure versus temperature. Determination of temperature. Distribution of elements between coexisting minerals
  - 3.4 Generation of Magmas: Cause of melting, tectonic environments of melting, melting in non tectonic environments. Inclusions derived from the mantle
  - 3.5 Occurrence and origin of Intermediate to Felsic Associations: Granite, diorite, basalt, andesite, decite, rhyolite, epicontinental andesitic environments. Ash flow caldera, shallow batholith complex, granitoid batholiths in arc environments
  - 3.6 Occurrence and origin of Mafic and Ultramafic associations: Ophiolites, Basalts, Diabase, dykes and sills, Gabbroic layered intrusions
  - 3.7 Occurrence and origin of alkaline association: General features, mineralogy, chemistry, phase relationship, variations in individual complexes or rock bodies
  - 3.8 Concept of metamorphism, types of metamorphism, compositional group

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- 3.9 Nomenclature and distribution of metamorphic rocks
- 3.10 Basic characteristics of metamorphic reactions. Movement of constituents, kinetics of metamorphic mineral reactions, Determination of parent rocks. Causes of regional metamorphism. Prograde and Retrograde metamorphism
- 3.11 Metamorphic Facies: High to moderate pressure facies at low temperature, moderate pressure facies, high pressure facies, low pressure facies, Mylonitic rocks. Metamorphic grades, Index minerals, Paired metamorphic belts and geothermal gradients, Chemical Geothermometers and Geobarometers. Temperature and pressure corresponding to individual metamorphic facies
- 3.12 Description, occurrences and origin of metamorphic rock associations. Type of metamorphism: Cataclastic metamorphism, Contact metamorphism, Burial metamorphism, Regional metamorphism, Ocean floor metamorphism
- 3.13 Igneous rock association relation to regional metamorphism. Geological mapping of metamorphic terrain

### 4. Sedimentary Rocks

10%

- 4.1 Sedimentary particles: Transported in the solid state, precipitated and biogenic particles. Sedimentary processes: Physical processes and dynamics of moving particles, Chemical Biological processes. Weathering and Geochemical Cycle of sediments
- 4.2 Properties of sediments: Texture, grain size and provenance. Grain size and Depositional processes. Shape and Roundness. Surface features. Manner of Packing and Orientation. Maturity of sediments. Density, Porosity, Permeability
- 4.3 Methods of sedimentological study: Mechanical analysis of sediments. Grade scale. Grain size distribution. Phi scale. Normal distribution, Cumulative frequency distribution and its characteristics. Shape analysis and its significance. Mineral separation, mineral stability
- 4.4 Structure of sedimentary rocks: Bedding and cross lamination, graded bedding. Sole marks, mud cracks, surface marks, penecontemporaneous deformation structures. Sandstone dykes and sills. Convolute beddings. Stromatolites and other biogenic structures. Trace fossils
- 4.5 Diagenesis: Dissolution, precipitations, cementation and compaction
- 4.6 Classification of sediments and sedimentary rocks: Conglomerate, breccia, and gravel. Sand, sandstone, siltstone, argillite, shale and claystone. Limestone and dolomite. Volcanoclastic sediments. Cherts and other siliceous sediments. Iron bearing sediments, glauconite, phosphorite, saline and other evaporates. Carbonaceous sediments, coal and oil shale
- 4.7 Paleocurrents, paleogeography
- 4.8 Environment of deposition: desert, fluvial, lacustrine, glacial, coastal, deltaic, estuarine and marine environments

### 5. Stratigraphy

10%

- 5.1 Principles of stratigraphy, geological timescale, law of superposition
- 5.2 Distribution of organism in space and time, and their role in stratigraphy
- 5.3 Stratigraphy and tectonics: Tectonic interpretations, method of stratigraphy, litho, bio, magneto and chrono-stratigraphy. Dating of rocks, stratigraphic nomenclature, lateral variation and facies. Rock units, time rock units, biostratigraphic units
- 5.4 Correlation of litho, bio, magneto and chrono-stratigraphic unit. Limitation and subjective nature of correlation. Construction of ancient sedimentary environments and related stratigraphic implications

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- 5.5 Relevance of paleontology to the problems in the earth science. Bionomical nomenclature. Grouping of species into higher categories. Conservation law and fossilization. Origin of life
  - 5.6 Marine ecosystem. Biosphere and living and fossil population adapting and functional morphology. Evolution and fossils records of different groups of organism through geological ages
  - 5.7 Micropaleontology, definition and scope. Types of microfossils and their classification, taxonomic nomenclature. Fundamentals of biostratigraphy, ecology, paleoecology
  - 5.7.1 Morphology, classification, ecology and geological history of the following groups: Brachiopods, gastropods, bivalves, trilobites, ammonites, belemnites and other index fossils
  - 5.8 Biogeography of fossil plants and Gondwana flora. Elements of Gondwana flora. Mega fossils and Polinomorphs, their implication in Stratigraphy and Paleogeography
  - 5.9 Origin and evolution of vertebrates with special reference to horse and elephant. Evolution of men
- 6. Structural Geology** **10%**
- 6.1 Primary sedimentary structures and their significance in stratigraphy and structural geology. Diapirs and salt domes, their classifications and origin. Collapse structures
  - 6.2 Stress in two or three dimensions, Mohr diagram. Strain in two dimensions. Progressive deformation
  - 6.3 Fold morphology. Classification of folds. Fold mechanism: Single layer and multi layers. Small scale structures in folds and their interpretations. Distribution of strain in folds. Superposed folding. Criteria of recognition of folds
  - 6.4 Fault geometry and morphology. Classification of faults. Faults and associated minor structures. Balance cross sections. Stress distribution in faulting. Criteria of recognition of faults
  - 6.5 Joints: Geometrical classification. Mechanical analysis of fractures
  - 6.6 Lination, cleavage, foliation and schistosity. Relationship between planer and linear elements
  - 6.7 Structures of Igneous and Metamorphic rocks
  - 6.8 Graphical treatment of fabric data, plotting and analysis of various structural elements including stereographic projection. Uses and limitations of Pi and Beta diagrams. Concept of preferred orientation. Fabric and its symmetry in tectonites and non-tectonites
  - 6.9 Structural geological mapping. Rule of V's. Identification of structural features of various generations
  - 6.10 Principles of tectonic: Orogeny and Epeirogeny. Megascopic and microscopic structures. Thrusts and Napes, Schuppen (imbricate faults), and duplex
  - 6.11 Tectonic significance of linear structures. Geosynclines and continental margins
  - 6.12 Continental drift. Introduction to plate tectonics. Sea floor spreading, mid oceanic ridges, Paleomagnetism, Seismic zones. Transform faults and triple junctions. Island Arcs
- 7. Mineral resources** **10%**
- 7.1 Ore minerals, their textures, and structures development in open space and in crystalline aggregates. Process of formation and transformation of ore

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- 7.2 Endogenous Processes: Magmatic, pegmatitic, contact metasomatic and hydrothermal ore generations, emphasis on critical aspects of Physicochemical conditions
- 7.3 Endogenous processes: Residual process, chemical weathering and mechanical emphasis on chemical and accumulations. Sedimentary process including bacteriogenic and submarine exhalation and biochemical factors. Metamorphic process and metamorphosed ore bodies
- 7.4 Ores associated with Ultramafic and Mafic plutonic rocks. Ores associated with Felsic plutonic rocks. Ores associated with Acidic and Mafic volcanic rocks including those in greenstone belts. Stratiform and Stratabound ore deposits associated with volcanic and sedimentary rocks. Placer deposits: Factors contributing to their formations.
- 7.5 Oxidation and Supergene sulphide enrichment, emphasis on the chemical aspects of the process. Residual concentration of ore: Buxite and Laterite formation.
- 7.6 Distribution, geological setting and ideas on ore deposition in Nepal.
- 8. Hydrogeology 10%**
- 8.1 Introduction: Hydrological cycle. Occurrences of ground water. Hydrogeological properties of rocks and sediments. Vertical distribution of ground water. Types of aquifer, aquifer parameters, springs.
- 8.2 Ground water movements: Darcys Law and its validity. Hydraulic conductivity and its determination by laboratory and field methods. Well hydraulics, steady state and unsteady state radial flow. Pumping tests.
- 8.3 Water wells: Different kinds of well structures, Methods of drilling in hard rocks, soft rocks and unconsolidated sediments for groundwater development. Well construction methods, well design and well development. Well rehabilitation, estimation of well efficiency. Pumping equipments for shallow and deep wells.
- 8.4 Influence of environmental factors on ground water level: Secular, seasonal, diurnal and incidental changes.
- 8.5 Quality of groundwater: Causes and measures of water quality, standard for different purposes of usage, sources of ground water pollution
- 8.6 Ground water Resources of Nepal: Ground condition in different Geological formations; Ground water potential of Nepal
- 9. Engineering Geology and Geomorphology 10%**
- 9.1 Role of engineering geology in planning, design, construction and maintenance of infra structures. Engineering Geological maps: Types and contents, scale and uses
- 9.2 Elements of soil mechanics: Engineering properties of soil, Unified soil, classification system. Stress within an earth mass. Mohr circle. Stress distribution in loaded earth mass, Failure criteria for soils. Consolidation, compaction and settlement
- 9.3 Elements of rock mechanics: Engineering properties of rocks, rock mass classification, rock mass rating (RMR) and Q system, analysis of rock slope, stability, use of stereographic projection, failure criteria of rock slopes
- 9.4 Rock and soil as construction materials: requirement for selecting borrow area, searching and exploration of construction materials. Properties of construction materials, Dimension and decorative stones
- 9.5 Landslides: Classification, Factor causing landslides, Analysis and control of landslides. Problems of landslides and Glacier lake outburst flood (GLOF) in Nepal and their mitigation methods
- 9.6 Introduction to geomorphology, Scope and its relation to other sciences. Concept of relief, order and physical landscape, their types, nature of development, stage of

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maturity. Major geomorphological subdivisions of Nepal, their characteristics and  
evolution

- 9.7 Weathering of rocks, factors controlling weathering, depth of weathering zones, types of weathering, weathering in relation to climate
- 9.8 Soil forming factors and processes. Development of soil profiles and classification of soils. Prevention of soil erosion
- 9.9 Glaciers: Their origin, structural features (Erosional and depositional), classification. Causes of glaciation. Pleistocene glaciation and its distribution
- 9.10 Fluvio-glacial and fluvio-genetic cycle of landscape. Drainage, its development pattern, relation to geological structures and types. Morphometric measurement and analysis. Peneplains. Characteristics of Bhabar and Terai regions. Water logged swamps. Floods and their control
- 9.11 Tectonic landforms and landforms due to volcanism
- 9.12 Development of badlands. Origin of deserts, advancing of desert and preventive measures

### **10. Introductory Geophysics and Geochemistry 10%**

- 10.1 Methods of Geophysical exploration. Significance and measurement of physical quantities involved. Arrangement of observation points with respect to geological objects. Geophysical anomaly, regional and local anomalies, factors controlling the anomaly. Factors giving rise to noise qualitative and quantitative interpretation.
- 10.2 Gravity Methods: Newton's Law of gravitational attraction. Gravitational potential and equipotential surfaces. Geoid, curvature and gradient. The shape and size of the earth.
- 10.3 Magnetic properties of rocks and minerals. Theory of origin of earth magnetism. Variation with time in the earth's magnetic field. Geomagnetic field and its elements. Basic principles of rock magnetism, paleomagnetism. Magnetic surveying procedures.
- 10.4 Electrical methods: Basic concepts and definitions. Electrical properties of rocks and soils. Induced polarization (IP) self potential (SP) and electrical resistivity methods.
- 10.5 Earthquake and structure of the earth. Path and types of earthquakes waves. The earth crust and internal structure as deduced from the earthquake evidences.
- 10.6 Seismic Refraction methods: Wave paths and time distance relations for horizontal layers. Continues change of speed with depth
- 10.7 Seismic Reflection Methods: Geometry of reflection path of horizontal interfaces. Reflection from dipping interfaces. Choice of shooting procedures. Determination of average velocity. Correction used in reduction of reflection records
- 10.8 Geophysical well logging methods: Self potential logging. Resistivity logging. Natural gamma logging
- 10.9 Principles of Geochemistry, the structure and composition of the earth, elements, structures of the atoms, molecules and ions. Lithosphere, hydrosphere, atmosphere, biosphere, geochemical cycle
- 10.10 Geochemical exploration methods, Primary and secondary dispersion pattern, element mobilities, geochemical soil and stream sediment survey. Geochemical anomalies, background value, Threshold value, Anomalous values, anomalous areas, anomaly categorization, interpretation of geochemical data, graphical plotting of data. Application of geochemistry in mineral exploration. Geochemical maps

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वस्तुगत बहुउत्तर नमूना प्रश्नहरू (Sample questions)

1. In which system, vertical crystallographic axis is an axis of four fold symmetry?  
(A) Hexagonal (B) Monoclinic  
(C) Tetragonal (D) Cubic  
**Correct Answer:- (C)**
2. Mineral aragonite belongs to the following crystal system:  
(A) Cubic (B) Hexagonal  
(C) Orthorhombic (D) Tetragonal  
**Correct Answer:- (C)**
3. Hematite shows the streak colour as:  
(A) Yellow (B) Brown  
(C) Black (D) Cherry red  
**Correct Answer:- (D)**
4. The Main central thrust (MCT) of the Himalayas separates  
(A) Higher Himalayas from the Lesser Himalayas  
(B) Lesser Himalayas from the Sub-Himalayas  
(C) Siwaliks from the alluvium of Indo-Gangetic Plain  
(D) None of above  
**Correct Answer:- (A)**
5. The Kathmandu basin and the hills south of it occupy the centre of the mega structure  
(A) Plunging anticlinorium (B) Plunging synclinorium  
(C) Faulted trough (D) Graben Basin  
**Correct Answer:- (B)**