चिलिमे जलविद्युत कम्पनी लिमिटेड

प्राविधिक सेवा, जियोलजि समूह, तह-७, जियोलजिष्ट पदको

खुला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

१. शैक्षिक योग्यताः चिलिमे जलविद्युत कम्पनी लिमिटेड कर्मचारी सेवा शर्त विनियमावलीमा व्यवस्था भए अनुसार।

२. लिखित परीक्षाको विषय, पूर्णाङ्क, परीक्षा प्रणाली, प्रश्न संख्या, अंकभार र समय निम्नानुसार हुनेछ।

पत्र	विषय	परीक्षा प्रणाली		प्रश्न संख्या	प्रति प्रश्न अंकभार	पूर्णांक	समय
प्रथम	जनरल जियोलजि	वस्तुगत बहुउत्तर		३०	०.५	१५	३० मिनेट
द्वितीय	ईन्जिनियरिङ जियोलजि	विषयगत	लामो उत्तर	२	१०	७०	२ घण्टा ३० मिनेट
			छोटो उत्तर	१०	५		
अन्तर्वार्ता						१५	

३. वस्तुगत बहुउत्तर परीक्षा प्रणालीमा प्रत्येक पश्नका चार वटा सम्भाव्य उत्तर दिइने छ। प्रश्नको उत्तर लेख्दा केरमेट गरेको, दोहोरो लेखेको, सच्याएको, निर्दिष्ट स्थानभन्दा अन्यत्र लेखेको वा उत्तर नै सारेकोलाई गल्ती मानिनेछ।

४. बस्तुगत बहुउत्तरमा प्रत्येक गलत उत्तर वापत सो प्रश्न वापत पाउने अंकको ०.२ (बीस प्रतिशत २०%) का दरले सो विषयमा पाएको कूल प्राप्तांकबाट घटाइनेछ।

५. कालो/नीलो मसी मात्र भएको डटपेन/कलमले उत्तरको लागि निर्धारित कोठाका पश्नमा क,ख,ग,घ मध्ये एउटा मात्र सही उत्तर स्पष्ट रूपले लेख्नुहोला। पेन्सिलले लेखेकोलाई मान्यता दिइने छैन।

६. प्रत्येक पत्रको न्यूनतम ४० प्रतिशत उत्तीर्णाङ्क हुनेछ।

७. प्रथम र द्वितीयपत्रको परीक्षा २ पटक गरेर हुनेछ। प्रथम पत्रको परीक्षा सकिएपछि द्वितीयपत्रको परीक्षा तत्काल हुनेछ।

८. द्वितीयपत्रको लिखित परीक्षाको माध्यम नेपाली वा अंग्रेजी भाषा हुनेछ।

९. सामान्यतः प्रत्येक शिर्षकको अंकभार तोकिए बमोजिम हुनेछ।

प्रथम पत्रः जनरल जियोलजि

1. INTRODUCTION (3X0.5)

1.1 Basic review of earth sciences: scope, its various branches, method of study

1.2 The earth: Its internal structure and environment

1.3 Landforms: Major features on the continent, and on the ocean floor

1.4 Plate tectonics: continental drifting and see floor spreading

1.5 Seismicity: Cause and effects of earthquakes

1.6 Volcanoes: origin and types

1.7 Mountain building processes

2. CRYSTALLOGRAPHY AND MINERALOGY (2X0.5)

2.1 History and importance of crystallography and mineralogy.

2.2 Crystallography: crystal systems and classes; crystal growth, ordered patterns and their properties, symmetry operations without translation, translation lattices, crystal notations, crystal morphology, measurement of crystal angles, spherical and stereographic projections, determination of axial ratios. Intergrowth of crystals; causes, effects and origin of twinning.

2.3 Optical mineralogy: principle and application of Becke method. Uniaxial and Biaxial crystals, their indicatrices and interference patterns. Accessory plates and Berek compensator. Crystals in the convergent light and determination of their optic signs.

2.4 Descriptive mineralogy: Naming of minerals and their important physical properties. Native elements, sulphides, chromates, sulphates, halides, borates, tungstates molybdates, phosphates, aresenates and vanadates, carbonates, oxides and hydroxides. Study of rock-forming minerals, Silica and silicates: nesosilicates, sorosilicates, cyclosilicates inosilicates, phyllosilicates and tectosilicates. Determination of minerals by chemical analysis.

3. IGNEOUS AND METAMORPHIC PETROLOGY (3X0.5)

3.1 Classification of igneous rocks: Mineralogical classification, chemical classification, geological occurrence and association.

3.2 Characteristics of magma: temperature, pressure, density. Constitution of magma. Kinetics of magma: viscosity, diffusion, formation of crystal in a liquid.

3.3 Crystallisation of magma: crystallization and melting as changes in state. Crystallisation and 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 systems. Convective meteoric water systems 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-gectonic environments, Inclusions derived from the mantle. Mantle inhomogeneity.

3.5 Occurrence and origin of intermediate to felsic associations: granite, diorite, basalt, andesite, dacite, rhyolite, epicontinental andesitic environments. Ash flow caldera, shallow batholith complex, granitoid batholiths in arc environments, anorthosite massifs and other anorthosites.

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 associations: general features, mineralogy, chemistry, phase relationship, variation in individual complexes or rock bodies. Processes leading to variation in alkaline complexes, kimberlites.

3.8 Concept of metamorphism. Types of metamorphism. Compositional groups.

3.9 Nomenclature and distribution of metamorphic rocks.

3.10 Basic characteristics of metamorphic reaction movements of constituents, kinetics of metamorphic mineral reaction. Determination of parent rocks. Causes or regional metamorphism. Controls of metamorphism. Progressive regional metamorphism.

3.11 Outline of metamorphic facies. Basic types, paired metamorphic belts and geothermal gradient. Determination of the condition of metamorphism. Reaction boundaries. Chemical geothermometers and geobarometers. Temperature and pressure corresponding to individual metamorphic facies.

3.12 Solid-state crystal growth. Stress and deformation. Ductile flow. Role of fluids in deformation. Origin of anisotropic fabric in metamorphic tectonites.

3.13 Description, occurrence and origin of metamorphic rock associations. Types of metamorphism: cataclastic metamorphism, contact metamorphism, burial metamorphism, regional metamorphism, ocean floor metamorphism. Metamorphic facies: high- to moderate-pressure facies at low temperatures, moderate-pressure facies, hig-pressure facies, low-pressure facies, mylonitic rocks.

3.14 Igneous rock associations realated to regional metamorphism. Volcanic arcs in relation to low-pressure regional metamorphism. Metamorphic facies and geological age. Geological mapping of metamorphic terrain.

4. SEDIMENTOLOGY AND SEDIMENTARY PETROLOGY (3X0.5)

4.1 Sedimentary particles: transported in the solid state, precipitated and biogenic particles. Sedimentary processes: physical processes and dynamics of moving particles. Chemical and Biological processes. Weathering and geochemical cycle of sediments.

4.2 Properties of sediments: Texture — particle size. Classification of sedimentary aggregates, Grain Size and provenance. Grain size and depositional processes. Shape and roundness. Surface features. Manner of packing and orientation. Maturity of sediments. Density porosity and 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 bedding. Stromatolites and other biogenic structures. Trace fossils.

4.5 Diagenesis: dissolution, precipitation, cementation and compaction.

4.6 Classification of sediments and sedimentary rocks: conglomerate, breccia and gravel. Sand and sandstone. Siltstone, argillite, shale and claystone. Limestone and dolomite. Volcanoclastic sediments. Cherts and other siliceous sediments. Ironbearing sediments, glauconite phosphorite, saline and other evaporates. Carbonaceous sediments, coal and oil shale.

4.7 Palaeocurrents and palaeogeography.

4.8 Environment of deposition. Non-marine environments: desert, fluvial, lacustrine and glacial environments. Transitional environments: coastal, deltaic and estuarine. Marine environments.

5. STRATIGRAPHY AND PALAEONTOLOGY (3X0.5)

5.1 Historical background of stratigraphy. Principles of stratigraphy, stratigraphic scale and geological time scale, vertical succession.

5.2 Distribution of organisms in space and time and their role in stratigraphy.

5.3 Stratigraphy and tectonics. Tectonic interpretation: methods of stratigraphy: litho-, bio-, magneto- and chrono-stratigraphy, Dating of rocks. Stratigraphic nomenclature. Lateral variation and facies. Rock units, time-rock units, biostratigraphic units, glacial stratigraphic units.

5.4 Correlation of litho-, bio-, magneto- and chrono-stratigraphic units. Limitations and subjective nature of correlation. Construction of ancient sedimentary environments and related stratigraphic implications. Surface and subsurface procedures in stratigraphy.

5.5 Relevance of palaeontology to the problems in the earth sciences. Modern systematics. Bionomical nomenclature. The species identification of species level. Grouping of species into higher categories. Conservation law and fossilization. Origin of life and Precambrian palaeontology.

5.6 Marine ecosystem. Biosphere and living and fossil populations adapting and functional morphology. Evolution and fossil records of different groups of organisms through geological ages.

5.7 Micropaleontology, definition and scope. Types of microfossils and their classification, taxonomic nomenclature, basis and kinds of taxonomic classifications. Fundamentals of biostratigraphy, ecology and palaeoecology.

5.8 Detailed study of morphology, classification, ecology and geological history of foraminifera and radiolaria with special reference to the following groups: Nummulitidae, Fusulinidae, Alveolinidae, Globigerinidae, Discocyclinidae, Lepidocyclinindae.

5.9 Detailed study of morphology, classification, ecology and geological history of the following groups: brachiopods, gastropods, bivalves, trilobites, ammonites, belemnites and other index fossils.

5.10 Biogeography of fossil plants and Gondwana flora. Elements of Gondwana flora. Megafossils and polinomorphs, their implication in stratigraphy and palaeogeography.

5.11 Origin and evolution of vertebrates with special reference to horse and elephant. Evolution of man.

6. MINERAL RESOURCES (3X0.5)

6.1 Ore minerals, their textures and structures developed in open space and in crystalline aggregates. Process of formation and transformations of ores.

6.2 Endogenous process: Magmatic, pegmatitic, contact metasomatic and hydrothermal ore generations, emphasis on critical aspects and physico-chemical conditions.

6.3 Exogenous processes: Residual process, chemical weathering and mechanical accumulation. Sedimentary process including bacteriogenic and submarine exhalation and emphasis on chemical and biochemical factors. Metamorphic process and metamorphosed ore bodies.

6.4 Ores associated with ultramafic and related 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 formation.

6.5 Oxidation and supergene sulphide enrichement, emphasis on the chemical aspects of the process. Residual concentration of ores: bauxite and laterite formation.

6.6 Distribution, geological setting and ideas on ore deposits in Nepal.

6.7 Mining geology: elements of mining. Opencast and underground mining. Explosives and blasting methods. Mine ventilation and mine supports. Drilling.

6.8 Geological prospecting of metallic, non-metallic and industrial rocks and minerals. Sampline, estimation of ore reserves and their categorization.

6.9 Industrial rocks and minerals of Nepal: important properties, industrial uses. Specifications, mode of occurrence and distribution in Nepal and adjacent areas of the following industrial minerals and rocks: micas, salts, minerals for ceramic industry, fertilizer minerals, refractory minerals, building stones, abrasives, minerals for pigment, precious and semiprecious stones.

6.10 Exploration of fuels, energy minerals and hydrocarbons.

7. STRUCTURAL GEOLOGY (3X0.5)

7.1 Primary sedimentary structures and their significance in structural geology. Diapirs and salt domes, their classification and origin. Collapse structures.

7.2 Stress in two and three dimensions. Mohr diagram. strain in two dimensions. Progressive deformation.

7.3 calculation of finite strain in two dimensions. Rheology, stress-strain relation of elastic, viscous and viscoelastie materials. Theory of brittle and semibrittle rock behaviours. Behaviour of crystal structures under stress.

7.4 Fold morphology. Classification of folds. Fold mechanism: single layer and multilayers. Small-scale structures in folds and their interpretation. Distribution of strain in folds. Superposed folding. Criteria of recognition of folds.

7.5 Fault geometry and morphology. Classification of faults. Faults and associated minor structures. Balanced cross-sections. Stress distribution in faulting. Criteria of recognition of faults.

7.6 Joints: Geometrical classification. Mechanical analysis of fractures.

7.7 Lineation, cleavage and schistosity. Relationship between planar and linear elements.

7.8 Structure of igneous and metamorphic rocks.

7.9 Graphical treatment of the fabric data. Plotting and analysis of various structural elements. Uses and limitations of pi and beta diagrams. Concept of preferred orientation. Fabric and its symmetry in tectonites and non-tectonites.

7.10 Structural geological mapping. Rule of V's. Identification of structural features of various generations.

7.11 Principles of tectonics: Orogeny and epeirogeny. Mesoscopic and microscopic structures. Thrusts and nappes, schuppen (imbricate faults) and duplex.

7.12 Tectonic significance of linear structures. Geosynclines and continental margins.

7.13 Continental drift. Introduction to plate tectonics. Seafloor spreading. Mid-ocean ridges, palaeomagnetism. Seismic zones. Transform faults and triple junctions. Island arcs.

7.14 Causes of progeny and global tectonics. Orogenic belts with special references to the Himalaya.

8. GEOMORPHOLOGY (3X0.5)

8.1 Introduction to geomorphology, scope and its relation to other sciences. Concept of relief, order and physical landscape, their types, nature of development, stage of maturity. Major geomorphological subdivisions of Nepal, their characteristics and evolution. Slope formation processes and their bearing on landscape.

8.2 weathering of rocks, factors controlling weathering, depth of weathering zones, types of weathering, weathering in relation to climate.

8.3 Soil-forming factors and processes. Development of soil profile and classification of soils. Prevention of soil erosion. Soils of Nepal and their distribution.

8.4 Glaciers: their origin, structural features (erosional and depositional), classification. Causes of glaciation. Pleistocene glaciation and its distribution.

8.5 Fluvioglacial and fluviogenetic cycles of landscape. Drainage, its development, patterns, relation to geological structures and types. Morphometric measurements and analysis. Peneplains. Characteristics of Bhabar and Terai regions. Waterlogged swamps. Flood and their control.

8.6 Tectonic landforms and landforms due to volcanism.

8.7 Desert and fertility. Development of badlands. Origin of deserts, Advancing of deserts and preventive measures.

9. GEOCHEMISTRY (2X0.5)

9.1 Composition of the universe. Sun, planets and meteorites. Abundance of elements in the earth and universe. Origin of elements. The structure and composition of the earth. Primary differentiation of the elements. Pregeological history of the

9.2 Structure of the atoms, ions and molecules. Chemical bonding. Structure of crystalline material. Principles of thermodynamics and their application to petrology. Chemical potential equilibrium constants. Thermodynamics of chemical reaction. Nature of ideal solution. Geochemistry of magmatism, sedimentary formations, metamorphism, endogenic ore formation, atmosphere, hydrosphere, biosphere and hypergenesis. Geochemistry of isotopes. Geochemical evolution of the earth. Geochemical cycles.

9.3 Geochemical exploration: basic principles of trace analysis. Primary and secondary dispersion patterns. Anomalies in residual overburden. Anomalies in transported overburden. Geochemical soil and sediment survey. Anomalies in natural waters. Vegetation surveys, Treatment of geochemical data. Application of geochemistry in mineral exploration.

9.4 Chemical composition of different rocks.

10. GEOLOGY OF NEPAL HIMALAYA (3X0.5)

10.1 Geology of Nepal and adjacent regions: broader framework of the Himalay, its relation to other mountain chains of the region.

10.2 Introduction to the geology of peninsular India with special reference to Delhis, Vindhyans and Gondwanas.

10.3 A brief account on the geology of the Salt Range, Punjab, Kumaon, Sikkim, Bhutan and Arunachal Himalaya.

10.4 Physiographic and geological divisions of Nepal. History of geological research in Nepal. Introduction to basic problems in the study of Himalayan Geology.

10.5 Description of the Terai region, Siwaliks, Lesser Himalaya, Higher Himalaya and the Tibetan-Tethys zone.

10.6 Main characteristics of the Main Frontal Thrust, Main Boundary Thrust, Main Central Thrust and the South Tibetan Detachment System.

10.7 Stratigraphy: Precambrian, Palaeozoic, Mesozoic and Cenozoic rocks ofNepal.

10.8 Magmatism, metamorphism and mineral deposits of the Nepal Himalaya.

10.9 Detailed geological account of Eastern, Central, Western, Central Western and Far Western Nepal.

11. INSTITUTIONAL KNOW-HOW (2X0.5)

11.1 General knowledge of Nepal Electricity Authority, Chilime Jalvidhyut Company Limited its organizational structure and function of various business groups.

11.2 General knowledge of various power plants of Nepal, their types, salient features and their geographical locations.

11.3 General knowledge on Nepalese power transmission system, voltage levels and lengths, export-import links for power exchange with India.

द्वितीय पत्रः ईन्जिनियरिङ जियोलजि

1. SCOPE OF ENGINEERING GEOLOGY IN crv1L ENGINEERING (1X5)

1.1. Definition of engineering geology
1.2. Scope and objective of engineering geology
1.3. Importance of engineering geological studies in Nepal
1.4. Relationships between geology and engineering geology

2. SITE INVESTIGSTION(1X5)

2.1. Phases, scope and, methods of field investigation
2.2. Data collection, analysis, interpretation and presentation techniques
2.3. Geophysical investigation, Tomography
2.4. Engineering geological mapping
2.5. Core drilling
2.6. Permeability tests and grouting
2.7. Test auditing
2.8. In-situ tests in rocks and soils
2.9. Laboratory testing of rock and soil samples

3. SOIL MECHANICS(1X5)

3.1 Soil formation, classification, and exploration: Nature, and composition of soils, soils formation, soil classification, soil exploration, laboratory testing.

3.2 Strength and deformation: Principle of effective stress, concept of failure, principles of strength and deformation testing, field testing for strength and deformation. Laboratory tests, strength and deformation parameters of soils.

3.3 Flow of water through a soil mass: Flow laws, field measurement of permeability, flow rate, flow nets, solution of flow equations.

3.4 Settlement and consolidation: Compressibility of soils, rate of primary settlement, multidimensional settlement, secondary compression, measurement of soil parameters, over comentidetion.

3.5 Retaining structures: Limiting stress state in a soil mass, intermediate stress state pressures on a rigid retaining wall, passive pressure analysis, stability analysis.

3.6 Stability of slopes: Types of instability mechanisms, methods of stability analysis, applicability of stability analysis, detection and control of landslides.

3.7 Foundations: Foundation systems, stability analysis, stress distribution analysis, settlement analysis of shallow foundations, settlement analysis of piles and deep foundations laterally loaded pile. Raft (mat) foundation, dynamic analysis of foundation.

3.8 Soil treatment: Deep layers, superficial layers.

4. ROCK MECHANICS(1X5)

4.1 Planning considerations: Types of underground excavations, underground excavation design.

4.2 Strength of rock and rock mass: Brittle and ductile behavior, laboratory testing of intact rock samples, an empirical failure criterion for rock. Use of rock mass classification for rock strength prediction. Approximate equations defining the strength of intact rock and heavily jointed rock masses.

4.3 Classification of rock masses: Terzaghi's rock load classification, classification by Lauffer, Deere's rock quality designation (RQD). Influence of clay seams and fault gouge. CSIR classification of jointed rock mass. NGI tunneling index, discussion on rock mass.

4.4 Stress around underground excavations: Components of stress, two-dimensional state of stress, stress distribution around open excavation, stresses around a circular excavation, calculation of stresses around other excavation shapes. Stresses around multiple excavations.

5. HYDROGEOLOGY(1X5)

5.1 Introduction: Hydrological cycle. Occurrence of groundwater. Hydrogeolgical properties of rocks and sediments. Vertical distribution of groundwater. Types of aquifer, aquifer parameters, springs, ground water in permafrost regions.

5.2 Ground water movement: Darcy's law and its validity. Hydraulic conductivity and its determinations by laboratory and field methods. Well hydraulics, steady state and unsteady state radial flow. Pumping test.

5.3 Water wells: different kinds of well structures, methods of drilling deep wells in hard rocks, soft rocks and unconsolidated sediments. Well construction methods, well design and well development. Well rehabilitation, estimation of well efficiency. Pumping equipment for shallow and deep wells.

5.4 Influence of environmental factors on ground water levels: secular, seasonal, diurnal and incidental changes.

5.5 Quality of groundwater: causes and measures of water quality, standards for different purposes of usage, sources of ground water pollution.

5.6 Management of ground water: concepts of basin management, hydrological budget, water balance, perennial yield and artificial recharge methods.

5.7 Groundwater resources of Nepal: groundwater conditions in different geological formations; groundwater provinces of Nepal.

6. GEOPHYSICS(1X5)

6.1 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 anomalies. Factors giving rise to noise, qualitative and quantitative interpretations.

6.2 Gravity methods: Newton's law of gravitational attraction. Gravitational potential and equipotential surfaces. Geoid, curvature and gradient. The shape and size of the earth. Distribution of densities within the earth.

6.3 Determination of absolute gravity. Gravimeters. Techniques of gravity surveys. Rock densities. Gravity anomalies.

6.4 Magnetic properties of rocks and minerals. Theory of the origin of earth's magnetism. Variations with time in the earth's magnetic field. Geomagnetic field and its elements. Basic principle of rock magnetism and palaeomagnetism. Magnetic surveying procedures.

6.5 Electrical methods: Basic concepts and definitions. Electrical properties of rocks and soils. Induced polarization (IP), self potential (SP) and electrical resistivity methods.

6.6 Earthquake and the structure of the earth. Paths and types of earthquake waves. The earth's crust and internal structure as deduced from the earthquake evidence.

6.7 Seismic wave propagation, elastic constants, elastic waves, attenuation, reflection and refraction. Principle of a seismograph. Instruments used in seismic prospecting, sources of seismic energy.

6.8 Seismic refraction method: wave paths and time distance relations for horizontal layers. Continuous change of speed with depth.

6.9 Seismic reflection method: geometry of reflection paths for horizontal interfaces. Reflection from dipping interfaces. Choice of shooting procedures. Determination of average velocity. Correction used in deduction of reflection records.

6.10 Introduction to radioactivity methods.

6.11 Geophysical well logging methods: classification of borehole geophysical methods. Self-potential logging. Resistivity logging. Natural gamma logging.

7. MASS MOVEMENTS PROCESSESS(1X5)

7.1 Types of landslides and factors affecting slope stability

7.2 Preventive measures for landslides and corrective methods for maintaining stability

7.3 Rock fall, rock slide and mud flow

8. ROCK SLOPE STABILITY ANALYSIS(1X5)

8.1 Discontinuity studies: Effects of discontinuities on slope stability, orientation of discontinuities, stereographic analysis of join data, pole, point, contour data, great circles, lines of intersection

8.2 Identification of modes of slope instability: Kinematic analysis, plane failure, wedge failure, toppling failure, friction cone, applications of kinematic analysis

8.3 Strength of rocks: Scale effects and rock joint strength, shear strength of discontinuities, definition of cohesion and friction, friction angle of rock surfaces, shearing on an inclined plane, surface roughness, discontinuity infilling, influence of water on shear strength of discontinuities, shear strength of rock masses by back analysis of slope failures, Hoek—Brown strength criterion for fractured rock masses

8.4 Plane failure analysis: General conditions for plane failure, reinforcement of a slope, seismic analysis of rock slopes

8.5 Wedge failure analysis: Definition of wedge geometry, analysis of wedge failure, wedge analysis including cohesion, friction and water pressure, wedge stability charts for friction only, comprehensive wedge analysis

8.6 Circular failure analysis: Conditions for circular failure and methods of analysis, shape of slide surface, stability analysis procedure, derivation of circular failure charts, location of critical slide surface and tension crack

8.7 Toppling failure analysis: Types of toppling failure, kinematics of block toppling failure, limit equilibrium analysis of toppling on a stepped base, stability analysis of flexural toppling.

8.8 Stabilization of rock slopes: Causes of rock falls, stabilization by rock reinforcement, stabilization by rock removal, resloping and unloading, trimming, scaling, rock removal operations, protection measures against rock falls.

9. CONSTRUCTION MATERIALS(1X5)

9.1 Types of construction materials and their properties

9.2 Method of field and laboratory investigation

9.3 Planning for investigation works

9.4 Quantification of constructions materials

10. INFRASTRUCTURES(1X5)

10.1 Dams: Classification of dams according to use, classification by hydraulic design, classification by materials: earthfill, rockfill, concrete, gravity, concrete arch, other types. Physical factors governing the selection of dams: topography, geology and foundation conditions, materials availability, spillway, size and location, earthquake. Dam construction materials: embankment soils, core material, filter material, rockfill, riprap, and concrete aggregate. Surface investigation of dam site: fluvial soils, glacial deposits, residual soils, colluvial soils. Subsurface exploratory methods: test

pits, trenches, and test adits. Auger boring, and drilling, geophysical exploration, mapping, etc.

10.2 Canals: Site selection, problems of instabilities, erosion and sedimentation, measure of their control.

10.3 Tunnels: Classification and nomenclature, exploration for tunnel alignment, determination of rock loads, methods of tunneling including NATM, case histories.

10.4 Roads, bridges, and buildings: Location and site selection, use of geological maps and aerial photographs for road corridor building site studies. Problem of slope stability and erosion, drainage, landslide hazard maps, stable cut slopes in soil and rocky areas. Subsurface exploration for bridge and building foundation, construction materials.

Note: 2 questions weightage of 10 for each question will be asked one from Curriculum Chapter 1 to 5 and another one from Curriculum Chapter 6 to 10.

द्रष्टव्यः - पाठ्यक्रममा राखिएका संविधान, ऐन, नियम र विनियमहरु परीक्षा हुनु भन्दा ३ महिना अगाडिसम्म संशोधन वा खारेज भएकालाई सोही अनुरुप पाठ्यक्रममा समावेश भएको मानिने छ।

- लिखित परीक्षा उत्तीर्ण हुनेहरूको मात्र अन्तरवार्ता हुनेछ।

✡

Number of objection question (बस्तुगत बहुउत्तर) to be asked from each Chapter of First Paper (General Geology)

Curriculum Chapters	1	2	3	4	5	6	7	8	9	10	11
No. of objective question	3	2	3	3	3	3	3	3	2	3	2
Weightage of each question	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Number of subjective (बिषयगत) questions to be asked from each Chapter of Second Paper (Engineering Geology)

Curriculum Chapters	1	2	3	4	5	6	7	8	9	10
No. of subjective question (छोटो उत्तर)	1	1	1	1	1	1	1	1	1	1
Weightage of each question	5	5	5	5	5	5	5	5	5	5
No. of subjective question (लामो उत्तर)	1					1				
Weightage of each question	10					10				