# विद्युत नियमन आयोग
## इन्जिनिरिङ सेवा, जियोलोजी समूह, तह ७, जियोलोजिस्ट पदको
## खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

यस पाठ्यक्रमलाई दुई चरणमा विभाजन गरिएको छः

प्रथम चरण :- लिखित परीक्षा (Written Examination) पूर्णाङ्क :- २००

द्वितीय चरण :- अन्तर्वार्ता (Interview) पूर्णाङ्क :- ३०

**परीक्षा योजना (Examination Scheme)**

**१. प्रथम चरणः लिखित परीक्षा (Written Examination)** **पूर्णाङ्क :- २००**

| पत्र | विषय | पूर्णाङ्क | उत्तीर्णाङ्क | खण्ड | परीक्षा प्रणाली | प्रश्न संख्या | अङ्क भार | समय |
|---|---|---|---|---|---|---|---|---|
| प्रथम | सामान्य ज्ञान, बौद्धिक परीक्षण तथा विद्युत नियमन सम्बन्धी | १०० | ४० | (क) | वस्तुगत बहुवैकल्पिक प्रश्न (MCQs) | ५० | १ | १ घण्टा ३० मिनेट |
| | General Technical Subject | | | (ख) | वस्तुगत बहुवैकल्पिक प्रश्न (MCQs) | ५० | १ | |
| द्वितीय | Technical Subject | १०० | ४० | (क) | छोटो उत्तर आउने प्रश्न | २ | ५ | ३ घण्टा |
| | | | | | लामो उत्तर आउने प्रश्न | ४ | १० | |
| | | | | (ख) | छोटो उत्तर आउने प्रश्न | २ | ५ | |
| | | | | | लामो उत्तर आउने प्रश्न | ४ | १० | |

**२. द्वितीय चरणः अन्तर्वार्ता (Interview)** **पूर्णाङ्क :- ३०**

| विषय | पूर्णाङ्क | परीक्षा प्रणाली |
|---|---|---|
| अन्तर्वार्ता | ३० | मौखिक |

**द्रष्टव्यः**

१. लिखित परीक्षाको माध्यम भाषा नेपाली अथवा अंग्रेजी वा नेपाली र अंग्रेजी दुवै हुन सक्नेछ।

२. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ।

३. लिखित परीक्षामा सोधिने प्रश्न संख्या र अङ्कभार यथासम्भव सम्बन्धित पत्र / विषयमा दिइए अनुसार हुनेछ।

४. 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।

५. वस्तुगत बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital Letter) A, B, C, D मा लेख्नुपर्नेछ। सानो अक्षर (Small Letter) a, b, c, d लेखेको वा अन्य कुनै सङ्केत गरेको भए सबै उत्तरपुस्तिका रद्द हुनेछ।

६. बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन।

७. विषयगत प्रश्नहरूको हकमा 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 सकिनेछ।

८. विषयगत प्रश्न हुने पत्र/ विषयको प्रत्येक खण्डका प्रश्नका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परीक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ।

९. यस पाठ्यक्रम योजना अन्तर्गतका प्रश्न/ विषय विषयवस्तुमा जुनसुकै कुरा लेखिएको भए तापनि पाठ्यक्रममा परेको कानुन, ऐन, नियम, विनियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ।

१०.प्रथम चरणको परीक्षाबाट छनौट भएका उमेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ।

**११.पाठ्यक्रम स्वीकृत मिति : २०८२/०१/०८**

**विद्युत नियमन आयोग**

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**खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम**

**प्रथम पत्र :**

**खण्ड (क) सामान्य ज्ञान, बौद्धिक परीक्षण तथा विद्युत नियमन सम्बन्धी : ५० अङ्क**

**1. सामान्य ज्ञान (१५ × १ = १५ अङ्क)**

1.1 नेपालको भूगोल र आर्थिक तथा सामाजिक क्रियाकलापः धरातलीय स्वरुपको किसिम र विशेषता, नेपालमा पाइने हावापानीको किसिम र विशेषता, नदीनाला, तालतलैया, खनिज पदार्थ, प्राकृतिक श्रोत साधन, विद्युत, शिक्षा, स्वास्थ्य र सन्चार सम्बन्धी जानकारी

1.2 नेपालको सामाजिक एवं सांस्कृतिक अवस्थाः परम्परा, धर्म, जाति, भाषाभाषी, कला, संस्कृति र साहित्य

1.3 नेपालमा विद्युत विकास, उर्जाका श्रोत र सम्भावना

1.4 नेपालको संघीय, प्रादेशिक र स्थानीय संरचना तथा शासन प्रणाली सम्बन्धी जानकारी

1.5 विश्वको भूगोलः महादेश, महासागर, अक्षांश, देशान्तर, अन्तर्राष्ट्रिय तिथि रेखा, समय, पर्वतशृंखला, नदी, हिमनदी. ताल, हिमताल

1.6 संयुक्त राष्ट्र संघ र यसका एजेन्सीहरू सम्बन्धी जानकारी

1.7 दक्षिण एशियाली क्षेत्रीय सहयोग संगठन (SAARC), SAARC- Energy Center, बिमस्टेक (BIMSTEC) सम्बन्धी जानकारी

1.8 राष्ट्रिय र अन्तर्राष्ट्रिय महत्त्वका समसामयिक घटना तथा नवीनतम गतिविधिहरू

**2. संविधान, विद्युत क्षेत्रको नियमन र सम्बन्धित कानुनी व्यवस्था (१५ × १ = १५ अङ्क)**

2.1 नेपालको संविधानः मौलिक हक र कर्तव्य, राज्यका निर्देशक सिद्धान्त, नीति तथा दायित्व, अनुसूचीहरू

2.2 विद्युत ऐन, २०४९ र विद्युत नियमावली, २०५०

2.3 विद्युत नियमन आयोग ऐन, २०७४ तथा विद्युत नियमन आयोग नियमावली, २०७५

2.4 विद्युत नियमन आयोग कर्मचारी प्रशासन विनियमावली, २०८१

2.5 सार्वजनिक खरिद ऐन, २०६३

2.6 विद्युत क्षेत्रमा नियमनको अवधारणा

2.7 विद्युत नियमन आयोगको काम, कर्तव्य तथा अधिकार

2.8 उपभोक्ता महशुल निर्धारणको सिद्धान्त तथा प्रक्रिया

2.9 विद्युत खरिद बिक्री दर निर्धारणका सिद्धान्त तथा प्रक्रिया

2.10 विद्युत नियमन आयोगको पाँच वर्षे मार्गचित्र २०८१-८६

**3. Aptitude Test (20 ×1 = 20 Marks)**

3.1 Verbal reasoning :

Series, analogy, classification, coding-decoding, insert the missing character, direction and distance sense test, ranking order, assertion and reason, statement and conclusion

3.2 Non-verbal reasoning:

Series, analogy, classification, matrices, figure formation and analysis, dot situation, water images, mirror images, embedded figures.

3.3 Quantitative aptitude:

Arithmetical reasoning/operation, percentage, fraction, ratio, average, profit & loss, time and work

3.4 General mental ability, logical reasoning and analytical ability, data interpretation

विद्युत नियमन आयोग

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खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

खण्ड (ख)

**General Technical Subject: (50 ×1 = 50 Marks)**

1. **Introduction**
   - 1.1 Theory of plate tectonic: plates and plate boundaries
   - 1.2 Overview of the geology of the Himalaya and Nepal
   - 1.3 Tectonic division of Nepal Himalaya: Terai, Siwaliks, Lesser Himalaya, Higher Himalaya and Tibetan Tethys
   - 1.4 Geological maps and profiles and their uses
   - 1.5 Natural hazards : types and mitigations

2. **Hydrogeology**
   - 2.1 Hydrological cycle, occurrences of groundwater, Hydrogeological properties of rocks and sediments, vertical distribution of ground water, Types of aquifers, aquifer parameters, springs
   - 2.2 Groundwater movements: Darcy's law and its validity, hydraulic conductivity and its determination by laboratory and field methods, groundwater exploration techniques
   - 2.3 Water wells: different kinds of well structures, methods of drilling in hard rocks, soft rocks and unconsolidated sediments for groundwater development
   - 2.4 Influence of environmental factors on groundwater level
   - 2.5 Quality of groundwater: causes and measures of water quality, standard for different purposes of usage, sources of groundwater pollution
   - 2.6 Groundwater resources of Nepal: ground condition in different geological formations, groundwater potential of Nepal in mountains and Terai region

3. **Engineering Geology**
   - 3.1 Scope and objectives of engineering geology
   - 3.2 Importance of engineering geological studies
   - 3.3 Rock types
   - 3.4 Surface (quaternary) deposits
   - 3.5 Specific engineering properties of rocks and soils of Nepal

4. **Geological Data Collection and Survey**
   - 4.1 Geological survey
   - 4.2 Geophysical exploration
   - 4.3 Exploratory drilling and subsurface exploration
   - 4.4 Core logging, water pressure tests and in-situ/laboratory tests
   - 4.5 Exploratory audit and shafts and caverns

5. **Soil Mechanics**
   - 5.1 Soil classification and index properties and American Society for Testing and Materials (ASTM) procedures
   - 5.2 Soil deformations: uniaxial and tri-axial

5.3 Soil deformation environment: undrained and drained
5.4 Soil foundation: types, tests and construction practices

6. **Rock Mechanics**
   6.1 Classification of rock mass; rating methods
   6.2 Rock mass forming the in the tunnels: structural qualification of rocks (Mohr's hardness scale, rock quality designation and stability), rock mass competence and structural stability, other irregularities influencing rock mass in situ characteristics
   6.3 Ground forces, stress fields and stress concentration: empirical concepts of stress concentration, concepts of ground failure (bumps, rock bursts, theories of bumps and rock burst), stress concentration around excavations, stress concentration in structures
   6.4 Failure characteristic around mine workings: fracture development around excavation, fracture development in structures
   6.5 Rock mechanics and experimental techniques: determinable rock properties, strength properties, strength indices, rock mass hardness, and material characteristics
   6.6 Protective and preventive measures: classification of supports, form of supports and material of construction, protection of excavation, roadways, various types of supports, rock bolting, roof stitching, preventive measures (guniting, grouting), face supports)
   6.7 Strength of rock mass; investigation methods and tests
   6.8 Surface and underground excavations and tunnel working
   6.9 Support of excavated surface and caverns
   6.10 Terzaghi's rock load classification
   6.11 Deere's Rock Quality Designation (RQD)
   6.12 CSIR Classification and Rock Masses Rating (RMR)
   6.13 NGI Tunneling Quality Index (Q System)

7. **Slope Stability**
   7.1 Types of mass movement: Varne's classification and factors affecting slope stability; hazards and risk: hazard mapping
   7.2 Prevention and slope stabilization measures in rock and soil slopes
   7.3 Retaining structures: types, safety factors and construction

8. **Construction Materials**
   8.1 Types of exploration for construction material
   8.2 In-situ and laboratory tests for index properties
   8.3 Reserve estimation
   8.4 Environmental assessments

9. **Phases and Stages of Engineering Geological Studies**
   9.1 Preconstruction, construction, operation and maintenance

10. **Geophysical and Geochemical Exploration**
    - 10.1 General principles of geophysical exploration and its applicability and limitations, application and significance of local and regional anomalies
    - 10.2 Principles, application and limitation of gravity survey; identification and interpretation of anomalies; importance of correction factors in gravity survey
    - 10.3 Basic principles, application and limitation of magnetic survey; identification and interpretation of anomalies; significance of correction factors in magnetic survey
    - 10.4 Basic principles, application and limitation of electrical resistivity, induced polarization, self-potential, telluric and electromagnetic methods; basic factors essential in such survey; identification and interpretation of anomalies
    - 10.5 Basic principles, application and limitation of seismic reflection and refraction surveys; factors important in seismic reflection and refraction surveys; earthquake seismology
    - 10.6 Principles of geochemistry, application and limitation of geochemical exploration
    - 10.7 Primary and secondary dispersion: clastic and hydromorphic dispersion; mobility of elements, indicator and path finder elements
    - 10.8 Trace element abundance in natural materials, common geochemical association of the trace elements in different types of mineral deposits and rocks
    - 10.9 Soil survey: drainage sediment survey, heavy concentrate survey, water and vegetation survey, background and threshold values and geochemical anomalies
    - 10.10 Dating techniques of rocks and sediments

11. **Engineering Structures**
    - 11.1 Dams : foundation excavation and foundation treatment
    - 11.2 Tunnel and caverns : tunnel geometry and design, excavation methods
    - 11.3 Roads : road slope stability analysis, retaining structures and bio-engineering
    - 11.4 Bridges and buildings : foundation types and design, bearing capacity and tests, construction and soil-treatments
    - 11.5 Irrigation and river training works
    - 11.6 Intake facilities: weir and barrages
    - 11.7 Distribution facilities: canals and regulators
    - 11.8 River training works: embankments, spurs and diversions

12. **Engineering Seismology**
    - 12.1 Earthquake: generation and classification
    - 12.2 Seismic hazards, seismic zonation maps
    - 12.3 Aseismic design

13. **Remote Sensing and GIS**
    - 13.1 Aerial and space photography, advantages and limitations
    - 13.2 Aerial Photography and Satellite Imagery: conventional aerial photographs and satellite imageries, basic geometrical relations of scale parallax and heights using stereoscopes, quantitative determination of geological data

13.3 Photo/Image Interpretation: Principles and elements of photo/image for geological applications, interpretation of SLAR imagery
13.4 Digital image processing and image classification
13.5 GPS: data acquisition, error in GPS data, applications in mapping and seismic monitoring
13.6 GIS : development, uses, GIS data sources and database management
13.7 Maps : characteristics, projections, coordinate system, precision and error
13.8 Spatial data models; spatial analysis and preparation of maps

14. **General Geology of Nepal**

14.1 Geology of Nepal Himalaya, sedimentary basin, stratigraphy, tectonic divisions and structures
14.2 Common minerals found in Nepal, their applications and status of mining
14.3 Identification of rocks, minerals and their potential use
14.4 Geological mapping, granite occurrences, petrography and age
14.5 Engineering properties of soil and rocks
14.6 Site investigation for heavy structures such as dam, bridge and buildings
14.7 Soil erosion, landslides and their preventive measures
14.8 Earthquakes and causes of frequent earthquakes in Himalayan region, seismo-tectonics of the Himalaya
14.9 Leakage and siltation problems in a huge water reservoir and their solutions

15. **Application of Geology in Hydropower Development**

15.1 Types and significance of geotechnical investigation for hydropower projects; sources of geological data of hydropower projects
15.2 Types of tunnels used in hydropower projects in Nepal and their significances
15.3 Interrelation between hydrological and geotechnical aspects of hydropower
15.4 Concept of overburden and squeezing phenomenon, impact and remedy of squeezing
15.5 Hydrogeology and its impact on hydropower construction and operation
15.6 Impact of seismic hazards construction and operation of hydropower projects and reservoir induced seismicity
15.7 Underground excavation, advantages and disadvantages of tunnel boring machine (TBM) over traditional tunnel excavation techniques; underground supports, types and application
15.8 Common geological challenges in hydropower projects of Nepal and its mitigation measures

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खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र :

**Technical Subject**

खण्ड (क) : ५० अङ्क

## 1. Introduction

1.1 Theory of plate tectonic: Plates and Plate Boundaries
1.2 Overview of the geology of the Himalaya
1.3 Geology of Nepal: Litho-tectonic divisions and structures
1.4 Tectonic division of Nepal Himalaya: Terai, Siwaliks, Lesser Himalaya, Higher Himalaya and Tibetan Tethys
1.5 Physiographic and geological divisions of Nepal
1.6 Geological Maps and Profiles and their uses
1.7 Natural Hazards; types and mitigations

## 2. Hydrogeology

2.1 Introduction, Hydrological cycle, Occurrences of groundwater, Hydrogeological properties of rocks and sediments, Vertical distribution of ground water, Types of aquifers, aquifer parameters, springs
2.2 Groundwater Movements: Darcy's Law and its validity. Hydraulic conductivity and its determination by laboratory and field methods. Groundwater exploration techniques
2.3 Water Wells: Different kinds of well structures, methods of drilling in hard rocks, soft rocks and unconsolidated sediments for groundwater development. Well design and well development. Well rehabilitation, estimation of well efficiency
2.4 Influence of Environmental Factors on Groundwater Level: Secular, seasonal, diurnal and incidental changes
2.5 Quality of Groundwater: Causes and measures of water quality, standard for different purposes of usage, sources of groundwater pollution
2.6 Groundwater Resources of Nepal: Ground condition in different geological formations, groundwater potential of Nepal in mountains and Terai region

## 3. Engineering Geology

3.1 Scope and Objectives of Engineering Geology
3.2 Importance of Engineering Geological Studies
3.3 Rock Types
3.4 Surface (Quaternary) deposits
3.5 Specific engineering properties of rocks and soils of Nepal

## 4. Geological Data Collection and Survey

4.1 Geological Survey
4.2 Geophysical exploration
4.3 Exploratory drilling and subsurface exploration
4.4 Core logging, water pressure tests and In-situ/Laboratory tests

4.5 Exploratory audit and shafts and Caverns

**5. Soil Mechanics**

5.1 Soil Classification and Index Properties and American Society for Testing and Materials (ASTM) Procedures
5.2 Soil Deformations: Uniaxial and Tri-axial
5.3 Soil Deformation environment: Undrained and Drained
5.4 Soil Foundation: types, tests and construction practices

**6. Rock Mechanics**

6.1 Classification of Rock Mass; Rating Methods
6.2 Rock Mass forming the in the tunnels: Structural Qualification of Rocks (Mohs' Hardness Scale, Rock Quality Designation and Stability), Rock Mass Competence and Structural Stability, Other Irregularities Influencing Rock Mass in Situ Characteristics
6.3 Ground Forces, Stress Fields and Stress Concentration: Empirical Concepts of Stress Concentration, Concepts of Ground Failure (Bumps, Rock Bursts, Theories of bumps and rock burst), Stress concentration around Excavations, Stress concentration in Structures.
6.4 Failure Characteristic Around Mine Workings: Fracture Development around excavation, Fracture Development in Structures.
6.5 Rock Mechanics and Experimental Techniques: Determinable Rock Properties, Strength properties, Strength Indices, Rock Mass Hardness, and Material Characteristics
6.6 Protective and Preventive Measures: Classification of Supports, Form of Supports and Material of Construction, Protection of Excavation, Roadways, Various types of Supports, Rock Bolting, Roof Stitching, Preventive Measures (Guniting, Grouting), Face Supports)
6.7 Strength of Rock Mass; Investigation Methods and Tests
6.8 Surface and Underground Excavations and Tunnel Working
6.9 Support of Excavated Surface and Caverns
6.10 Terzaghi's Rock Load Classification
6.11 Deere's Rock Quality Designation (RQD)
6.12 CSIR Classification and Rock Masses Rating (RMR)
6.13 NGI Tunneling Quality Index (Q System)

**7. Slope Stability**

7.1 Types of Mass Movement: Varne's Classification and Factors Affecting Slope Stability
7.2 Hazards and Risk: Hazard Mapping
7.3 Prevention and Slope Stabilization Measures in Rock and Soil Slopes
7.4 Retaining Structures: Types, safety factors and construction

**8. Construction Materials**

8.1 Types of Exploration for Construction Material
8.2 In-situ and Laboratory Tests for Index Properties
8.3 Reserve Estimation
8.4 Environmental Assessments

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**9. Phases and Stages of Engineering Geological Studies**

9.1 Preconstruction
  9.1.1 Reconnaissance
  9.1.2 Pre-Feasibility
  9.1.3 Feasibility
  9.1.4 Detailed Design
9.2 Construction
9.3 Operation and Maintenance

**10. Geophysical and Geochemical Exploration**

10.1 General principles of geophysical exploration and its applicability and limitations, physical properties involved in geophysical exploration and factors controlling geophysical anomalies, application and significance of local and regional anomalies
10.2 Principles, application and limitation of gravity survey; identification and interpretation of anomalies; importance of correction factors in gravity survey
10.3 Basic principles, application and limitation of magnetic survey; identification and interpretation of anomalies; significance of correction factors in magnetic survey.
10.4 Basic principles, application and limitation of electrical resistivity, induced polarization, self-potential, telluric and electromagnetic methods; basic factors essential in such survey; identification and interpretation of anomalies
10.5 Basic principles, application and limitation of seismic reflection and refraction surveys; factors important in seismic reflection and refraction surveys; earthquake seismology, seismic waves propagation through interior of earth. Seismic wave velocity model
10.6 Principles of geochemistry, application and limitation of geochemical exploration
10.7 Primary and secondary dispersion: clastic and hydromorphic dispersion; mobility of elements, indicator and path finder elements
10.8 Trace element abundance in natural materials, common geochemical association of the trace elements in different types of mineral deposits and rocks
10.9 Soil survey: drainage sediment survey, heavy concentrate survey, water and vegetation survey, background and threshold values and geochemical anomalies
10.10 Dating techniques of rocks and sediments

**11. Engineering Structures**

11.1 Dams
  11.1.1 Foundation Excavation

11.1.2 Foundation Treatment

11.2 Tunnel and Caverns
- 11.2.1 Tunnel Geometry and Design
- 11.2.2 Excavation Methods

11.3 Roads
- 11.3.1 Road Slope Stability Analysis
- 11.3.2 Retaining Structures and Bio-engineering

11.4 Bridges and Buildings
- 11.4.1 Foundation Types and Design
- 11.4.2 Bearing Capacity and Tests
- 11.4.3 Construction and Soil-treatments

11.5 Irrigation and River Training Works
- 11.5.1 Intake facilities: weir and barrages
- 11.5.2 Distribution Facilities: Canals and Regulators
- 11.5.3 River Training Works: Embankments, Spurs and Diversions

**12. Engineering Seismology**

12.1 Earthquake: generation and classification

12.2 Seismic Hazards, Seismic Zonation Maps

12.3 Aseismic Design

**13. Remote Sensing and GIS**

13.1 Development in aerial and space photography, advantages and limitations of photo geological techniques

13.2 Aerial Photography and Satellite Imagery: Use of conventional aerial photographs and satellite imageries, basic geometrical relations of scale parallax and heights using stereoscopes, quantitative determination of geological data

13.3 Photo/Image Interpretation: Principles and elements of photo/image for geological applications, interpretation of SLAR imagery

13.4 Digital Image Processing: Image rectification and restoration. Image enhancement.

13.5 Contrast manipulation. Spatial feature manipulation. Multi-image manipulation.

13.6 Image classification. Supervised classification. Unsupervised classification

13.7 Classification accuracy assessment

13.8 GPS: Data acquisition, error in GPS data, applications in mapping and seismic monitoring

13.9 GIS and Maps: Development of GIS and its uses, GIS data sources and database management. Maps characteristics, projections, coordinate system, precision and error

13.10 Spatial Data Models: Concept of data model, vector and raster data model, topology, TIN data model

13.11 Spatial Analysis and Preparation of Maps: Spatial interpolation methods, raster and vector analysis, map overlay, map calculations, statistics, integrated spatial analysis

13.12 Map design, map elements, choosing a map type, exporting map in different format, printing a map

**14. General Geology of Nepal**

14.1 Geology of Nepal Himalaya, Sedimentary Basin, Stratigraphy, Tectonic Divisions and Structures
14.2 Common minerals found in Nepal, their applications and status of mining
14.3 Identification of rocks, minerals and their potential use
14.4 Geological mapping, acid magmatism, granite occurrences, their petrography and age
14.5 Engineering properties of soil and rocks
14.6 Site Investigation for Heavy Structures such as dam, bridge and buildings
14.7 Soil erosion, landslides and their preventive measures
14.8 Earthquakes and causes of frequent earthquakes in Himalayan Region, Seismo-tectonics of the Himalaya
14.9 Leakage and siltation problems in a huge water reservoir and their solutions
14.10 Soil erosion, landslides and flooding as common geological hazards in Nepal and their mitigation measures

**15. Application of Geology in Hydropower Development**

15.1 Types and significance of geotechnical investigation for hydropower projects; Sources of geological data of hydropower projects
15.2 Types of tunnels used in hydropower projects in Nepal and their significances
15.3 Interrelation between hydrological and geotechnical aspects of hydropower
15.4 Concept of overburden and squeezing phenomenon, impact and remedy of squeezing
15.5 Hydrogeology and its impact on hydropower construction and operation
15.6 Impact of seismic hazards construction and operation of hydropower projects and Reservoir induced seismicity
15.7 Underground excavation, advantages and disadvantages of tunnel boring machine (TBM) over traditional tunnel excavation techniques; Underground Supports, types and application
15.8 Common geological challenges in hydropower projects of Nepal and its mitigation measures