

द्वितीय पत्र (Paper II): Technical Subject

Section A – 30 Marks

1. Fundamentals of Surveying

1.1 Introduction

- 1.1.1 Historical Background
- 1.1.2 Objectives
- 1.1.3 Principles of surveying
- 1.1.4 Classification
- 1.1.5 Linear and Angular Measurements
- 1.1.6 Survey computations: Bearing, Coordinates, Reduced Level, Area & Volume
- 1.1.7 Units, Standardization and Conversion
- 1.1.8 Application of Surveying
- 1.1.9 Role of International Surveying and Mapping Communities

1.2 Surveying and Mapping Technology

- 1.2.1 Selection, Use, Feasibility, Sustainability, Transfer and Development
- 1.2.2 Instruments, Hardware, Software, Procuring, Maintaining and Upgrading

1.3 Survey Management

- 1.3.1 Surveying Need Assessment
- 1.3.2 Terms of Reference
- 1.3.3 Survey Design, Specification and Costing
- 1.3.4 Tasks, Identification and distribution
- 1.3.5 Tools, Equipment and accessories
- 1.3.6 Checking and Adjusting Instruments
- 1.3.7 Supervision
- 1.3.8 Production
- 1.3.9 Reports
- 1.3.10 Problems of Field Surveying in Nepal
- 1.3.11 Safety Management
- 1.3.12 Professional Ethics, Code and Conduct
- 1.3.13 Community Skill of Surveyor
- 1.3.14 Coordination of Institutional Resources
- 1.3.15 Governmental, Non Governmental and International Non Governmental Organization
- 1.3.16 Public Private Partnership
- 1.3.17 User Groups
- 1.3.18 Public Relations

1.4 Statistical Concepts

- 1.4.1 Introduction and Application
- 1.4.2 Measure of Central Tendency: Mean, Median, Mode, Standard Deviation
- 1.4.3 Variance, Co-Variance
- 1.4.4 Correlation and Regression
- 1.4.5 Probability, Normal Distribution

1.5 Error and Adjustments

- 1.5.1 Introduction
- 1.5.2 Fundamentals of Theory of Measurement Errors
- 1.5.3 Accuracy and Precision
- 1.5.4 Least Square Adjustments
- 1.5.5 Propagation of Errors

2. Cadastre

2.1 Land Registration

- 2.2.1 Land Rights and Land Records
- 2.2.2 Land Transfers
- 2.2.3 Registration of Deeds
- 2.2.4 Registration of Titles
- 2.2.5 Fragmentation and Consolidation
- 2.2.6 Horizontal Sub division
- 2.2.7 Systematic Adjudication
- 2.2.8 Land Tenure
- 2.2.9 Land Record in Nepal
- 2.2.10 Land Registries

2.2 Cadastral Surveying

- 2.2.1 Cadastral Concepts
- 2.2.2 Principles of cadastral Surveying
- 2.2.3 Boundaries
- 2.2.4 Parcel
- 2.2.5 Cadastral Survey Methods
- 2.2.6 Cadastral System
- 2.2.7 Cadastral Interface
- 2.2.8 Maintenance of cadastre
- 2.2.9 Land Laws
- 2.2.10 Cadastral Surveys in Nepal

2.3 Land Management

- 2.3.1 Principles of Management
- 2.3.2 Cadastral Organization
- 2.3.3 Land Development Planning
- 2.3.4 Financial Aspects
- 2.3.5 Land Use
- 2.3.6 Land Management
- 2.3.7 GIS Applications
- 2.3.8 Land Administration
- 2.3.9 Overview of Land related Acts and Rules of Nepal

2.4 Land Information System (LIS)

- 2.4.1 Need for LIS
- 2.4.2 Concept of LIS
- 2.4.3 Need for coordination: Structure
- 2.4.4 Parcel based LIS: The Multipurpose Cadastre
- 2.4.5 The Economics of LIS

Section B – 20 Marks

3. Geodesy

3.1 Introduction to Control Surveying

- 3.1.1 Horizontal Controls
- 3.1.2 Vertical Controls

3.2 Methods of Control Surveying

- 3.2.1 Leveling: Geodetic and Ordinary Leveling
- 3.2.2 Triangulation and Trilateration: Principle, Figure and Strength, Procedures, Computation

- 3.2.3 Traversing: Principle, Procedures, Computation
- 3.2.4 Intersection and Resection: Importance, Procedures, Computation
- 3.3 Elementary Geodesy and Astronomy
 - 3.3.1 Concepts
 - 3.3.2 Geodetic Datum and Reference Ellipsoid, Deflection of Vertical, Laplace Equation
 - 3.3.3 Coordinate Systems: Spherical, Geodetic and Astronomical Coordinates
 - 3.3.4 Transformations of Coordinates and Datum Transformation
 - 3.3.5 Celestial Sphere, Celestial Elements, Astronomical Triangle and Time Systems
 - 3.3.6 Astronomical Positioning: Determination of Azimuth, Latitude and Longitude
- 3.4 Physical Geodesy
 - 3.4.1 Concepts
 - 3.4.2 Gravity Force, Gravity Potential, Measured and Normal Gravity, Gravity Anomaly
 - 3.4.3 Equipotential Surface, Orthometric Height and Dynamic Height
 - 3.4.4 Absolute and Relative Gravimeters
- 3.5 Global Positioning System
 - 3.5.1 Introduction to Space Geodesy
 - 3.5.2 Principle of Global Positioning System (GPS)
 - 3.5.3 GPS Signals
 - 3.5.4 Satellite Geometry and Accuracy
 - 3.5.5 GPS Positioning
 - 3.5.6 Static and Kinematic Observations
 - 3.5.7 Geocentric Coordinates and WGS 84
 - 3.5.8 GPS Data Processing

Section C – 20 Marks

4. Photogrammetry and Remote Sensing

- 4.1 Introduction
 - 4.1.1 Basic Principles of Photogrammetry
 - 4.1.2 Definitions of some terms used in Photogrammetry
- 4.2 Aerial Camera
 - 4.2.1 Introduction
 - 4.2.2 Parts of Aerial Camera
 - 4.2.3 Types of Camera
 - 4.2.4 Characteristics of Aerial Camera
- 4.3 Aerial Photography
 - 4.3.1 Types of Aerial Photography
 - 4.3.2 Scale of Aerial Photography
 - 4.3.3 Format of the Photograph
 - 4.3.4 Flight Planning
 - 4.3.5 Aerial Photo Processing
 - 4.3.6 Relief Displacement
 - 4.3.7 Tilt Displacement
- 4.4 Binocular Vision
 - 4.4.1 Stereoscopic Vision
 - 4.4.2 Pseudoscopic Vision
 - 4.4.3 Anaglyph System

- 4.4.4 Parallax
- 4.5 Photo Interpretations
 - 4.5.1 Steps in Photo Interpretation
 - 4.5.2 Elements of Photo Interpretation
- 4.6 Rectification
 - 4.6.1 Introduction
 - 4.6.2 Conventional Rectification
 - 4.6.3 Differential Rectification
 - 4.6.4 Ortho-photo
 - 4.6.5 Photo-mosaics
- 4.7 Photo Control and Aerial Triangulation
 - 4.7.1 Selection of Photo Control Points
 - 4.7.2 Pre-marking and Post-marking
 - 4.7.3 Point Transfer
 - 4.7.4 Introduction to aerial Triangulation
 - 4.7.5 Phases of Aerial Triangulation
 - 4.7.6 Methods of Aerial Triangulation Adjustment
- 4.8 Analogue Photogrammetry
 - 4.8.1 Introduction to Analogue Plotters
 - 4.8.2 Types of Stereo Plotters
 - 4.8.3 Principles of Stereo Plotters
 - 4.8.4 Orientations: Inner, Relative and Absolute Orientation
 - 4.8.5 Data Acquisition
- 4.9 Analytical Photogrammetry
 - 4.9.1 Introduction
 - 4.9.2 Mathematical relationship between image and object space
 - 4.9.3 Spatial Orientation and Measurements
- 4.10 Digital Photogrammetry
 - 4.10.1 Introduction and Concepts
 - 4.10.2 Image Acquisition
 - 4.10.3 Processing
 - 4.10.4 Feature Extraction
- 4.11 Remote Sensing
 - 4.11.1 Introduction
 - 4.11.2 Brief History of Remote Sensing
 - 4.11.3 Concepts of Satellite Remote Sensing
- 4.12 Image Processing and Interpretation
 - 4.12.1 Geo-referencing
 - 4.12.2 Processing: Geometric and Radiometric Processing
 - 4.12.3 Image Interpretation and Analysis
 - 4.12.4 Errors
- 5. Engineering Survey**
 - 5.1 Introduction
 - 5.1.1 Control and Detail Surveys
 - 5.1.2 Route Surveying-Plan and Profiles
 - 5.1.3 Curves- Types, Geometry Setting out and Application
 - 5.1.4 Area and Volume
 - 5.2 Construction Surveys
 - 5.2.1 Buildings

- 5.2.2 Pipelines
- 5.2.3 Roads and Highways
- 5.2.4 Tunnels
- 5.2.5 Hydropower-Intake, Reservoir, Dam, Powerhouse
- 5.2.6 Bridges
- 5.2.7 Canals
- 5.2.8 Transmission Lines
- 5.2.9 Setting out Surveys
- 5.3 Hydrographic Surveys
 - 5.3.1 Discharge
 - 5.3.2 Bathymetric Survey

Section D – 30 Marks

6. Cartography

6.1 Introduction

- 6.1.1 Historical Background
- 6.1.2 Scope of Cartography and Earth as a Cartographic Problem
- 6.1.3 Cartographic Concepts
- 6.1.4 Conventional and Digital Cartography
- 6.1.5 Map Production: Map Compilation and Map Reproduction
- 6.1.6 Topographic Cartography: Large Scale and Base Map
- 6.1.7 Small Scale mapping
- 6.1.8 Thematic Cartography

6.2 Geo Information

- 6.2.1 Data (Geometric and Attribute)
- 6.2.2 Information & Information System
- 6.2.3 Geographical Information System (GIS)
- 6.2.4 Database (Basic Concepts, Design and Principles)

6.3 Data Acquisition, Processing, Analysis, Visualization and Presentation (Conventional and Digital Environments)

- 6.3.1 Data Acquisition: Data Sources- Maps, Records (Tables, Texts), Digital Data, Ground Surveys, GPS, Aerial Photography, Satellite Imagery, Documents; Toponymy; Digitization
- 6.3.2 Data Processing: Geo-referencing; Map Projection (Introduction, Classification, Choice and Uses); Data Integration; Editing, Spatial Relationship and Topology; Spatial Analysis (Merge, Buffer Overlay); Attribute Database (Topographic and Thematic)
- 6.3.3 Visualization and Presentation: Spatial and Attribute data; Statistical Surface; Classification of Data; Measurement Level of Data (Nominal, Ordinal, Interval and Ratio); Map design (Principles); Mapping Methods -Symbols; Generalization – conceptual and graphical; Graphic Variables; Typography-Map in and for www (Web Cartography)

6.4 Map Reproduction

- 6.4.1 Map Reproduction in Conventional Environment - Photography, Copying and Printing
- 6.4.2 Map Reproduction in Digital Environment

7. Spatial Information System and Digital Terrain Model (SIS and DTM)

- 7.1 Data Structure, Spatial-Non Spatial Data Source
 - 7.1.1 Vector Data and Raster Data

- 7.1.2 Resolution of Raster Image
- 7.1.3 Object oriented Vector Data
- 7.1.4 Topological Vector Data
- 7.1.5 Data Integration
- 7.2 Spatial Database Management
 - 7.2.1 Introduction
 - 7.2.2 Data Modeling
 - 7.2.3 Database Design and Maintenance
 - 7.2.4 6.2.4 Storage and Archives, Data Security
- 7.3 Data Standards and Quality
 - 7.3.1 Data/Metadata standards: Standardization Format and Accuracy
 - 7.3.2 Data quality Administration
 - 7.3.3 Copyright
- 7.4 Geographical Information System (GIS)
 - 7.4.1 Introduction to GIS
 - 7.4.2 GIS components
 - 7.4.3 Data Model
 - 7.4.4 GIS Operations and Spatial Analysis
- 7.5 National Spatial Database Infrastructure
 - 7.5.1 Metadata
 - 7.5.2 Data Sharing
 - 7.5.3 Clearinghouse
 - 7.5.4 Spatial Information Service
- 7.6 Digital Terrain Model (DTM)
 - 7.6.1 Introduction
 - 7.6.2 Data Collection, Processing and Creation of DTM
 - 7.6.3 Storage and Presentation: Triangulated Irregular Network (TIN), Grid and Contours
 - 7.6.4 Resolution, Error and Implications
 - 7.6.5 Application: Flythrough, View shed, Overlay
- 7.7 Global Mapping
- 7.8 Information Communication Technology (ICT) Applications
 - 7.8.1 Introduction to Web and Internet
 - 7.8.2 Client server computing
 - 7.8.3 Data dissemination through web
 - 7.8.4 Web Maps: Static, Dynamic and Interactive

प्रदेश लोक सेवा आयोग, प्रदेश नं.२
इञ्जिनियरिङ्ग सेवा, सर्भे समूह, अधिकृत सातौं तह, नापी अधिकृत पदको खुला तथा अन्तर सेवा
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

इञ्जिनियरिङ्ग सेवाका विभिन्न समूह/उपसमूह, अधिकृत सातौं तहको पदमा प्रथम चरणको लिखित परीक्षाबाट
छनौट भएका उम्मेदवारहरुलाई मात्र लिइने सामूहिक परीक्षण (**Group Test**) को लागि

सामूहिक छलफल (**Group Discussion**)

यस प्रयोजनका लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेता विहिन सामूहिक
छलफल (Leaderless Group Discussion) का रुपमा अवलम्बन गरिने छ । दिइएका प्रश्न वा Topic का
विषयमा पालैपालोसँग निर्दिष्ट समय भित्र समूह बीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति
(Individual Presentation) गर्नु पर्नेछ । यस परीक्षणमा मूल्याङ्कनका लागि ३ जना भन्दा बढीको समिति
रहनेछ ।