

लोक सेवा आयोग
नेपाल इन्जिनियरिङ्ग सेवा, सर्भे समूह, राजपत्राङ्कित तृतीय श्रेणीका पदहरूको खुला र आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

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

प्रथम चरण :- लिखित परीक्षा पूर्णाङ्क :- २००
द्वितीय चरण :- अन्तर्वार्ता पूर्णाङ्क :- ३०

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या X अङ्कभार	समय
प्रथम	सर्भे विज्ञान सम्बन्धी विषय	१००	४०	वस्तुगत बहुउत्तर (Multiple Choice)	१००X१ = १००	१ घण्टा १५ मिनेट
द्वितीय		१००	४०	विषयगत (Subjective)	१०X१० = १००	३ घण्टा

द्वितीय चरण

विषय	पूर्णाङ्क	परीक्षा प्रणाली
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक

- लिखित परीक्षाको माध्यम भाषा अंग्रेजी वा नेपाली, अथवा अंग्रेजी र नेपाली दुवै हुन सक्नेछ ।
- माथि उल्लिखित समूहको पाठ्यक्रमको प्रथम तथा द्वितीय पत्रको विषयवस्तु एउटै हुनेछ ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- प्रथम तथा द्वितीय पत्रहरूका एकाईहरूको प्रश्नसंख्या निम्नानुसार हुनेछ :

प्रथम पत्रका एकाई	1	2	3	4	5	6	7
प्रश्न संख्या	20	15	15	15	10	10	15
द्वितीय पत्रका एकाई	1	2	3	4	5	6	7
प्रश्न संख्या	2	2	1	2	1	1	1

- द्वितीय पत्रको विषयगत प्रश्नहरूको स्वरूप निम्नानुसार हुन सक्नेछ :
 - ५.१ लामो उत्तर दिने १० अङ्कका पूरा प्रश्नहरू सोध्न सकिनेछ ।
 - ५.२ एउटै प्रश्नलाई दुई वा दुई भन्दा बढी भागमा (Two or more parts of a single question) विभाजन गरी सोध्न सकिनेछ ।
 - ५.३ एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- प्रथम पत्रमा वस्तुगत बहुउत्तर (Multiple Choice) प्रश्नहरूको उत्तर सही दिएमा प्रत्येक सही उत्तर बापत १ (एक) अङ्क प्रदान गरिनेछ भने गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अर्थात ०.२ अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- यस पाठ्यक्रममा जेसुकै लेखिएको भएता पनि पाठ्यक्रममा परेका ऐन, नियमहरू परीक्षाको मिति भन्दा ३ (तीन) महिना अगाडि (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा रहेको सम्झनु पर्दछ ।
- प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको अन्तर्वार्तामा सम्मिलित गराइनेछ ।
- यस भन्दा अगाडि लागू भएका माथि उल्लिखित उपसमूहहरूका पाठ्यक्रमहरू खारेज गरिएका छन् ।
- पाठ्यक्रम लागू मिति :- २०६२/२/१७ देखि

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प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम
प्रथम र द्वितीय पत्र :- सर्भे बिज्ञान सम्बन्धी विषय

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 Geodesy

2.1 Introduction to Control Surveying

2.2.1 Horizontal Controls

2.2.2 Vertical Controls

2.2 Methods of Control Surveying

2.2.1 Leveling: Geodetic and Ordinary Leveling

2.2.2 Triangulation and Trilateration: Principle, Figure and Strength, Procedures, Computation

2.2.3 Traversing: Principle, Procedures, Computation

2.2.4 Intersection and Resection: Importance, Procedures, Computation

2.3 Elementary Geodesy and Astronomy

2.3.1 Concepts

2.3.2 Geodetic Datum and Reference Ellipsoid, Deflection of Vertical, Laplace Equation

2.3.3 Coordinate Systems: Spherical, Geodetic and Astronomical Coordinates

2.3.4 Transformations of Coordinates and Datum Transformation

2.3.5 Celestial Sphere, Celestial Elements, Astronomical Triangle and Time Systems

2.3.6 Astronomical Positioning: Determination of Azimuth, Latitude and Longitude

2.4 Physical Geodesy

2.4.1 Concepts

2.4.2 Gravity Force, Gravity Potential, Measured and Normal Gravity, Gravity Anomaly

2.4.3 Equipotential Surface, Orthometric Height and Dynamic Height

2.4.4 Absolute and Relative Gravimeters

2.5 Global Positioning System

2.5.1 Introduction to Space Geodesy

2.5.2 Principle of Global Positioning System (GPS)

2.5.3 GPS Signals

2.5.4 Satellite Geometry and Accuracy

2.5.5 GPS Positioning

2.5.6 Static and Kinematic Observations

2.5.7 Geocentric Coordinates and WGS 84

2.5.8 GPS Data Processing

3 Photogrammetry and Remote Sensing

3.1 Introduction

3.1.1 Basic Principles of Photogrammetry

3.1.2 Definitions of some terms used in Photogrammetry

3.2 Aerial Camera

3.2.1 Introduction

3.2.2 Parts of Aerial Camera

3.2.3 Types of Camera

3.2.4 Characteristics of Aerial Camera

3.3 Aerial Photography

3.3.1 Types of Aerial Photography

3.3.2 Scale of Aerial Photography

3.3.3 Format of the Photograph

3.3.4 Flight Planning

- 3.3.5 Aerial Photo Processing
- 3.3.6 Relief Displacement
- 3.3.7 Tilt Displacement
- 3.4 Binocular Vision
 - 3.4.1 Stereoscopic Vision
 - 3.4.2 Pseudoscopic Vision
 - 3.4.3 Anaglyph System
 - 3.4.4 Parallax
- 3.5 Photo Interpretations
 - 3.5.1 Steps in Photo Interpretation
 - 3.5.2 Elements of Photo Interpretation
- 3.6 Rectification
 - 3.6.1 Introduction
 - 3.6.2 Conventional Rectification
 - 3.6.3 Differential Rectification
 - 3.6.4 Ortho-photo
 - 3.6.5 Photo-mosaics
- 3.7 Photo Control and Aerial Triangulation
 - 3.7.1 Selection of Photo Control Points
 - 3.7.2 Pre-marking and Post-marking
 - 3.7.3 Point Transfer
 - 3.7.4 Introduction to aerial Triangulation
 - 3.7.5 Phases of Aerial Triangulation
 - 3.7.6 Methods of Aerial Triangulation Adjustment
- 3.8 Analogue Photogrammetry
 - 3.8.1 Introduction to Analogue Plotters
 - 3.8.2 Types of Stereo Plotters
 - 3.8.3 Principles of Stereo Plotters
 - 3.8.4 Orientations: Inner, Relative and Absolute Orientation
 - 3.8.5 Data Acquisition
- 3.9 Analytical Photogrammetry
 - 3.9.1 Introduction
 - 3.9.2 Mathematical relationship between image and object space
 - 3.9.3 Spatial Orientation and Measurements
- 3.10 Digital Photogrammetry
 - 3.10.1 Introduction and Concepts
 - 3.10.2 Image Acquisition
 - 3.10.3 Processing
 - 3.10.4 Feature Extraction
- 3.11 Remote Sensing
 - 3.11.1 Introduction
 - 3.11.2 Brief History of Remote Sensing
 - 3.11.3 Concepts of Satellite Remote Sensing
- 3.12 Image Processing and Interpretation
 - 3.12.1 Geo-referencing
 - 3.12.2 Processing: Geometric and Radiometric Processing
 - 3.12.3 Image Interpretation and Analysis
 - 3.12.4 Errors

4 Cartography

4.1 Introduction

- 4.1.1 Historical Background
- 4.1.2 Scope of Cartography and Earth as a Cartographic Problem
- 4.1.3 Cartographic Concepts
- 4.1.4 Conventional and Digital Cartography
- 4.1.5 Map Production: Map Compilation and Map Reproduction
- 4.1.6 Topographic Cartography: Large Scale and Base Map
- 4.1.7 Small Scale mapping
- 4.1.8 Thematic Cartography

4.2 Geo Information

- 4.2.1 Data (Geometric and Attribute)
- 4.2.2 Information
- 4.2.3 Information System
- 4.2.4 Geographical Information System (GIS)
- 4.2.5 Database (Basic Concepts, Design and Principles)

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

4.3.1 Data Acquisition:

- 4.3.1.1 Data Sources- Maps, Records (Tables, Texts), Digital Data, Ground Surveys, GPS, Aerial Photography, Satellite Imagery, Documents

4.3.1.2 Toponymy

4.3.1.3 Digitization

4.3.2 Data Processing:

- 4.3.1.4 Geo-referencing
- 4.3.1.5 Map Projection (Introduction, Classification, Choice and Uses)
- 4.3.1.6 Data Integration
- 4.3.1.7 Editing, Spatial Relationship and Topology
- 4.3.1.8 Spatial Analysis (Merge, Buffer Overly etc.)
- 4.3.2.6 Attribute Database (Topographic and Thematic)

4.3.3 Visualization and Presentation:

- 4.3.3.1 Spatial and Attribute data
- 4.3.3.2 Statistical Surface
- 4.3.3.3 Classification of Data
- 4.3.3.4 Measurement Level of Data (Nominal, Ordinal, Interval and Ratio)
- 4.3.3.5 Map design (Principles)
- 4.3.3.6 Mapping Methods -Symbols
- 4.3.3.7 Generalization – conceptual and graphical
- 4.3.3.8 Graphic Variables
- 4.3.3.9 Typography
- 4.3.3.10 Map in and for www (Web Cartography)

4.4 Map Reproduction

- 4.4.1 Map Reproduction in Conventional Environment - Photography, Copying and Printing
- 4.4.2 Map Reproduction in Digital Environment

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

6 Spatial Information System and Digital Terrain Model (SIS and DTM)

6.1 Data Structure, Spatial-Non Spatial Data Source

- 6.1.1 Vector Data and Raster Data
- 6.1.2 Resolution of Raster Image
- 6.1.3 Object oriented Vector Data
- 6.1.4 Topological Vector Data
- 6.1.4 Data Integration

6.2 Spatial Database Management

- 6.2.1 Introduction
- 6.2.2 Data Modeling
- 6.2.3 Database Design and Maintenance
- 6.2.4 Storage and Archives, Data Security

6.3 Data Standards and Quality

- 6.3.1 Data/Metadata standards: Standardization Format and Accuracy
- 6.3.2 Data quality Administration
- 6.3.3 Copyright

6.4 Geographical Information System (GIS)

- 6.4.1 Introduction to GIS
- 6.4.2 GIS components
- 6.4.3 Data Model
- 6.4.4 GIS Operations and Spatial Analysis

6.5 National Spatial Database Infrastructure

- 6.5.1 Metadata
- 6.5.2 Data Sharing
- 6.5.3 Clearinghouse
- 6.5.4 Spatial Information Service

6.6 Digital Terrain Model (DTM)

- 6.6.1 Introduction
- 6.6.2 Data Collection, Processing and Creation of DTM

- 6.6.3 Storage and Presentation: Triangulated Irregular Network (TIN), Grid and Contours
- 6.6.4 Resolution, Error and Implications
- 6.6.5 Application: Flythrough, View shed, Overlay
- 6.7 Global Mapping
- 6.8 Information Communication Technology (ICT) Applications
 - 6.8.1 Introduction to Web and Internet
 - 6.8.2 Client server computing
 - 6.8.3 Data dissemination through web
 - 6.8.4 Web Maps: Static, Dynamic and Interactive

7 Cadastre

- 7.1 Land Registration
 - 7.1.1 Land Rights and Land Records
 - 7.1.2 Land Transfers
 - 7.1.3 Registration of Deeds
 - 7.1.4 Registration of Titles
 - 7.1.5 Fragmentation and Consolidation
 - 7.1.6 Horizontal Sub division
 - 7.1.7 Systematic Adjudication
 - 7.1.8 Land Tenure
 - 7.1.9 Land Record in Nepal
 - 7.1.10 Land Registries
- 7.2 Cadastral Surveying
 - 7.2.1 Cadastral Concepts
 - 7.2.2 Principles of cadastral Surveying
 - 7.2.3 Boundaries
 - 7.2.4 Parcel
 - 7.2.5 Cadastral Survey Methods
 - 7.2.6 Cadastral System
 - 7.2.7 Cadastral Interface
 - 7.2.8 Maintenance of cadastre
 - 7.2.9 Land Laws
 - 7.2.10 Cadastral Surveys in Nepal
- 7.3 Land Management
 - 7.3.1 Principles of Management
 - 7.3.2 Cadastral Organization
 - 7.3.3 Land Development Planning
 - 7.3.4 Financial Aspects
 - 7.3.5 Land Use
 - 7.3.6 Land Management
 - 7.3.7 GIS Applications
 - 7.3.8 Land Administration
 - 7.3.9 Overview of Land related Acts and Rules of Nepal
- 7.4 Land Information System (LIS)
 - 7.4.1 Need for LIS
 - 7.4.2 Concept of LIS
 - 7.4.3 Need for coordination: Structure
 - 7.4.4 Parcel based LIS: The Multipurpose Cadastre
 - 7.4.5 The Economics of LIS

वस्तुगत बहुउत्तर नमूना प्रश्नहरू (Sample Questions)

1. Which instrument is not used to measure distance between two points?
A) Planimeter
B) Geodimeter
C) Subtense bar
D) Tape

Correct Answer :- (A)

2. What is the relation between error and correction?
A) Equal in magnitude and of same sign
B) Equal in magnitude and of opposite sign
C) Different in magnitude and of same sign
D) Different in magnitude and of opposite sign

Correct Answer :- (B)

3. GPS Survey
A) gives satellite orbit
B) does not require Ephemeris for post processing
C) and Doppler Survey are same
D) gives co-ordinates in Earth-fix reference system

Correct Answer :- (D)

4. While making observation for the determination of latitude the celestial body should be near
A) Prime Vertical
B) Meridian
C) Equator
D) Horizon

Correct Answer :- (B)

5. Tilt Displacement in a near Vertical Photograph is radial from
a) Principal Point
b) Nadir
c) Isocentre
d) Optical Centre

Correct Answer :- (A)

6. Simple Rectification of an air Photograph eliminates Distortion due to
A) Camera Optics
B) Relief
C) Tilt
D) Curvature of the Earth

Correct Answer :- (C)

7. What would be the ground area represented by a map at scale 1:100 000, if the ground area has been represented in the map by 50cm x 50cm.
A) 100 000sq.m.
B) 100 sq. km.
C) 2500 sq. km.
D) 250sq. km.

Correct Answer :- (C)

8. In the series of the latest topographical base maps prepared by Survey Department Nepal, a map sheet was numbered as 2785 04, what is the scale of that map?

- A) 1:10 000
- B) 1:50 000
- C) 1:25 000
- D) 1:5 000

Correct Answer :- (B)

9. A Spiral Curve is

- A) Simple Horizontal Curve
- B) Vertical Curve
- C) Transition Curve
- D) Composite Curve

Correct Answer :- (C)

10. For two points A (1350.617m) and B (1362.517m) lying 238m apart the Gradient AB is

- A) +1:200
- B) -1:200
- C) +1:20
- D) -1:20

Correct Answer :- (C)

11. Which feature may be stored as a pair of x y coordinates ?

- A) Polygon
- B) Point
- C) Line
- D) Image

Correct Answer :- (B)

12. Which one of the following is a Temporal aspect of Spatial Data Quality ?

- A) Topological Consistency
- B) Type of Update
- C) Availability and Accessibility
- D) Positional Accuracy of Features and Attribute

Correct Answer :- (B)

13. For linking Cadastral map and Land Register, which one is essential?

- A) Parcel Number
- B) Parcel Index
- C) Co-ordinates of point within the Parcel
- D) Parcel Definition

Correct Answer :- (B)

14. A Cadastral Map is a Large Scale map

- A) featuring all Man-made and Natural details
- B) clearly describing the Shape and Size of land in question
- C) prepared to provide distinct Information on Parcel Boundary, Ownership and Land Use
- D) Made for public use and on a scale larger than 1:5000

Correct Answer :- (C)

विषयगत नमूना प्रश्नहरू (Sample questions)

1. What do you understand by Public Private Partnership and how does it contribute in the field of surveying and mapping?
2. Distinguish between (any three)
 - a) Geodetic Latitude and Astronomical Latitude
 - b) Geoid and Spheroid
 - c) Altitude (H) and Zenith Distance (Z)
 - d) Orthometric Height and Dynamic Height
3. Describe in Detail Orientation of a Photogrammetric Model.
4. How do you understand Geographical Information System (GIS) and what is the role of Cartography in GIS?
5.
 - a) What are the Methods used for Earth-work in any construction? Explain one of them.
 - b) Find the area of a quadrilateral PQRS if the vertices have their Eastings and Northings in metres as P(50,50), Q(63,48), R(61,62), S(40,66)
6. What do you understand by Digital Terrain Model (DTM)? Compare representations of DTM in different ways in terms of Efficiency and Accuracy.
7. What are the fundamental components of Cadastre? Describe the role of Cadastre in managing Man-Land relation.