गुठी संस्थान

इञ्जिनियरिङ सेवा, सर्भे समूह, अधिकृत तृतीय श्रेणी, नापी अधिकृत पदको खुला तथा आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसारका चरणमा परीक्षा लिइने छ :

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

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

परीक्षा योजना (Examination Scheme)

प्रथम चरण : लिखित परीक्षा (Written Examination) **पूर्णाङ्क :– २००**

पत्र	विषय	खण्ड	पूर्णाङ्क	उर्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या ×अङ्क	समय
प्रथम	General Subject	Part I: General Awareness & General Reasoning Test	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	५० प्रश्न × १ अङ्क	१ घण्टा ३० मिनेट
		Part II: General Technical Subject					५० प्रश्न × १ अङ्क	
द्वितीय	Technical Subject		१००	४०	विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	४ प्रश्न × ५ अङ्क ८ प्रश्न × १०अङ्क	३ घण्टा

द्वितीय चरण : अन्तर्वार्ता (Interview) **पूर्णाङ्क :– ३०**

पत्र /विषय	पूर्णाङ्क	उर्तीर्णाङ्क	परीक्षा प्रणाली	समय
अन्तर्वार्ता (Interview)	३०		बोर्ड अन्तर्वार्ता (Board Interview)	-

द्रष्टव्य :

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुबै हुनेछ ।

२. प्रथमपत्र र द्वितीयपत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

३. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस वापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।

४. वस्तुगत बहुवैकल्पिक परीक्षामा परीक्षार्थील उत्तर लेख्दा अंग्रेजी ठूलो अक्षरहरु (Capital letters): A, B, C, D मा लेख्नुपर्नेछ । सानो अक्षरहरू (Small letters): a, b, c, d लेखेका वा अन्य कुनै सङकेत गरेका भए सबै उत्तरपुस्तिका रद्द हुनेछ ।

५. बहुवैकल्पिक प्रश्न हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।

६. विषयगत प्रश्नको हकमा तोकिएको अंकको 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 ।

७. द्वितीय पत्रमा (विषयगत प्रश्न हुनेका हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोहीखण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

८. 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 पाठ्क्रममा परेको सम्झनु पर्दछ ।

९. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

१०. **पाठ्यक्रम स्वीकृत मिति : - २०८२/०३/२५**

गुठी संस्थान

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प्रथम पत्र (Paper I)

General Subject

Part (I) : - General Awareness & General Reasoning Test (50 Marks)

1. General Awareness and Contemporary Issues (25 Question ×1 Mark = 25 Marks)

1.1 Physical, socio-cultural and economic geography and demography of Nepal
1.2 Major natural resources of Nepal
1.3 Geographical diversity, climatic conditions, and livelihood & lifestyle of people
1.4 Notable events and personalities, social, cultural and economic conditions in modern history of Nepal
1.5 Current periodical plan of Nepal
1.6 Information on sustainable development, environment, pollution, climate change, biodiversity, science and technology
1.7 Nepal's international affairs and general information on the UNO, SAARC & BIMSTEC
1.8 The Constitution of Nepal (From Part 1 to 5 and Schedules)
1.9 Governance system and Government (Federal, Provincial and Local)
1.10 Provisions of civil service act and regulation relating to constitution of civil service, organizational structure, posts of service, fulfillment of vacancy and code of conduct
1.11 Functional scope of public services
1.12 Public Service Charter
1.13 Concept, objective and importance of public policy
1.14 Fundamentals of management: planning, organizing, directing, controlling, coordinating, decision making, motivation and leadership
1.15 Government planning, budgeting and accounting system
1.16 Major events and current affairs of national and international importance

2. General Reasoning Test (25 Question ×1 Mark = 25 Marks)

2.1 Logical Reasoning (9×1 Mark = 9 Marks)
Verbal Ability, Alphanumeric Series, Reasoning Analogies, Classification, Coding-Decoding, Order & Ranking, Distance & Directions, Analytical and Logical Reasoning, Assertion and Reason, Statement and Conclusion, Input Output, Venn- diagram

2.2 Numerical Reasoning (8×1 Mark = 8 Marks)
Arithmetic Series, Analogy, Classification, Arithmetical Reasoning, Fraction. Percentage, Ratio, Average, Profit & Loss, Time & Work, Date & Calendar, Data Sufficiency, Data Interpretation & Data Verification

2.3 Spatial Reasoning (8×1 Mark = 8 Marks)
Figure Series, Figure Analogy, Figure Classification, Figure Matrix, Pattern Completion, Embedded Images, Image Formation & Analysis, Mirror and Water Images, Cubes and Dices, Paper Folding & Cutting

गुठी संस्थान

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Part (II): - General Technical Subject (50 Marks)

1. Fundamentals of Surveying **(7 Question ×1 Mark = 8 Marks)**

1.1 Introduction
- 1.1.1 Historical Background
- 1.1.2 Principles of surveying
- 1.1.3 Classification of surveying
- 1.1.4 Linear and Angular Measurements
- 1.1.5 Survey computations: Bearing, Coordinates, Reduced Level, Area & Volume
- 1.1.6 Units, Standardization and Conversion
- 1.1.7 Application of Surveying
- 1.1.8 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 and Public Relation
- 1.3.14 Public Private Partnership
- 1.3.15 User Groups

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 **(6 Question ×1 Mark = 8 Marks)**

2.1 Land Registration
- 2.1.1 Land Rights and Land Records
- 2.1.2 Land Transfers
- 2.1.3 Registration of Deeds
- 2.1.4 Registration of Titles
- 2.1.5 Fragmentation and Consolidation
- 2.1.6 Horizontal Sub-division
- 2.1.7 Systematic Adjudication
- 2.1.8 Land Tenure
- 2.1.9 Land Record in Nepal

2.1.10 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 Cadastral Surveys in Nepal
2.3 Land Management
2.3.1 Principles of Land 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
2.4 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

3. Geodesy **(7 Question ×1 Mark = 8 Marks)**

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

4. Photogrammetry and Remote Sensing (7 Question ×1 Mark = 8 Marks)

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 Question ×1 Mark = 5 Marks)

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 Setting out Surveys

6. Cartography (6 Question ×1 Mark = 25 Marks)

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; Toponomy; 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 Overly); 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 (7 Question ×1 Mark = 8 Marks)

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 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

8. **Legal and Institutional Framework** **(5 Question ×1 Mark = 5 Marks)**

८.१. संवैधानिक एवं कानूनी व्यवस्था

८.१.१. नेपालको संविधानमा भूमि तथा गुठी सम्बन्धी व्यवस्थाहरु

८.१.२ गुठी संस्थान ऐन,२०३३,गुठी संस्थान (कार्यव्यवस्था) विनयम,२०४९

८.१.३ जग्गा (नापजाँच) ऐन, २०१९ र जग्गा (नापजाँच नियमावली, २०५८

८.१.४ मालपोत ऐन, २०३४ र मालपोत नियमाली, २०३६

८.१.५ भूमि व्यवस्थापन तथा अभिलेख विभाग र नापी विभागले जारी गरेका निर्देशिका कार्यविधिहरूमा गुठी व्यवस्थापन सम्बन्धी विषय

८.१.६ मुलुकी देवानी (संहिता) ऐन,२०७४ को भाग ४ परिच्छेद ६ को गुठी सम्बन्धी व्यवस्था

८.१.७ गुठी सम्बद्ध भूमिलगतको प्रकार, प्राप्त गर्ने तरिका

८.१.८ भूमि सम्बन्धी ऐन, २०२१ तथा भूमि सम्बन्धी नियमहरू २०२१

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८.१.९ भूउपयोग ऐन, २०७६ र भूउपयोग नियमावली, २०७९ तथा भूउपयोग कार्यक्रम कार्यान्वयन निर्देशिका, २०८०

८.२ गुठी संस्थान सम्बन्धी सामान्य जानकारी

८.२.१ गुठी संस्थानको परिचय

८.२.२ गुठी संस्थान कर्मचारी विनियमावली

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द्वितीय पत्र (Paper II)

Technical Subject

Section A- 50 Marks

11. Fundamentals of Surveying

1.1 Introduction
- 1.1.1 Historical Background
- 1.1.2 Principles of surveying
- 1.1.3 Classification of surveying
- 1.1.4 Linear and Angular Measurements
- 1.1.5 Survey computations: Bearing, Coordinates, Reduced Level, Area & Volume
- 1.1.6 Units, Standardization and Conversion
- 1.1.7 Application of Surveying
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- 1.3.1 Surveying Need Assessment
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- 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 and Public Relation
- 1.3.14 Public Private Partnership
- 1.3.15 User Groups

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
- 2.1.1 Land Rights and Land Records
- 2.1.2 Land Transfers
- 2.1.3 Registration of Deeds
- 2.1.4 Registration of Titles
- 2.1.5 Fragmentation and Consolidation
- 2.1.6 Horizontal Sub-division

2.1.7 Systematic Adjudication
2.1.8 Land Tenure
2.1.9 Land Record in Nepal
2.1.10 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 Cadastral Surveys in Nepal
2.3 Land Management
2.3.1 Principles of Land 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
2.4 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

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 B – 50 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 Setting out Surveys

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; Toponomy; 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 Overly); 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

- 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 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