GOVERNMENT OF NEPAL
MINISTRY OF LAND MANAGEMENT, COOPERATIVES AND POVERTY ALLEVIATION

LAND MANAGEMENT TRAINING CENTER

Dhulikhel, Kavre

Long Training Course: Junior Survey Training Fresh

Revised on 2082 BS (2025 AD)

Table of Contents

Course Overview

One Year Junior Survey Training Course (Starts in Aswin and completes in Aswin)								
Block	**Block name**	**Module: Code**		**Duration (Days)**	**Training level and Course Name**	**Evaluation**		
					Junior Inservice	**Theory**		**Internal Evaluation**
						Subjective	**Objective**	
1	Fundamental Concepts	I: JSTI 201	IV: JSTI 204	23 (17+6)	Understanding Society and Culture	60	20	20
		II: JSTI 202		23 (17+6)	Mathematics and Statistics	60	20	20
		III: JSTI 203		23 (18+5)	Surveying techniques	60	20	20
		IV: JSTI 204			Computer Application	Practical Exam	Presentation	Class Performance
						60	20	20
2	**Instrument Handling Practice**							
	Field Skill	V: JSTI 205		25	Field Survey I (Geodetic Survey Methods)	**Data collection, processing (Instructor, Coordinator)**	**Maps, Records, Report (Camp In-charge)**	**Viva (LMTC)**
						60	20	20
		VI: JSTI 206		25	Field Survey II (Cadastral Survey and Thematic Mapping)	60	20	20
		VII: JSTI 207		25	Field Survey III (Engineering Survey)	60	20	20
	Field Observation tour and Excursion							
3	Tools and Techniques	VIII: JSTI 208		21	Geographic Information System	**Subjective**	**Objective**	**Internal Evaluation**
						40	20	40
		IX: JSTI 209		21	Photogrammetry and Remote Sensing Techniques	40	20	40
		X: JSTI 210		21	Cartography	40	20	40
		XI: JSTI 211		21	Advanced Surveying Techniques	40	20	40
	Sports Week							
4	Application	XII: JSTI 212		21	Cadastre	60	20	40
		XIII: JSTI 213		21	Land Administration	60	20	40
		XIV: JSTI 214		21	Engineering Survey	60	20	40
		XV: JSTI 215		25	Project work	**Project Presentation**	**Project Report**	**Overall Project Execution**
						30	30	40
Closing and Farewell								

Module I: Understanding Society and Culture

JSTF 201

Introduction

This course is developed as a Module for partial fulfilment of Junior Survey Training Fresh Course. This module has been developed to enhance administrative knowledge, skills and attitude in trainees providing them general awareness on society, culture, public administration, and management ensuring the trainees be able to fit in the society and real office environment

Objectives

Upon completion of this Module, the participants will be able to:

- Develop general awareness of society, culture, ethics, and integrity.
- Understand the basic concepts of public administration, and organization management.
- Acquire knowledge on contemporary issues
- Acquire Knowledge on Constitution and legal provisions regarding fundamentals rights and responsibilities.
- Develop basic skills in computer usage, office management, and communication.

Training Details

Approach of Instruction:	Lecture, Group Discussion, Presentation, Field Visit
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday) 3 Sessions (Friday) 1 hour and 30 minutes each session
Total Number of Sessions:	55 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Module End Written Exam
- Project Work/Case Study/Presentation
- Internal Assessment, Attendance, Discipline

Attendance Requirement

Continued 7 days of absence (except in unavoidable condition) will disqualify the candidate for the completion of the module

Course Contents

Part A: Theory [45 Session]

1. Introduction [5]

1.1 Concept of Family, Society and State
1.2 Role of citizen towards state

2. Managing Self Worklife Balance [5]

2.1 Stress Management
2.2 Spiritualism

3. Behaviour and Culture [4]

3.1 Concept of Integrity, Ethics, Morality and Code of Conduct
3.2 Social norms and Values
3.3 Human Behaviour
3.4 Professionalism

4. Administration and Management [8]

4.1 Concept, Principles, Functions, Roles
4.2 Role of administration in development
4.3 Difference between administration and Management

5. Office Management [5]

5.1 Fundamentals of Office Management
5.2 Office Correspondence and letter writing
5.3 Registration, Dispatch and Filing
5.4 Writing Minutes, Circulars, and Memos(Tippani)

6. Public Service Delivery [4]

6.1 Concept and Importance of Public Service Delivery
6.2 Citizen Charter
6.3 Service Provider and Receiver
6.4 Oversight Agencies and Functions

7. Communication Skills [4]

7.1 Negotiation skills, Mediation and interpersonal communication
7.2 Public Speaking
7.3 Report Writing and Presentation
7.4 Self Discipline

8. Major Provision of Constitution and Major Acts [10]

8.1 Key Characteristics of the Constitution of Nepal
8.2 Fundamental Rights and Duties: Part Three
8.3 Policies, Directive Principles and Obligations: Part Four
8.4 Civil Service Act and Regulations
8.5 Right to Information Act

Part B: Practical [8 Sessions]

9. Case Study: Field Visit, Issues Identification and Presentation [8]

9.1 Office Visit
9.2 Connecting with Public
9.3 Appropriate Approach to Respond
9.4 Group Presentation

Further breakdown of evaluation is given in the following table

Activities		Time Allocated (Sessions)	Description	Marks allocated for evaluation
Theory	Classroom Lectures	45	Direct supervised by instructor in the class	
Exam	Final exam	2	Comprises with subjective and objective questions	Total marks:80 Subjective:60 Objective:20
Case Study with Presentation		8	Field visit and to be presented in class	10
Class Performance and Home Assignment				10
Total		**55**		**100**

Further breakdown of question weightage is given in the following table

Chapter	Objective Question		Subjective Question			
			Short Questions		Long Questions	
	Number of Questions	Marks (20)	Number of Questions	Marks (24)	Number of Questions	Marks (16)
	(Attempt All)		(Attempt Any Nine)		(Attempt Any Three)	
1	3	1	2	2*4	-	-
2	2	1	2	2*4	-	-
3	3	1	-	-	1	1*8
4	3	1	1	1*4	1	1*8
5	2	1	2	2*4	-	-
6	2	1	-	-	1	1*8
7	2	1	2	2*4	-	
8	3	1	1	1*4	1	1*8
9	-	-	Field Related Report Writing/ Presentation			
Total	**20**	**20**	**10**	**36**	**4**	**24**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Detail Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1.	**Introduction**	– Concept of Family, Society and State – Role of Citizen towards State	– Assess basic concepts of family, society, and state. – Identify role and responsibility of citizen towards state.	Pretest Interactions	5

2.	**Managing Self**	– Understanding self – Worklife Balance – Stress Management – Spiritualism	– Develop awareness about self. – Manage work life balance. – Internalize spirituality – Make trainees familiar with – yoga, meditation and stress management.	Brainstorming Interactive Presentation Exercise	5
3	**Behavior and Culture**	– Concept of Integrity, Ethics, Morality and Code of Conduct – Social norms and Values – Human Behaviour – Professionalism	– Understand the concept of – Integrity, ethics, morality and Code of Conduct. – Learn professional and societal – norms, values and human behavior – Embrace professionalism in – practice through understanding and execution.	Ethical Dilemma Discussions, Reflective Exercises Case Studies	4
4	**Administration and Management**	– Concept, Principles, Functions, – Roles – Role of Administration in Development – Difference Between Administration and Management	– Grasp the fundamental – concepts, principles, functions, and roles of administration and management. – Recognize the significance of – administration in fostering development and societal progress. – Identify the Differences between – administration and management,	Case Studies Group Works	8
5	**Office Management**	– Fundamentals of Office Management – Office Correspondence and letter writing – Registration, Dispatch and Filing – Writing Minutes, Circulars, and Memos, Tippani	– Communicate effectively in – office settings, including composing professional correspondence. – Optimize productivity through – time management in various office tasks. – Efficiently organize tasks and – resources to achieve organizational goals. – Apply essential office – management procedures to support smooth operations and success.	Interactions Presentations	5

6	**Public Service Delivery**	– Concept and Importance of Public Service Delivery – Citizen Charter – Service Provider and Receiver – Oversight Agencies and Functions	– Understand the principle, – origin and theory behind public service. – Knowledge of rules and – regulations of organizations. – Identify the gap between service provider and receiver. – Recognize different medium of – public service delivery.	Interactive Lectures Presentations	4
7	**Communication Skills**	– Negotiation skills, Interpersonal – Communication – Public Speaking – Self-Discipline	– Develop effective negotiation skills and enhance interpersonal communication abilities. – Improve public speaking proficiency. – Enhance Self-Discipline	Team-building Simulations Role-playing Simulations Report writing Presentation	4
8	**Major Provision of Constitution and Major Acts**	– Key Characteristics of the Constitution of Nepal, Fundamental Rights and Duties, Policies, Directive Principles and Obligations of the State and land-related provisions in the constitution – Civil Service Act and Regulations – Right to Information Act – Land policies	– Understand major provisions including land related provisions – of the Constitution of Nepal. – Understand Major provision of – Civil service and right to information act and land policies of the GoN.	Presentations Interactions	10

References

नेपालको संबिधान

निजामती सेवा ऐन, २०४९

सूचनाको हक सम्बन्धी ऐन, २०६४

भ्रस्टाचार निवारण ऐन, २०५९

सार्वजनिक प्रशासनमा आचरण, व्यावसायिकता र जवाफदेहिता, तारानाथ अधिकारी, जनसेवा प्रिन्टर्स एण्ड ट्रेडर्स प्रा.लि.

सार्वजनिक व्यवस्थापन, उदय रानामगर, पैरवी प्रकाशन

Introduction to Computers, Peter Norton, Mc Graw Hill Productions

Understanding Human Behaviour, Jason Miller

An Expert Guide to Stress Management, Sarmila Sinha

Office management, Dr. T.S. Devanarayanan, N.S. Raghunathan, Margham Publication

Module II: Mathematics and Statistics

JSTF 202

Introduction

This course is developed as a module for partial fulfilment of Junior Survey Training Fresh Course. This module aims to empower trainees with a foundational grasp of the fundamental mathematical and physical principles underpinning surveying and mapping technologies. Mathematics and statistics play a pivotal role in surveying, facilitating precise measurements and calculations.

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Understand the basic concepts of Mathematics for Surveying and Geoinformatics
- Recognize and utilize the relevance of Mathematics in Surveying and Mapping
- Enhance skills in interpreting and manipulating numerical data and mathematical expressions to solve problems

Training Details

Approach of Instruction:	Lecture, Group Discussion, Presentation, Exercise
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	55 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Internal Assessment
- Module End Written Exam
- Presentation

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the module

Course Contents

Theory [50 Sessions]

1. Arithmetic [8]

1.1 Set Theory and its Application in Surveying
1.2 Numbers, Significant Digits and Significant Figures
1.3 Mensuration

1.3.1 Area and Perimeter of 2D Geometrical figures (Triangle, Quadrilateral, Trapezium, Parallelogram, Rectangle, Square, Rhombus)
1.3.2 Area and Volume of different Geometrical figures (Prism, Cylinder, Pyramid, Cone)

1.4 Ratio and Proportion
1.5 Fraction and Percentage
1.6 Unitary Method

2. Sequence and Series [3]

2.1 Arithmetic Sequence and Series

2.1.1 General Term
2.1.2 Arithmetic Mean
2.1.3 Arithmetic Series

2.2 Geometric Sequence and Series

2.2.1 General Term
2.2.2 Geometric Mean
2.2.3 Geometric Series

3. Algebra [5]

3.1 Basics of Algebra
3.2 Degree, coefficient and terms of Polynomial
3.3 Linear Equations and solving linear equation
3.4 Standard form and methods of solving Quadratic Equations
3.5 Exponents and Laws of Indices

4. Geometry [6]

4.1 Triangle, Quadrilateral and Circle
4.2 Properties and Solution of Triangles
4.3 Properties of Circle, Tangent Secant
4.4 Basics of Ellipse and Ellipsoid Geometry

5. Trigonometry [4]

5.1 Basic of Trigonometry
5.2 Pythagoras Theorem
5.3 Trigonometrical Ratios and Functions
5.4 Application of Trigonometry**:** Height and Distance

6. Coordinate Geometry [6]

6.1 Dimensional Study
6.2 Rectangular, Polar and Spherical Coordinates
6.3 Computation of horizontal distance, vertical distance, Midpoint and slope using coordinates
6.4 Equation of straight lines and its form
6.5 Graphs of Straight Lines
6.6 Concept of Three Dimensional Geometry

7. Matrix and Determinant [8]

7.1 Matrix and Types of Matrix
7.2 Operation on Matrix
7.3 Determinant of Matrix
7.4 Minor and Cofactor
7.5 Adjoint and Inverse of Matrix
7.6 Solving System of linear equations by Matrix method

8. Statistics [5]

8.1 Introduction and Application
8.2 Measure of Central tendency: Mean, Median, Mode
8.3 Measure of Dispersion: Variance and Standard Deviation

9. Probability [5]

9.1 Introduction
9.2 Sampling
9.3 Probability Distribution of Random Variables
9.4 Normal Distribution

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		**Time Allocated (Sessions)**	**Description**	**Marks allocated for evaluation**
Theory	Class Room Lectures	50	Direct supervision by the instructor in the class	
Exam	Final Exam	2	Comprises subjective and objective questions	Total marks: 80 Subjective: 60 Objective: 20
Case Study with Presentation Linking Mathematics with Surveying and Mapping		3	To be presented in class	10
Class Performance and Home Assignment				10
Total		55		100

Further breakdown of question weightage is given in the following table:

Chapter	**Objective Question**		**Subjective Question**			
			Short Questions		**Long Questions**	
	Number of Questions	**Marks (20)**	**Number of Questions**	**Marks (24)**	**Number of Questions**	**Marks (16)**
	(Attempt All)		(Attempt Any Nine)		(Attempt Any Three)	
1	3	3*1	2	2*4	1	1*8
2	2	2*1	1	1*4		
3	2	2*1	2	2*4		
4	2	2*1	2	2*4		
5	2	2*1	2	2*4		
6	2	2*1			1	1*8
7	3	3*1			1	1*8
8	2	2*1			1	1*8
9	2	2*1	1	1*4		
Total	**20**	**20**	**10**	**36**	**4**	**24**

******Note: Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins. ******

Detailed Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1.	**Arithmetic**	– Set Theory and its Application in Surveying – Numbers, Significant Digits and Significant Figures – Mensuration – Area and Perimeter of 2D Geometrical figures (Triangle, Quadrilateral, Trapezium, Parallelogram, Rectangle, Square, Rhombus) – Area and Volume of different Geometrical figures (Prism, Cylinder, Pyramid, Cone) – Ratio and Proportion – Fraction and Percentage – Unitary Method	– Understand set theory and its application in Surveying – Understands the importance of numbers, significant figures and digits – Assess basic concepts of Mensuration, calculate area, perimeter and volume of different geometrical figure – Perform basic numerical aptitude related to ratio, proportion, percentage, unitary method	Interactive Lectures Presentations Exercise	8
2	**Sequence and Series**	– Arithmetic Sequence and Series – General Term – Arithmetic Mean – Arithmetic Series – Geometric Sequence and Series – General Term – Geometric Mean – Geometric Series	– Understand General Term, Arithmetic mean and arithmetic series – Understand General Term, Arithmetic mean and arithmetic series	Interactive Lectures Presentations Exercise	3
3	**Algebra**	– Basics of Algebra – Degree, coefficient and terms of Polynomial – Linear Equations and solving linear equation – Standard form and methods of solving Quadratic Equations – Exponents and Laws of Indices	– Understand and apply fundamental algebraic concepts – Identify the degree, coefficients, and individual terms of a polynomial – Understand and apply methods for solving systems of linear equations – Recognize and solve quadratic equations using various methods – Understand exponents and laws of indices and apply it to solve equations	Interactive Lectures Presentations Exercise	5
4	**Geometry**	– Triangle, Quadrilateral and Circle – Properties and Solution of Triangles – Properties of Circle,	– Understand and apply the fundamental properties of triangles, quadrilaterals, and circles. – Solve triangles using sine and	Interactive Lectures Presentations Exercise	6

		Tangent Secant – Basics of Ellipse and Ellipsoid Geometry	cosine laws – Understand properties of circles, tangents, and secants – Introduce and explore the basic properties and equations of ellipses and ellipsoids.		
5	**Trigonometry**	– Basic of Trigonometry – Pythagoras Theorem – Trigonometrical Ratios and Functions – Application of Trigonometry – Height and Distance	– Understand angular measurements methods, conversion and basic of trigonometry – Solve problems using Pythagorean Theorem – Understand and use ratios to solve problems – Use trigonometry in various fields such as physics, engineering, and geography – Solving problems involving the height of buildings, trees, and other objects using trigonometric ratios.	Interactive Lectures Presentations Exercise	4
6	**Coordinate Geometry**	– Dimensional Study – Rectangular, Polar and Spherical Coordinates – Computation of horizontal distance, vertical distance, Midpoint and slope using coordinates – Equation of straight lines and its form – Graphs of Straight Lines – Concept of ThreeDimensional Geometry	– Understand concepts of dimensions – Learn and apply different coordinate systems to represent points in space – Compute distances, midpoints, and slopes between points using coordinate – Understand the different forms of the equation of a straight line – Graphically represent straight lines – Understand the concepts of threedimensional geometry.	Interactive Lectures Presentations Exercise	6
7	**Matrix and Determinant**	– Matrix and Types of Matrixes – Operation on Matrix – Determinant of Matrix – Minor and Cofactor – Adjoint and Inverse of Matrix – Solving System of linear equations by Matrix method	– Understand matrix and types of matrices. – Perform basic operations on matrices. – Compute the determinant of a matrix. – Compute Minor and Cofactor – Calculate the adjoint and inverse of a matrix. – Apply matrix method to solve system of linear equations	Interactive Lectures Presentations Exercise	8
8	**Statistics**	– Introduction and Application – Measure of Central tendency: Mean, Median, Mode	– Develop awareness on data and statistics. – Calculates mean, median and mode – Learn Measure of dispersion	Interactive Lectures Presentations Exercise	5

		– Measure of Dispersion: Variance and Standard Deviation	and application of measure of dispersion on Surveying and mapping		
9	**Probability**	– Sampling – Probability Distribution of Random Variables – Normal Distribution	– Understand the concept of – Sampling – Learn Probability Distribution of Random Variables – Understand Normal Distribution	Interactive Lectures Presentations Exercise	5

References

Textbooks on Engineering Mathematics part I, Bhim Prasad Kafle, Makalu Publication House, Dillibazar, Kathmandu

A Textbook of statistics – B.C. Bajracharya

Model Questions

Section A: Objective Questions (5*1=5)

1. Coordinate बाट horizontal distance निकाल्ने सूत्र के हो?
   a. D= $\frac{\Delta x}{\Delta y}$
   b. D=Δy+Δx
   c. D= $\frac{\Delta y}{\Delta x}$
   d. D2=Δy2+Δx2
2. If there is a deck of 52 cards. If any one card is chosen, the probability of getting 'A' card is
   a. 1/26
   b. 1/13
   c. 1/52
   d. ¼
3. If the perimeter of equilateral triangle is 18 cm, then area of the triangle is
   a. 3√3
   b. 9√3
   c. 6√3
   d. 12√3
4. What percentage of 2/7 is 1/35?
   a. 20%
   b. 10%
   c. 30%
   d. 40%
5. A= $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ Matrix A is
   a. Null Matrix
   b. Rectangular Matrix
   c. Identity Matrix
   d. Row Matrix

Section B: Short Questions (2*4=8)

1. If the angles of depression are 30° and 45° respectively when looking at the top and the bottom of a house from the top of tower having a height 180m, what will be the height of that house?

   180 मिटर अग्लो कुनै टावर माथि बसी कुनै घरको धुरी र सोको फेदमा हेर्दा अवनति कोणहरु क्रमशः 30° र 45° पाइयो भने सो घरको उचाई कति होला?

2. In a triangle ABC, if angle A and B are 40° and 45° respectively and side AB is 70 meters. Solve the triangle.

   कुनै त्रिभूज ABC मा भित्री कोणहरु A र B क्रमशः 40° र 45° छन् । यदि भुजा AB को लम्बाइ 70 मिटर भए सो त्रिभूज हल गर्नुहोस्।

Section C: Long Questions (1*8=8)

1. Solve the following system of linear equation using inverse matrix method.

   Inverse matrix विधि प्रयोग गरि तलको समिकरणहरु हल गर्नुहोस्।

   $5x+15y+56z=35$
   $-4x-11y-41z=26$
   $-x-3y-11z=35=-26=-7$

Module III: Fundamentals of Surveying

JSTF 203

Introduction

This course module is designed to provide participants with a comprehensive understanding of surveying and geoinformation technology. The course spans three weeks, combining theoretical knowledge with practical applications. Participants will delve into foundational concepts such as surveying principles, map scale, measurements, and instruments.

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Perceive the basic concepts of surveying and geoinformation technology.
- Understand how to handle different surveying instruments and make computations.

Training Details

Approach of Instruction:	Lecture, Indoor Practical Classes, Outdoor Practical Classes
Duration of the Course:	3 Weeks
	1 Weeks Instrument Handling)
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	55 Sessions
	28 Sessions (Instrument Handling)

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Module End Written Exam
- Project Work/prese
- Internal Assessment, Attendance, Discipline

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course

Course Content

Part A: Theory [44 Sessions]

1. Fundamental Concepts [6]

1.1 Introduction and History of Surveying and Mapping
1.2 Principles of Surveying
1.3 Objectives of Surveying
1.4 Classification of Surveying: Based on Methods, Accuracy Desired, Purpose, Place and Instruments
1.5 Definition and Function of Surveyor

1.6 Different Terms used in Surveying and Mapping: Angle, Meridian, Bearing, Declination, Convergence, North Direction, Coordinate System, Longitude, Latitude

2. Scale, Measurements and Units [6]

2.1 Scale Concept, Definition, Types, and Representation
2.2 Importance and Use of Map Scale
2.3 Scale Related Numerical: Wrong Scale, Shrinkage Factors
2.4 Linear Measurement: Horizontal, Slope, and Vertical Distance, Error in Linear Measurement
2.5 Angular Measurement: Horizontal and Vertical/Zenithal
2.6 Units and Conversion for Linear, Angular, and Area

3. Classical and Modern Surveying Instruments [8]

3.1 Introduction to Survey Instruments
3.2 Different Types of Survey Instruments
3.3 Standardization, Care, and Adjustment
3.4 Classical Instruments: Chain, Tape, Compass, Plane Alidade
3.5 Optical Instruments: Telescopic Alidade, Clinometers, Level, Plane Table, Theodolite, Tacheometer (Stadia and Tangential System) Optical Square,

3.5.1 Concept of Optics: Telescope, Eyepiece, Lens Power, Magnification, Lens Aberration and Distortions

3.6 Electronic and Modern Instruments: E.D.M., Total Station, GNSS, LiDAR, UAV

3.6.1 Relationship between Frequency, Wavelength, and Velocity of Light

3.7 Use of Surveying Instruments

4. Measurement and Errors [8]

4.1 Definition
4.2 Sources of Errors
4.3 Types of Errors
4.4 Accuracy and Precision
4.5 Definitions of Different Terms
4.6 Laws of Weights
4.7 Principle of Least Square
4.8 Methods of Least Square

5. Introduction to Traverse [8]

5.1 Introduction to Traverse: Definition of terms, Principles of traversing, Different orders of traverse and their use, Method of traversing, Traverse Route: Open and Closed
5.2 Field operation: Reconnaissance, Monumentation, and Signaling, Selection of Traverse Station, Types of Monumentation, Construction of a monument, DCards, Traverse Chart/ Sketch, Angle measurement: Horizontal Angles, Zenithal/Vertical Angle, Bearing Computation Recording, Computation, and Plotting, Omitted Measurement
5.3 Error and Adjustment in Traverse
5.4 Types of error, Sources of error, Standard and Specification, Traverse Adjustment by Bowditch, Transit and Graphical Methods

6. Introduction to Levelling [8]

6.1 Introduction: Principles of Levelling, Definitions of terms: Level, Levelling, level surface, level line, datum, MSL, RL, BM (PBM & TBM), HI, BS, FS, IS, turning point, Horizontal plane, Horizontal line, Elevation, Altitude, Vertical plane, Vertical line, Levelling instruments and accessories.

6.2 Classification of Levelling: Spirit, barometric, trigonometric, GNSS, Methods of Levelling: Simple Levelling, Differential Levelling, Check Levelling, Fly Levelling, Reciprocal Levelling, Precise Levelling, Profile Levelling, Cross Sectioning.

6.3 Field Procedure: Testing levels and Checking collimation error, Reccee, Monumentation, Observation, Recording, Computation, Precautions to be taken in the field

6.4 Errors and adjustment in Levelling: Types of error, Sources of error, Permissible error in different order of Levelling, Adjustment

Part B: Practical [7]

7. Scale Construction, Lettering and Drawing [7]

Part C: Instrument Handling [28]

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		**Time Allocated (Sessions)**	**Description**	**Marks allocated for evaluation**
Theory	Classroom lectures	44	Direct supervised by the instructor in the class	
Practical Exercises	Supervised	7	Supervised by instructors in class	
Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 80 Subjective: 60 Objective: 20
Case Study with Presentation		2	To be presented in class	10
Home Assignments, Class Discipline				10
Total		**55**		**100**

Further breakdown of question weightage is given in the following table:

Chapter	**Objective Question**		**Subjective Question**			
			Short Questions		**Long Questions**	
	Number of Questions	**Marks (20)**	**Number of Questions**	**Marks (36)**	**Number of Questions**	**Marks (24)**
	(Attempt All)		(Attempt Any Nine)		(Attempt Any Three)	
1	3	3*1	3	2*4		
2	3	3*1	3	2*4		
3	3	3*1	1	2*4	1	1*8
4	3	3*1	1	2*4	1	1*8
5	3	3*1	1	1*4	1	1*8
6	3	3*1	1	1*4	1	1*8
7	2	2*1	Practical			
Total	**20**	**20**	**10**	**36**	**4**	**24**

***Note: Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins. ***

Detail Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1.	**Fundamental Concepts**	– Introduction and History of Surveying and Mapping – Principles of Surveying – Objectives of Surveying – Classification of Surveying: Based on Methods, Accuracy Desired, Purpose, Place and Instruments – Definition and Function of Surveyor – Different Terms used in Surveying and Mapping: Angle, Meridian, Bearing, Declination, Convergence, North Direction, Longitude, Latitude, Geoid, Ellipsoid, Spherical triangle, time, Projection, coordinate system	– Assess the introduction, history, and principles of surveying – Identify objectives of surveying and classification based on methods, accuracy, purpose, place and instruments – Outline the definition and function of the surveyor – Develop awareness about different terms used in surveying and mapping	Class lecture Discussion	6
2.	**Scale, Measurements and Units**	– Scale Concept, Definition, Types and Representation – Importance and Use of Map Scale – Scale Related Numerical: Wrong Scale, Shrinkage factors – Linear Measurement: Horizontal, Slope, and vertical distance, Error in linear Measurement – Angular Measurement: Horizontal and Vertical/Zenithal – Units and Conversion for Linear, Angular, and Area	– Develop basic concepts of scale and types. – Explain the importance and use of Map scale – Solve scale related numerical problems – Learn how to take linear measurements and calculate errors – Explain horizontal and vertical/zenithal error – Convert one unit to another for linear and angular observation	Class lecture Presentation Exercise	6
3	**Classical and Modern Surveying Instrument**	– Introduction to Survey Instruments – Different Types of Survey Instruments – Standardization, Care and Adjustment – Classical Instruments: Chain, Tape, Compass, Plane Alidade – Optical Instruments: Telescopic Alidade, Clinometers, Level, Plane Table, Theodolite, Tacheometer Optical Square, – Concept of Optics: Telescope, Eyepiece, Lens Power, Magnification, Lens Aberration and Distortions – Electronic and Modern Instruments: E.D.M., Total Station, GNSS, LiDAR, UAV – Relationship between Frequency, Wavelength and Velocity of Light – Use of Surveying Instruments	– Understand the concept of different survey instruments and uses – Grasp the concept of standardization for different survey equipment. – Understand basic operational aspects of classical to modern survey equipment. – Identify the basic concept of optics and possible errors – Understand electronic and modern instruments – Learn to use survey instruments in different geospatial domains.	Class lecture Demonstration	8

4	**Measurement and Errors**	– Definition – Sources of errors – Types of Errors – Accuracy and Precision – Definitions of Different Terms – Laws of Weights – Principle of Least Square – Methods of Least Square	– Grasp the fundamental – concept of errors, their, sources and types. – Differentiate between accuracy and precision. – Introduce different terms in surveying and measurement – Understand laws of weight and least square methods and principles.	Class lecture Discussion	8
5	**Introduction to Traverse**	– Introduction to Traverse: Definition of terms, Principles of traversing, Different orders of traverse and their use, Method of traversing, Traverse Route: Open and Closed – Field operation: Reconnaissance, Monumentation, and Signaling, Selection of Traverse Station, Types of Monumentation, Construction of monument, DCards, Traverse Chart/ Sketch, Angle measurement: Horizontal angles, zenithal/vertical angle, bearing computation Recording, Computation and Plotting, omitted measurement – Error and Adjustment in Traverse – Types of error, Sources of error, Standard and Specification, Traverse Adjustment by Bowditch, Transit, Graphical methods	– Understand basic concepts of traverse, their orders, principles and types – Gain detailed ideas about field operation, computation and plotting – Identify potential errors and their adjustments for traversing. – Prepare specifications for traversing	Class Lecture Interactions Presentations	8
6	**Introduction to Levelling**	– Introduction: Principles of Levelling, Definitions of terms: Level, Levelling, level surface, level line, datum, MSL, RL, BM (PBM & TBM), HI, BS, FS, IS, turning point, Horizontal plane, Horizontal line, Elevation, Altitude, Vertical plane, Vertical line, Levelling instruments and accessories. – Classification of Levelling: Spirit, barometric, trigonometric, GNSS, Methods of Levelling: Simple Levelling, Differential Levelling, Check Levelling, Fly Levelling, Reciprocal Levelling, Precise Levelling, Profile Levelling, Cross Sectioning. – Field Procedure: Testing levels and Checking collimation error, Reccee, Monumentation, Observation, Recording, Computation, Precautions to be taken in the field – Errors and adjustment in Levelling: Types of error, Sources of error, Permissible error in different order of Levelling, Adjustment	– Understand levelling principles, definition of different terms, their orders, principles and different types. – Gain detailed ideas about field operation, computation and plotting – Able to make computation and plotting of levelling – Identify potential errors and their adjustments for levelling. – Prepare specifications for levelling	Class Lecture Interactions Presentations	8

References

Surveying (Volume 1 and 2) by Dr. K.R. Arora: Rajons Publication Pvt. Ltd.

Surveying (Volume 1 and 2) by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain: Laxmi Publication (P) Ltd.

The Textbook of Surveying & Levelling, by R. Agor

Shrestha, H.G., Computer Introduction — Ratna Pustak Bhandar

Saxena, S., A first course in computers — Vikas Publishing House

Microsoft Office Bible, Wiley India Pvt. Ltd.

Adhikari M.S, आधारभुत सर्भेक्षण, Zenith Publishers and Distributors PVT. LTD

Model Questions

Section A: Objective Questions (Attempt ALL) [5*1=5]

1. For the reconnaissance survey, if you use total station, which principle of surveying would it violate? (Reconnaissance survey गर्दा यदि total station प्रयोग गरिएमा कुन सिदान्त को उल्लंघन हुन जान्छ?)
    a. Consistency of work
    b. Economy of accuracy
    c. Working from whole to part
    d. Independent check
2. A land parcel of 2500 sq.m. has to be plotted in the map at the scale of 1:2500. What will be the map area of that parcel?
    a. 4 sq.m.
    b. 3 sq.m.
    c. 2 sq.m.
    d. 5 sq.m.
3. Which of the given scales is the smallest? (तलका मध्य कुन scale सबैभन्दा सानो माननापको हो ?)
    a. 1mm= 25m
    b. 1inch=2000 feet
    c. 1:20000
    d. 1:1500
4. The most probable error is equal to:
    a. 0.6745σ
    b. 1.6449 σ
    c. 1.9559 σ
    d. 2.2123 σ
5. URL को पूरा रुप के हो?
    a. Uniform Reference Locator
    b. Uniform Reference Line
    c. Unform Resource Locator
    d. Uniform Resource Line

Section B: Short Questions [2*4=8]

Answer any Two of the following (तलका मध्य कुनै दुइ प्रश्नको उत्तर दिनुहोस ।)

1. Describe the field process of establishing a benchmark by differential levelling.
2. Differentiate between accuracy and precision with examples.
3. Write short notes on: [2*2=4]
   a. Plane table
   b. UAV

Section C: Long Questions (1*8=8)

Answer any One of the following (तलका मध्य कुनै १ प्रश्नको उत्तर दिनुहोस ।)

1. Define error. What are the sources and types of errors? Describe. [2+3+3]

   Error लाई परिभाषित गर्नुहोस । Error को type र source को बारेमा बर्णन गर्नुहोस।

2. You are provided with the observed horizontal angles and a pair of coordinates of known stations. Apply the appropriate corrections to the observed horizontal angles and compute the bearing of all traverse legs.

Station	Observed angles	Distance	Known coordinates	
Ts			488885.19	3112914.33
A	229.8435	5320.927	486409.43	3117624.20
B	219.4279	940.61		
C	212.8259	2876.86		
D	240.6595	737.01		
E	300.2228	1578		
F	305.5287	2196.18		
G	57.4882	2759.71		
H	331.4487	1525.5		
A	102.5567	2562.78		

Module IV: Computer Application

JSTF 204

Introduction

This course is developed as a module for partial fulfilment of Junior Survey Training Fresh. This module aims to empower trainees with a foundational grasp of the fundamental computer technology and geospatial data management. Computer Application plays a pivotal role in surveying and mapping, facilitating a solid foundation in practical applications enabling them to effectively utilize computer technology

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Understand the basic concepts of computer and computer applications in the field of Surveying and mapping.
- Recognize and utilize the relevance of Computer Applications in Surveying and Mapping
- Develop basic skills related to computer usage, office management, and communication.

Training Details

Approach of Instruction:	Lecture, Group Discussion, Presentation, Exercise
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	46 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Internal Assessment , Attendance, Discipline
- Module End Practical Exam
- Presentation

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the module

Theory [18 Sessions]

8. Basics of Computer [3]

8.1 Introduction to computer
8.2 History and evolution of computers
8.3 Types of Computers (Laptop, Desktop, Workstation, Tablet, Server)
8.4 Components of Computer
8.5 Basics of Operation Systems
8.6 Concept of Data and Information

9. Word Processing [3]

9.1 Introduction to Word Processing
9.2 Different (Open/Commercial) word processing platforms (Microsoft Word, Apple Pages, LibreOffice Writer, Google Docs etc…)
9.3 Features and Benefits of Word Processors
9.4 Document Types and File Formats (.docx, .doc, .rtf, .txt, .gdoc, .odt, .pdf etc…)

10. Spread Sheet [3]

10.1 Introduction to spread sheet
10.2 Data types
10.3 Different (Open/Commercial) spread sheet platforms (Microsoft Excel, Apple Numbers LibreOffice Calc, Google Sheets etc…)
10.4 Features and Benefits of spread sheet
10.5 Document Types and File Formats (.xlsx, .xls, .csv, .ods, .fods etc…)

11. Presentation [3]

11.1 Introduction to Presentation
11.2 Different (Open/Commercial) Presentation platforms (Microsoft PowerPoint, Apple Keynote LibreOffice Impress, Prezi, Google Slides,Canva,Slides.com etc…)
11.3 Features and Benefits of presentations
11.4 Document Types and File Formats (.pptx,.ppt,.odp,.gslides etc…)

12. Introduction to Internet, WWW, and Web Browser [3]

12.1 Internet

12.1.1 Concept of Internet
12.1.2 Introduction to computer networks (LAN, WAN, MAN)
12.1.3 IP Adress, Domain Name System (DNS), URLs
12.1.4 Overview on Internet Protocols (HTTP,HTTPS,FTP, TCP/IP)

12.2 Internet and Web Browser

12.2.1 Concept of WWW and its difference from internet
12.2.2 History and evolution of the web
12.2.3 Types of web browsers and their components
12.2.4 Basics of Search engines

13. Communication and Collaboration [3]

13.1 Fundamentals of Communication

13.1.1 Definition and importance of digital communication
13.1.2 Overview of communication tools (Email, Instant Messaging (IM), Video Conferencing etc..
13.1.3 Synchronous and asynchronous communication
13.1.4 Netiquette: email etiquette, online collaboration behavior

13.2 Collaboration Tools and Concepts

13.2.1 Understanding collaboration in a digital environment
13.2.2 Tools(Google Workspace, Microsoft365,Slack,Zoom etc…)
13.2.3 Concept of Cloud Storage
13.2.4 Concept of document sharing and co-editing

Practical [28 Sessions]

14. Basic Computer Skills [2]

14.1 Getting started with computer and its parts
14.2 Operating System
14.2.1 User Interface
14.2.2 System Settings
14.2.3 File and Directory Management

15. Word Processing [5]

15.1 Basic Document handling and text formatting
15.1.1 Installation and Opening word processing application
15.1.2 Creating new document
15.1.3 Page and Print Setup
15.1.4 Type and edit text (cut, copy, paste, undo, redo)
15.1.5 Formatting tools (size, orientation, colour, alignment etc…)
15.1.6 Insert and edit Header/Footer
15.1.7 Bullets and Numbered Lists
15.1.8 Insert (table, graphics, symbols, shapes, images, hyperlink etc…)
15.1.9 Spell Check and Grammer reviews
15.1.10 Saving and Closing Documents
15.2 Print Preview and Printing Documents
15.3 Report writing and Presentation

16. Spread Sheet [6]

16.1 Entering and Editing data
16.2 Elements of Electronic Spread Sheet
16.2.1 Opening of Spread Sheet
16.2.2 Addressing of Cells
16.2.3 Printing of Spread Sheet
16.2.4 Saving Workbooks
16.3 Manipulation of Cells
16.3.1 Entering Text, Numbers and Dates
16.3.2 Creating Text, Number and Date Series
16.3.3 Editing Worksheet Data
16.3.4 Inserting and Deleting Rows, Column
16.3.5 Changing Cell Height and Width
16.4 Modifying a worksheet
16.5 Formulas and Function

17. Presentations [6]

17.1 Creation and Preparation of Slides

17.1.1 Inserting Word Table or An Excel Worksheet
17.1.2 Adding Clip Art Pictures
17.1.3 Inserting Other Objects
17.1.4 Resizing and Scaling an Object

17.2 Presentation of Slides

17.2.1 Viewing A Presentation
17.2.2 Choosing a Set Up for Presentation
17.2.3 Printing Slides and Handouts

17.3 Slide Show

17.3.1 Running a Slide Show
17.3.2 Transition and Slide Timings
17.3.3 Automating a Slide Show

17.4 Master Slide

18. Introduction to Internet, WWW, and Web Browser [4]

18.1 Network Address, IP Address
18.2 Internet: Concept of Internet, Applications of Internet, connecting to the Internet, Troubleshooting
18.3 World Wide Web (WWW) and Web Browsing Software, Search Engines, Accessing Web Browser, Using Favourites Folder, Downloading Web Pages, Printing Web Pages
18.4 Understanding URL
18.5 Exploring Government Website

19. Communication and Collaboration [5]

19.1 Using E-mails: Opening Email account, Mailbox, Inbox and Outbox, Creating and Sending a new E-mail, replying to an E-mail message, Forwarding an E-mail message, Sorting and Searching Emails
19.2 Document Collaboration
19.3 Instant Messaging and Collaboration: Using Instant Messaging, Instant Messaging Provider
19.4 Mail Merge

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		**Time Allocated (Sessions)**	**Description**	**Marks allocated for evaluation**
Theory	Classroom lectures	18	Direct supervised by instructor	
Practical	Supervised	28	Direct supervision by the instructor in the class	-
Practical Exam	Final Exam	2		Total marks: 60
Case Study /Project Work		4		-
Project Presentation		3	To be presented in class	20

Class and Home Assignments			10
Class and Lab Performance, Attendance and Discipline			10
Total	**55**		**100**

Further breakdown of question weightage is given in the following table:

Chapter	Practical Exam Questions	
	Number of Questions	**Marks**
1,7	1	1*10
2,8	1	1*10
3,9	1	1*10
4,10	1	1*10
5,11	1	1*10
6,12	1	1*10
Total	**6**	**60**

****Note: Practical end exam will be held in 3 phases each of 60 Mins. ****

Detailed Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1	**Basic Computer Skill**	– Introduction to Computer – Components of Computer – Concept of Data and Information – Bringing Computer to Life – Operating System; User Interface, Settings, File and Directory Management	– Understand concepts of computer and its components. – Familiarize with data and Information – To familiarize with word processing – Connecting keyboard, mouse, monitor and printer to CPU to make computer alive.	Interactive Lectures Exercises Demonstration Presentations	5
2	**Word Processing**	– Word Processing; Opening, Manipulation, Formatting and Closing Documents – Report writing and presentation	– To make capable of preparing documents in word. – To be able to write report and present it.	Interactive Lectures Exercises Demonstration Presentations	8

2	**Spread Sheet**	– Entering and Editing data – Elements of Electronic Spread Sheet – Opening of Spread Sheet – Addressing of Cells – Printing of Spread Sheet – Saving Workbooks – Manipulation of Cells – Entering Text, Numbers and Dates – Creating Text, Number and Date Series – Editing Worksheet Data – Inserting and Deleting Rows, Column – Changing Cell Height and Width – Modifying a worksheet – Formulas and Function	– Develop skills on spreadsheet – Demonstration of manipulations of cells in excel – Use formula and function in spreadsheet – Develop basic skill to understand data in spreadsheet	Interactive Lectures Presentations Demonstration	9
3	**Presentations**	– Introduction – Creation of Presentation – Inserting Word Table or An Excel Worksheet – Adding Clip Art Pictures – Inserting Other Objects – Resizing and Scaling an Object – Viewing A Presentation – Choosing a Set Up for Presentation – Printing Slides and Handouts – Slide Show – Master Slide	– Create Presentation, insert data from word and excel – Develop skills on viewing a presentation, printing slides and handout – Develop skills of Slide show – Develop skills on Preparation of Presentation layout using Master slide	Interactive Lectures Presentations Demonstration	9
4	**Introduction to Internet, www and web browser**	– Introduction – Network Address, IP Address – Basic of Computer Networks: Local Area	– Identify internet, www and web browsers – Understand the basics of computer networks and IP address	Practical Demonstration	7

		Network (LAN), Wide Area Network (WAN) – Internet: Concept of the Internet, Applications of the Internet, connecting to the Internet, Troubleshooting – World Wide Web (WWW) and Web Browsing Software – Search Engines, Popular Search Engines / Search for content, Accessing Web Browser, Using Favorites Folder, Downloading Web Pages, Printing Web Page – Understanding URL – Surfing the web using e-governance website	– Introduce LAN and WAN connection – Familiar with the concept internet, and different applications of the internet – Grasp knowledge of web browsing software. – Understand downloading and printing of web pages. – Identify key concepts of URL – Develop general awareness about surfing e-governance website		
5	**Communication and Collaboration**	– Using E-mails: Opening Email account, Mailbox, Inbox and Outbox, Creating and Sending a new E-mail, replying to an E-mail message, Forwarding an E-mail message, Sorting and Searching emails – Document collaboration – Instant Messaging and Collaboration: Using Instant messaging, Instant messaging provider – Mail Merge	– Understand the opening and operating email messages. – Identify the necessity of document collaboration. – Experience instant messaging techniques. – Able to merge mail.	Practical Demonstration	8

References

Basic Computer Course Soumya Ranjan Behera

Computer Basics Bittu Kumar

Model Questions (1*12=12)

1. Document Formatting (6*2=12)
    a. You have been given a plain text document. Perform the following formatting tasks:
    b. Apply the "Title" style to the main heading.
    c. Change the font of the entire document to "Times New Roman," size 12.
    d. Set the line spacing of the document to 1.5 lines.
    e. Insert a header with your name on the right side and Insert a footer with the page number centered at the bottom.
    f. Add a bullet point list with at least three items of your choice.
2. Tables and Images (6*2=12)
    a. Create a table and insert an image as described below:
    b. Create a table with 3 columns and 4 rows. Fill in the first row with the headers "Item," "Description," and "Price."
    c. Merge the cells in the first column of the second and third rows.
    d. Insert an image of your choice into the merged cell. Resize the image to fit within the cell without distorting its aspect ratio.
    e. Keep the background color of the table blue
    f. Add a caption below the table that says "Table 1: Item List and Description."

Module V: Field Survey I (Geodetic Survey Methods)

JSTF 205

Introduction

This module is a part of the Junior Survey Training (Fresh), aiming to develop foundation for geodetic field survey among the trainees. This module focuses on different techniques of gathering geodetic data. The trainees will be able to gain experience of handling different conventional (such as Theodolite) and modern surveying instruments (such as Level, Digital Level, GNSS etc.) and use them to collect geodetic data.

Objectives

Upon completion of this Module, the participants will be able to:

- Understanding of traditional and modern surveying techniques, including their principles and applications.
- Establish horizontal and vertical control points using both conventional and modern equipment and methodologies.
- Check Collimation error and Errors in various Instruments and survey methods.
- Conducting reconnaissance for survey sites and establishing stable and accurate reference points.
- Understanding various levelling methods such as fly levelling, Profile levelling, Cross section levelling and differential levelling, understanding their procedures, advantages, and limitations and finally plotting L section and X section diagrams.
- Use of modern surveying tools and software for data processing and analysis, including GNSS and digital levelling.
- Handle different software for computation of control points.
- Understand the importance of accurate field procedures, detailed notetaking, and proper recordkeeping to ensure the reliability and reproducibility of survey results.

Training Details

Approach of Instruction:	Lecture, Indoor Practical / Outdoor Practical
Duration of the Course:	25 days
Sessions per day:	8 hours per day
Total Number of Sessions:	200 hours

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Viva (onsite/ external)
- Field Activities
- Field Project Outputs and Reports

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the module

Course Contents

Field Work [25 days]

1. Ordinary Levelling [4 days]

1.1 Collimation check

1.1.1 Explanation of the collimation error and methods for checking and correcting it.

1.2 Reconnaissance and Monumentation

1.2.1 Overview of reconnaissance procedures for selecting survey locations.

1.2.2 Explanation of monumentation techniques for establishing reference points.

1.3 Differential Levelling

1.3.1 Detailed explanation of the principles and procedures of differential leveling.

1.3.2 Demonstration of setup, readings, and calculations involved in a typical differential leveling survey.

1.4 LSection and XSection levelling

1.4.1 Explanation of Lsection and Xsection diagrams and their use in representing ground profiles.

1.4.2 Demonstration of LSection and XSection levelling

1.4.3 Interpret and analyze Lsection and Xsection diagrams.

1.5 Computation and adjustment

1.5.1 Methods for computing elevation differences and adjustments in leveling surveys.

1.5.2 Introduction to adjustment techniques for optimizing survey data.

1.6 Field Procedures

1.6.1 Detailed instructions on setting up leveling instruments, taking readings, and recording field data.

1.6.2 Demonstration of proper field techniques for ensuring accurate and reliable survey measurements.

2. Theodolite Traversing [5 days]

2.1 Collimation Test

2.1.1 Performing collimation tests.

2.2 Reconnaissance and Monumentation

2.2.1 Techniques for conducting a reconnaissance to identify suitable traverse stations.

2.2.2 Factors to consider when selecting traverse stations, such as accessibility, visibility, and stability.

2.2.3 Methods for monumentation to establish control points for the traverse.

2.3 Observation

2.3.1 Procedures for setting up the theodolite and taking horizontal and vertical angle measurements.

2.3.2 Techniques for ensuring accurate and precise observations during traversing.

2.4 Computation and adjustment

2.4.1 Calculation methods for reducing observed angles and distances to determine traverse coordinates.

2.4.2 Adjustment techniques to minimize errors and optimize the traverse network.

3. Triangulation and Trilateration [6 days]

3.1 Reconnaissance and Monumentation

3.1.1 Identification of suitable observation stations to form a network of triangles.
3.1.2 Methods for monumentation to establish control points for the Triangulation and Trilateration.

3.2 Observation

3.2.1 Observation of angles, baseline distances and other necessary Observations.

3.3 Adjustment and computation

3.3.1 Methods such as Bowditch's or least squares adjustment to iteratively refine the computed coordinates, ensuring a balanced closure and minimizing errors within the network.
3.3.2 Computation of adjusted coordinates for control points based on observed distances and known baseline lengths.
3.3.3 Deriving accurate coordinates for the survey points based on the refined observations.

4. Theodolite Resection and Intersection [1 day]

4.1 Observation and Setup

4.1.1 Setting up the theodolite at an observation station with known coordinates or at a new station for resection.

4.2 Measurement and Recording

4.2.1 Observations for intersection and resection.
4.2.2 Recording horizontal and vertical angles measured to each reference point.

4.3 Computation and Adjustment

4.3.1 Computational methods to calculate the coordinates of the observation station or the unknown points.
4.3.2 Adjustment techniques to refine the computed coordinates.

5. Astronomical Observation [1 day]

5.1 Preparation and Setup

5.1.1 Careful planning and preparation, considering factors such as the time, location, and weather conditions.
5.1.2 Suitable observation site with clear visibility of the celestial bodies of interest.

5.2 Observation and Recording

5.2.1 Observations may include measuring the altitude and azimuth angles of celestial objects or recording their positions relative to known stars or landmarks.
5.2.2 Recording time of observation, the position of the celestial body relative to the instrument, and any relevant environmental conditions.

5.3 **C**omputation

5.3.1 To calculate the geographical coordinates or determine other relevant information based on the observed celestial positions.
5.3.2 Trigonometric calculations and astronomical algorithms to convert observed angles into geographic coordinates, such as latitude and longitude, or to determine time-related parameters, such as local time or Greenwich Mean Time (GMT).

6. Precise Levelling by Digital Method [3 days]

6.1 Instrument Handling and Collimation Check

6.1.1 Handling Digital Level.
6.1.2 Checking collimation error.

6.2 Reconnaissance and Monumentation

6.2.1 Assess terrain characteristics, identifying optimal locations for leveling lines.
6.2.2 Monumentation techniques to mark stations accurately, ensuring longterm stability and reference.
6.2.3 Proper documentation of monument details is essential for future surveys.

6.3 Observation

6.3.1 Precise height measurements at designated stations, utilizing advanced technology to capture data efficiently.

6.4 Height Computation and Adjustment

6.4.1 Computational methods to determine elevations, leveraging digital tools for efficient data processing.
6.4.2 Rise and Fall Method
6.4.3 Height of Instrument Method
6.4.4 Adjustment techniques to optimizing network consistency and minimizing errors.

7. Differential Positioning (GNSS) [3 days]

7.1 Instrument Handling

7.1.1 Handling GNSS equipment.
7.1.2 Set up and calibrate instruments, ensuring optimal performance for accurate positioning.

7.2 Reconnaissance and Monumentation

7.2.1 Evaluate potential observation sites, considering factors like satellite visibility, obstructions, and multipath interference.
7.2.2 Monumentation techniques to mark stations accurately, ensuring longterm stability and reference.
7.2.3 Proper documentation of monument details

7.3 Observation

7.3.1 Instrument setup and environmental conditions to enhances observation accuracy.
7.3.2 Data collection.

7.4 Data Downloading and Processing

7.4.1 Downloading raw GNSS data from receivers and processing it using specialized software.
7.4.2 Postprocessing techniques, such as differential correction and precise point positioning, refine positioning accuracy.

8. Report Preparation [1 day]

8.1 To prepare a detailed report of Field Survey I (Geodetic Survey Methods)

9. Viva [1 day]

9.1 Viva of Field Survey I (Geodetic Survey Methods).

Further breakdown of the allocated time and method of evaluation is given in the following table.

S.N.	Criteria	Mark Allotted
1	Data collection, processing (Instructor, Coordinator)	60
2	Maps, Records, Report (Camp Incharge)	20
3	Viva (LMTC)	20
	Total	**100**

Detail Curriculum

S.N.	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1	**Ordinary Levelling**	– Collimation Check – Reconnaissance and Monumentation – Fly Levelling, Differential Levelling, L section and XSection Levelling – Computation and adjustment	– Understanding, checking, and correcting Learning Outcomes collimation error – Develop skills in site reconnaissance for survey location – Acquire a detailed understanding of principles and procedures of different leveling. – Compute elevation differences and apply adjustment techniques in leveling surveys.	Class Demonstration Field Work Report Writing In Field Viva Final Viva	4 days
2	**Theodolite Traversing**	– Collimation Test Reconnaissance and Monumentation – Observation Computation and Adjustment	– Perform collimation tests effectively. – Conduct reconnaissance to identify suitable traverse stations. – Apply monumentation techniques to establish control points for traverses. – Set up the theodolite and take horizontal and vertical angle measurements with precision. – Apply calculation methods to determine traverse coordinates. – Utilize adjustment techniques to optimize the traverse network and minimize errors.		5 days
3	**Triangulation and Trilateration**	– Reconnaissance and Monumentation Observation Adjustment and Computation	– Identify suitable observation stations for forming a network of triangles in triangulation and trilateration. – Apply monumentation methods effectively to establish control points for the survey. – Conduct accurate observations of angles, baseline distances, and other necessary data. – Utilize adjustment methods such as Bowditch's or least squares to refine computed coordinates and minimize errors within the network.		6 days
4	**Theodolite Resection and Intersection**	– Observation and Setup – Measurement – Data Recording – Computation	– Ability to set up a theodolite accurately at both known and unknown observation stations. – Competence in conducting observations for both intersection and resection		1 day

		– Adjustment	purposes.		
5	**Astronomical Observation**	– Preparation and Setup – Observation – Data Recording – Computation – Analysis and Interpretation	– Ability to plan and prepare for astronomical observations. – Understanding of trigonometric calculations and astronomical algorithms used in computation.		1 day
6	**Precise Levelling by Digital Method**	– Instrument Handling and Collimation Check – Reconnaissance and Monumentation – Observation – Height Computation and Adjustment	– Proficiency in handling digital level instruments and performing collimation checks. – Understanding and application of the Rise and Fall Method and Height of Instrument Method. – Competence in adjustment techniques to optimize network consistency and minimize errors in precise leveling surveys.		3 days
7	**Differential Positioning**	– Instrument Handling – Reconnaissance and Monumentation – Observation – Data Downloading and Processing	– Proficiency in handling GNSS equipment – Capability to set up instruments. – Proficiency in data collection techniques during GNSS observation. – Competence in downloading raw GNSS data from receivers and processing it using specialized software. –		3 days
8	**Report Preparation**		– Proficiency in preparing detailed reports of field surveys using geodetic survey methods. – Ability to organize and present survey data in a clear and comprehensive manner. – Skill in documenting survey methodologies, observations, and results effectively.		1 day
9	**Viva**		– Proficiency in participating in a viva session, demonstrating knowledge, and understanding of the subject matter. – Ability to answer questions effectively and articulate ideas clearly during the viva. – Skill in defending the content and methodology of the report prepared for Field Survey II (Geodetic Survey Methods).		1 day

Module VI: Field Survey II (Cadastral Survey and Thematic Mapping)

JSTF 206

Introduction

This module is a part of the Junior Survey Training (Fresh), aiming to develop practical skills and knowledge needed to create accurate topographic maps and manage property boundaries among the trainees. This module focuses on principles and techniques of capturing intricate details of the Earth's surface, understanding property boundaries, and creating visual representations that aid in decision making.

Objectives

Upon completion of this Module, the participants will be able to:

- Understand the basic concepts, principles, working methodologies cadastral survey.
- Process and analyze data, cadastral maps, and records preparation.
- Gain skills in existing map reading, demarcation of parcels in the field using maps, and using Total Station for field demarcation.
- Learn effectively utilize handheld GPS and mobile mapping applications for measuring horizontal and vertical positions, route tracking, detailing, and plotting GPS data for thematic mapping.

Training Details

Approach of Instruction:	Lecture, Indoor Practical / Outdoor Practical
Duration of the Course:	25 days
Sessions per day:	8 hours per day
Total Number of Sessions:	200 hours

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Viva (onsite/ external)
- Field Activities
- Field Project Outputs and Reports

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidatefor the completion of the module

Course Contents

Field Work [25 days]

1. Review of Plane Table Survey [4 days 2 days]

1.1 Recording data from Telescope Alidade

1.1.1 Recording HScale, V Scale, Horizontal Distance and Vertical Distance

1.2 Concept of Intersection and Resection

1.2.1 Techniques for determining positions using intersection and resection methods

1.3 Resection Methods

1.3.1 Bessel's Method, Tracing Paper Methods and Trial and Error Method

2. Photo/ Image Interpretation and Field Verification [3 days 4 days]

2.1 Photo/image interpretation, place name collection and Map verification

2.1.1 Reading Topo maps/Google Maps
2.1.2 Downloading satellite image using Opensource Platforms
2.1.3 Downloading OSM Data
2.1.4 Techniques for interpreting aerial photos/images and OSM Data.
2.1.5 Collecting place names and verifying maps using photos and images
2.1.6 Updating old map using current Topo map of the area
2.1.7 Field Verification

3. Thematic mapping using handheld GPS and Mobile Applications [5 days]

3.1 Instrument handling practice
3.2 Practicing the use of handheld GPS and mobile applications.
3.3 Measuring horizontal and vertical positions using handheld GPS and mobile application.
3.4 Route tracking and detailing using handheld GPS and mobile applications.
3.5 Plotting data from using handheld GPS and mobile application.
3.6 Thematic Map Design

4. Cadastral Survey by Digital Methods [7 days 8 days]

4.1 Data acquisition by RTK, TS and UAV for Cadastral Surveying
4.2 Instrument handling Practice
4.3 Planning
4.4 Traversing
4.5 Adjudication
4.6 Sketch preparation
4.7 Data capturing
4.8 Data downloading
4.9 Processing and analyzing
4.10 Database preparation
4.11 Mapping
4.12 Record preparation (field book, purja, etc)
4.13 Report generation
4.14 parcel subdivision
4.15 Record maintenance (using parcel editor application).

5. Map Reading, Demarcation of parcel in field [4 days]

5.1 Map Reading
5.2 Overlapping Satellite images with Cadastral Map
5.3 Field demarcation using maps and Total Station
5.4 Parcel demarcation using GNSS

6. Report Preparation [1 day]

6.1 Preparing detailed report of Field Survey III (cadastral survey and thematic mapping)

7. Viva [1 day]

7.1 Viva of Field Survey III (Cadastral Survey and Thematic Mapping)

Further breakdown of the allocated time and method of evaluation is given in the following table.

S.N.	Criteria	Mark Allotted
1	Data collection, processing (Instructor, Coordinator)	60
2	Maps, Records, Report (Camp Incharge)	20
3	Viva (LMTC)	20
	Total	**100**

Detail Curriculum

S.N.	Topics	SubTopics	Learning Outcomes	Learning Activities	No of Days
1	**Review of Plane Table Survey**	– Control Point Densification by PT Traverse – Intersection and Resection – Detailing	– Understand how to set up, level, and orient a plane table. – Effectively use an alidade to measure angles and distances. – Accurately plot survey points and features on a plane table sheet. – Apply the intersection and resection method to determine unknown positions from known points.	Class Demonstration Field Work Report Writing In Field Viva Final Viva	2 days
2	**Photo/ Image Interpretation**	– Reading Topo Maps/Google Maps – Downloading Satellite Images Using OpenSource Platforms – Techniques for Interpreting Aerial Photos and Images – Collecting Place Names and Verifying Maps Using Photos and Images – Updating Old Maps Using Current Topo Maps of the Area	– Reading and interpreting topographical maps and Google Maps. – Identify and utilize various opensource platforms for downloading satellite images. – Recognize and interpret key elements of aerial photographs, including scale, resolution, shadows, shapes, and textures. – Update old maps with new information derived from current topographical data		4 days
3	**Thematic mapping using handheld GPS and Mobile applications**	– Instrument Handling Practice – Practicing the Use of Handheld GPS Units – Measuring Horizontal and Vertical Positions – Route Tracking and Detailing – Plotting Data from GPS Measurements	– Demonstrate proficiency in handling handheld GPS units and mobile mapping applications. – Accurately measure and record horizontal and vertical positions using GPS devices. – Effectively track and detail routes using GPS technology. – Plot and visualize data		5 days

			obtained from GPS measurements for thematic mapping purposes.		
4	**Cadastral Survey by Digital Methods**	– Instrument Handling Practice – Traversing – Adjudication – Sketch Preparation – Data Capturing – Data Downloading – Processing and Analyzing – Database Preparation – Mapping – Record Preparation – Report Generation – Parcel Subdivision – Record Maintenance	– Conduct accurate traversing using digital methods. – Perform adjudication processes accurately. – Prepare detailed sketches and capture data effectively. – Prepare comprehensive databases and generate maps. – Generate detailed reports. – Conduct parcel subdivision and maintain records using parcel editor applications.		8 days
5	**Map Reading, Demarcation of parcel in field**	– Map Reading Skills – Overlapping Satellite Images with Cadastral Map – Field Data Collection – Overlay Techniques – Field demarcation Using Total Station	– Demonstrate proficiency in reading existing maps and understanding their features. – Overlay satellite images with cadastral maps for accurate field demarcation. – Use a Total Station for precise field sketching and parcel demarcation.		4 days
6	**Report Preparation**		– Proficiency in preparing detailed reports of field surveys. – Ability to organize and present survey data in a clear and comprehensive manner. – Skill in documenting survey methodologies, observations, and results effectively.		1 day
7	**Viva**		– Proficiency in participating in a viva session, demonstrating knowledge and understanding of the subject matter. – Ability to answer questions effectively and articulate ideas clearly during the viva. – Skill in defending the content and methodology of the report prepared for Field Survey III (cadastral survey and thematic mapping).		1 day

ModuleVII: Field Survey III (Engineering Survey)

JSTF 207

Introduction

This module is a part of the Junior Survey Training (Fresh), aiming to develop foundational knowledge and practical skills necessary to excel in the field of engineering surveying among the trainees. Throughout this module, the trainees will deal with principles, techniques, and applications of engineering surveying and they will be able to learn how to accurately measure and represent the physical world, enabling the creation of precise maps, plans, and data for various engineering projects.

Objectives

Upon completion of this Module, the participants will be able to

- Understand the basic concepts, principles, working methodologies, and application of Engineering and Construction surveys
- Carryout Engineering and construction field survey work
- Utilize UAVs for aerial surveying, including data collection and mapping.
- Implement DGPS (real-time kinematic) for high-precision positioning and real-time data collection.

Training Details

Approach of Instruction:	Lecture, Indoor Practical / Outdoor Practical
Duration of the Course:	25 days
Sessions per day:	8 hours per day
Total Number of Sessions:	200 hours

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Viva (onsite/ external)
- Field Activities
- Field Project Outputs and Reports

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the module

Course Contents

Field Work [25 days]

1. Road Survey with Bridge Survey [8 days]

1.1 Planning
1.2 Route selection, Recce, Monumentation
1.3 Control point establishment (Link Traversing), Chainage, Intersection Point Establishment

1.4 Detailing, Sketching
1.5 Data download
1.6 Curve setting

2. Hydropower Survey [6 days]

2.1 Planning
2.2 Site selection for intake, dam, canal/tunnel, reservoir, transmission line
2.3 control points establishment (traversing), detailing, Sketching
2.4 Data download.

3. Stake out [2 days]

3.1 Stake out of Building, roads, parcel, control points using Total Station
3.2 Stake out according to Design drawings and sections.

4. Functions of Total Station [1 days]

4.1 REM, MLM, Resection, Traversing, Area Calculation

5. Data acquisition from UAV AND LIDAR [2 days]

5.1 Use UAVs (drones)/LiDAR for aerial surveying and data collection
5.2 Generating topographic maps and Digital Terrain Models (DTM) from UAV imagery/LiDAR Data.

6. Detailing from DGPS (RTK) [2 days]

6.1 Using DGPS (RealTime Kinematic) for detailed surveying.
6.2 Highprecision positioning and data collection in realtime.

7. Plotting [2 days]

7.1 Installation of software
7.2 Plotting and mapping topographical map of route survey, bridge Survey and Hydropower Survey
7.3 Generating Lsection and X section of the route
7.4 Map layout

8. Report Preparation [1 day]

8.1 To prepare detailed report of Field Survey IV (Engineering Survey)

9. Viva [1 day]

9.1 Viva of Field Survey IV (Engineering Survey)

Further breakdown of the allocated time and method of evaluation is given in the following table.

S.N.	Criteria	Mark Allotted
1	Data collection, processing (Instructor, Coordinator)	60
2	Maps, Records, Report (Camp Incharge)	20
3	Viva (LMTC)	20
	Total	**100**

Detail Curriculum

S.N.	Topics	SubTopics	Learning Out comes	Learning Activities	No of Days
1	**Road Survey with Bridge Survey**	– Planning – Route Selection, Recce, Monumentation – – Control Point Establishment – Detailing, Sketching – Data Download – Curve Setting:	– Develop a comprehensive survey plan for road and bridge projects. – Select optimal routes and conduct reconnaissance surveys effectively. – Set up monuments and reference points accurately. – Establish control points using link traversing techniques. – Measure chainage and set up intersection points precisely. – Record detailed topographical features and create accurate sketches. – Apply techniques for setting out curves in road surveys.		8 days
2	**Hydropower Survey**	– Planning – Site Selection – Control Points Establishment – Data Download	– Develop a detailed survey plan tailored to hydropower projects. – Select optimal sites for intake, dam, canal/tunnel, reservoir, and transmission lines effectively. – Conduct feasibility assessments for hydropower site selection. – Establish control points accurately using traversing techniques. – Conduct detailed surveys and create precise sketches. – Download and manage survey data efficiently.		6 days
3	**Stake out**	– Stake Out of Building, Roads, Parcel, Control Points Using Total Station	– Demonstrate proficiency in using a Total Station for staking out building corners and foundations. – Accurately stake out road alignments and curves.		2 days

			– Perform parcel boundary staking with precision. – Establish and verify control points using Total Station.		
4	**Functions of Total Station**	– REM – MLM – Resection – Traversing – Area Calculation	– Understand Remote Elevation Measurement (REM – Measurement of Horizontal and Vertical Angles (MLM) – Apply resection methods to determine the coordinates of unknown points using known points – Calculate the area of polygons using measurements obtained from Total Station surveys.		1 day
5	**Data acquisition from UAV AND LIDAR**	– Using DGPS (RealTime Kinematic) for detailed surveying. – Highprecision positioning and data collection in realtime. – Importance of detailed data collection using RTK/LiDAR for accurate mapping and surveying projects.	– Utilize UAVs (drones) for aerial surveying and data collection. – Generate topographic maps and Digital Terrain Models (DTM) from UAV imagery. – Explore applications of UAV technology in surveying and mapping, including its benefits and limitations.		2 days
6	**Detailing from DGPS (RTK)**	– Using DGPS (RealTime Kinematic) for detailed surveying. – Highprecision positioning and data collection in realtime. – Importance of detailed data collection using RTK for accurate mapping and surveying projects	– Utilize DGPS (RealTime Kinematic) for detailed surveying applications. – Perform highprecision positioning and data collection in realtime using RTK. – Understand the importance of detailed data collection with RTK for ensuring accuracy in mapping and surveying projects.		2 days
7	**Plotting**	– Installation of software – Plotting and mapping topographical map of route survey, bridge Survey and Hydropower Survey – Generating Lsection and X section of the route	– Plot and map topographical data from route surveys, bridge surveys, and hydropower surveys using the installed software.		2 days

		– Map layout	– Generate Lsections (Longitudinal Sections) and Xsections (Cross Sections) of surveyed routes. – Create map layouts that effectively communicate survey findings, including legends, scales, titles, and annotations.		
8	**Report Preparation**		– Proficiency in preparing detailed reports of field surveys using geodetic survey methods. – Ability to organize and present survey data in a clear and comprehensive manner. – Skill in documenting survey methodologies, observations, and results effectively.		1 day
9	**Viva**		– Proficiency in participating in a viva session, demonstrating knowledge and understanding of the subject matter. – Ability to answer questions effectively and articulate ideas clearly during the viva. – Skill in defending the content and methodology of the report prepared for Field Survey IV (Engineering Survey). –		1 day

Module VIII: Geographic Information System

JSTF 208

Introduction

This module is a part of the Junior Survey Training Fresh Course, aiming to develop a foundation for GIS and mapping technology among the trainees. This module covers GIS concepts, operations, and analysis. The key topics that will be discussed throughout the module include an introduction to GIS, spatial data foundations, GIS software and tools, geospatial analysis, map projection and spatial reference systems, data visualization and role of GIS in decision-making..

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Develop and Manage Spatial Databases.
- Visualize and Analyses Geospatial Data on different platforms.
- Promote and Utilize Open Source and Web Mapping Technologies.

Training Details

Approach of Instruction:	Lecture, Indoor Practical Classes
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	69 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Internal Assessment
- Module End Written Exam
- Practical Exam
- Project Work

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course

Course Content

Part A: Theory [31 Sessions]

1. Introduction to GIS & Geographic Phenomena [5]

1.1 Introduction GIS definition, Development of GIS, Functions of GIS
1.2 Component of GIS, GIS application and benefits
1.3 Introduction to Geographic phenomena
1.4 Introduction to fields and object, Data types
1.5 Spatial Data Models and Structures: Vector and Raster Data (Regular tessellations and Irregular tessellations)

1.6 Vector and Raster file formats

2. Spatial Data Collection, Entry & Preparation [5]

2.1 Concept and Methods of Data Collection: Primary data Sources (Field surveys and observations, GPS, Photogrammetry and remote sensing, Direct measurements and interviews), Secondary data Sources (Existing paper maps, Available data sets)
2.2 Data preparation and input techniques: (Data georeferencing and digitization, Data cleaning and preprocessing, converting data formats and importing data into GIS software, Geocoding)
2.3 Spatial Data Relationship and topology, data check and repair
2.4 Spatial Data Quality: Components of data quality: accuracy, precision, completeness, consistency, Data quality assessment methods

3. Database Management [4]

3.1 Introduction to Database Management System:
Data, Information and Knowledge, users, Database Management System, its Components and Functions
3.2 Database management system: field, record, key field, field types, rules for assigning database fields, creating tables, viewing records, sorting records,
3.3 Relational Data Model (Concept, Domains, Sub type, Attributes and Relations)
3.4 Keys in Database Management System and various software of DBMS
3.5 Introduction to Spatial Database Management
3.6 Data standards (e.g., ISO, OGC) and its Importance, Metadata

4. Basics of Map Projections and Coordinate System [6]

4.1 Map Projection and Classifications
4.2 Factors of map projections, Scale Factor
4.3 Projections used in Nepal (UTM, MUTM Projections, Lambert Conformal Conic Projection)
4.4 Coordinate System: Geocentric Cartesian coordinate system, Geodetic coordinate system, and their types
4.5 Coordinate transformations: Datum and its types, Datum Transformation, Projection
4.6 Georeferencing and Geocoding

5. Spatial Data Analysis and its types [6]

5.1 Concept and Importance of Spatial Analysis
5.2 Vector Data Analysis
5.2.1 Vector Data Types, Spatial Operations: Measurement, retrieval and classification functions, basics of overlay, neighbourhood and connectivity functions
5.3 Raster Data Analysis
5.3.1 Raster Data Structure, Common Raster Operations: ((Re)classification, Map Algebra, Overlay, Resampling, Interpolation, Zonal Statistics,)

6. Modeling and Simulation [2]

6.1 Concept and types of modelling
6.2 Building and Running Model

7. Volunteered and OpenSource GIS [3]

7.1 Definition, Importance and Uses
7.2 Map Making using open software and open data (Google Earth, QGIS, OSM), mobile maps such as SW maps

Part B: Practical [28]

8. Introduction to GIS software and concept on data preparation [2]

8.1 Installation of GIS Software, Software Anatomy, Interface and available platform,
8.2 Concept on project, data frame and data file and layers
8.3 Creating Metadata
8.4 Understanding GIS Software (proprietary and Open Source) for creating spatial project and visualize the given set of data

9. MS Access [2]

9.1 Startup MSAccess, tables and saving file, creating forms and tables
9.2 Query execution and definition,
9.3 Querying in small database SQL – Queries

10. Spatial Database Management [2]

10.1 Geodatabase and Feature dataset preparation
10.2 Applying Coordinate system to the feature dataset
10.3 Preparation of feature class and shapefile
10.4 Applying field in feature class and its data types
10.5 Importing data into feature class

11. Digitization of map features [4]

11.1 Georeferencing, Digitizing scanned map/image
11.2 Adding attributes to point features, line themes and polygons
11.3 Topological Editing of spatial data in GIS Software

12. Attribute manipulation and basic queries [3]

12.1 Introduction and modify tabular data
12.2 Link tables and performs basic queries (Attribute query)
12.3 Summarizing tables
12.4 Hyperlinks
12.5 Table operations

13. Map projection and coordinate transformation [4]

13.1 Defining spatial reference system
13.2 Set a data frame's map projection system
13.3 Changing projection system
13.4 Datum Transformation
13.5 Plotting GPS data to GIS interface
13.6 Coordinate conversion form metric and decimal and vice versa

14. Model Builder and Model Execution [3]

14.1 Create, test and run a Model for a case in GIS Software

15. Spatial Query and Measurement Operation (Vectorbased) and (Raster Analysis) [3]

15.1 Selection by location
15.2 Selection by attribute
15.3 Selection by graphics
15.4 Save selected feature
15.5 Spatial query
15.6 Clip, intersect, union, buffer operations
15.7 Raster Overlay
15.8 Suitability analysis using vectors model: Case Study

16. Map printing [2]

16.1 Map Layout design
16.2 Editing layout component
16.3 DataDriven Page

17. Map making using open software and open data [3]

17.1 Create a map using QGIS and open data.

Part C: Project work [6 Sessions]

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		**Time Allocated (Sessions)**	**Description**	**Marks allocated for evaluation**
Theory	Classroom lectures	31	Direct supervised by the instructor in the class	
Practical Exercises/ Project Work	Supervised	28	Supervised by instructors in class	
Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
	Practical Exam	2	Lab	20
Revision and Presentation		6	To be presented in class	10
Lab Exercises, Home Assignments, Attendance and Discipline				10
Total		**69**		**100**

Further breakdown of question weightage is given in the following table:

Chapter	**Objective Question**		**Subjective Question**			
			Short Questions		**Long Questions**	
	Number of Questions	**Marks (20)**	**Number of Questions**	**Marks (24)**	**Number of Questions**	**Marks (16)**
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	4	4*1	1	1*4	1	1*8
2	3	3*1	1	1*4	-	-
3	4	4*1	1	1*4	1	1*8
4	3	3*1	2	2*4	-	-
5	4	4*1	1	1*4	1	1*8
6	2	2*1	2	2*4		
Total	**20**	**20**	**8**	**24**	**3**	**16**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Detail Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1.	**Introduction to GIS &Geographic Phenomena**	– GIS definition, Functions of GIS, Development of GIS, – Component of GIS, GIS application and benefits, – Introduction to Geographic phenomena – Introduction to fields and object, Metadata, Data types – Spatial Data Models and Structures: Vector and Raster Data (Regular tessellations and Irregular tessellations) – Vector and Raster file formats	– Define GIS and explain its function and development – Understanding its core components and application. – Understanding geographic phenomena. – Explain concepts of fields and objects in GIS, metadata, and data types. – Familiarize with different representation of vector and raster data – Identify and describe common vector file formats: Shapefile, GeoJSON, KML – Identify and describe common raster file formats: TIFF, JPEG, PNG, and GRID.	Brainstorming Lecture and Interactive Discussion	5
2.	**Spatial Data Collection, Entry & Preparation**	– Concept and Methods of Data Collection – Primary data and Secondary data Sources – Data preparation and input techniques – Spatial Data Relationship and topology, data check and repair – Spatial Data Quality and its Components	– Understand the concept of data collection. – Learn methods of data collection: primary data sources and secondary data sources. – Apply input techniques for importing spatial data – Understand spatial data relationships and topology concepts for spatial analysis. – Evaluate spatial data quality: accuracy, completeness, consistency, and currency. – Understand the importance of data standards in GIS for interoperability and data sharing	Lecture, Demonstration and Group Works	5
3	**Database Management**	– Introduction to Database Management System: – Data, Information and Knowledge, users, Database Management System, its Components and Functions – Database management system: field, record, key field, field types, rules for assigning database fields, creating tables, viewing records, sorting records, – Relational Data Model (Concept, Domains, Sub type, Attributes and Relations)	– Understand distinctions between data, information, and knowledge in a DBMS – Describe major DBMS functions: storage, retrieval, manipulation, security, and concurrency control. – Learn basic DBMS terminology and operations. – Explain relational data model concepts: domains, subtypes, tuples, attributes, and relations.	Lecture, Demonstration and Group Works	6

		– Keys in Database Management System and various software of DBMS – Introduction to Spatial Database Management – Data standards (e.g., ISO, OGC) and its Importance, Metadata	– Understand database keys and identify DBMS tools. – Learn about spatial database management and its role in handling geographic data.		
4	**Map Projections and Coordinate System**	– Map Projection and Classifications – Factors of map projections, Scale Factor – Projections used in Nepal (UTM, MUTM Projections, Lambert Conformal Conic Projection) – Coordinate System and their types – Coordinate transformations – Georeferencing, Resampling and Geocoding	– Understand concepts and definitions related to map projections and coordinate systems. – Learn about different classifications of map projections. – Explore factors influencing map projections, including scale factor. – Study projection systems used in Nepal: UTM, Modified UTM, and Lambert Conformal Conic. – Understand coordinate systems and their transformations. – Gain knowledge on georeferencing, resampling and geocoding	Interactive Lectures, Discussions	5
5	**Spatial Data Analysis and its types**	– Concept and Importance of Spatial Analysis – Vector Data Analysis – Spatial Operations: Measurement, retrieval and classification functions, basics of overlay, neighborhood and connectivity functions – Raster Data Analysis – Common Raster Operations: ((Re)classification, Map Algebra, Overlay, Resampling, Interpolation, Zonal Statistics,) – Modeling and Simulation – Concept and types of modelling – Building and Running Model	– Understanding the concept and steps of spatial analysis. – Identity the steps of spatial analysis – Identify and describe different types of vector data and understand their representation in GIS. – Comprehend the structure of raster data. – Perform common raster operations to analyze and manipulate raster datasets effectively. – Identify and describe different types of models – Learn to build GIS models using modeling software	Interactive Lectures and Discussion Case Studies	7
6	**Volunteered and OpenSource GIS and Web Mapping**	– Definition, Importance and Uses – Map Making using open software and open data (Google Earth, QGIS, OSM)	– Understand opensource GIS software and its advantages. – Utilize open data in map making by importing, processing, and visualizing open data layers within GIS software.	Interactive Lectures, Discussion, Case Studies, Presentations	3

References

Sahoo, R.N. &Chakraborty, D., Fundamentals of Geographic Information System, Viva Books, New Delhi, 2007. LMTC Accession No. 910.285 CHAf

DemersM.N, Fundamentals of Geographic Information Systems, Wiley India Pvt. Ltd. LMTC Library Accession No. 910.285 DEM

Chang, K.T., Introduction to Geographic Information System, Tata McGraw Hill Pvt. Ltd. Principles of Geographic Information System. ITC, The Netherlands.

Burrough, P.A., &McDonnel, R. A., Principles of Geographic Information Systems, Oxford University Press, 2011. LMTC Library Accession No. 910.285 Burp

Lloyd, C.D., Spatial Data AnalysisAn Introduction for GIS Users, Oxford University Press, 2010. LMTC Library Accession No. 910.285 LLOs

Korte, G.B., et.al, The GIS Book, Cengage Learning India Pvt. Ltd., 2001. LMTC Library Accession No. 910.285 Korteg

Model Questions

Section A: Objective Questions (5*1=5)

1. Which of the following is NOT a function of GIS?
    a. Data capture
    b. Data storage
    c. Data analysis
    d. Data transmission
2. Which software is known for its opensource GIS capabilities?
    a. ArcGIS
    b. QGIS
    c. AutoCAD
    d. Google Earth
3. In GIS, metadata refers to:
    a. Data about data
    b. Spatial data
    c. Raster data
    d. Vector data
4. Which map projection is commonly used in Nepal?
    a. Mercator projection
    b. Lambert Conformal Conic Projection
    c. Robinson projection
    d. Mollweide projection
5. Buffering in GIS is used for:
    a. Creating a zone around a spatial feature
    b. Overlaying maps
    c. Joining spatial data
    d. Querying spatial data

Section B: Short Questions (2*4=8)

1. What are the primary differences between vector and raster data models in GIS? GIS मा vector र raster डेटा मोडेलहरू बीचको प्राथमिक भिन्नताहरू के हुन्? Describe two primary data sources used in spatial data collection. Spatial data सङ्कलनमा प्रयोग हुने दुई प्राथमिक डेटा स्रोतहरू वर्णन गर्नुहोस् ।

Section C: Long Questions (1*8=8)

1. Describe input techniques such as digitizing, scanning, and importing data from various formats. Input प्रविधिहरू जस्तै Digitize, scanning, र अन्य format हरु वर्णन गर्नुहोस् ।

Module IX: Photogrammetry and Remote Sensing Techniques

JSTF 209

Introduction

This course is developed as a module for partial fulfilment of Junior Survey Training Fresh Course. The course is designed with dual focus on Photogrammetry and Remote Sensing. This course includes the principles that underpin remote sensing techniques, exploring the various sources for data acquisition, and apply the knowledge in the domain of environment, climate, natural resources, and urban landscapes.

Objectives

Upon completion of this Module, the participants will be able to:

- Understand the basic concepts, principles, working methodologies, and application of photogrammetry and remote sensing
- Develop skills to download various remote sensing images and perform basic digital image processing.
- Familiarize with the concepts, principles, and uses of unsupervised and supervised image classification techniques, and perform land cover classification

Training Details

Approach of Instruction:	Lecture, Indoor Practical / Outdoor Practical
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	69 Sessions

Evaluation Criteria:
Evaluation of this Module is conducted based on:

- Module End Written Exam
- Practical Exam
- Project Work
- Internal Assessment, Attendance, Discipline

Attendance Requirement:
Continued 7 days of absence (except in unavoidable condition) will disqualify the candidate for the completion of the module.

Course Contents

Theory [31 Sessions]

Part A: Photogrammetry [17]

1. Introduction to Photogrammetry [2]

1.1 Definition of Photogrammetry
1.2 Principle of Photogrammetry

1.3 Types of Photogrammetry
1.4 Evolution of Photogrammetry
1.5 Scope of Photogrammetry
1.6 Application of Photogrammetry

2. Human eye and stereoscopic vision [2]

2.1 Human Eye, its Parts and Function
2.2 Depth Perception by Human Eyes: Monoscopic and Stereoscopic Vision
2.3 Stereoscopic Vision and Parallax in Photogrammetry and their Use in Height Measurement

3. Basic Photogrammetry [4]

3.1 Concept of Orthographic and Perspective Projection
3.2 Difference Between Aerial Photographs and Maps
3.3 Types of Aerial Photographs
3.4 Terminologies Used in Photogrammetry
3.5 Scale of a Vertical Aerial Photograph
3.6 Distortion in a Photograph
3.7 Effect of Relief and Tilt Displacement
3.8 Rectification
3.9 Photo Mosaics and Photo Maps

4. Aerial Photography Planning [3]

4.1 Aerial Cameras: Structure and Types
4.2 Photo Control Points, Their Types and Selection Criteria
4.3 Pre-Marking and Post Marking of Control Points
4.4 Properties of Ideal GCP
4.5 Planning for Aerial Photography and Factors to be Considered (With Numerical Examples)
4.6 Indexing of Aerial Photographs on a Map

5. Photogrammetric process [6]

5.1 Analogue/ Analytical Photogrammetry [3]

5.1.1 Coordinate Systems and Orientation
5.1.2 Types of Coordinate System: Photo, Camera, Ground
5.1.3 Orientation: Interior, Relative, Absolute
5.1.4 Process of Analog and Analytical Photogrammetry:
5.1.5 Aerial Triangulation Process and Resulting Photogrammetric Products

5.2 Digital Photogrammetry [3]

5.2.1 Digital Photogrammetry and its Advantages
5.2.2 Process of Digital Photogrammetry
5.2.3 Orientation: Interior, Exterior; GCP Measurement and Tie Points; Digital Aerial Triangulation and Bundle Block Adjustment; Image matching and Point Cloud Generation, DEM/DTM Generation and Orthophoto Production, Feature Extraction

Part B: Remote Sensing [14]

6. Fundamental of RS [3]

6.1 Definition and Concept
6.2 Brief History of Remote Sensing
6.3 Electromagnetic Radiation and Spectrum
6.4 Process of Remote Sensing
6.5 Atmospheric Window and its Significance

6.6 Spectral Reflectance and Spectral Reflectance Curve
6.7 Spectral Signature of Different Materials (Water, Soil, Vegetation)

7. Sensor and Platform [2]

7.1 Sensors: Passive and Active
7.2 Platforms: Groundbased, Airborne and Space Borne Remote Sensing
7.3 Resolution: Spatial, Spectral, Radiometric and Temporal
7.4 Multispectral Remote Sensing: Introduction, Types and Some Operational MS Sensors

8. Digital Image Processing [4]

8.1 Radiometric Distortion and Corrections
8.2 Geometric Distortion and Correction
8.3 Image Enhancement: Contrast Enhancement, Spatial Feature Manipulation, Multiimage ManipulationSpectral Ratioing
8.4 Visualization of Image Data: Types of Image Interpretation, Elements of Image Interpretation, Color Composites

9. Digital Image Classification [3]

9.1 Types of Image Classification Techniques
9.2 Pixel Based Classification: Unsupervised and Supervised
9.3 Accuracy Assessment

10. Applications and Recent Developments in RS [2]

10.1 Freely Available Image Data
10.2 Application of RS: Surveying and Mapping, Agriculture, Forestry, Land Cover and Land Use and Others
10.3 Concept of Active RS: LIDAR, RADAR and their applications

Practical [26 Sessions]

Part A: Photogrammetry [9]

11. Exploring Aerial Photos and 3D Visualization Using Stereoscopes and StereoPair of Aerial Photos [2]
12. 3D Modelling of Object Using Terrestrial Photogrammetry [2]
13. Digital Photogrammetry [5]

13.1 Orientation, GCP Measurement and Tie Points, Digital Aerial Triangulation and Bundle Block Adjustment, Image Matching, Point Cloud, DEM/DTM Generation, Orthophoto Production and Feature Extraction

Part B: Remote Sensing [17]

14. Introduction to RS software [3]
15. Downloading Freely Available Satellite Image [2]
16. Georeferencing and Image Rectification [2]
17. Image Subset, Layer Stack, Image Mosaic and Resolution Merge [2]
18. Image Interpretation [2]
19. Image Enhancement [2]
20. Digital Image Classification and Accuracy Assessment [4]

20.1 Unsupervised Classification
20.2 Supervised Classification
20.3 Accuracy Assessment

Part C: Group Project Work [6 sessions]

Groupwise project work in several applications of Photogrammetry and Remote Sensing

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		Time Allocated (Sessions)	Description	Marks allocated for evaluation
Theory	Classroom Lectures	31	Direct supervised by instructor in the class	
Practical/ Lab	Supervised	26	Supervised by instructors in lab	
Group Project	Supervised	6	Direct supervised by instructor in class	
Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
	Practical Exam	2	Lab	20
Revision and Presentation		2	To be presented in class	10
Lab Exercises, Home assignment, Attendance, Discipline				10
Total		**69**		**100**

Further breakdown of question weightage is given in the following table:

Chapter	Objective Question		Subjective Question			
			Short Questions		Long Questions	
	Number of Questions	Marks (20)	Number of Questions	Marks (24)	Number of Questions	Marks (16)
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
Part A: Photogrammetry						
1	2	2*1	1	-	-	-
2	1	1*1	1	-	-	-
3	3	3*1	1	-	-	-
4	2	2*1	-	-	1	1*8
5	3	3*1	-	-	1	1*8
Part B: Remote Sensing						
6	2	2*1	1	1*4	-	-
7	2	2*1	1	1*4	-	-
8	2	2*1	1	1*4	-	-
9	1	1*1	1	1*4	1	1*8
10	2	2*1	1	1*4	-	-
Total	**20**	**20**	**8**	**24**	**3**	**16**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Detail Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
Part A: Photogrammetry					
1.	**Introduction to Photogrammetry**	– Definition of Photogrammetry – Principle of Photogrammetry – Types of Photogrammetry – Evolution of Photogrammetry – Scope of Photogrammetry – Application of Photogrammetry	– Understand about the fundamental concept in photogrammetry and its principle – Know about the historical development of photogrammetry – Explain the differences between types of photogrammetry – Familiarize with application sectors and scope of photogrammetry	Lectures Interactive Discussions	2
2.	**Human Eye and Stereoscopic Vision**	– Human Eye, its Parts and Function – Depth Perception by Human Eyes: Monoscopic and Stereoscopic Vision – Stereoscopic Vision and Parallax in Photogrammetry and their Use in Height Measurement	– Identify different parts of human eye and explain its functions. – Understand about depth perception techniques of human eyes – Relate human eye functioning with 3D vision in photogrammetry – Know about the usage of stereoscopic vision and parallax in photogrammetry	Brainstorming Lectures Interactive Discussions and Exercises	2
3.	**Basic Photogrammetry**	– Concept of Orthographic and Perspective Projection – Difference Between Aerial Photographs and Maps – Types of Aerial Photographs – Terminologies Used in Photogrammetry – Scale of a Vertical Aerial Photograph – Distortion in a Photograph – Effect of Relief and Tilt Displacement – Rectification – Photo Mosaics and Photo Maps –	– Familiarize with orthographic and perspective projection – Identify the differences between photographs and maps – Understand different terminologies in Photogrammetry – Understand about distortions and displacement in photogrammetry and their removal techniques – Explain the similarities and differences in photo mosaics and photo maps – Practice exercises associated with scale of vertical photograph	Lectures Interactive Discussions Numerical calculation and Exercises	4
4.	**Aerial Photography Planning**	– Aerial Cameras: Structure and Types – Photo Control Points, Their Types and Selection Criteria – PreMarking and Post Marking of Control Points – Properties of Ideal GCP	– Recognize different parts of an aerial camera and understand their functions. – Familiarize with working mechanism and output of digital and analog cameras. – Explain about nature and types of photo control points	Lectures Interactive Discussions Numerical calculation and Exercises	3

		– Planning for Aerial Photography and Factors to be Considered (With Numerical Examples) – Indexing of Aerial Photographs on a Map	– Identify suitable GCP for photogrammetric mission. – Plan aerial photography missions by considering different factors.		
5.	**Photogram metric Process**	– Analogue/ Analytical Photogrammetry – Coordinate Systems and Orientation – Types of Coordinate System: Photo, Camera, Ground – Orientation: Interior, Relative, Absolute – Process of Analog and Analytical Photogrammetry: – Aerial Triangulation Process and Resulting Photogrammetric Products – Digital Photogrammetry – Digital Photogrammetry and its Advantages – Process of Digital Photogrammetry – Orientation: Interior, Exterior; GCP Measurement and Tie Points; Digital Aerial Triangulation and Bundle Block Adjustment; Image matching and Point Cloud Generation, DEM/DTM Generation and Orthophoto Production, Feature Extraction	– Differentiate between different coordinate systems on photogrammetry. – Understand the different orientation techniques in analog / analytical photogrammetry. – Describe Aerial Triangulation Process in Analog / Analytical Photogrammetry and its importance – – Identify the difference of digital photogrammetry from Analog / Analytical photogrammetry – Know the basic usage of digital photogrammetric workstation. – Describe different steps / process involved in Digital photogrammetry – Familiarize with the products of Digital Photogrammetry –	Lectures Interactive Discussions	6
Part B: Remote Sensing					
6.	**Fundamenta l of RS**	– Definition and concept – Brief history of Remote Sensing – Electromagnetic Radiation and Spectrum – Process of Remote Sensing – Atmospheric window and its significance – Energy interaction in atmosphere – Energy interaction with earth surface – Spectral reflectance and spectral reflectance curve – Spectral signature of different materials (water, soil, vegetation) –	– Understand the definition, concept of RS and identify differences between photogrammetry and RS – Know about the evolution and history of RS – Familiarize with process of RS – Gain knowledge about atmospheric window and its significance in RS – Understand about the energy interaction in atmosphere and with earth surface – Know about the Spectral reflectance and spectral reflectance curve – Identify the differences in spectral signature plot of different materials	Brainstorming Lectures Interactive Discussions	3

7.	**Sensor and Platform**	– Sensors: Passive and Active, – Platforms: Groundbased, Airborne and Space borne remote sensing – Resolution: Spatial, Spectral, Radiometric and Temporal – Multispectral Remote Sensing: Introduction, Types and some operational MS Sensors	– Explain the differences between: passive & active – Understand types of remote sensing based on platforms – Familiarize with the concept of multispectral RS and its types	Lectures Interactive Discussions	2
8.	**Digital Image Processing**	– Visualization of image data: Types of image interpretation, Elements of image interpretation, Color composites – Image enhancement: Contrast enhancement, Spatial feature manipulation, multiimage manipulationspectral rationing – Radiometric distortion and corrections – Geometric distortion and correction	– Interpret images by analyzing image interpretation elements – Visualize multiband images using different color composites – Understand the concept of image enhancement and its types and applications – Understand the sources of radiometric and geometric distortions and recognize the ways to correct these distortions	Lectures Interactive Discussions Numerical calculation and Exercises	4
9.	**Digital Image Classification**	– Types of image classification techniques – Pixel based classification: unsupervised and supervised – Validation and accuracy assessment	– Explain and compare different types of image classification techniques – Familiarize with the concepts of and algorithms used in supervised and unsupervised classification – Understand the ways to perform accuracy assessment of classified image and interpret the results of classification	Lectures Interactive Discussions Numerical calculation and Exercises	3
10.	**Applications and Recent Developments in RS**	– Freely available image data – Surveying and Mapping, Agriculture, forestry, Land covers and land use and others – Active RS: LIDAR, RADAR and their applications	– Familiarize with the applications of Remote sensing in several sectors of Nepal – Explore and download freely available images – Understand about active RS such as LIDAR, RADAR and know about its applications – Familiarize with the recent developments of RS in context of Nepal	Lectures Interactive Discussions Case Studies Demonstration and exercise	2

References:

Bhatta, Remote Sensing and GIS, Oxford University Press, 2010. (Unit 1, 2, 5, 7, 9 & 10).

Fundamental of Remote Sensing, A Canada Centre for Remote Sensing Remote Sensing Tutorial

Lucas L.F. Janssen, Gerrit C. Huurneman, Principles of Remote Sensing: An Introductory textbook, International Institute for Geoinformation Science and Earth Observation (ITC), The Netherlands.

Linder, W. (2009). Digital photogrammetry (Vol. 1). Berlin/Heidelberg, Germany: Springer.

Model Questions

Section A: Objective Questions (5*1=5)

1. Usual lateral overlap in Photogrammetry is
    a. 60%
    b. 45%
    c. 30%
    d. 50%
2. Which projection system is used in orthophoto?
    a. Parallel Projection
    b. Central Projection
    c. Orthogonal Projection
    d. Perspective Projection
3. Which type of error occur due to terrain undulation in aerial photograph
    a. Tilt displacement
    b. Relief Displacement
    c. Both
    d. None
4. Landsat रिमोट सेन्सिंङ इमेजको pixel size 30*30m रहेको हुन्छ। यसलाइ इमेजको कुन resolution भनिन्छ?
    a. Spatial
    b. Spectral
    c. Radiometric
    d. Temporal
5. तलका मध्ये कुन algorithm लाई unsupervised classification को वर्गमा राख्न सकिन्छ?
    a. Minimum distance
    b. Parallelepiped
    c. Maximum likelihood
    d. Kmean

Section B: Short Questions (2*4=8)

1. Define Photogrammetry. Discuss the types of photogrammetry on the basis of historical development.
2. Photogrammetry परिभाषित गर्नुहोस्। ऐतिहासिक विकासको आधारमा Photogrammetry का प्रकारहरू छलफल गर्नुहोस्.
3. What is image interpretation? Explain elements of Image interpretation.
4. Image interpretation भनेको के हो? Image interpretation का elements लाई व्याख्या गर्नुहोस

Section C: Long Questions (1*8=8)

1. What are the factors to be considered while planning aerial photography? A ground area 30km x 20km is to be surveyed by aerial surveying. Following data are available (3+5=8)
    - a. Format size: 230mm x 230mm
    - b. Scale: 1:25000
    - c. Forward Overlap: 60%
    - d. Lateral Overlap: 25%

Compute the total number of photographs required.

ModuleX: Cartography

JSTF 210

Introduction

This module has been is developed for partial fulfillment of the Junior Survey Training (Inservice) Course. The course is targeted to impart knowledge on traditional, digital, and web cartography to trainees, making them capable of performing cartography-related activities for their professional career.

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Acquire knowledge about analogue, digital cartography, Map projection, and Generalization.
- Visualize and Design Geospatial Data on different platforms
- Prepare map layout using map design principles

Training Details

Approach of Instruction:	Lecture, Indoor Practical Classes, Outdoor Practical Classes
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (1 hour and 30 minutes each session) 3 session in friday
Total Number of Sessions:	69 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Module End Written Exam
- Practical Exam
- Project Work
- Internal Assessment, Attendance, Discipline

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course

Course Contents

Part A: Theory [32 Sessions]

1. Introduction to Cartography [4]

1.1 Introduction: Definitions, History, Scope
1.2 Cartography, GIS and Information Technology
1.3 Map Characteristics and Uses
1.4 Map Classification: Scale, Purpose, Contents: General and Thematic
1.5 Enlargement and Reduction of Map Scales
1.6 Map as an Interface to Data

2. Cartographic Design [8]

2.1 Map Design

2.1.1 Introduction and Map Design Steps
2.1.2 Good Map Design Characteristics
2.1.3 Map revision

2.2 Cartographic Communication Process and Perception Properties: Selective, Associative, Ordered, Quantitative

2.3 Visual variables: Bertin's Visual Variable and Symbol Design: Point, Line, and Area data types

2.4 Understanding Color

2.4.1 Nature of Color: Spectral and Reflected Color
2.4.2 Color Model: Additive, Subtractive
2.4.3 Use of Color in Map

2.5 Typography Design

2.5.1 Elements of Typography: Style, form, size, color
2.5.2 Typographic Guidelines
2.5.3 Toponomy
2.5.4 Gazetter

2.6 Map Layout

2.6.1 Introduction
2.6.2 Elements
2.6.3 Map Layout Examples

3. Map Projection and Sheet Numbering [7]

3.1 Concept and Definitions
3.2 Map Projection Classifications: Surface, Point of Contact, Aspect, Distortion Property
3.3 Scale Factor
3.4 Projection system used in Nepal: UTM, MUTM, and LCC (Lambert Conformal Conic)
3.5 Sheet Numbering: Small to Large Scale in Nepal

4. Map Making Process [3]

4.1 Conventional map-making process

4.1.1 Procedures, Materials, and Instruments: Drawing and Scribing
4.1.2 Introduction: Negative and Positive Plates

4.2 Digital Map Making Process

4.2.1 Concept of Digital Map
4.2.2 Classification of Maps in Digital Environment: Static and Dynamic
4.2.3 Digital Map Models: Digital Landscape Model, Digital Cartographic Model, Digital Image Model
4.2.4 Digital Plates
4.2.5 Comparison to Conventional Map-Making Techniques

4.3 Map Printing and Dissemination Techniques: Analogue and Digital

5. Map Generalization [2]

5.1 Concept and Definitions
5.2 Conceptual and Graphic Generalizations
5.3 Guidelines of Map Generalizations
5.4 Importance of Map Generalization

6. Thematic data visualizations [4]

- 6.1 Thematic Data and Framework/Foundation Data
- 6.2 Qualitative and Quantitative Data and Their Mapping
- 6.3 Measurement Scales: Nominal, Ordinal, Interval, Ratio
- 6.4 Different Types of Thematic Maps: Choropleth, Dot Density, Proportional Point Symbol, Chorochromatic, Isopleth
- 6.5 Basic of Atlas

7. Web Cartography [4]

- 7.1 Types of Web Map: Static, Dynamic, Interactive, Collaborative and Real Time
- 7.2 Exploring open software and data visualization
- 7.3 Overview of web mapping platforms (Google Maps, Leaflet, Mapbox, ArcGIS Online, Story maps)
- 7.4 Web map architecture (client-server, APIs, tiles)
- 7.5 Web mapping technologies:
  - 7.5.1 HTML, CSS, JavaScript
  - 7.5.2 Libraries: Leaflet, OpenLayers, D3.js, Mapbox
  - 7.5.3 GeoJSON, KML, WMS/WFS basics
- 7.6 Introduction to interactive elements (zoom, pan, tooltips, popups)
- 7.7 Types of Web Map: Static, Dynamic, Interactive, Collaborative and Real Time

Part B: Practical [22 Sessions]

8. Visualization technique: Symbols, Color, Templates, Annotations, Labels, Graphics, and Map Components by using different software [4]
9. Topographic Mapping [4]
10. Map generalization [2]
11. Transliteration [2]
12. Thematic mapping [6]
13. Map Layout and Design [4]

Part C: Project work and presentation [7 Sessions]

Part D: Filed Visits: Data dissemination methods [4 Sessions]

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		Time Allocated (Sessions)	Description	Marks allocated for evaluation
Theory	Classroom Lectures	32	Direct supervision by the instructor in the class	-
Practical Exercises/ Project Work	Supervised	22	Supervised by instructors in class	-
Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
	Practical Exam	2	Practical Exam	20
Project Work		4	Project Work	-
Project Presentation		3	To be presented in class	10
Field visit on data dissemination methods and reporting		4	Reports need to submit to supervisor	-
Lab Exercises, Home Assignments, Attendance and Discipline				10
Total		**69**		**100**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Further breakdown of question weightage is given in the following table:

Chapter	Objective Question		Subjective Question			
			Short Questions		Long Questions	
	Number of Questions	Marks (20)	Number of Questions	Marks (24)	Number of Questions	Marks (6)
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	2	2*1	2	2*4	-	-
2	2	2*1	1	1*4	1	1*8
3	2	2*1	1	1*4	1	1*8
4	2	2*1	2	1*4	-	-
5	2	2*1	1	1*4	-	-
6	2	2*1	-	-	1	1*8
7	2	2*1	1	1*4	-	-
8,9,10	2	2*1	Practical			
11,12	2	2*1				

13,14	2	2*1	Lab and Home related Assignment/ Presentation			
Total	**20**	**20**	**8**	**24**	**3**	**16**

Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	**Introduction to Cartography**	– Introduction: Definitions, History, Scope – Cartography, GIS, and Information Technology – Map Characteristics and Uses – Map Classification: Scale, Purpose, Contents: General and Thematic – Enlargement and Reduction of Map Scales – Map as an Interface to Data	– Understand the concept, milestones, and innovations in cartography – Demonstrate how cartography and GIS can be integrated to convey information – analyze how changes in scale impact the map's readability, size, and application.	Lecture Interactions	4
2.	**Cartographic Design**	– Map Design – Perception Properties – Cartographic Communication Process – Symbol Design – Visual Variables – Understanding Color – Typography Design – Map Layout	– Understand how the map design principles enhance the effectiveness in information interpretation – Demonstrate the effect of human understanding with the use of different visual variables – Design the map graphics using colors, text, symbols, and visual variables. – Emphasize the use of Map graphics to communicate with map user – Prepare the various types of well-designed maps balancing all map layout elements	Brainstorming Group Discussion Exercise	9
3	**Map Projection and Sheet Numbering**	– Concept and definitions – Map Projection Classification – Scale Factor – UTM and MUTM – Sheet Numbering: Small and Large Scale in Nepal	– Understand how the earth's features are projected on a 2D surface. – Understand Map projection system used in Nepal for different types of Map – Able to Number and index the topographic map sheets	Lecture Brainstorming Exercises Group Discussions	7
4	**Map Making Process**	– Conventional map-making process – Digital Map Making Process – Map Printing	– Differentiate the map-making and dissemination process	Interactive Presentations Task	4

5	**Map Generalisation**	– Concept and Definitions – Conceptual and Graphic Generalisation – Guidelines of Map Generalisation	– Gain an idea on how to simplify large-scale spatial databases to visualize in a small scale, while maintaining essential features and readability.	Interactions Demonstration	2
6	**Thematic Data Visualisation**	– Thematic Data and Framework/Foundation Data – Qualitative and Quantitative Data and their Mapping – Measurement Scales: Nominal, Ordinal, Interval, Ratio – Different Types of Thematic Maps: Choropleth, Dot Density, Proportional Point Symbol, Chorochromatic, flowline, Isopleth – Atlas basic	– develop skills in designing different types of thematic maps, by selecting appropriate symbols, colors, and legends that enhance the map's clarity and readability. – explore the use of GIS and other technological tools in the production of thematic maps	Interactive Lectures Presentations	4
7	**Web Cartography**	– Types of Web Map: Static, Dynamic, Interactive, Collaborative and Real Time – Exploring open software and data visualization: Google, QGIS, OSM	– Learn about various web mapping technologies and platforms (e.g. OSM Mapbox, Google Maps API. – Capable of converting and visualizing various data formats across multiple platforms.	Interactions Demonstrations Group work	2

References

Sahoo, R.N. &Chakraborty, D., Fundamentals of Geographic Information System, Viva Books, New Delhi, 2007. LMTC Accession No. 910.285 CHA-f

DemersM.N, Fundamentals of Geographic Information Systems, Wiley India Pvt. Ltd. LMTC Library Accession No. 910.285 DEM-f

Chang, K.T., Introduction to Geographic Information System, Tata McGraw Hill Pvt. Ltd. Principles of Geographic Information System. ITC, The Netherlands.

Burrough, P.A.,&McDonnel, R. A., Principles of Geographic Information Systems, , Oxford University Press, 2011. LMTC Library Accession No. 910.285 Bur-p

Lloyd, C.D.,Spatial Data Analysis- An Introduction for GIS Users, Oxford University Press, 2010 . LMTC Library Accession No. 910.285 LLO-s

Korte,G.B.,et.al, The GIS Book, Cengage Learning India Pvt. Ltd., 2001. LMTC Library Accession No. 910.285 Korte-g

Elements of Cartography, H. Rabison

Cartography for Mapping, Rabin Kaji Sharma

Cartography Visualization of Geospatial Data, Menno Kraak & Ferhan Ormeling

Basic Cartography Vol I, International Cartographic Association

Model Questions

Section A: Objective Questions

1. Open street Map is an example of which web map
    a. Static Map
    b. Collaborative map
    c. Multimedia map
    d. Real map
2. The line surrounding the body of map is called:
    a. Frame line
    b. Neatline
    c. Borderline
    d. Margin line
3. Transverse Mercator कस्तो projection system हो?
    a. Conformal
    b. Equivalent
    c. Equidistant
    d. None of the above
4. Which of the following is not visual variable?
    a. Position
    b. Text
    c. Form
    d. Size

Section B: Short Question (2*4=8)

1. What is Typography? List out the Typography guidelines.

    Typography भनेको के हो? नक्सामा अक्षर राख्ने नियमहरुको बारेमा लेख्नुहोस।
2. What do you understand by Map Generalization? Differentiate Conceptual and Graphic Generalization

    Map generalization लाई परिभाषित गर्नुहोस् । Conceptual र Graphical generalization विचको फरकको व्याख्या गर्नुहोस् ।

Section C: Long Question (1*8=8)

1. Describe any five methods of Thematic Visualization.

    Thematic data visualization का कुनै पाँच विधिहरूको संक्षेपमा वर्णन गर्नुहोस।

Module XI: Advanced Surveying Techniques

JSTF 211

Introduction

This module has been developed for partial fulfillment of Junior Survey Training Fresh Course. This module has been developed to enhance knowledge, and theoretical and practical skills related to advanced surveying techniques and methods, including GNSS survey, RTK surveying, LiDAR survey, Gravimetry, Geodetic Positioning, Elementary Geodesy, and Datum Transformation.

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Acquire knowledge of Geodetic Positioning (Triangulation, Trilateration, Resection and Intersection)
- Understand the basic concept of Elementary Geodesy, Gravimetry survey and gravimeters
- Acquire knowledge of LiDAR survey, GNSS survey, RTK survey, and applications.
- Understand Datum Transformation.

Training Details

Approach of Instruction:	Lecture, Group Discussion, Presentation, and Field Visit.
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	69 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Module End Written Exam
- Practical Exam
- Project Work
- Internal Assessment, Attendance, Discipline
-

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course

Course Content

Part A: Theory [34 Sessions]

1. Control Survey [5]

1.1 Triangulation

1.1.1 Definition, Purpose, Scope, Classification of Triangulation Network, Different Orders of Triangulation and their Specifications

1.1.2 Types of Figures, Strength of Figure, Types of Control stations, Triangular misclosure

1.1.3 Spherical triangle and spherical excess

1.2 Trilateration

1.2.1 Definition and Principles, Purpose, Instruments to be Used, Method of Observation and Recording

1.2.2 Comparison of Triangulation and Trilateration, Advantages and Disadvantages

1.3 Theodolite Resection and Intersection

1.3.1 Definition and Principles, Purpose, Method of Observation and Recording, Advantages and Disadvantages

2. Elementary Geodesy [6]

2.1 Figure of the Earth

2.2 Different Terms Used in Geodesy (Geoid, Ellipsoid, Geoid Undulation, geodetic datum, Deflection of Vertical, Equipotential Surface, Laplace Station, Convergence of Meridian)

2.3 Geometry of Ellipsoid, Characteristics of Different Ellipsoids; Reference Ellipsoid, Geoid, Geodetic coordinates (Geographic and geocentric) and projected coordinates

2.4 Coordinate Transformation: Rectangular to Geodetic coordinate system and viceversa

2.5 Height systems (Geodetic height, Orthometric height, Dynamic Height, and Normal heights)

3. Gravimetry survey [2]

3.1 Introduction to Gravity, Gravimetry, Gravimeter Instruments, and its principle

3.2 Data acquisition, processing and analysis, its scope and applications

4. LiDAR survey [2]

4.1 Introduction to LiDAR surveying and its principle

4.2 Components, Applications, and Use

5. Basics of GNSS surveying [5]

5.1 Introduction to GNSS, History, Development, Different components, Types of navigation system: GPS, GLONASS, Galileo

5.2 Basic principles of GNSS positioning

5.3 Satellite orbits, types of orbits, Kepler's law

5.4 GNSS Signals and frequencies: Pseudo range, Code (P, C/A), Carrier frequencies (L1, L2), data massage

5.5 Components of GNSS system and Segments

6. GNSS positioning Techniques [3]

6.1 Positioning Techniques: Static, Kinematic

6.2 Realtime Kinematic (RTK) surveying

7. Accuracy, Errors in GNSS and GNSS applications [3]

7.1 Accuracy and Precision in GNSS

7.1.1 Sources of GNSS errors: Ionospheric, Tropospheric, Multipath

7.1.2 Error Mitigation Techniques

7.2 GNSS applications

8. Continuously Operating Reference Stations (CORS) [2]

8.1 Introduction to CORS network, its Function and Importance

8.2 Accessing CORS data from remote servers

9. UAV survey [3]

9.1 Introduction to UAV, and its applications

9.2 Components and types, GCPs, and Operating UAV in Nepal: legal procedures

10. Basics of Astronomy [3]

10.1 Definitions of Astronomical Terms

10.2 Coordinate system in astronomy

10.3 Concept of time, applications in field astronomy

11. Part B: Case Study: Field Visit [8]

11.1 Geodetic Observatory Station Visit

11.2 Group Task

11.3 Group Presentation

12. Part C: Field works and lab/classroom exercises [22]

12.1 LiDAR data acquisition, data processing, and data analysis

12.2 GNSS Data Acquisition

12.2.1 Survey Planning and site selection

12.2.2 Field procedures for GNSS data collection

12.2.3 GNSS receiver setting and configurations

12.3 GNSS data processing

12.3.1 GNSS data formats

12.3.2 Post processing techniques

12.4 Datum transformation, transformation parameters

12.5 Field procedures, mission design, outputs of UAV survey

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		**Time Allocated (Sessions)**	**Description**	**Marks allocated for evaluation**
Theory	Classroom lectures	34	Direct supervised by the instructor in the class	
Practical Exercises/ Project Work	Supervised	22	Supervised by instructors in class	

Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
	Practical exam	3	Lab	20
Case Study and Presentation		8	To be presented in class	10
Assignments, Attendance, and Discipline				10
Total		**69**		**100**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Further breakdown of question weightage is given in the following table:

Chapter	**Objective Question**		**Subjective Question**			
			Short Questions		**Long Questions**	
	Number of Questions	**Marks (20)**	**Number of Questions**	**Marks (24)**	**Number of Questions**	**Marks (6)**
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	2	2*1	1	1*4	-	-
2	2	2*1	1	1*4	-	-
3	2	2*1	1	1*4	-	-
4	2	2*1	1	1*4	-	-
5	2	2*1	1	1*4	1	1*8
6	2	2*1	-	-	1	1*8
7	2	2*1	-	-	1	1*8
8	2	2*1	1	1*4	-	-
9	2	2*1	1	1*4	-	-
10	2	2*1	1	1*4	-	-
11			Case Study/ Presentation			
12			Field Related Assignment/ Presentation			
Total	**20**	**20**	**8**	**24**	**3**	**16**

Detail Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1.	**Control Survey**	– Triangulation – Trilateration – Theodolite Resection and Intersection – Spherical triangle and spherical excess	– Understand concepts on Trilateration, triangulation, resection and intersection. – Acquire knowledge on spherical triangle and spherical excess.	Lecture Interactions	5
2.	**Elementary Geodesy**	– Figure of Earth – Terms used in Geodesy – Geometry of Ellipsoid, its characteristics – Conversion of Rectangular to Geodetic coordinate system and viceversa. – Height System	– Assess basic concepts of the figure of the earth. – Understand the terms used in Geodesy – Understand ellipsoid, its properties. – Grasp the fundamentals of conversion of coordinate system – Acquire knowledge on different height system.	Lecture Interactions	6
3	**Gravimetry Survey**	– Introduction to Gravity, Gravimetry, Gravimeter instruments – Principle of Gravimetry – Gravimetry Data acquisition, processing and analysis – Scope and application	– Acquire knowledge on Gravitational force, gravity and laws related to it. – Grasp the fundamentals of height systems – Understand Gravimetry and gravimeters and their scope and applications	Presentations Interactions	2
4	**LiDAR survey**	– Introduction to LiDAR surveying – Principles of LiDAR operation	– Understand the basic principles and components of LiDAR systems.	Presentations Interactions	2
5	**Basics of GNSS Survey**	– Introduction to GNSS – Principle of GNSS – Satellite orbits, Kepler's law – GNSS signals – Components of GNSS system, and segments	– Grasp the fundamentals of GNSS, and its principle – Understand satellite orbits, their types, Kepler's orbit and orbital elements – Acquire knowledge on GPS signals	Presentations Interactions	5
6	**GNSS Positioning Techniques**	– Positioning Techniques: Static, Kinematic – Realtime Kinematic (RTK)	– Understand different positioning techniques – Acquire knowledge on RTK	Presentations Interactions	3

7	**Accuracy, Errors in GNSS and GNSS applications**	– Accuracy, errors and precision in GNSS – GNSS applications	– Acquire knowledge on accuracy, errors and precision in GNSS – Learn GNSS applications	Presentations Interactions	3
8	**Continuously Operating Reference Stations (CORS)**	– Introduction to CORS network – Function and importance of CORS – Data collection and distribution from CORS	– Grasp the fundamentals of CORS – Understand its functions and its importance – Acquire knowledge on data collection and distribution of CORS	Presentations Interactions	2
9	**UAV survey**	– Introduction to UAV, and its applications – UAV components and types, GCPs and operating UAV in Nepal: legal procedures	– Grasp the fundamentals of UAV survey – Understand its components and types, GCPs and operating UAV in Nepal: its legal procedures	Presentations Interactions	3
10	**Basics of Astronomy**	– Definitions of Astronomical terms – Coordinate system in Astronomy – Concept of time, applications in field astronomy	– Grasp the fundamentals of astronomical terms – Understand coordinate system in Astronomy – Acquire knowledge on concept of time, applications in field astronomy	Presentations Interactions	3

References

Surveying (Volume 1 and 2) by K.R. Arora: Rajons Publication Pvt. Ltd.

Surveying (Volume 1 and 2) by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publication (P) Ltd.

Triangulation Instruction Book, Survey Department of Nepal

GPS Theory & Practice, B. Hofmann, J. Collion et al.

Model Questions

Section A: Objective Questions (5*1=5)

1. Which of the following best describes geodesy?
    a. The study of the shape, size, and gravitational field of the Earth
    b. The study of rocks and minerals
    c. The study of weather patterns
    d. The study of oceanography
2. Which of the following is the European Satellite System?
    a. GPS
    b. GLONASS
    c. GALILEO
    d. NavIC
3. Which of the following segments is responsible for the health of the satellites?
    a. Space Segment
    b. Control Segment
    c. User segment
    d. High segment
4. Which of the following statements is false about geoid?
    a. It is an equipotential surface
    b. It is a physical model of Earth's figure
    c. It is a mathematical surface for positioning on the surface of the Earth
    d. It serves as a reference for height determination
5. Which of the following statements is true?
    a. In prograde orbits, the satellite travels in the opposite direction as the rotation of the earth
    b. In retrograde orbits, the satellite travels in the opposite direction as the rotation of the earth
    c. Prograde orbits are the least common orbits
    d. Retrograde orbits are the most common orbits.

Section B: Short Questions (2*4=8)

1. Describe Kepler's law of planetary motion.
2. Kepler को law of planetary motion को बर्णन गर्नुहोस्।
3. What is orthometric height? How is it different from Geometric height?
4. Orthometric height भन्नाले के बुझ्नुहुन्छ? यो Geometric height भन्दा कसरी फरक छ, उल्लेख गर्नुहोस।
5. Differentiate between Geoid and Ellipsoid.
6. Geoid र Ellipsoid को फरक बर्णन गर्नुहोस्।

Section C: Long Questions (1*8=8)

1. Convert rectangular coordinates (x,y,z) to geodetic coordinates (r,θ,λ). Rectangular coordinate (x,y,z) लाई geodetic coordinate (r,θ,λ) मा लग्नुहोस्।
2. What is GNSS? Write the principle of GNSS measurements. What are the error sources of GNSS measurements? GNSS भनेको के हो? GNSS measurements को सिद्धान्त के हो? GNSS सर्भेक्षणमा त्रुटिका श्रोतहरु के के हुन्?

Module XII: Cadastre

JSTF 212

Introduction

This course is developed as a Module for partial fulfillment of the Junior Survey Training Fresh Course. This module includes the core concepts of cadastral surveying. The course provides insights of cadastral survey methods from analogue to digital together with techniques ranging from compass surveys to cutting-edge GNSS technology. With various tools and technologies, the course provides the methodology to carryout cadastral survey and data updating and record maintenance both in conventional and digital environment.

Objectives

Upon completion of this Module, the participants will be able to:

- Develop and understand the concepts and principle of cadastre.
- Acquire knowledge on analogue and digital cadastral survey.
- Construct Knowledge on institutional and legal provisions regarding cadastre.

Training Details

Approach of Instruction:	Lecture, Group Discussion, Presentation, Indoor and Outdoor Practical
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Session (Friday), (1 hour and 30 minutes each session)
Total Number of Sessions:	69 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Module End Written Exam
- Practical Exam
- Project Work
- Internal Assessment, Attendance, Discipline

Attendance Requirement:

Continued 7 days of absence (except in unavoidable condition) will disqualify the candidate for the completion of the module.

Course Contents

Part A: Theory [36 Sessions]

1. Introduction and Basic Concepts [6]

1.1 Definition, concept and Importance of Cadastral Survey
1.2 Historical Background of Cadastral survey
1.3 Principle of Cadastral Survey
1.4 Types of Cadastral Survey (In terms of Objective, Technology)

1.5 Concept of Sporadic and Systematic Cadastral survey
1.6 Cadastral Survey Technological Evolution (Chain Survey to Lidar Survey in Nepal)
1.7 Parcel and Boundary
1.8 Parcel Numbering
1.9 Cadastral Documents: Cadastral map, Field Book, Plot register, Land Ownership Registration Book (Shrestha), Title Document (Purja) etc.
1.10 Application and use of Cadastre

2. Cadastral Survey Methods [6]

2.1 Analogue Method
- 2.1.1 Chain Survey
- 2.1.2 Compass Survey
- 2.1.3 Plane table Survey

2.2 Introduction and Application of Digital Method
2.3 Total station
2.4 Photogrammetry/Remote Sensing
2.5 GNSS method (RTK)
2.6 UAV Method (Photogrammetric Method)
2.7 Hybrid method
2.8 Comparison)Principle, Application, Use and Impact(of different methods

3. Cadastral Survey Procedure [8]

3.1 Preparation for cadastral survey
- 3.1.1 Need Assessment for Cadastral Survey
- 3.1.2 Notification Process and public awareness
- 3.1.3 Formation of Cadastral Survey Team

3.2 Cadastral Survey and Mapping Process
- 3.2.1 Analogue (Plane table and accessories, plane table setting, surveying and mapping, inking maps, area computation and validation, field book and other necessary documents preparation.
- 3.2.2 Digital (Tools and access for data collection, standardization and calibration, parcel boundary survey and measurements, sketching, data download and preprocessing, map making with appropriate application, database preparation, field book, and other documentation)

3.3 Land registration Process
- 3.3.1 Preparation and issue of land title (Land registration Ownership Certificate)
- 3.3.2 Arrangement for addressing incomplete task
- 3.3.3 Handover of Map and Documents
- 3.3.4 Verification Process of New Records with existing)

4. Business Service Delivery at Survey Office [2]

4.1 लिखत
4.2 कित्ताकाटटायल चेक ,
4.3 कित्ता एकीकरणकित्ता खण्डिकरण ,
4.4 फिल्ड रेखांकनदुरी अंकित ,, नक्सा प्रिन्ट
4.5 नक्सा सुधार

5. Legal Framework [6]

5.1 जग्गा नाप जांच ऐन, २०१९ तथा नियमवाली २०५८

5.2 जग्गा नाप जांच तथा नक्सा श्रेस्ता अधवाधिक सम्बन्धि निर्देशिका, २०८१

5.3 डिजिटल प्रणाली मार्फत जग्गाको नापनक्सा तथा जग्गा प्रशासन सम्बन्धी सेवा प्रवाह. निर्देशिका २०७८

5.4 भू-उपयोग ऐन २०७६ , भू-उपयोग नियमावली २०७९, भू-उपयोग कार्यक्रम कार्यान्वयन निर्देशिकाहरु २०८१

5.5 मानवरहित हवाई उपकरण (Unmanned Aerial Vehicle) मार्फत डिजिटल कित्तानापी कार्य संचालन विधि २०७९

5.6 डिजिटल कित्तानापीकार्य संचालन विधि (Digital Cadastral Standard Operation Procedure,,SOP) २०८१

5.7 गाउँब्लक क्षेत्रको नापजांच सम्बन्धि निर्देशिका , २०७७

5.8 द्वन्द्ववाट भूमि लगत क्षति भएका क्षेत्रको नापजाँच गरी पुर्नस्थापना गर्ने सम्वन्धि निर्देशिका २०७१

6. Institutional Framework [2]

6.1 Concerned Ministry

6.2 Survey Department, Department of Land Management and Archived

6.3 District Survey Offices and Land Revenue Offices

6.3.1 Update section

6.3.2 Surveying and Mapping Section

6.3.3 Special Survey Offices

6.4 Role of Province government and local government

6.5 Land management and land issues related Commissions

7. Archiving Cadastral Documents and Updating [2]

7.1 Map tracing, Digitization

7.2 Parcel Fragmentation and integration

7.3 Parcel history maintenance; Field Book, Plot register, Kittakat Trace etc.

7.4 Concept of Index map, File map, parcel map etc.

7.5 Parcel delineation; Process and technique archiving of Cadastral Documents

8. Land Information System [4]

8.1 Introduction to LIS, Components, Importance, and Applications

8.2 Introduction, Application, Importance and use of NeLIS and Merokitta

8.3 Introduction, Application, Importance and use of LRIMS and PAMS

8.4 Introduction to SAEx, Parcel Editor etc.

Part B: Practical [28 Sessions]

9. Process of cadastral map and documents preparation [24]

9.1 Use of Cadastral Application Software: NeLIS, Merokitta

9.1.1 Geodatabase Preparation

9.1.2 Scanning

9.1.3 Georeferencing

9.1.4 Scaling

9.1.5 Digitization

9.1.6 Documents Preparation and Printing

9.2 Map Layout and Printing

9.3 Updating and Maintenance

9.4 Checking Error and Completeness
9.5 Topological Validation
9.6 Record Preparation
9.7 Observation, Case study, Focused Group DiscussionFGD

10. Field Parcel Demarcation (फिल्ड रेखांकन) [४]

Further breakdown of the evaluation is given in the following table:

Activities		Time Allocated (Sessions)	Description	Marks allocated for evaluation
Theory	Classroom Lectures	36	Direct supervised by instructor in the class	
Practical Exercises	Cadastral Surveying and Field Parcel Delineation	28	Supervised by the instructor in field	
Exam	Final exam	2	Comprises subjective and objective questions	Total mark: 60 Subjective: 40 Objective 20
Case Study and Presentation		3	To be presented in Class	20
Assignment, Attendance, and Discipline				20
Total		**69**		**100**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Further breakdown of question weightage is given in the following table:

Chapter	Objective Question		Subjective Question			
			Short Questions		Long Questions	
	Number of Questions	Marks (20)	Number of Questions	Marks (24)	Number of Questions	Marks (16)
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	3	3*1			1	1*8
2	3	3*1	1	1*4		
3	3	3*1			1	1*8
4	3	3*1			1	1*8
5	2	2*1	1	1*4		
6	2	2*1	2	2*4		
7	2	2*1	2	2*4		
8	2	2*1	2	2*4		
Total	**20**	**20**	**8**	**24**	**3**	**16**

Detail Curriculum

S. N	Topics	Sub Topics	Learning Outcomes	Learning Activities	Session Hour
1	**Introduction and Basic Concepts**	– Definition, concept and Importance of Cadastral Survey – Historical Background of Cadastral survey – Principle of Cadastral Survey – Types of Cadastral Survey (In terms of Objective, Technology) – Concept of Sporadic and Systematic Cadastral survey – Cadastral Survey Technological Evolution (Chain Survey to Lidar Survey in Nepal) – Parcel and Boundary – Parcel Numbering – Cadastral Documents: Cadastral map, Field Book, Plot register, Land Ownership Registration Book (Shrestha), Title Document (Purja) and other related documents – Application and use of Cadastre	– Understand the principle, – origin and theory behind cadastre – Assess basic concepts of – Cadastre and its types. – Develop theory on different types of archiving	Exercise Interactions Presentation	6
2.	**Cadastral Survey Methods**	– Analogue Method – Chain Survey – Compass Survey – Plane table Survey – Introduction and Application of Digital Method – Total station – Photogrammetry/Remote Sensing – GNSS method (RTK) – UAV Method (Photogrammetric Method) – Hybrid method – Comparison)Principle, Application, Use, and Impact(of different methods	– Understand the types of cadastral survey. – Knowledge on trends and technology. – Explain the different principle behind the technology.	Presentation Exercise Interactions	6

3	**Cadastral Survey Procedure**	– Preparation for cadastral survey – Need Assessment for Cadastral Survey – Notification Process and public awareness – Formation of Cadastral Survey Team – Cadastral Survey and Mapping Process – Analogue (Plane table and accessories, plane table setting, surveying and mapping, inking maps, area computation and validation, field book and other necessary documents preparation. – Digital (Tools and access for data collection, standardization and calibration, parcel boundary survey and measurements, sketching, data download and preprocessing, map making with appropriate application, database preparation, field book, and other documentation) – Land registration Process – Preparation and issue of land title (Land registration Ownership Certificate) – Arrangement for addressing incomplete task – Handover of Map and Documents – Verification Process of New Records with existing)	– Understand and apply the concept of cadastral survey – Learn professional and societal norms, values and human behavior on cadastre – Embrace professionalism in practice through understanding and execution.	Presentation Exercise GroupDiscussion	8
4	**Business Service Delivery at Survey Office**	– लिखत – कित्ताकाट, टायल चेक – कित्ता एकीकरण, कित्ता खण्डिकरण – फिल्ड रेखांकन, दुरी अंकित, नक्सा प्रिन्ट – नक्सा सुधार – मौजुदा दर्ता श्रेस्ता भिडाउने	– Understand and apply the concept of cadastral survey – Learn professional and societal norms, values and human behavior on cadastre – Embrace professionalism	Presentation Exercise Group Discussion	2
5	**Legal Framework**	– जग्गा नाप जांच ऐन, २०१९ तथा नियमवाली २०५८ – जग्गा नाप जांच तथा नक्सा श्रेस्ता अधवाधिक सम्बन्धि निर्देशिका, २०८१ – डिजिटल प्रणाली मार्फत जग्गाको नापनक्सा तथा जग्गा प्रशासन सम्बन्धी सेवा प्रवाह. निर्देशिका २०७८ – भू-उपयोग ऐन २०७६ , भू-उपयोग नियमावली २०७९, भू-उपयोग कार्यक्रम कार्यान्वयन निर्देशिकाहरु २०८१ – मानवरहित हवाई उपकरण (Unmanned Aerial Vehicle) मार्फत डिजिटल कित्तानापी कार्य संचालन विधि २०७९ – डिजिटल कित्तानापीकार्य संचालन विधि (Digital Cadastral Standard Operation Procedure, SOP) २०८१	– Understand major provisions of the acts and directives. – Recognize the significance of Rules and regulations in fostering professionalism. – Knowledge on regulations, norms and acts	Case Studies Presentation	6

		– गाउँल्लक क्षेत्रको नापजांच सम्बन्धि निर्देशिका, २०७७ – द्वन्द्ववाट भूमि लगत क्षति भएका क्षेत्रको नापजाँच गरी पुर्नस्थापना गर्ने सम्वन्धि निर्देशिका २०७१			
6	**Institutional Framework**	– Concerned Ministry – Survey Department, Department of Land Management and Archived – District Survey Offices and Land Revenue Offices – Update section – Surveying and Mapping Section – Special Survey Offices – Role of Province government and local government – Specific Commission (Land Commission etc.)	– Grasp the fundamental concepts, principles, functions, and roles of different organization. – Knowledge of organogram. – Efficiently organize tasks and resources to achieve organizational goals.	Interactions Presentations	2
7	**Archiving Cadastral Documents and Updating**	– Map tracing, Digitization – Parcel Fragmentation and integration – Parcel history maintenance; Field Book, Plot register, Kittakat Trace etc. – Concept of Index map, File map, parcel map etc. – Parcel delineation; Process and technique archiving of Cadastral Documents	– Identify the gap between existing cadastre system. – Recognize different medium of updating cadastre.	Interactive Lectures Presentations	2
8	**Land Information System**	– Introduction to LIS, Components, Importance, and Applications – Introduction, Application, Importance and use of NeLIS and Merokitta – Introduction, Application, Importance and use of LRIMS and PAMS – Introduction to SAEx, Parcel Editor etc.	– Develop effective and enhance computer abilities. – Improve digital tools and technology. proficiency. – Enhance SelfSkill	Exercise Presentation	4

References

Land Registration and Cadastral System, Gerhard Larsson, Pearson Education

Gopali, S. B (2039 B.S.) नेपालमा नापी प्रणाली आवश्यकता र उपलब्धि

Land (Survey & measurement) act 2019

Introduction to Cadastral Survey 2nd Edition, Modh Adhar Abd Samad

Shrestha, B. L (2042 B.S.), Kitta Napiyasamiksha कित्ता नापी एक समिक्षा

Shrestha, B.N. (2038 B.S.). Jana Upayogko Lagi Kitta Napi: Pustak Sansar (जन उपयोगको लागि कित्तानापी)

Steudler D. (2014) CADASTRE 2014 and Beyond. FIG Report 2014

Williamson, et. al, (2009). Land administration for sustainable development: Esri academic press

Model Questions

Section A: Objective Questions (5*1=5)

1. In cadastre Numbering of Parcel starts from? (कित्तानापीमा कित्ता न कहाँबाट शुरु हुन्छ?)
    a. उत्तर पुर्व (North East)
    b. उत्तर पश्चिम (North West)
    c. दक्षिण पुर्व (South East)
    d. दक्षिण पश्चिम (South West)
2. Which of the following documents not in Survey Office? (नापी कार्यलयमा तल दिएका कुन कागजात हुदैन?)
    a. Plot Register (प्लट रजिस्टर)
    b. Field Book (फिल्ड बुक)
    c. Map (नक्सा)
    d. Shersta (श्रेस्ता)
3. What is the type Cadastral Survey in Nepal? (नेपालको कित्ता नापी कुन प्रकारको हो?)
    a. Sporadic
    b. Systematic
    c. Continuous
    d. Different
4. NeLIS stands for (NeLIS को पूर्ण रुप?)
    a. Nepal Land Information System
    b. Nepal Land In System
    c. Nepal Land Info System
    d. Nepal Land Intermediate System
5. तल दिएका मध्य दुवै सरकारी र सार्वजनिक जग्गग कुन हो?
    a. जंगल
    b. पोखरीको डिल
    c. बाटो
    d. गुठी

Section B: Short Questions (2*4=8)

Answer any **Two** of the following (तलका मध्य कुनै दुइ प्रश्नको उत्तर दिनुहोस ।)

1. What are documents needed for cadastral survey? Describe in short.
   कित्तानापी गर्न कुन कुन कागजातहरुको आवश्यक पर्दछ ? छोटकरिमा वर्णन गर्नुहोस ।
2. What is UAV Cadastral Survey Method? Write down the importance of UAV survey.
   UAV कित्तानापी भन्नाले के बुझ्नुहुन्छ? यसको महत्व उल्लेख गर्नुहोस ।
3. Differentiate between analog and digital cadastre.

Section C: Long Questions (1*8=8)

Answer any **One** of the following (तलका मध्य कुनै १ प्रश्नको उत्तर दिनुहोस।)

1. Describe the methods of cadastral survey in Nepal. Which aspects can be considered for effective and quality service delivery? Elaborate.

   नेपालमा कित्तानापीको प्रकारहरु बर्णन गर्दै यसलाई थप प्रभावकारी र गुणस्तरीय बनाउन के कस्तो पक्षमा ध्यान दिनुपर्ला बिबेचना गर्नुहोस ।

2. List out the acts and polices of present Cadastre of Nepal. Explain what are the drawback of Land Measurement Act2019?

   नेपालको कित्तानापीको लागि आवस्यक पर्ने ऐन, कानुनहरु List गर्नुहोस? जग्गा नाप जांच ऐन २०१९ को कमिकमजोरीहरु बर्णन गर्नुहोस?

Module XIII: Land Administration

JSTF 213

Introduction

This course is developed as a Module for partial fulfilment of Junior Survey Training Fresh Course. The course incorporates with land administration systems, land tenure, ownership, rights, management principles, land reform and land governance. The syllabus also delves into Nepal's land administration system, legal arrangements, and policy landscape.

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Understand the basic concepts and principles of Land Administration
- Understand national and international Land Administration System
- Understand the legal provisions for Land Administration in Nepal

Training Details

Approach of Instruction:	Lecture, Indoor Practical Classes, Outdoor Practical Classes
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	69 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Module End Written Exam
- Practical Exam
- Project Work
- Internal Assessment, Attendance, Discipline

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course

Course Contents

Part A: Theory [34 Sessions]

1. Introduction to Land Administration [2]

1.1 Definition
1.2 Terms
1.3 Elements
1.4 Importance
1.5 Functions

2. Land Administration System [4]

2.1 Definition, Types of Land Administration System (LAS): (Traditional and Modern LAS), Characteristics Features of LAS
2.2 Concepts of Land Governance
2.3 International Practices and Vision

3. Land Tenure, Ownership and Rights [6]

3.1 Land Tenure
3.2 Land Tenure System in Nepal
3.2.1 Land Tenure System in Nepal: Rakam, Jagir and Birta
3.2.2 Rakam, Jagir, Birta and Guthi Land
3.3 Guthi land and its types of Tenure Security Basic Concept of land Ownership and its Type
3.4 Basic Concept of land Rights (Including 3R)
3.5 Land Registration
3.5.1 Principles of Land Registration
3.5.2 Types of Land Registration

4. Concept of Land Reform and Land Management [6]

4.1 Definition and Concept
4.2 Land Reform Approaches
4.3 Land Reform Initiatives in Nepal
4.4 Concept and Definition of Land Management
4.5 Land Management Tools
4.5.1 Land Consolidation
4.5.2 Land Development
4.5.3 Land Pooling
4.5.4 Land Use Planning

5. Legal Provisions for Land Administration in Nepal [7]

5.1 Basic Concept of Policies
5.1.1 National Land Policy and Land Use Policy
5.2 Laws, Acts, Regulations, Directives, Manuals and Circulars
5.2.1 नेपालको संविधानमा भूमि सम्बन्धि व्यवस्था
5.2.2 मुलुकी(भूमि सम्बन्धित दफाहरू) २०७४-ऐन-संहिता-देवानी-
5.2.3 मालपोत ऐन २०३४ तथा मालपोत नियमावली, २०३६
5.2.4 भूमि सम्बन्धी ऐन २०२१
5.2.5 गुठी ऐन २०३३
5.2.6 जग्गा प्राप्ति ऐन २०३४
5.2.7 सरकारी जग्गा दर्ता, उपयोग तथा लिजमा उपलब्ध गराउने सम्बन्धी (पहिलो संशोधन) कार्यनीति, २०८२
5.2.8 जग्गा प्रशासन सम्वन्धी आदेशहरू

6. Land Administration System in Nepal [9]

6.1 Land Ownership Transfer Process in Nepal

6.1.1 अंशवण्डा, बकसपत्र, राजिनामा, अदालतको फैसला, लगतकट्टा

6.1.2 हालसाविक

6.1.3 Issues of Land Registration in Nepal

6.2 Land Acquisition Process in Nepal

6.3 Land valuation Process in Nepal

6.4 Land Disputes in Nepal and Measures of Resolution

7. Recent Developments in Land Administration [2]

7.1 Land Market??

7.2 Land Banking Initiatives

7.3 Different Tools and Approaches in Land Administration

Part B: Case Study [8 Sessions]

8. Office Visit and Case Study

8.1 Visit to Land Administration and Management Institution

8.2 Visit to Survey Offices

8.3 Case Study

8.4 Group Presentation

Part C: Practical [22 Sessions]

9. Land Records Preparation and Management [8]

9.1 जग्गा प्रशासनमा प्रयोग हुने विभिन्न प्रकारका लिखत

9.2 लिखत तयार गर्ने प्रक्रिया

9.3 मिसिल अध्ययन

9.4 मोठ भिडाउने

9.5 रोक्का, फुकुवा, दृस्टी बन्धक

9.6 अदालतको निर्णय कार्यान्वयन

9.7 मुचुल्का लेखन, प्रतिवेदन लेखन

9.8 Use of PAM, LRIMS for Land Records Management

10. Application of GIS Tools for Land Management [10]

10.1 Land Use Mapping

10.2 Land Pooling

10.3 Land Compensation Model

11. Parcel Delineation Using Total Station [4]

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		Time Allocated (Sessions)	Description	Marks allocated for evaluation
Theory	Classroom Lectures	34	Direct supervision by the instructor in the class	
Practical Exercises	Supervised	22	Supervised by instructors in class	
Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
Self Study		3		
Case Study and Presentation		8	Case Study	20
Lab Assignments, Home Assignments, and Discipline				20
Total		**69**		**100**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Further breakdown of question weightage is given in the following table:

Chapter	Objective Question		Subjective Question			
			Short Questions		Long Questions	
	Number of Questions	Marks (20)	Number of Questions	Marks (24)	Number of Questions	Marks (6)
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	2	2*1	1	1*4	-	-
2	2	2*1	1	1*4	-	-
3	3	3*1	1	1*4	1	1*8
4	3	3*1	1	1*4	-	-
5	2	2*1	1	1*4	-	-
6	3	3*1	1	1*4	1	1*8
7	3	3*1	1	1*4	1	1*8
8	2	2*1	1	1*4	-	-
9	-	-	Case Study and Presentation			
10,11,12	-	-	Lab Assignments and Lab Exam			
Total	**20**	**20**	**8**	**24**	**3**	**16**

Detail Curriculum

S. N	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1	**Introduction to Land Administration**	– Definition – Terms – Elements – Importance – Functions	– Understand the definition, terms, and elements of cartography – Realize the importance and functions of Land Administration	Lecture Interactions	2
2	**Land Administration System**	– Definition, Types of Land Administration System (LAS): (Traditional and Modern LAS), Characteristics Features of LAS – Concepts of Land Governance – International practices and Vision	– Understand about traditional and modern LAS – Understand the characteristics features of LAS – Understand the concept of Land Governance – Learn the international practices and vision of LAS	Lecture Interactions	4
3	**Land Tenure, Ownership and Rights**	– Land Tenure – Land Tenure System in Nepal – Administration of Guthi Land – Basic Concepts of Land Ownership and its Types – Basic Concepts of Land Rights (Including 3R) – Land Registration	– Understand the basic concept of Land Tenure – Recognize the different Land Tenure Systems in Nepal from ancient time – Understand the basic concept of Land Ownership and its types – Understand the concept of Land Rights – Understand the concept, principles, and types of Land Registration System	Lectures Group Discussions	6
4	**Concept of Land Reform and Land Management**	– Definition and Concept – Land Reform Approaches – Land Reform Initiatives in Nepal – Land Management	– Understand the definition and concept of Land Reform and Land Management – Grasp knowledge about different approaches of Land Reform and Land Reform initiatives in Nepal – Understand different land Management tools	Interactive Lectures Presentations	5
5	**Institutional Arrangements for Land Administration in Nepal**	– Concerned Ministry, Department and Offices – Provincial Government – Local Government – District Administration Office – Commissions on Land	– Gain knowledge on organizational structure for Land Administration in the context of Nepal	Lectures Interactions	2

6	**Legal Provisions for Land Administration in Nepal**	– Basic Concept of Policies – Laws, Acts, Regulations, Directives, Manuals and Circulars	– Understand the major legal provisions for Land Administration in Nepal	Interactive Lectures Presentations	6
7	**Land Administration System in Nepal**	– Land Ownership Transfer Process in Nepal – Issues of Land Registration in Nepal – Land Acquisition Process in Nepal – Land Valuation Process in Nepal – Land Disputes in Nepal and	– Understand the process of ownership transfer in Nepal – Recognize different issues of Land Registration in Nepal – Understand the land acquisition process in Nepal	Interactive Lectures	7
8	**Recent Developments in Land Administration**	– Different Tools and Approaches in Land Administration – Land Market and Land Banking Initiatives	– Understand different tools and approaches of Land Administration – Understand the concept of Land Market and Land Banking – Grasp knowledge about Land Banking Initiatives in Nepal	Interactive Lectures	2

References

Shrestha, B. L. (1999). Land Registration in Nepalese Perspective. Nepal Survey Society.

Deininger et al (2012) The land governance assessment framework, Identifying good practice in the land sector. World bank

Enemark, et. Al (2014). FitForPurpose Land Administration joint. FIG/World Bank publication. FIG Guide

Lemmen, C. and Oosterom, (2013) The Land Administration Domain Model Standard. 5th Land Administration Domain Model Workshop 2425 September 2013, Kualaumpur, Malaysia

UN, (1996). Land administration guidelines. New York & Geneva

Williamson, et. al, (2009). Land administration for sustainable development: Esri academic press

नेपालको संबिधान (भूमि सम्बन्धित धारा)

मुलुकीदेवानीसंहिताऐन२०७४ (भूमि सम्बन्धित दफाहरू)

मालपोतऐन२०३४

मालपोतनियमावली२०३६

भूमिसम्बन्धीऐन२०२१

भूउपयोगसम्बन्धिऐन२०७६

भूउपयोग नियमावली, २०७९

मुलुकीदेवानीकार्यविधिसंहिता२०७४ (भूमि सम्बन्धित महल)

राष्ट्रिय भूमि नीति, २०७५

राष्ट्रिय भूउपयोग नीति, २०७२

Model Questions

Section A: Objective Questions (1*4=4)

1. ससाना तथा छरिएर रहेको कित्तारुलाई एकतृत गरि खेति प्रणालिमा सुधार ल्याउने बिधिलाइ के भनिन्छ?
    a. Land Consolidation
    b. Land Ceiling
    c. Land Pooling
    d. Land Development
2. नेपालमा हाल कुन जग्गा दर्ता प्रणाली अवलम्बन गरिएको छ?
    a. Private Conveyancing System
    b. Title Registration System
    c. Deed Registration System
    d. Improved Deed Registration System
3. भूमि सम्बन्धि ऐन २०२१ अनुसार कुनै व्यक्ति वा जग्गावालाले काठमाडौं उपत्यकामा राख पाउने जग्गाको हद कति रहेको छ?
    a. १० रोपनी
    b. १५ रोपनी
    c. २० रोपनी
    d. २५ रोपनी
4. GLTN को पूरा रुप के हो?
    a. Global Land Tool network
    b. Geospatial Land Tool Network
    c. Geographic Land Tool Network
    d. Global Land Tenure Network

Section B: Short Questions (2*4=8)

1. What do you mean by Land Administration? Discuss about the importance of Land Administration.
2. जग्गा प्रशासन भनेको के हो ? जग्गा प्रशासनको महत्व बारे चर्चा गर्नुहोस ।
3. What do you mean by Land Registration? Write the principles of Land Registration.

    जग्गा दर्ता भन्नाले के बुझिन्छ ? जग्गा दर्ताका सिद्धान्तहरु लेख्नुहोस।
4. What do you mean by Land Tenure? Mention various types of land tenure systems that exist in Nepal.

    भूसम्बन्ध भन्नाले के बुझिन्छ? नेपालमा रहेका विभिन्न प्रकारका भूसम्बन्ध बारे उल्लेख गर्नुहोस्?

Section C: Long Questions (1*8=8)

1. Define Land Acquisition and Land Valuation. Mention various problems that exist in Land Valuation in the context of Nepal and write the measures of solution.

    जग्गा प्राप्ति तथा जग्गा मुल्यांकनको परिभाषा दिनुहोस? नेपालमा जग्गा मूल्यांकन मा देखिएका विभिन्न समस्याहरु उल्लेख गरी समाधानका उपायहरु लेख्नुहोस?
2. What do you mean by Land Registration? Write the principles of Land Registration.

    जग्गा दर्ता भन्नाले के बुझिन्छ ? जग्गा दर्ताका सिद्धान्तहरु लेख्नुहोस।

3. Define Guthi Land. Describe the process of administration of Guthi Land in Nepal.
   गुठि जग्गाको परिभाषा दिनुहोस । नेपालमा गुठी जग्गाको प्रशासनको प्रक्रिया बारे वर्णन गर्नुहोस ।
4. What do you mean by Land Tenure? Mention various types of land tenure systems that exist in Nepal.
   भूसम्बन्ध भन्नाले के बुझिन्छ? नेपालमा रहेका विभिन्न प्रकारका भूसम्बन्ध बारे उल्लेख गर्नुहोस्?

Module XIV: Engineering Survey

JSTF 214

Introduction

This course is developed as a module for partial fulfillment of the Junior Survey Training Fresh course. This comprehensive module is tailored to equip junior-level participants with both theoretical insights and Handson expertise in the field of engineering survey. In this course, participants will explore various aspects of different engineering tasks, layout strategies, and construction survey procedures.

Objectives

Upon the successful completion of this module, the participants will be able to:

- Understand the basic concepts, principles and process of engineering works.
- Acquire knowledge on construction survey and layout of different types of engineering works.
- Familiar with the applications of engineering survey.

Training Details

Approach of Instruction:	Lecture, Indoor Practical Classes, Outdoor Practical Classes
Duration of the Course:	3 Weeks
Sessions per day:	4 Sessions (Sunday to Thursday)
	3 Sessions (Friday), 1 hour and 30 minutes each session
Total Number of Sessions:	69 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Internal Assessment
- Module End Written Exam
- Practical Exam
- Project Work

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course

Course Content

Part A: Engineering Survey [69 Sessions]

Theory [43 Sessions]

1. Introduction to Engineering survey [1]

1.1 Introduction: Definition, Importance, Purpose, Applications

2. Relief Representation [2]

2.1 Contour

2.1.1 Definition and terms: Contour interval, Horizontal equivalent, Contour gradient
2.1.2 Characteristics of Contours
2.1.3 Use of contour maps

2.2 Brief introduction of spot height, Hill shading, Layer tinting, Hachures, Rock drawing

3. Area and Volume Calculation [4]

3.1 Area of irregular figure: Average ordinate rule, Mid ordinate rule, Trapezoidal rule, Simpson rule, Area by coordinate,
3.2 Area determination by graphical method: By square grids, By planimeter,
3.3 Determination of earthwork volumes: By contour maps, By section (one level section)
3.4 Mass haul
3.5 Numerical problems

4. Route Surveying [9]

4.1 Introduction

4.1.1 Definition, Purpose
4.1.2 Field Procedure: Planning, Reconnaissance, Preliminary survey, Location survey, Construction survey
4.1.3 Concept of L-section and X-section

4.2 Road survey: Introduction, Different terms used and Field procedure
4.3 Bridge survey: Introduction, Different terms used and Field procedure
4.4 Irrigation and water supply survey: Introduction, Different terms used and Field procedure
4.5 Transmission line survey: Definition, Types, Importance, Different terms used, Field procedure

5. Curves [9]

5.1 Introduction: Definitions, Types of curves
5.2 Circular curve

5.2.1 Radius and degree of Curve, Elements of simple circular curves
5.2.2 Methods of setting out: Tape method, Method of offset from the chord produce, Tape and theodolite method, Two theodolite method, Total station instrument method,
5.2.3 Problems in setting out curve

5.3 Transition Curve: Brief introduction, Advantages, Basic criteria for design of transition curve, Superelevation
5.4 Vertical Curve: Brief introduction, Gradient and Slope, Sight distance

6. Hydropower Survey [4]

6.1 Introduction: Definitions, Components, Different terms used in hydropower survey
6.2 Field procedure: Planning, Reconnaissance, Monumentation, Detailing
6.3 Canal survey: Alignment, Gradient determination, LSection and XSection data capturing

7. Hydrographic Survey [3]

7.1 Introduction
7.2 Different terms used in hydrographic survey
7.3 Provision of control [Horizontal and Vertical]
7.4 Theory of tides, Tide gauges
7.5 Bathymetric techniques
7.6 Methods of discharge measure: Bucket method, Area Velocity method, Weir method, Salt dilution method

8. Mining and Tunnel Survey [2]

8.1 Introduction: Definitions, Different terms used in mining
8.2 Surface and underground Surveying
8.3 Basics of tunnel surveying
8.4 Instruments used for mining

9. Concept of geological, geomorphological and mineral maps and symbolsBuilding Design and Survey [2]

9.1 Basic terms and components of a building and construction
9.2 Large scale mapping for building design

10. 9.3 Selection and Demarcation of Building SiteSetting out Survey [2]

10.1 Introduction
10.2 Techniques of setting out
10.3 Concept of as built drawings

11. Survey Management [5]

11.1 Understanding terms of reference (TOR), Technical standards, Specification, costing
11.2 Basic concepts and introduction of safety management
11.3 Care and precautions to be taken during field surveys
11.4 Professional ethics and code of conduct of surveyor

Part B: Practical [16]

12. Hydropower Visit [4]

13. Use of AutoCAD [6]:

13.1 Plot coordinates, Contour plotting, Alignment, Profile and crosssection, Create map layout

14. Basic Structure Design using AutoCAD [6]

Further breakdown of the allocated time and method of evaluation is given in the following table:

Activities		**Time Allocated (Sessions)**	**Description**	**Marks allocated for evaluation**
Theory	Class room lectures	43	Direct supervision by the instructor in the class	
Practical Exercises/ Project Work	Supervised	16	Supervised by instructors in class	
Exam	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
Revision, Case Study, and Presentation		8	Lab exam	20
Assignments, Attendance and Discipline				20
Total		**69**		**100**

******Note : Subjective exam will be of 2:30 Hrs. and Objective exam will be of 30 Mins.******

Further breakdown of question weightage is given in the following table:

Chapter	Objective Question		Subjective Question			
			Short Questions		Long Questions	
	Number of Questions	Marks (20)	Number of Questions	Marks (24)	Number of Questions	Marks (16)
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	2	2*1	-	-	-	-
2	2	2*1	1	1*4	-	-
3	2	2*1	-	-	1	1*8
4	3	3*1	-	-	1	1*8
5	3	3*1	-	-	1	1*8
6	2	2*1	1	1*4	-	-
7	1	1*1	1	1*4	-	-
8	1	1*1	1	1*4	-	-
9	1	1*1	1	1*4	-	-
10	1	1*1	1	1*4	-	-
11	2	2*1	2	2*4	-	-
12	Computer Practical Exam Case Study					
13						
14						
Total	20	20	8	24	3	16

Detail Curriculum

S.N.	Topics	SubTopics	Learning Outcomes	Learning Activities	Session Hour
1.	**Introduction to Engineering Survey**	– Introduction: Definition, Purpose, Importance, Applications	– Understand the fundamental definitions and purposes of engineering surveys. – Recognize the critical role these surveys play in the planning, design, and construction of engineering projects.	Interactive Lectures Presentations	1
2	**Relief Representation**	– Contour – Definition and terms: Contour interval, Horizontal equivalent, contour gradient – Characteristics of contours – Use of contour maps – Brief introduction of Spot Height, Hill shading, Layer Tinting, Hachures, Rock Drawing	– Learn about the various methods of relief representation. – Understand the contour interval, horizontal equivalent and contour gradient. – Understand the principles and characteristics of contouring. – Learn the various methods of locating contour. – Identify the uses of contour	Interactive Lectures Presentations Exercise	2
3.	**Area and Volume Calculation**	– Area of irregular figure: Average ordinate rule, Mid ordinate rule, Trapezoidal rule, Simpson rule,	– Understand and apply the averageordinate rule, midordinate rule, trapezoidal	Interactive Lectures	4

		Area by coordinate, – Area determination by graphical method: By square grids, By planimeter – Determination of earthwork volumes: By contour maps, By section (one level section) – Mass haul diagram – Numerical problems	rule, and simpson's rule for calculating the area of irregular shapes. – Learn how to determine areas using square grids and planimeters. – Understand different methods of determining earthwork volumes	Exercise	
4.	**Route Survey**	– Introduction – Definition, Purpose – Field procedure: Planning, Reconnaissance, Preliminary survey, Location survey, Construction survey – Concept of Lsection and Xsection – Road Survey: Introduction, Different terms used and Field procedure – Bridge Survey: Introduction, Different terms used and Field procedure – Irrigation and Water Supply Survey: Introduction, Different terms used and Field procedure – Transmission Line Survey: Definition, Types, Importance, Different terms used, Field procedure	– Understand the fundamental principles and objectives of route surveying in engineering projects, including roads, transmission, etc. – Learn systematic approaches to planning route surveys, starting with reconnaissance to gather initial data and proceeding through preliminary and location surveys. – Learn the Lsection and Xsection analysis in route survey. – Understand the concept of road, bridge and irrigation survey in engineering projects. – Learn the fundamental concept of canal and transmission line survey.	Interactive Lectures Presentations Exercise	9
5.	**Curves**	– Introduction: Definitions, Types of curves – Circular Curve – Radius and degree of curve, Elements of simple circular curves – Methods of setting out: Tape method, Method of offset from the chord produce, Tape and theodolite method, Two theodolite method, Total station instrument method, – Problems in setting out curve – Transition Curve: Brief introduction, Advantages, Basic criteria for design of transition curve, Superelevation – Vertical Curve: Brief introduction, Gradient and slope, Sight distance	– Understand the fundamental concept and types of curves. – Learn about the elements of a simple circular curve, including tangent points, curve points, and intersection points. – Learn various methods used to set out circular curves in the field. – Gain a basic understanding of transition and vertical curve.	Interactive Lectures Presentations Exercise	9
6.	**Hydropower Survey**	– Introduction: Definitions, Components, Different terms used in hydropower survey – Field procedure: Planning Reconnaissance, Monumentation,	– Understand the concept of hydropower survey in engineering projects. – Learn systematic approaches to planning hydropower	Interactive Lectures Exercise	4

		Detailing – Canal survey: Gradient determination, LSection and XSection data capturing	survey, starting with reconnaissance to gather initial data and proceeding through detailing and plotting the collected data.		
7.	**Hydrographic Survey**	– Introduction – Different term used in Hydrographic survey – Provision of control [Horizontal and Vertical] – Theory of tides, Tide gauges – Bathymetric techniques – Method of Sounding [Horizontal and Vertical position] – Methods of discharge measure: Bucket method, Area velocity method, Weir method, Salt dilution method	– Understand the concept of hydrographic survey in engineering projects. – Understand the different terms used in hydrographic survey. – Learn the bathymetric techniques. – Understand various methods used to measure discharge	Interactive Lectures Presentations Exercise	3
8.	**Mining and Geological Survey**	– Introduction: Definitions, Different terms used in mining – Surface and underground surveying – Basics of tunnel surveying – Instruments used for mining – Concept of geological, mineral maps and symbols	– Understand the fundamental concept of mining and geological survey. – Learn the different terms used in mining and geological survey. – Learn about instruments used in mining.	Interactive Lectures Exercise	2
9.	**Building Construction**	– Basic terms and components of a building and construction – Large scale mapping for building design	– Learn various components and terms used in building construction. – Understand large scale mapping for building design.	Interactive Lectures Demonstration Exercise	2
10.	**Setting out survey**	– Introduction – Techniques of setting out – Concept of as built drawings	– Understand the fundamental concept of setting out survey. – Learning the equipment and techniques used for setting out.	Interactive Lectures Exercise	2
11.	**Survey Management**	– Understanding terms of reference (TOR), Technical standards, specification – Basic concepts and introduction of safety management – Care and precautions to be taken during field surveys – Professional ethics and code of conduct of surveyor	– Understand the fundamental principles and importance of survey management. – Understand the professional ethics and code of conduct expected of surveyors. – Equipped with the skills and knowledge necessary to manage surveying projects effectively, ensuring they are completed safely and accurately	Interactive Lectures Exercise Presentations	5

References

Surveying Volume1 and 2, Dr. K.R. Arora, Rajsons Publications Pvt. Ltd.

Surveying Vol. II, Dr. B.C Punmia, A.K Jain, Laxmi Publication Pvt. Ltd. New Delhi

Surveying Vol. I, S. K Duggal, Tata McGraw Hill Publishing Company Ltd. New Delhi3. Fundamental of Surveying, S.K Roy, Prentice Hall of India, New Delhi

Surveying, A. Bannister and S. Raymond, ELBS

Surveying for Engineers, J. Urenand W.F. Price, ELBS

Surveying for Construction, William Irvine, McGrawHill

Engineering Surveying Manual, American Society of Civil Engineering, Scientific Publishers

Model Questions

Section A: Objective Questions (5*1=5)

1. In the Trapezoidal formula of area calculation, the number of divisions should be

   क्षेत्र गणना को Trapezoidal सूत्र मा, विभाजन को संख्या कत्ति हुनुपर्छ?

   a. Even or odd
   b. Even
   c. Odd
   d. >5

2. In which condition the contour overlap?

   Contour Line हरु कुन अवस्थामा overlap हुन्छन?

   a. Vertical cliff
   b. Flat terrain
   c. Ridge line
   d. Hill

3. What is the name of theodolite used to find True North in Mine Surveying?

   Mine Surveying मा True North पत्ता लगाउन प्रयोग गरिने Theodolite लाई के भनिन्छ?

   a. Wild T2 Theodolite
   b. Wild T3 Theodolite
   c. Gyrotheodolite
   d. Total Station

4. If the radius of a simple circular is 500m and length of its specified chord is 30m. The degree of the curve is

   यदि simple circular को radius ५०० मि. छ र यसको special chord को लम्बाइ ३० मि. छ। Curve को डिग्री..... हुन्छ।

   a. 3.44^0
   b. 4.37^0
   c. 3.57^0
   d. 3.75^0

5. The term DPC used during building construction stands for:

   भवन निर्माण गर्दा प्रयोग हुने DPC शब्दको अर्थ हो?

   a. Damp Proofing Course
   b. Damp Proofing Concrete
   c. Dust Proofing Concrete
   d. Dust Proofing Course

Section B: Short Questions (2*4=8)

1. What do you mean by relief representation? Briefly explain the different methods of relief representation. (1+3)

   Relief representation भनेको के हो? Relief representation का विभिन्न विधिहरू संक्षिप्त रूपमा व्याख्या गर्नुहोस्।

2. Write down the difference between Surface Surveying and Underground survey. (4)

   Surface Surveying र Underground survey को विचमा केके भिन्नताहरु छन्?

3. Describe the various discharge measurement methods. (4)

   विभिन्न discharge मापन विधिहरू वर्णन गर्नुहोस्।

Section C: Long Questions (1*8=8)

1. A series of offsets was taken from a base line to a curved boundary line at intervals of 10m in the following order:

   0, 2.68, 3.64, 3.70,4.60, 3.62, 4.84, 5.74

   Compute the area between the base line, the curved boundary line and the end offsets using the averageordinate rule, Mid ordinate rule, Simpson's rule and Trapezoidal rule. (1.5+1.5+2.5+2.5)

   निम्न क्रममा १० मिटरको अन्तरालमा आधार रेखाबाट curved सीमा रेखामा offset हरुको श्रृंखला लिइयो:

   ०, २.६८, ३.६४, ३.७०, ४.६०, ३.६२, ४.८४, ५.७४

   Average ordinate rule, Mid ordinate rule, Simpson's rule and Trapezoidal rule प्रयोग गरी आधार रेखा, घुमाउरो सीमा रेखा र अन्तिम offset हरू बीचको क्षेत्रफल गणना गर्नुहोस्।)

2. What do you mean by Route Surveying? Briefly explain the field procedure of route surveying. What do you mean by Transmission Line Survey? What should be considered while fixing the alignment of the transmission line? (1+3+1+3)

   Route Surveying भनेको के हो? Route surveying को field procedureहरूको बारेमा विस्तृत रूपमा लेख्नुहोस्। Transmission Line Survey भन्नाले के बुझिन्छ? Transmission Line को alignment fix गर्दा केके कुरामा ध्यान दिनु पर्दछ?

Module XV: Project Work

JSTF 215

Introduction

This module is a part of the Junior Survey Training (Fresh), aiming to provide an exciting opportunity for trainees to unleash their creativity, curiosity, and problem solving skills. Instead of following a predetermined curriculum, trainees will have the autonomy to select a project that aligns with their interests, expertise and career perspective.

Objectives

Upon the successful completion of this Module, the participants will be able to:

- Understand the planning process and preparation of a survey project
- Carryout survey project independently
- Prepare and present the findings and output in the form of a technical report

Training Details

Approach of Instruction:	Lecture, Indoor Practical Classes, Outdoor Practical Classes
Duration of the Course:	25 days
Sessions per day:	5 Sessions (Sunday toFriday)
	(1 hour and 30 minutes each session)
Total Number of Sessions:	125 Sessions

Evaluation Criteria:

Evaluation of this Module is conducted based on:

- Project Proposal
- Project Execution
- Project Presentation
- Project Report

Attendance Requirement:

Continued 7 days of absence (except some unavoidable condition) will disqualify the candidate for the completion of the course.

Course Contents

Project Work [21 days]

1. **Preparation [2 days]**
2. **Proposal writing [2 days]**
3. **Proposal defence [1 day]**
4. **Data collection [5 days]**
5. **Data processing and analysis [5 days]**
6. **Mapping/ output [3 days]**
7. **Report writing [2 days]**
8. **Report presentation: [1 day]**

The no. of days allocated to the particular activities may differ according as the subject and content of the project. The final project most likely will be individual, but can also be a group (in rare cases). It will be assigned to the students from among the following possible topics:

1. **Engineering survey projects**
2. **Data base preparation/development**
3. **Cadastral Survey Projects**
4. **Land administration/Land use/ Land pooling/zoning projects**
5. **GIS analysis and its application fields, LIS**
6. **Remote Sensing image analysis and its application**
7. **Photogrammetric data acquisition, DEM generation/ Orthophoto/Image map preparation and verifying in field and Accuracy assessment**
8. **Digital cartography, data visualization and presentation, Google Earth**
9. **Thematic mapping**
10. **Disaster Mapping and Management**
11. **Web Mapping**
12. **Socioeconomic surveys and mapping.**
13. **Other Relevant Topics**

Breakdown of Evaluation is given in the following table:

Activities	Evaluated By	Marks allocated	Criteria for Evaluation	
Project Presentation	Project Evaluation Committee	30	Individual Viva	10
			Presentation Skills	10
			Slides Contents and Arrangement	10
Project Report	Coordinator and Committee	30	Coordinator	15
			Committee	15
Overall Project Execution	Project Supervisor	40	Project Proposal	5
			Coordination with Supervisor	15
			Involvement in Teamwork	15
			Discipline and Sincerity	5