



GOVERNMENT OF NEPAL  
MINISTRY OF LAND MANAGEMENT, COOPERATIVES AND POVERTY ALLEVIATION  
**LAND MANAGEMENT TRAINING CENTER**  
Dhulikhel, Kavre



Junior Survey Training (Local Level/Province) Courses  
*Revised on 2082 BS (2025 AD)*

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## Course Overview

<b>One Year Junior Survey Training Course (Starts in Shrawan and completes in Asar/Shrawan)</b>								
Block	Block name	Module: Code	Duration (Days)	Training level and Course Name	Evaluation			
				Junior Local Level/Province	Theory		Internal Evaluation	
		Subjective	Objective					
1	Fundamental Concepts	I: JSTL 401	23 (17+6)	Understanding Society and Culture	60	20	20	
		II: JSTL 402		Mathematics and Statistics	60	20	20	
		III: JSTL 403		Surveying techniques	60	20	20	
		IV: JSTL 404		Computer Application	Practical Exam	Presentation	Class Performance	
					60	20	20	
<b>Instrument Handling Practice</b>								
2	Field Skill	V: JSTL 405		Field Survey I (Geodetic Survey Methods)	Data collection, processing (Instructor, Coordinator)	Maps, Records, Report (Camp In-charge)	Viva (LMTC)	
					60	20	20	
		VI: JSTL 406		Field Survey II (Cadastral Survey and Thematic Mapping)	60	20	20	
		VII: JSTL 407		Field Survey III (Engineering Survey)	60	20	20	
<b>Field Observation tour and Excursion</b>								
3	Tools and Techniques	VIII: JSTL 408		Geographic Information System	Subjective	Objective	Internal Evaluation	
					40	20	40	
		IX: JSTL 409		Photogrammetry and Remote Sensing Techniques	40	20	40	
		X: JSTL 410		Cartography	40	20	40	
<b>Sports Week</b>								
4	Application	XII: JSTL 412		Cadastre	60	20	40	
		XIII: JSTL 413		Land Administration	60	20	40	
		XIV: JSTL 414		Engineering Survey	60	20	40	
		XV: JSTL 415		Project work	Project Presentation	Project Report	Overall Project Execution	
					30	30	40	
<b>Closing and Farewell</b>								

## **Module I: Understanding Society and Culture**

### **JSTL 401**

#### **Introduction**

This course is developed as a Module for partial fulfillment of the Junior Survey Training Local Level/Province Course. This module has been designed to enhance administrative knowledge, skills and attitudes in students providing them with general awareness on society, culture, public administration, and management ensuring the trainees are able to fit in the society and real office environment

#### **Objectives**

Upon the successful 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 of contemporary issues
- Acquire Knowledge of Constitution and legal provisions regarding fundamentals rights and responsibilities.
- 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:	17 days
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
- Internal Assessment, Attendance, Discipline

#### **Attendance Requirement:**

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

## **Course Contents**

### **Part A: Understanding Society and Culture [45 Sessions]**

#### **Theory [45]**

##### **1. Introduction [4]**

- 1.1 Concept of Family, Society and State
- 1.2 Geography of Nepal
- 1.3 History and Culture of Nepal

##### **2. Managing Self [4]**

- 2.1 Spiritualism
- 2.2 Stress Management
- 2.3 Time Management

##### **3. Behavior and Culture [4]**

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

##### **4. Administration and Management [8]**

- 4.1 Concept, Principles and Functions
- 4.2 Role Of Public Administration in Development
- 4.3 Governmental Planning
- 4.4 Governmental Budgeting
- 4.5 Sustainable Development Goals

##### **5. Office Management [5]**

- 5.1 Fundamentals of Office Management
- 5.2 Office Correspondence
- 5.3 Registration, Dispatch and Filing
- 5.4 Preparing Meeting 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 Recent Trends

##### **7. Communication Skills [4]**

- 7.1 Negotiation skills
- 7.2 Interpersonal communication
- 7.3 Public Speaking
- 7.4 Self-Discipline

##### **8. Constitution, Policies, and Laws [12]**

- 8.1 Constitution of Nepal
  - 8.1.1 Key Characteristics
  - 8.1.2 Fundamental Rights and Duties
  - 8.1.3 Policies, Directive Principles and Obligations
  - 8.1.4 Land-related Provisions
- 8.2 Provincial Level Laws/Acts

- 8.2.1 Provincial Government Operation Act
- 8.2.2 Provincial Civil Service Acts
- 8.2.3 Provincial Financial Procedures Acts
- 8.3 Local Level Laws/Acts
  - 8.3.1 Local Government Operation Act, 2017
  - 8.3.2 Intergovernmental Fiscal Arrangement Act, 2017
- 8.4 Civil Service Act and Regulations
- 8.5 Right to Information Act
- 8.6 Land Policies

**Part B: Practical [8 Sessions]**

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

- 9.1 Office/field Visit
- 9.2 Issues identification
- 9.3 Connecting with Service Provider and Receiver
- 9.4 Best Practices
- 9.5 Presentation

*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	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 presentation in class	10
Class Performance, Home assignment, Attendance, 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 (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			
<b>Total</b>	<b>20</b>	<b>20</b>	<b>10</b>	<b>36</b>	<b>4</b>	<b>24</b>

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

### Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Introduction</b>	<ul style="list-style-type: none"> <li>- Concept of Family, Society and State</li> <li>- Acquire basic knowledge on Geography and culture of Nepal</li> </ul>	<ul style="list-style-type: none"> <li>- Assess basic concepts of Family, society, and state.</li> <li>- Assess basic knowledge on Geography and culture of Nepal</li> </ul>	Pre-test Interactions	4
2.	<b>Managing Self</b>	<ul style="list-style-type: none"> <li>- Spiritualism</li> <li>- Understanding self</li> <li>- Stress Management</li> </ul>	<ul style="list-style-type: none"> <li>- Develop awareness about self.</li> <li>- Internalize spirituality</li> <li>- Make trainees familiar with yoga, meditation and stress management.</li> </ul>	Brainstorming Interactive Presentation Exercise	4
3	<b>Behavior and Culture</b>	<ul style="list-style-type: none"> <li>- Concept of Integrity, Ethics, Morality and Code of Conduct</li> <li>- Social norms and Values</li> <li>- Human Behavior</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the concept of</li> <li>- Integrity, ethics, morality and Code of Conduct.</li> <li>- Learn professional and societal norms, values and human behavior</li> </ul>	Ethical Dilemma Discussions, Reflective Exercises Case Studies	4

4	<b>Administration and Management</b>	<ul style="list-style-type: none"> <li>- Concept, Principles, Functions,</li> <li>- Role of Administration in Development</li> <li>- Difference Between Administration and Management</li> <li>- Governmental Planning</li> <li>- Governmental Budgeting</li> <li>- Sustainable Development Goals</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamental concepts, principles, functions, and roles of administration and management.</li> <li>- Recognize the significance of administration in fostering development and societal progress.</li> <li>- Acquire basic knowledge on Governmental Planning, Governmental Budgeting, Sustainable Development Goals</li> </ul>	Case Studies Group Works	8
5	<b>Office Management</b>	<ul style="list-style-type: none"> <li>- Fundamentals of Office Management</li> <li>- Office Correspondence</li> <li>- Registration, Dispatch and Filing</li> <li>- Writing Minutes, Circulars, and Memos, Tippani</li> </ul>	<ul style="list-style-type: none"> <li>- Communicate effectively in office settings, including composing professional correspondence.</li> <li>- Apply essential office management procedures to support smooth operations and success.</li> </ul>	Interactions Presentations	5
6	<b>Public Service Delivery</b>	<ul style="list-style-type: none"> <li>- Concept and Importance of Public Service Delivery</li> <li>- Citizen Charter</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the principle, origin and theory behind public service.</li> <li>- Knowledge of rules and regulations of organizations.</li> <li>- Recognize different medium of public service delivery.</li> </ul>	Interactive Lectures Presentations	4
7	<b>Communication Skills</b>	<ul style="list-style-type: none"> <li>- Negotiation skills, Interpersonal</li> <li>- Communication</li> <li>- Public Speaking</li> <li>- Self-Discipline</li> </ul>	<ul style="list-style-type: none"> <li>- Develop effective negotiation skills and enhance interpersonal communication abilities.</li> <li>- Improve public speaking proficiency.</li> <li>- Enhance Self-Discipline</li> </ul>	Team-building Simulations Role-playing Simulations Report writing Presentation	4
8.	<b>Major Provision of Constitution and Major Acts</b>	<ul style="list-style-type: none"> <li>- 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</li> <li>- Civil Service Act and Regulations</li> <li>- Right to Information</li> </ul>	<ul style="list-style-type: none"> <li>- Understand major provisions including land related provisions of the Constitution of Nepal.</li> <li>- Understand Major provision of Civil service and right to information act and land policies of the GoN.</li> </ul>	Presentations Interactions	12

		<p>Act</p> <ul style="list-style-type: none"> <li>- Land policies</li> <li>- Local Level Laws/Acts</li> <li>- Provincial Level Laws/Acts</li> </ul>		
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## References

नेपालको संविधान

निजामती सेवा ऐन, २०४९

सूचनाको हक सम्बन्धी ऐन, २०६४

भ्रस्टाचार निवारण ऐन, २०५९

स्थानीय सरकार सञ्चालन ऐन, २०७४

अन्तः सरकारी वित्तीय व्यवस्था ऐन, २०७४

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

## Model Questions

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

1. What is the basic unit of society? (समाजको आधारभूत एकाई के हो?)

- a. परिवार (Family)
- b. राष्ट्र (Nation)
- c. संघ (Union)
- d. संस्थान (Institution)

2. What is stress management? (तनाव व्यवस्थापन भनेको के हो?)

- a. Ignoring stress (तनावलाई वेवास्ता गर्नु)
- b. Creating stress (तनाव सिर्जना गर्नु)
- c. Learning to handle stress effectively (तनावलाई प्रभावकारी रूपमा व्यवस्थापन गर्न सिक्नु)
- d. Sharing stress with others (अरूसँग तनाव साझा गर्नु)

3. Which of the following best defines professionalism? (तलका मध्ये व्यावसायिकताको राम्रो परिभाषा कुन हो?)
  - a. आफ्नो काममा राम्रो देखिनु (Looking good at work)
  - b. आफ्नो काममा ज्ञान र कौशलको प्रदर्शन गर्नु (Demonstrating knowledge and skills in one's work)
  - c. काममा ढिला हुनु (Being late to work)
  - d. आफ्ना सहकर्मीहरूसँग विवाद गर्नु (Arguing with colleagues)
4. What does ethical behavior in the workplace include? (कार्यस्थलमा नैतिक व्यवहारमा तलका मध्ये कुन कुरा पर्दछ?)
  - a. गोप्य जानकारी बाँड्नु (Sharing confidential information)
  - b. पारदर्शिता र इमानदारी (Transparency and honesty)
  - c. काममा ढिला हुनु (Being late to work)
  - d. सहकर्मीहरूसँग विवाद गर्नु (Arguing with colleagues)
5. What is the primary focus of public administration? (सार्वजनिक प्रशासनको मुख्य उद्देश्य के हो?)
  - a. सरकारी नीतिहरूको कार्यान्वयन (Implementation of Government Policies)
  - b. निजी क्षेत्रको विकास (Development of Private Sector)
  - c. अन्तर्राष्ट्रिय व्यापार (International Trade)
  - d. सैन्य रणनीति (Military Strategy)

#### **Section B: Short Questions (4\*4=16)**

1. Describe the characteristics of a good citizen. (एक असल नागरिकका विशेषताहरूको वर्णन गर्नुहोस्।)
2. Describe the key methods of effective communication in the workplace. (कार्यस्थलमा प्रभावकारी सञ्चारका मुख्य उपायहरूको वर्णन गर्नुहोस्।)
3. Explain the importance of management in office work. (कार्यालयको काममा व्यवस्थापनको महत्वको व्याख्या गर्नुहोस्।)

#### **Section C: Long Questions (2\*8=16)**

1. Describe the role of public administration in the development of a country. (देशको विकासमा सार्वजनिक प्रशासनको भूमिकाको वर्णन गर्नुहोस्।)
2. Discuss the key components of effective communication skills and their importance in public administration. (सार्वजनिक प्रशासनमा प्रभावकारी सञ्चार सीपका मुख्य घटक र तिनको महत्वको बारेमा छलफल गर्नुहोस्।)

## **Module II: Mathematics and Statistics**

### **JSTL 402**

#### **Introduction**

This course is developed as a module for partial fulfilment of Junior Survey Training Local Level/Province 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:	17 days
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
- Internal Assessment, Attendance, Discipline

#### **Attendance Requirement:**

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

#### **Course Contents**

##### **Theory [50]**

###### **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. Algebra [6]**

- 2.1 Basics of Algebra
- 2.2 Degree, coefficient and terms of Polynomial
- 2.3 Linear Equations and solving linear equation
- 2.4 Standard form and methods of solving Quadratic Equations
- 2.5 Exponents and Laws of Indices

**3. Geometry [6]**

- 3.1 Triangle, Quadrilateral and Circle
- 3.2 Properties and Solution of Triangles
- 3.3 Properties of Circle, Tangent Secant
- 3.4 Basics of Ellipse and Ellipsoid Geometry

**4. Trigonometry [6]**

- 4.1 Basic of Trigonometry
- 4.2 Pythagoras Theorem
- 4.3 Trigonometrical Ratios and Functions
- 4.4 Application of Trigonometry
- 4.5 Height and Distance

**5. Coordinate Geometry [6]**

- 5.1 Dimensional Study
- 5.2 Rectangular, Polar and Spherical Coordinates
- 5.3 Computation of horizontal distance, vertical distance, Midpoint and slope using coordinates
- 5.4 Equation of straight lines and its form
- 5.5 Graphs of Straight Lines
- 5.6 Concept of Three-Dimensional Geometry

**6. Matrix and Determinant [8]**

- 6.1 Matrix and Types of Matrix
- 6.2 Operation on Matrix
- 6.3 Determinant of Matrix
- 6.4 Adjoint and Inverse of Matrix
- 6.5 Solving System of linear equations by Matrix method

**7. Statistics [5]**

- 7.1 Introduction and Application
- 7.2 Measure of Central tendency: Mean, Median, Mode
- 7.3 Measure of Dispersion: Variance and Standard Deviation

**8. Probability [5]**

- 8.1 Introduction
- 8.2 Sampling
- 8.3 Probability Distribution of Random Variables
- 8.4 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	Classroom 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
<b>Case Study with Presentation</b>		3	To be presented in class	10
<b>Class Performance and Home Assignment</b>				10
<b>Total</b>		<b>55</b>		<b>100</b>

*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	4	4*1	2	2*4	1	1*8
2	2	2*1	2	2*4	-	-
3	2	2*1	2	2*4	-	-
4	3	3*1	2	2*4	-	-
5	2	2*1	-	-	1	1*8
6	2	2*1	-	-	1	1*8
7	2	2*1	-	-	1	1*8
8	3	3*1	2	2*4	-	-
<b>Total</b>	<b>20</b>	<b>20</b>	<b>10</b>	<b>36</b>	<b>4</b>	<b>24</b>

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

## Detailed Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Arithmetic</b>	<ul style="list-style-type: none"> <li>– Set Theory and its Application in Surveying</li> <li>– Numbers, Significant Digits and Significant Figures</li> <li>– Mensuration</li> <li>– Area and Perimeter of 2D Geometrical figures (Triangle, Quadrilateral, Trapezium, Parallelogram, Rectangle, Square, Rhombus)</li> <li>– Area and Volume of different Geometrical figures (Prism, Cylinder, Pyramid, Cone)</li> <li>– Ratio and Proportion</li> <li>– Fraction and Percentage</li> <li>– Unitary Method</li> </ul>	<ul style="list-style-type: none"> <li>– Understand set theory and its application in Surveying</li> <li>– Understands the importance of numbers, significant figures and digits</li> <li>– Assess basic concepts of Mensuration, calculate area, perimeter and volume of different geometrical figure</li> <li>– Perform basic numerical aptitude related to ratio, proportion, percentage, unitary method</li> </ul>	Interactive Lectures Presentations Exercise	8
2	<b>Algebra</b>	<ul style="list-style-type: none"> <li>– Basics of Algebra</li> <li>– Degree, coefficient and terms of Polynomial</li> <li>– Linear Equations and solving linear equation</li> <li>– Standard form and methods of solving Quadratic Equations</li> <li>– Exponents and Laws of Indices</li> </ul>	<ul style="list-style-type: none"> <li>– Understand and apply fundamental algebraic concepts</li> <li>– Identify the degree, coefficients, and individual terms of a polynomial</li> <li>– Understand and apply methods for solving systems of linear equations</li> <li>– Recognize and solve quadratic equations using various methods</li> <li>– Understand exponents and laws of indices and apply it to solve equations</li> </ul>	Interactive Lectures Presentations Exercise	6
3	<b>Geometry</b>	<ul style="list-style-type: none"> <li>– Triangle, Quadrilateral and Circle</li> <li>– Properties and Solution of Triangles</li> <li>– Properties of Circle, Tangent Secant</li> <li>– Basics of Ellipse and Ellipsoid Geometry</li> </ul>	<ul style="list-style-type: none"> <li>– Understand and apply the fundamental properties of triangles, quadrilaterals, and circles.</li> <li>– Solve triangles using sine and cosine laws</li> <li>– Understand properties of circles, tangents, and secants</li> <li>– Introduce and explore the basic properties and equations of ellipses and ellipsoids.</li> </ul>	Interactive Lectures Presentations Exercise	6
4	<b>Trigonometry</b>	<ul style="list-style-type: none"> <li>– Basic of Trigonometry</li> <li>– Pythagoras Theorem</li> <li>– Trigonometrical Ratios and Functions</li> <li>– Application of Trigonometry</li> <li>– Height and Distance</li> </ul>	<ul style="list-style-type: none"> <li>– Understand angular measurements methods, conversion and basic of trigonometry</li> <li>– Solve problems using Pythagorean Theorem</li> <li>– Understand and use ratios to solve problems</li> <li>– Use trigonometry in various fields</li> </ul>	Interactive Lectures Presentations Exercise	6

			<ul style="list-style-type: none"> <li>such as physics, engineering, and geography</li> <li>Solving problems involving the height of buildings, trees, and other objects using trigonometric ratios.</li> </ul>		
5	<b>Coordinate Geometry</b>	<ul style="list-style-type: none"> <li>Dimensional Study</li> <li>Rectangular, Polar and Spherical Coordinates</li> <li>Computation of horizontal distance, vertical distance, Midpoint and slope using coordinates</li> <li>Equation of straight lines and its form</li> <li>Graphs of Straight Lines</li> <li>Concept of Three-Dimensional Geometry</li> </ul>	<ul style="list-style-type: none"> <li>Understand concepts of dimensions</li> <li>Learn and apply different coordinate systems to represent points in space</li> <li>Compute distances, midpoints, and slopes between points using coordinate</li> <li>Understand the different forms of the equation of a straight line</li> <li>Graphically represent straight lines</li> <li>Understand the concepts of three-dimensional geometry.</li> </ul>	Interactive Lectures Presentations Exercise	6
6	<b>Matrix and Determinant</b>	<ul style="list-style-type: none"> <li>Matrix and Types of Matrixes</li> <li>Operation on Matrix</li> <li>Determinant of Matrix</li> <li>Adjoint and Inverse of Matrix</li> <li>Solving System of linear equations by Matrix method</li> </ul>	<ul style="list-style-type: none"> <li>Understand matrix and types of matrices.</li> <li>Perform basic operations on matrices.</li> <li>Compute the determinant of a matrix.</li> <li>Calculate the adjoint and inverse of a matrix.</li> <li>Apply matrix method to solve system of linear equations</li> </ul>	Interactive Lectures Presentations Exercise	8
7	<b>Statistics</b>	<ul style="list-style-type: none"> <li>Introduction and Application</li> <li>Measure of Central tendency: Mean, Median, Mode</li> <li>Measure of Dispersion: Variance and Standard Deviation</li> </ul>	<ul style="list-style-type: none"> <li>Develop awareness on data and statistics.</li> <li>Calculates mean, median and mode</li> <li>Learn Measure of dispersion and application of measure of dispersion on Surveying and mapping</li> </ul>	Interactive Lectures Presentations Exercise	5
8	<b>Probability</b>	<ul style="list-style-type: none"> <li>Sampling</li> <li>Probability Distribution of Random Variables</li> <li>Normal Distribution</li> </ul>	<ul style="list-style-type: none"> <li>Understand the concept of Sampling</li> <li>Learn Probability Distribution of Random Variables</li> <li>Understand Normal Distribution</li> </ul>	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.  $D = \Delta y + \Delta x$
  - c.  $D = \frac{\Delta y}{\Delta x}$
  - d.  $D^2 = \Delta y^2 + \Delta x^2$
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.  $1/4$
3. If the perimeter of equilateral triangle is 18 cm, then area of the triangle is
  - a.  $3\sqrt{3}$
  - b.  $9\sqrt{3}$
  - c.  $6\sqrt{3}$
  - d.  $12\sqrt{3}$
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  $30^\circ$  and  $45^\circ$  respectively when looking at the top and the bottom of a house from the top of tower having 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 कोणहरू क्रमशः  $30^\circ$  र  $45^\circ$  पाइयो भने सो घरको उचाई कति होला?)
2. In a triangle ABC, if angle A and B are  $40^\circ$  and  $45^\circ$  respectively and side AB is 70 meters. Solve the triangle.  
(कुनै त्रिभूज ABC मा भिन्नी कोणहरू A र B क्रमशः  $40^\circ$  र  $45^\circ$  छन् । यदि भुजा AB को लम्बाई 70 मिटर भए सो त्रिभूज हल गर्नुहोस् ।)

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

1. Find the equation of straight line which passes through the intersection of pairs of straight lines  $x+y=5$  र  $3x-y=7$  and having slope equal to the line parallel to  $3x+2y-8=0$ .  
दुई रेखाहरू  $x+y=5$  र  $3x-y=7$  को अन्तरछेदन विन्दु (intersection point) भएर जाने तथा रेखा  $3x+2y-8=0$  सँग समानान्तर हुने रेखाको समीकरण निकाल्नुहोस्।

## **Module III: Surveying Techniques**

### **JSTL 403**

#### **Introduction**

This course module is designed to provide participants with a comprehensive understanding of surveying and geo-information 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 geo-information 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:	18 days
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
- Internal Assessment, Attendance, Discipline

#### **Attendance Requirement:**

Continued 7 days of absence (except for 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 Signalling, Selection of Traverse Station, Types of Monumentation, Construction of a monument, D-Cards, 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, Recce, 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, Instrument Handling, 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 supervision by 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
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 (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			
<b>Total</b>	<b>20</b>	<b>20</b>	<b>10</b>	<b>36</b>	<b>4</b>	<b>24</b>

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

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Fundamental Concepts</b>	<ul style="list-style-type: none"> <li>– Introduction and History of Surveying and Mapping</li> <li>– Principles of Surveying</li> <li>– Objectives of Surveying</li> <li>– Classification of Surveying: Based on Methods, Accuracy Desired, Purpose, Place and Instruments</li> <li>– Definition and Function of Surveyor</li> <li>– Different Terms used in Surveying and Mapping: Angle, Meridian, Bearing, Declination, Convergence, North Direction, Longitude, Latitude, Geoid, Ellipsoid, Spherical triangle, time, Projection, coordinate system</li> </ul>	<ul style="list-style-type: none"> <li>– Assess the introduction, history, and principles of surveying</li> <li>– Identify objectives of surveying and classification based on methods, accuracy, purpose, place and instruments</li> <li>– Outline the definition and function of the surveyor</li> <li>– Develop awareness about different terms used in surveying and mapping</li> </ul>	Class lecture Discussion	6
2.	<b>Scale, Measurements and Units</b>	<ul style="list-style-type: none"> <li>– Scale Concept, Definition, Types and Representation</li> <li>– Importance and Use of Map Scale</li> <li>– Scale Related Numerical: Wrong Scale, Shrinkage factors</li> <li>– Linear Measurement: Horizontal, Slope, and vertical distance, Error in linear Measurement</li> <li>– Angular Measurement: Horizontal and Vertical/Zenithal</li> <li>– Units and Conversion for Linear, Angular, and Area</li> </ul>	<ul style="list-style-type: none"> <li>– Develop basic concepts of scale and types.</li> <li>– Explain the importance and use of Map scale</li> <li>– Solve scale-related numerical problems</li> <li>– Learn how to take linear measurements and calculate errors</li> <li>– Explain horizontal and vertical/zenithal error</li> <li>– Convert one unit to another for linear and angular observation</li> </ul>	Class lecture Presentation Exercise	6
3	<b>Classical and Modern Surveying Instrument</b>	<ul style="list-style-type: none"> <li>– Introduction to Survey Instruments</li> <li>– Different Types of Survey Instruments</li> <li>– Standardization, Care and Adjustment</li> <li>– Classical Instruments: Chain, Tape, Compass, Plane Alidade</li> <li>– Optical Instruments: Telescopic Alidade, Clinometers, Level, Plane Table, Theodolite, Tacheometer Optical Square,</li> <li>– Concept of Optics: Telescope, Eyepiece, Lens Power, Magnification, Lens Aberration and Distortions</li> <li>– Electronic and Modern Instruments: E.D.M., Total Station, GNSS, LiDAR, UAV</li> <li>– Relationship between Frequency,</li> </ul>	<ul style="list-style-type: none"> <li>– Understand the concept of different survey instruments and uses</li> <li>– Grasp the concept of standardization for different survey equipment.</li> <li>– Understand basic operational aspects of classical to modern survey equipment.</li> <li>– Identify the basic concept of optics and possible errors</li> <li>– Understand electronic and modern instruments</li> </ul>	Class lecture Demonstration	8

		Wavelength and Velocity of Light Use of Surveying Instruments	<ul style="list-style-type: none"> <li>Learn to use survey instruments in different geospatial domains.</li> </ul>		
4	<b>Measurement and Errors</b>	<ul style="list-style-type: none"> <li>Definition</li> <li>Sources of errors</li> <li>Types of Errors</li> <li>Accuracy and Precision</li> <li>Definitions of Different Terms</li> <li>Laws of Weights</li> <li>Principle of Least Square</li> <li>Methods of Least Square</li> </ul>	<ul style="list-style-type: none"> <li>Grasp the fundamental concept of errors, their, sources and types.</li> <li>Differentiate between accuracy and precision.</li> <li>Introduce different terms in surveying and measurement</li> <li>Understand laws of weight and least square methods and principles.</li> </ul>	Class lecture Discussion	8
5	<b>Introduction to Traverse</b>	<ul style="list-style-type: none"> <li>Introduction to Traverse: Definition of terms, Principles of traversing, Different orders of traverse and their use, Method of traversing, Traverse Route: Open and Closed</li> <li>Field operation: Reconnaissance, Monumentation, and Signaling, Selection of Traverse Station, Types of Monumentation, Construction of monument, D-Cards, Traverse Chart/Sketch, Angle measurement: Horizontal angles, zenithal/vertical angle, bearing computation Recording, Computation and Plotting, omitted measurement</li> <li>Error and Adjustment in Traverse</li> <li>Types of error, Sources of error, Standard and Specification, Traverse Adjustment by Bowditch, Transit, Graphical methods</li> </ul>	<ul style="list-style-type: none"> <li>Understand basic concepts of traverse, their orders, principles and types</li> <li>Gain detailed ideas about field operation, computation and plotting</li> <li>Identify potential errors and their adjustments for traversing.</li> <li>Prepare specifications for traversing</li> </ul>	Class Lecture Interactions Presentations	8
6	<b>Introduction to Levelling</b>	<ul style="list-style-type: none"> <li>Introduction: Principles of Levelling, Definitions of terms: Level, Levelling, level surface, level line, datum, MSL, RL, BM (PBM &amp; TBM), HI, BS, FS, IS, turning point, Horizontal plane, Horizontal line, Elevation, Altitude, Vertical plane, Vertical line, Levelling instruments and accessories.</li> <li>Classification of Levelling: Spirit, barometric, trigonometric, GNSS, Methods of Levelling: Simple Levelling, Differential Levelling, Check Levelling, Fly Levelling,</li> </ul>	<ul style="list-style-type: none"> <li>Understand levelling principles, definition of different terms, their orders, principles and different types.</li> <li>Gain detailed ideas about field operation, computation and plotting</li> <li>Able to make computation and plotting of levelling</li> <li>Identify potential errors and their adjustments</li> </ul>	Class Lecture Interactions Presentations	8

		<p>Reciprocal Levelling, Precise Levelling, Profile Levelling, Cross Sectioning.</p> <ul style="list-style-type: none"> <li>- Field Procedure: Testing levels and Checking collimation error, Recce, Monumentation, Observation, Recording, Computation, Precautions to be taken in the field</li> <li>- Errors and adjustment in Levelling: Types of error, Sources of error, Permissible error in different order of Levelling, Adjustment</li> </ul>	<p>for levelling. Prepare specifications for levelling</p>		
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## 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, आधारभूत सर्वेक्षण, 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.  $0.6745\sigma$
- b.  $1.6449\sigma$
- c.  $1.9559\sigma$
- d.  $2.2123\sigma$

5. URL को पूरा रूप के हो?

- a. Uniform Reference Locator
- b. Uniform Reference Line
- c. Uniform 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 वर्णन 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**

### **JSTL 404**

#### **Introduction**

This course is developed as a module for partial fulfilment of Junior Survey Training Local Level/Province. 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:	17 Days
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, Attendance, Discipline
- Module End Practical Exam
- Presentation

#### **Attendance Requirement:**

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

#### **Course Contents**

##### **Theory [18 Sessions]**

###### **1. Basics of Computer [3]**

- 1.1 Introduction to computer
- 1.2 History and evolution of computers
- 1.3 Types of Computers (Laptop, Desktop, Workstation, Tablet, Server)
- 1.4 Components of Computer

- 1.5 Basics of Operation Systems
- 1.6 Concept of Data and Information

## **2. Word Processing [3]**

- 2.1 Introduction to Word Processing
- 2.2 Different (Open/Commercial) word processing platforms (Microsoft Word, Apple Pages, LibreOffice Writer, Google Docs etc...)
- 2.3 Features and Benefits of Word Processors
- 2.4 Document Types and File Formats (.docx, .doc, .rtf, .txt, .gdoc, .odt, .pdf etc...)

## **3. Spread Sheet [3]**

- 3.1 Introduction to spread sheet
- 3.2 Data types
- 3.3 Different (Open/Commercial) spread sheet platforms (Microsoft Excel, Apple Numbers, LibreOffice Calc, Google Sheets etc...)
- 3.4 Features and Benefits of spread sheet
- 3.5 Document Types and File Formats (.xlsx, .xls, .csv, .ods, .fods etc...)

## **4. Presentation [3]**

- 4.1 Introduction to Presentation
- 4.2 Different (Open/Commercial) Presentation platforms (Microsoft PowerPoint, Apple Keynote, LibreOffice Impress, Prezi, Google Slides, Canva, Slides.com etc...)
- 4.3 Features and Benefits of presentations
- 4.4 Document Types and File Formats (.pptx, .ppt, .odp, .gslides etc...)

## **5. Introduction to Internet, WWW, and Web Browser [3]**

- 5.1 Internet
  - 5.1.1 Concept of Internet
  - 5.1.2 Introduction to computer networks (LAN, WAN, MAN)
  - 5.1.3 IP Address, Domain Name System (DNS), URLs
  - 5.1.4 Overview on Internet Protocols (HTTP, HTTPS, FTP, TCP/IP)
- 5.2 Internet and Web Browser
  - 5.2.1 Concept of WWW and its difference from internet
  - 5.2.2 History and evolution of the web
  - 5.2.3 Types of web browsers and their components
  - 5.2.4 Basics of Search engines

## **6. Communication and Collaboration [3]**

- 6.1 Fundamentals of Communication
  - 6.1.1 Definition and importance of digital communication
  - 6.1.2 Overview of communication tools (Email, Instant Messaging (IM), Video Conferencing etc..)
  - 6.1.3 Synchronous and asynchronous communication
  - 6.1.4 Netiquette: email etiquette, online collaboration behavior
- 6.2 Collaboration Tools and Concepts

- 6.2.1 Understanding collaboration in a digital environment
- 6.2.2 Tools(Google Workspace, Microsoft365,Slack,Zoom etc...)
- 6.2.3 Concept of Cloud Storage
- 6.2.4 Concept of document sharing and co-editing

### **Practical [28 Sessions]**

#### **7. Basic Computer Skills [2]**

- 7.1 Getting started with computer and its parts
- 7.2 Operating System
  - 7.2.1 User Interface
  - 7.2.2 System Settings
  - 7.2.3 File and Directory Management

#### **8. Word Processing [5]**

- 8.1 Basic Document handling and text formatting
  - 8.1.1 Installation and Opening word processing application
  - 8.1.2 Creating new document
  - 8.1.3 Page and Print Setup
  - 8.1.4 Type and edit text (cut, copy, paste, undo, redo)
  - 8.1.5 Formatting tools (size, orientation, colour, alignment etc...)
  - 8.1.6 Insert and edit Header/Footer
  - 8.1.7 Bullets and Numbered Lists
  - 8.1.8 Insert (table, graphics, symbols, shapes, images, hyperlink etc...)
  - 8.1.9 Spell Check and Grammer reviews
  - 8.1.10 Saving and Closing Documents
- 8.2 Print Preview and Printing Documents
- 8.3 Report writing and Presentation

#### **9. Spread Sheet [6]**

- 9.1 Entering and Editing data
- 9.2 Elements of Electronic Spread Sheet
  - 9.2.1 Opening of Spread Sheet
  - 9.2.2 Addressing of Cells
  - 9.2.3 Printing of Spread Sheet
  - 9.2.4 Saving Workbooks
- 9.3 Manipulation of Cells
  - 9.3.1 Entering Text, Numbers and Dates
  - 9.3.2 Creating Text, Number and Date Series
  - 9.3.3 Editing Worksheet Data
  - 9.3.4 Inserting and Deleting Rows, Column
  - 9.3.5 Changing Cell Height and Width
- 9.4 Modifying a worksheet
- 9.5 Formulas and Function

#### **10. Presentations [6]**

- 10.1 Creation and Preparation of Slides

- 10.1.1 Inserting Word Table or An Excel Worksheet
- 10.1.2 Adding Clip Art Pictures
- 10.1.3 Inserting Other Objects
- 10.1.4 Resizing and Scaling an Object
- 10.2 Presentation of Slides
  - 10.2.1 Viewing A Presentation
  - 10.2.2 Choosing a Set Up for Presentation
  - 10.2.3 Printing Slides and Handouts
- 10.3 Slide Show
  - 10.3.1 Running a Slide Show
  - 10.3.2 Transition and Slide Timings
  - 10.3.3 Automating a Slide Show
- 10.4 Master Slide

## **11. Introduction to Internet, WWW, and Web Browser [4]**

- 11.1 Network Address, IP Address
- 11.2 Internet: Concept of Internet, Applications of Internet, connecting to the Internet, Troubleshooting
- 11.3 World Wide Web (WWW) and Web Browsing Software, Search Engines, Accessing Web Browser, Using Favourites Folder, Downloading Web Pages, Printing Web Pages
- 11.4 Understanding URL
- 11.5 Exploring Government Website

## **12. Communication and Collaboration [5]**

- 12.1 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
- 12.2 Document Collaboration
- 12.3 Instant Messaging and Collaboration: Using Instant Messaging, Instant Messaging Provider
- 12.4 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
<b>Total</b>		<b>55</b>		<b>100</b>

*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
<b>Total</b>	<b>6</b>	<b>60</b>

*\*\*\*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	<b>Basic Computer Skill</b>	<ul style="list-style-type: none"> <li>- Introduction to Computer</li> <li>- Components of Computer</li> <li>- Concept of Data and Information</li> <li>- Bringing Computer to Life</li> <li>- Operating System; User Interface, Settings, File and Directory Management</li> </ul>	<ul style="list-style-type: none"> <li>- Understand concepts of computer and its components.</li> <li>- Familiarize with data and Information</li> <li>- To familiarize with word processing</li> <li>- Connecting keyboard, mouse, monitor and printer to CPU to make computer alive.</li> </ul>	Interactive Lectures Exercises Demonstration Presentations	5
2	<b>Word Processing</b>	<ul style="list-style-type: none"> <li>- Word Processing; Opening, Manipulation, Formatting and Closing Documents</li> <li>- Report writing and presentation</li> </ul>	<ul style="list-style-type: none"> <li>- To make capable of preparing documents in word.</li> <li>- To be able to write report and present it.</li> </ul>	Interactive Lectures Exercises Demonstration Presentations	8
2	<b>Spread Sheet</b>	<ul style="list-style-type: none"> <li>- Entering and Editing data</li> <li>- Elements of Electronic Spread Sheet</li> <li>- Opening of Spread Sheet</li> <li>- Addressing of Cells</li> <li>- Printing of Spread Sheet</li> <li>- Saving Workbooks</li> <li>- Manipulation of Cells</li> <li>- Entering Text, Numbers and Dates</li> <li>- Creating Text, Number and Date Series</li> <li>- Editing Worksheet Data</li> <li>- Inserting and Deleting Rows, Column</li> <li>- Changing Cell Height and Width</li> <li>- Modifying a worksheet</li> <li>- Formulas and Function</li> </ul>	<ul style="list-style-type: none"> <li>- Develop skills on spreadsheet</li> <li>- Demonstration of manipulations of cells in excel</li> <li>- Use formula and function in spreadsheet</li> <li>- Develop basic skill to understand data in spreadsheet</li> </ul>	Interactive Lectures Presentations Demonstration	9

3	<b>Presentations</b>	<ul style="list-style-type: none"> <li>- Introduction</li> <li>- Creation of Presentation</li> <li>- Inserting Word Table or An Excel Worksheet</li> <li>- Adding Clip Art Pictures</li> <li>- Inserting Other Objects</li> <li>- Resizing and Scaling an Object</li> <li>- Viewing A Presentation</li> <li>- Choosing a Set Up for Presentation</li> <li>- Printing Slides and Handouts</li> <li>- Slide Show</li> <li>- Master Slide</li> </ul>	<ul style="list-style-type: none"> <li>- Create Presentation, insert data from word and excel</li> <li>- Develop skills on viewing a presentation, printing slides and handout</li> <li>- Develop skills of Slide show</li> <li>- Develop skills on Preparation of Presentation layout using Master slide</li> </ul>	Interactive Lectures Presentations Demonstration	9
4	<b>Introduction to Internet, www and web browser</b>	<ul style="list-style-type: none"> <li>- Introduction</li> <li>- Network Address, IP Address</li> <li>- Basic of Computer Networks: Local Area Network (LAN), Wide Area Network (WAN)</li> <li>- Internet: Concept of the Internet, Applications of the Internet, connecting to the Internet, Troubleshooting</li> <li>- World Wide Web (WWW) and Web Browsing Software</li> <li>- Search Engines, Popular Search Engines / Search for content, Accessing Web Browser, Using Favorites Folder, Downloading Web Pages, Printing Web Page</li> <li>- Understanding URL</li> <li>- Surfing the web using e-governance website</li> </ul>	<ul style="list-style-type: none"> <li>- Identify internet, www and web browsers</li> <li>- Understand the basics of computer networks and IP address</li> <li>- Introduce LAN and WAN connection</li> <li>- Familiar with the concept internet, and different applications of the internet</li> <li>- Grasp knowledge of web browsing software.</li> <li>- Understand downloading and printing of web pages.</li> <li>- Identify key concepts of URL</li> <li>- Develop general awareness about surfing e-governance website</li> </ul>	Practical Demonstration	7
5	<b>Communication and Collaboration</b>	<ul style="list-style-type: none"> <li>- Using E-mails: Opening Email account, Mailbox, Inbox and Outbox, Creating and Sending a</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the opening and operating email messages.</li> <li>- Identify the necessity of</li> </ul>	Practical Demonstration	8

		<p>new E-mail, replying to an E-mail message, Forwarding an E-mail message, Sorting and Searching emails</p> <ul style="list-style-type: none"> <li>- Document collaboration</li> <li>- Instant Messaging and Collaboration: Using Instant messaging, Instant messaging provider</li> <li>- Mail Merge</li> </ul>	<p>document collaboration.</p> <ul style="list-style-type: none"> <li>- Experience instant messaging techniques.</li> <li>- Able to merge mail.</li> </ul>		
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## References

Basic Computer Course -Soumya Ranjan Behera

Computer Basics- Bittu Kumar

## Model Questions (1\*12=12)

### 1. Document Formatting (6\*2=12)

You have been given a plain text document. Perform the following formatting tasks:

- a. Apply the "Title" style to the main heading.
- b. Change the font of the entire document to "Times New Roman," size 12.
- c. Set the line spacing of the document to 1.5 lines.
- d. Insert a header with your name on the right side and insert a footer with the page number centered at the bottom.
- e. Add a bullet point list with at least three items of your choice.
- f. Indentation of 0.5 points.

### 2. Tables and Images (6\*2=12)

Create a table and insert an image as described below:

- a. Create a table with 3 columns and 4 rows. Fill in the first row with the headers "Item," "Description," and "Price."
- b. Merge the cells in the first column of the second and third rows.
- c. Insert an image of your choice into the merged cell. Resize the image to fit within the cell without distorting its aspect ratio.
- d. Keep background colour of the table blue
- e. Add a caption below the table that says "Table 1: Item List and Description."
- f. Adjust the layout of table as center alignment.

## **Module V: Field Survey I (Geodetic Techniques)**

### **JSTL 405**

#### **Introduction**

This module is a part of the Junior Survey Training Local Level/Province, aiming to develop the 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 the successful completion of this module, the participants will be able to:

- Understand traditional and modern surveying techniques, including their principles and applications.
- Use of modern surveying tools and software for data processing and analysis, including GNSS and digital levelling.
- Understand the importance of accurate field procedures, detailed note-taking, and proper record-keeping to ensure the reliability and reproducibility of survey results.

#### **Training Details**

Approach of Instruction:	Lecture, Indoor Practical Classes, Outdoor Practical Classes
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 for some unavoidable condition) will disqualify the candidate for the completion of the course

#### **Course Content**

##### **Field Work [25 days]**

###### **1. Ordinary Levelling [4 days]**

- 1.1 Collimation check: Explanation of the collimation error and methods for checking and correcting it.
- 1.2 Reconnaissance and Monumentation:
- 1.3 Fly Levelling: Introduction to fly leveling techniques for rapid elevation measurements

over long distances with advantages and limitations of fly leveling compared to other methods.

- 1.4 Differential Levelling: Principles and Procedures
- 1.5 L-Section and X-Section levelling
- 1.6 Computation and adjustment

## **2. Traversing [4 days]**

- 2.1 Reconnaissance and Monumentation
- 2.2 Observation: Setting up the theodolite and taking horizontal and vertical angle measurements.
- 2.3 Computation and adjustment

## **3. Triangulation and Trilateration [6 days]**

- 3.1 Reconnaissance and Monumentation
- 3.2 Observation: angles, baseline distances
- 3.3 Calculation and Adjustment (Angular misclosure and distance closure to assess the quality of the triangulation)

## **4. Theodolite Resection and Intersection [1 day]**

- 4.1 Observation and Setup
- 4.2 Measurement and Data Recording
- 4.3 Computation and Adjustment

## **5. Astronomical Observation [2 days]**

- 5.1 Preparation and Setup
- 5.2 Solar and Star Observation (Polaris, altitude and azimuth determination)
- 5.3 Computation (geographical coordinates based on the observed celestial positions).

## **6. Precise Levelling by Digital Method [3 days]**

- 6.1 Instrument Handling and collimation Check
- 6.2 Reconnaissance and Monumentation
- 6.3 Observation
- 6.4 Height Computation: Rise and Fall Method, Height of Instrument Method
- 6.5 Adjustment techniques to optimizing network consistency and minimizing errors.

## **7. Differential Positioning (GNSS) [3 days]**

- 7.1 Instrument Handling
- 7.2 Reconnaissance and Monumentation (satellite visibility, obstructions, and multipath).
- 7.3 Observation (static, elevation mask, logging interval, DOP)
- 7.4 Data Downloading and Processing (Data download, Differential correction, Ephemeris, Datum Transformation, Baseline Processing and Network Adjustment).

## **8. Report Preparation [1 day]**

- 8.1 To prepare 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	Marks Allotted
1	Data collection, processing (Instructor, Coordinator)	60
2	Attendance, Discipline, Maps, Records, Report (Camp In-charge)	20
3	Viva (LMTC)	20
	<b>Total</b>	<b>100</b>

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1	Ordinary Levelling	<ul style="list-style-type: none"> <li>– Collimation Check</li> <li>– Reconnaissance and Monumentation</li> <li>– Fly Levelling, Differential Levelling, L -section and X-Section Levelling</li> <li>– Computation and adjustment</li> </ul>	<ul style="list-style-type: none"> <li>– Understanding, checking, and correcting</li> <li>– Learning Outcomes collimation error</li> <li>– Develop skills in site</li> <li>– Reconnaissance for survey location</li> <li>– Acquire a detailed understanding of principles and procedures of different leveling.</li> <li>– Compute elevation differences and apply adjustment techniques in leveling surveys.</li> </ul>	Class Demonstration Field Work Report Writing In Field Viva Final Viva	4 days
2	Theodolite Traversing	<ul style="list-style-type: none"> <li>– Collimation Test</li> <li>– Reconnaissance and Monumentation Observation</li> <li>– Computation and Adjustment</li> </ul>	<ul style="list-style-type: none"> <li>– Perform collimation tests effectively.</li> <li>– Conduct reconnaissance to identify suitable traverse stations.</li> <li>– Apply monumentation techniques to establish control points for traverses.</li> <li>– Set up the theodolite and take horizontal and vertical angle measurements with precision.</li> <li>– Apply calculation methods to determine traverse coordinates.</li> <li>– Utilize adjustment techniques to optimize the traverse network and minimize errors.</li> </ul>		4 days

3	<b>Triangulation and Trilateration</b>	<ul style="list-style-type: none"> <li>– Reconnaissance and Monumentation</li> <li>– Observation</li> <li>– Adjustment and Computation</li> </ul>	<ul style="list-style-type: none"> <li>– Identify suitable observation stations for forming a network of triangles in triangulation and trilateration.</li> <li>– Apply monumentation methods effectively to establish control points for the survey.</li> <li>– Conduct accurate observations of angles, baseline distances, and other necessary data.</li> <li>– Utilize adjustment methods such as Bowditch's or least squares to refine computed coordinates and minimize errors within the network.</li> </ul>	6 days
4	<b>Theodolite Resection and Intersection</b>	<ul style="list-style-type: none"> <li>– Observation and Setup</li> <li>– Measurement</li> <li>– Data Recording</li> <li>– Computation</li> <li>– Adjustment</li> </ul>	<ul style="list-style-type: none"> <li>– Ability to set up a theodolite accurately at both known and unknown observation stations.</li> <li>– Competence in conducting observations for both intersection and resection purposes.</li> </ul>	1 day
5	<b>Astronomical Observation</b>	<ul style="list-style-type: none"> <li>– Preparation and Setup</li> <li>– Observation</li> <li>– Data Recording</li> <li>– Computation</li> <li>– Analysis and Interpretation</li> </ul>	<ul style="list-style-type: none"> <li>– Ability to plan and prepare for astronomical observations.</li> <li>– Understanding of trigonometric calculations and astronomical algorithms used in computation.</li> </ul>	2 days
6	<b>Precise Levelling by Digital Method</b>	<ul style="list-style-type: none"> <li>– Instrument Handling and Collimation Check</li> <li>– Reconnaissance and Monumentation</li> <li>– Observation</li> <li>– Height Computation and Adjustment</li> </ul>	<ul style="list-style-type: none"> <li>– Proficiency in handling digital level instruments and performing collimation checks.</li> <li>– Skill in documenting monument details effectively</li> <li>– Capability to perform precise height measurements at designated stations using advanced technology.</li> <li>– Understanding and application of the Rise and Fall Method and Height of Instrument Method.</li> <li>– Competence in adjustment techniques to optimize network consistency and minimize errors in precise leveling surveys.</li> </ul>	3 days

7	<b>Differential Positioning</b>	<ul style="list-style-type: none"> <li>– Instrument Handling</li> <li>– Reconnaissance and Monumentation</li> <li>– Observation</li> <li>– Data Downloading and Processing</li> </ul>	<ul style="list-style-type: none"> <li>– Proficiency in handling GNSS equipment</li> <li>– Ability to evaluate potential observation sites considering various factors for accurate positioning.</li> <li>– Skill in proper documentation of monument details.</li> <li>– Capability to set up instruments.</li> <li>– Proficiency in data collection techniques during GNSS observation.</li> <li>– Competence in downloading raw GNSS data from receivers and processing it using specialized software.</li> </ul>		3 days
8	<b>Report Preparation</b>		<ul style="list-style-type: none"> <li>– Proficiency in preparing detailed reports of field surveys using geodetic survey methods.</li> <li>– Ability to organize and present survey data in a clear and comprehensive manner.</li> <li>– Skill in documenting survey methodologies, observations, and results effectively.</li> </ul>		1 day
9	<b>Viva</b>		<ul style="list-style-type: none"> <li>– Proficiency in participating in a viva session, demonstrating knowledge and understanding of the subject matter.</li> <li>– Ability to answer questions effectively and articulate ideas clearly during the viva.</li> <li>– Skill in defending the content and methodology of the report prepared for Field Survey I (Geodetic Survey Methods).</li> <li>– Capability to engage in discussions, provide explanations, and address queries raised by the examiners.</li> <li>– Understanding of the viva process and its role in assessing comprehension, communication skills, and overall competency in the subject area.</li> </ul>		1 day

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

### **JSTL 406**

#### **Introduction**

This module is a part of the Junior Survey Training Local Level/Province, 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 the successful 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.
- 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 Classes, Outdoor Practical Classes
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 for some unavoidable condition) will disqualify the candidate for the completion of the course

#### **Course Content**

##### **Field Work [25 days]**

###### **1. Photo/ Image Interpretation and Field Verification [4 days]**

- 1.1 Reading Topo maps/Google Maps
- 1.2 Downloading satellite image using Open-source Platforms, Downloading OSM Data
- 1.3 Techniques for interpreting aerial photos/images and OSM Data.
- 1.4 Collecting place names and verifying maps using photos and images
- 1.5 Updating old map using current topographical map of the area and Field Verification

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

- 2.1 Instrument handling practice: Practicing the use of handheld GPS and mobile applications.
- 2.2 Measuring horizontal and vertical positions using handheld GPS and mobile application.
- 2.3 Route tracking and detailing using handheld GPS and mobile applications.
- 2.4 Plotting data from using handheld GPS and mobile application.
- 2.5 Thematic Map Design

**3. Cadastral Survey by Digital Methods [10 days]**

- 3.1 Instrument handling Practice; Data acquisition by RTK [2], TS [2] and UAV [1]
- 3.2 Traversing
- 3.3 Adjudication, Sketch preparation, Data capturing
- 3.4 Data downloading, Processing and analyzing
- 3.5 Database preparation and Mapping
- 3.6 Record preparation (field book, purja, etc)
- 3.7 Parcel subdivision
- 3.8 Record maintenance (using parcel editor application).

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

- 4.1 Map Reading
- 4.2 Overlapping Satellite images with Cadastral Map
- 4.3 Field demarcation using maps and Total Station
- 4.4 Parcel demarcation using GNSS

**5. Report Preparation [1 day]**

- 5.1 To prepare detailed report of Field Survey II (Cadastral survey and thematic mapping)

**6. Viva [1 day]**

- 6.1 Viva of Field Survey II (Cadastral Survey and Thematic Mapping)

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

S.N.	Criteria	Marks Allotted
1	Data collection, processing (Instructor, Coordinator)	60
2	Attendance, Discipline, Maps, Records, Report (Camp In-charge)	20
3	Viva (LMTC)	20
	<b>Total</b>	<b>100</b>

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1	<b>Photo/ Image Interpretation</b>	<ul style="list-style-type: none"> <li>– Reading Topo Maps/Google Maps</li> <li>– Downloading Satellite Images Using Open-Source Platforms</li> <li>– Techniques for Interpreting Aerial Photos and Images</li> <li>– Collecting Place Names and Verifying Maps Using Photos and Images</li> <li>– Updating Old Maps Using Current Topo Maps of the Area</li> </ul>	<ul style="list-style-type: none"> <li>– Reading and interpreting topographical maps and Google Maps.</li> <li>– Identify and utilize various open-source platforms for downloading satellite images.</li> <li>– Perform searches and download high-resolution satellite images based on specific criteria.</li> <li>– Recognize and interpret key elements of aerial photographs, including scale, resolution, shadows, shapes, and textures.</li> <li>– Collect and document place names using field surveys, interviews, and historical sources.</li> <li>– Update old maps with new information derived from current topographical data</li> </ul>	Class Demonstration	4 days
2	<b>Thematic mapping using handheld GPS and Mobile applications</b>	<ul style="list-style-type: none"> <li>– Instrument Handling Practice</li> <li>– Practicing the Use of Handheld GPS Units</li> <li>– Measuring Horizontal and Vertical Positions</li> <li>– Route Tracking and Detailing</li> <li>– Plotting Data from GPS Measurements</li> </ul>	<ul style="list-style-type: none"> <li>– Demonstrate proficiency in handling handheld GPS units and mobile mapping applications.</li> <li>– Accurately measure and record horizontal and vertical positions using GPS devices.</li> <li>– Effectively track and detail routes using GPS technology.</li> <li>– Plot and visualize data obtained from GPS measurements for thematic mapping purposes.</li> </ul>	Field Work Report Writing In Field Viva Final Viva	5 days
3	<b>Cadastral Survey by Digital Methods</b>	<ul style="list-style-type: none"> <li>– Instrument Handling Practice</li> <li>– Traversing</li> <li>– Adjudication</li> <li>– Sketch Preparation</li> <li>– Data Capturing</li> <li>– Data Downloading</li> <li>– Processing and Analyzing</li> <li>– Database Preparation</li> <li>– Mapping</li> <li>– Record Preparation</li> <li>– Report Generation</li> </ul>	<ul style="list-style-type: none"> <li>– Conduct accurate traversing using digital methods.</li> <li>– Perform adjudication processes accurately.</li> <li>– Prepare detailed sketches and capture data effectively.</li> <li>– Prepare comprehensive databases and generate maps.</li> <li>– Generate detailed reports.</li> <li>– Conduct parcel subdivision and maintain records using parcel editor applications.</li> </ul>		10 days

		<ul style="list-style-type: none"> <li>– Parcel Subdivision</li> <li>– Record Maintenance</li> </ul>		
4	<b>Map Reading, Demarcation of parcel in field</b>	<ul style="list-style-type: none"> <li>– Map Reading Skills</li> <li>– Overlapping Satellite Images with Cadastral Map</li> <li>– Field Data Collection</li> <li>– Overlay Techniques</li> <li>– Field demarcation Using Total Station</li> </ul>	<ul style="list-style-type: none"> <li>– Demonstrate proficiency in reading existing maps and understanding their features.</li> <li>– Overlay satellite images with cadastral maps for accurate field demarcation.</li> <li>– Use a Total Station for precise field sketching and parcel demarcation.</li> </ul>	4 days
5	<b>Report Preparation</b>		<ul style="list-style-type: none"> <li>– Proficiency in preparing detailed reports of field surveys using geodetic survey methods.</li> <li>– Ability to organize and present survey data in a clear and comprehensive manner.</li> <li>– Skill in documenting survey methodologies, observations, and results effectively.</li> </ul>	1 day
6	<b>Viva</b>		<ul style="list-style-type: none"> <li>– Proficiency in participating in a viva session, demonstrating knowledge and understanding of the subject matter.</li> <li>– Ability to answer questions effectively and articulate ideas clearly during the viva.</li> <li>– Skill in defending the content and methodology of the report prepared for Field Survey II (Topographical and cadastral survey).</li> <li>– Capability to engage in discussions, provide explanations, and address queries raised by the examiners.</li> <li>– Understanding of the viva process and its role in assessing comprehension, communication skills, and overall competency in the subject area.</li> </ul>	1 day

## Module VII: Field Survey III (Engineering Survey)

JSTL 407

## Introduction

This module is a part of the Junior Survey Training Local Level/Province, 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 the successful completion of this module, the participants will be able to:

- Carryout engineering and construction field survey work, generate data, processing and analyzing data, database, maps and records
- Plan and execute road and bridge surveys, including route selection and monumentation.
- Utilize UAVs for aerial surveying, including data collection and mapping; generate topographic maps and Digital Terrain Models (DTM) from UAV imagery.
- Implement DGPS (Real-Time Kinematic) for high-precision positioning and real-time data collection.

## Training Details

**Approach of Instruction:** Lecture, Indoor Practical Classes, Outdoor Practical Classes

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 for some unavoidable condition) will disqualify the candidate for the completion of the course

## Course Content

## Field Work [25 days]

## 1. Hydrographic Survey [2 days]

## 1.1 Planning, Recce, Monumentation

- 1.2 Control Point establishment
- 1.3 Area, Volume, Discharge Computation
- 1.4 Preparation of Bathymetric chart

**2. Road Survey with Bridge Survey [6 days]**

- 2.1 Planning
- 2.2 Route selection, Recce, Monumentation
- 2.3 Control point establishment (Link Traversing), Chainage, Intersection Point Establishment
- 2.4 Detailing, Sketching
- 2.5 Data download
- 2.6 Curve setting

**3. Hydropower Surveys [4 days]**

- 3.1 Planning
- 3.2 Site selection for intake, dam, canal/tunnel, reservoir, transmission line
- 3.3 Control points establishment (traversing), detailing, Sketching
- 3.4 Data download.

**4. Stake out [2 days]**

- 4.1 Stake out of Building, roads, parcel
- 4.2 Stake out according to Design drawings and as built drawing.

**5. Functions of Total Station [1 day]**

- 5.1 REM, MLM, Resection, Automatic Traversing, Area Calculation, Reflector-less prism

**6. Data acquisition from UAV and LIDAR [4 days]**

- 6.1 Use UAVs (drones) for aerial surveying and data collection
- 6.2 Generating topographic maps and Digital Terrain Models (DTM) from UAV imagery.
- 6.3 Applications of UAV technology in surveying and mapping.

**7. Detailing from DGPS (RTK) [2 days]**

- 7.1 Using DGPS (Real-Time Kinematic) for detailed surveying.
- 7.2 High-precision positioning and data collection in real-time.
- 7.3 Importance of detailed data collection using RTK for accurate mapping and surveying projects.

**8. Plotting [2 days]**

- 8.1 Installation of software
- 8.2 Plotting and mapping topographical map of route survey, bridge Survey and Hydropower Survey
- 8.3 Generating L-section and X- section of the route
- 8.4 Map layout

**9. Report Preparation [1 day]**

- 9.1 To prepare detailed report of Field Survey III (Topographical and cadastral survey)

**10. Viva [1 day]**

- 10.1 Viva of Field Survey III (Engineering Survey)

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

S.N.	Criteria	Marks Allotted
1	Data collection, processing (Instructor, Coordinator)	60
2	Attendance, Discipline, Maps, Records, Report (Camp In-charge)	20
3	Viva (LMTC)	20
	<b>Total</b>	<b>100</b>

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1	<b>Hydrographic Survey</b>	<ul style="list-style-type: none"> <li>– Planning, Recce, Monumentation</li> <li>– Control Point establishment</li> <li>– Area, Volume, Discharge Computation</li> <li>– Preparation of Bathymetric Chart</li> </ul>	<ul style="list-style-type: none"> <li>– Develop a comprehensive survey plan for bathymetric survey.</li> <li>– Select convenient river and conduct reconnaissance surveys effectively.</li> <li>– Set up monuments and reference points accurately.</li> <li>– Establish vertical and horizontal control point using GNSS/Total station</li> <li>– Record detailed topographical features and create accurate sketches along the stripe.</li> <li>– Apply techniques for area, volume and discharge calculation.</li> <li>– Prepare a bathymetric chart/map</li> </ul>	<ul style="list-style-type: none"> <li>Class</li> <li>Demonstration</li> <li>Field Work</li> <li>Report Writing</li> </ul>	2 days
2	<b>Road Survey with Bridge Survey</b>	<ul style="list-style-type: none"> <li>– Planning</li> <li>– Route Selection, Recce, Monumentation –</li> <li>– Control Point Establishment</li> <li>– Detailing, Sketching</li> <li>– Data Download-</li> <li>– Curve Setting:</li> </ul>	<ul style="list-style-type: none"> <li>– Develop a comprehensive survey plan for road and bridge projects.</li> <li>– Select optimal routes and conduct reconnaissance surveys effectively.</li> <li>– Set up monuments and reference points accurately.</li> <li>– Establish control points using link traversing techniques.</li> <li>– Measure chainage and set up intersection points precisely.</li> <li>– Record detailed topographical features and create accurate sketches.</li> <li>– Apply techniques for setting out curves in road surveys.</li> </ul>	<ul style="list-style-type: none"> <li>In Field Viva</li> <li>Final Viva</li> </ul>	6 days

3	<b>Hydropower Survey</b>	<ul style="list-style-type: none"> <li>- Planning</li> <li>- Site Selection</li> <li>- Control Points Establishment</li> <li>- Data Download</li> </ul>	<ul style="list-style-type: none"> <li>- Develop a detailed survey plan tailored to hydropower projects.</li> <li>- Select optimal sites for intake, dam, canal/tunnel, reservoir, and transmission lines effectively.</li> <li>- Conduct feasibility assessments for hydropower site selection.</li> <li>- Establish control points accurately using traversing techniques.</li> <li>- Conduct detailed surveys and create precise sketches.</li> <li>- Download and manage survey data efficiently.</li> </ul>		4 days
4	<b>Stake out</b>	<ul style="list-style-type: none"> <li>- Stake Out of Building, Roads, Parcel, Control Points Using Total Station</li> </ul>	<ul style="list-style-type: none"> <li>- Demonstrate proficiency in using a Total Station for staking out building corners and foundations.</li> <li>- Accurately stake out road alignments and curves.</li> <li>- Perform parcel boundary staking with precision.</li> <li>- Establish and verify control points using Total Station.</li> </ul>		2 days
5	<b>Functions of Total Station</b>	<ul style="list-style-type: none"> <li>- REM</li> <li>- MLM</li> <li>- Resection</li> <li>- Traversing</li> <li>- Area Calculation</li> </ul>	<ul style="list-style-type: none"> <li>- Understand Remote Elevation Measurement (REM)</li> <li>- Measurement of Horizontal and Vertical Angles (MLM)</li> <li>- Apply resection methods to determine the coordinates of unknown points using known points</li> <li>- Calculate the area of polygons using measurements obtained from Total Station surveys.</li> </ul>		1 day
6	<b>Topographic Map and DTM Generation from UAV</b>	<ul style="list-style-type: none"> <li>- Using DGPS (Real-Time Kinematic) for detailed surveying.</li> <li>- High-precision positioning and data collection in real-time.</li> <li>- Importance of detailed data collection using RTK for accurate mapping and surveying projects.</li> </ul>	<ul style="list-style-type: none"> <li>- Utilize UAVs (drones) for aerial surveying and data collection.</li> <li>- Generate topographic maps and Digital Terrain Models (DTM) from UAV imagery.</li> <li>- Explore applications of UAV technology in surveying and mapping, including its benefits and limitations.</li> </ul>		4 days
7	<b>Detailing from DGPS (RTK)</b>	<ul style="list-style-type: none"> <li>- Using DGPS (Real-Time Kinematic) for detailed surveying.</li> <li>- High-precision positioning and data collection in real-time.</li> <li>- Importance of detailed data collection using RTK for</li> </ul>	<ul style="list-style-type: none"> <li>- Utilize DGPS (Real-Time Kinematic) for detailed surveying applications.</li> <li>- Perform high-precision positioning and data collection in real-time using RTK.</li> <li>- Understand the importance of detailed data collection with RTK</li> </ul>		2 days

		accurate mapping and surveying projects	for ensuring accuracy in mapping and surveying projects.		
8	<b>Plotting</b>	<ul style="list-style-type: none"> <li>– Installation of software</li> <li>– Plotting and mapping topographical map of route survey, bridge Survey and Hydropower Survey</li> <li>– Generating L-section and X-section of the route</li> <li>– Map layout</li> </ul>	<ul style="list-style-type: none"> <li>– Successfully install plotting software for survey data processing and mapping.</li> <li>– Plot and map topographical data from route surveys, bridge surveys, and hydropower surveys using the installed software.</li> <li>– Generate L-sections (Longitudinal Sections) and X-sections (Cross Sections) of surveyed routes.</li> <li>– Create map layouts that effectively communicate survey findings, including legends, scales, titles, and annotations.</li> </ul>		2 days
9	<b>Report Preparation</b>		<ul style="list-style-type: none"> <li>– Proficiency in preparing detailed reports of field surveys using geodetic survey methods.</li> <li>– Ability to organize and present survey data in a clear and comprehensive manner.</li> <li>– Skill in documenting survey methodologies, observations, and results effectively.</li> </ul>		1 day
10	<b>Viva</b>		<ul style="list-style-type: none"> <li>– Proficiency in participating in a viva session, demonstrating knowledge and understanding of the subject matter.</li> <li>– Ability to answer questions effectively and articulate ideas clearly during the viva.</li> <li>– Skill in defending the content and methodology of the report prepared for Field Survey III (Engineering Survey).</li> <li>– Capability to engage in discussions, provide explanations, and address queries raised by the examiners.</li> <li>– Understanding of the viva process and its role in assessing comprehension, communication skills, and overall competency in the subject area.</li> </ul>		1 day

## **Module VIII: Geographic Information System**

### **JSTL 408**

#### **Introduction**

This module is a part of the Junior Survey Training Local Level/Province, aiming to develop 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 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:

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

#### **Attendance Requirement:**

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

#### **Course Content**

##### **Part A: Theory [31 Sessions]**

###### **Theory [31]**

###### **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 pre-processing, converting data formats and importing data into GIS software, Geo-coding)
- 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. Concept of Modelling and Simulation[2]**

- 6.1 Concept and types of modelling
- 6.2 Building and Running Model

## **7. Volunteered and Open-Source 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 Start-up MS-Access, 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 from 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 (Vector-based) 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 Data-Driven 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 supervision by the instructor in the class	-
Practical Exercises	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	Practical Exam	20
Project Presentation		6	To be presented in class	10
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 (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	-	-
<b>Total</b>	<b>20</b>	<b>20</b>	<b>8</b>	<b>24</b>	<b>3</b>	<b>16</b>

### Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	Introduction to GIS &Geographic Phenomena	<ul style="list-style-type: none"> <li>- GIS definition, Functions of GIS, Development of GIS,</li> <li>- Component of GIS, GIS application and benefits,</li> <li>- Introduction to Geographic phenomena</li> <li>- Introduction to fields and object, Metadata, Data types</li> <li>- Spatial Data Models and Structures: Vector and Raster Data (Regular tessellations and Irregular tessellations)</li> <li>- Vector and Raster file formats</li> </ul>	<ul style="list-style-type: none"> <li>- Define GIS and explain its function and development</li> <li>- Understanding its core components and application.</li> <li>- Understanding geographic phenomena.</li> <li>- Explain concepts of fields and objects in GIS, metadata, and data types.</li> <li>- Familiarize with different representation of vector and raster data</li> <li>- Identify and describe common vector file formats: Shapefile, GeoJSON, KML</li> <li>- Identify and describe common raster file formats: TIFF, JPEG, PNG, and GRID.</li> </ul>	Brainstorming Lecture Interactive Discussion	5
2.	Spatial Data Collection, Entry & Preparation	<ul style="list-style-type: none"> <li>- Concept and Methods of Data Collection</li> <li>- Primary data and Secondary data Sources</li> <li>- Data preparation and input techniques</li> <li>- Spatial Data Relationship and topology, data check and repair</li> <li>- Spatial Data Quality and its</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the concept of data collection.</li> <li>- Learn methods of data collection: primary data sources and secondary data sources.</li> <li>- Apply input techniques for importing spatial data</li> <li>- Understand spatial data relationships and topology concepts for spatial analysis.</li> </ul>	Lecture, Demonstration Group Works	5

		Components	<ul style="list-style-type: none"> <li>Evaluate spatial data quality: accuracy, completeness, consistency, and currency.</li> <li>Understand the importance of data standards in GIS for interoperability and data sharing</li> </ul>		
3	<b>Database Management</b>	<ul style="list-style-type: none"> <li>Introduction to Database Management System:</li> <li>Data, Information and Knowledge, users, Database Management System, its Components and Functions</li> <li>Database management system: field, record, key field, field types, rules for assigning database fields, creating tables, viewing records, sorting records,</li> <li>Relational Data Model (Concept, Domains, Sub type, Attributes and Relations)</li> <li>Keys in Database Management System and various software of DBMS</li> <li>Introduction to Spatial Database Management</li> <li>Data standards (e.g., ISO, OGC) and its Importance, Metadata</li> </ul>	<ul style="list-style-type: none"> <li>Understand distinctions between data, information, and knowledge in a DBMS</li> <li>Describe major DBMS functions: storage, retrieval, manipulation, security, and concurrency control.</li> <li>Learn basic DBMS terminology and operations.</li> <li>Explain relational data model concepts: domains, subtypes, tuples, attributes, and relations.</li> <li>Understand database keys and identify DBMS tools.</li> <li>Learn about spatial database management and its role in handling geographic data.</li> </ul>	Lecture Demonstration Group Works	6
4	<b>Map Projections and Coordinate System</b>	<ul style="list-style-type: none"> <li>Map Projection and Classifications</li> <li>Factors of map projections, Scale Factor</li> <li>Projections used in Nepal (UTM, MUTM Projections, Lambert Conformal Conic Projection)</li> <li>Coordinate System and their types</li> <li>Coordinate transformations</li> <li>Georeferencing, Resampling and Geo-coding</li> </ul>	<ul style="list-style-type: none"> <li>Understand concepts and definitions related to map projections and coordinate systems.</li> <li>Learn about different classifications of map projections.</li> <li>Explore factors influencing map projections, including scale factor.</li> <li>Study projection systems used in Nepal: UTM, Modified UTM, and Lambert Conformal Conic.</li> <li>Understand coordinate systems and their transformations.</li> <li>Gain knowledge on georeferencing, resampling and geocoding</li> </ul>	Interactive Lectures Discussions	5

5	<b>Spatial Data Analysis and its types</b>	<ul style="list-style-type: none"> <li>- Concept and Importance of Spatial Analysis</li> <li>- Vector Data Analysis</li> <li>- Spatial Operations: Measurement, retrieval and classification functions, basics of overlay, neighborhood and connectivity functions</li> <li>- Raster Data Analysis</li> <li>- Common Raster Operations: ((Re)classification, Map Algebra, Overlay, Resampling, Interpolation, Zonal Statistics,)</li> <li>- Modeling and Simulation</li> <li>- Concept and types of modelling</li> <li>- Building and Running Model</li> </ul>	<ul style="list-style-type: none"> <li>- Understanding the concept and steps of spatial analysis.</li> <li>- Identity the steps of spatial analysis</li> <li>- Identify and describe different types of vector data and understand their representation in GIS.</li> <li>- Comprehend the structure of raster data.</li> <li>- Perform common raster operations to analyze and manipulate raster datasets effectively.</li> <li>- Identify and describe different types of models</li> <li>- Learn to build GIS models using modeling software</li> </ul>	Interactive Lectures Discussion Case Studies	7
6	<b>Volunteered and Open-Source GIS and Web Mapping</b>	<ul style="list-style-type: none"> <li>- Definition, Importance and Uses</li> <li>- Map Making using open software and open data (Google Earth, QGIS, OSM)</li> <li>- Introduction to Web Mapping, Components of Web Mapping: Client-side components, Server-side components, APIs and libraries.</li> </ul>	<ul style="list-style-type: none"> <li>- Understand open-source GIS software and its advantages.</li> <li>- Utilize open data in map making by importing, processing, and visualizing open data layers within GIS software.</li> <li>- Provide a brief overview of web mapping and its key components</li> </ul>	Interactive Lectures Discussion, Case Studies Presentations	3

## References

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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

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## 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 open-source 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?
2. 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 डिजिटाइज, स्कयानिड, र अन्य formatहरू वर्णन गर्नुहोस् ।

## **Module IX: Photogrammetry and Remote Sensing Techniques**

### **JSTL 409**

#### **Introduction**

This course is developed as a module for partial fulfilment of Junior Survey Training Local Level/Province 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, principle, 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, principle 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-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 Content**

### **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
  - 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

- 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: Ground-based, 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, Multi-image Manipulation-Spectral 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 Stereo-Pair 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

### **21. Group Project Work [6]**

21.1 Group wise 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:*

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

*\*\*\*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)	
Part A: Photogrammetry						
1	2	2*1	1	1*4	-	-
2	1	1*1	1	1*4	-	-
3	3	3*1	1	1*4	-	-
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	1	1*1	1	1*4	-	-
8	2	2*1	1	1*4	-	-
9	2	2*1	1	1*4	1	1*8
10	2	2*1	1	1*4	-	-
<b>Total</b>	<b>20</b>	<b>20</b>	<b>8</b>	<b>24</b>	<b>3</b>	<b>16</b>

### Detail Curriculum

S. N	Topic	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
Part A: Photogrammetry					
1.	<b>Introduction to Photogrammetry</b>	<ul style="list-style-type: none"> <li>- Definition of Photogrammetry</li> <li>- Principle of Photogrammetry</li> <li>- Types of Photogrammetry</li> <li>- Evolution of Photogrammetry</li> <li>- Scope of Photogrammetry</li> <li>- Application of Photogrammetry</li> </ul>	<ul style="list-style-type: none"> <li>- Understand about the fundamental concept in photogrammetry and its principle</li> <li>- Know about the historical development of photogrammetry</li> <li>- Explain differences between types of photogrammetry</li> <li>- Familiarize with application sectors and scope of photogrammetry</li> </ul>	Lectures Interactive Discussions	2

2.	<b>Human Eye and Stereoscopic Vision</b>	<ul style="list-style-type: none"> <li>- Human Eye, its Parts and Function</li> <li>- Depth Perception by Human Eyes: Monoscopic and Stereoscopic Vision</li> <li>- Stereoscopic Vision and Parallax in Photogrammetry and their Use in Height Measurement</li> </ul>	<ul style="list-style-type: none"> <li>- Identify different parts of human eye and explain its functions.</li> <li>- Understand about depth perception techniques of human eyes</li> <li>- Relate human eye functioning with 3D vision in photogrammetry</li> <li>- Know about the usage of stereoscopic vision and parallax in photogrammetry</li> </ul>	Brainstorming Lectures Interactive Discussions Exercises	2
3.	<b>Basic Photogrammetry</b>	<ul style="list-style-type: none"> <li>- Concept of Orthographic and Perspective Projection</li> <li>- Difference Between Aerial Photographs and Maps</li> <li>- Types of Aerial Photographs</li> <li>- Terminologies Used in Photogrammetry</li> <li>- Scale of a Vertical Aerial Photograph</li> <li>- Distortion in a Photograph</li> <li>- Effect of Relief and Tilt Displacement</li> <li>- Rectification</li> <li>- Photo Mosaics and Photo Maps</li> </ul>	<ul style="list-style-type: none"> <li>- Familiarize with orthographic and perspective projection</li> <li>- Identify the differences between photographs and maps</li> <li>- Understand different terminologies in Photogrammetry</li> <li>- Understand about distortions and displacement in photogrammetry and their removal techniques</li> <li>- Explain the similarities and differences in photo mosaics and photo maps</li> <li>- Practice exercises associated with scale of vertical photograph</li> </ul>	Lectures Interactive Discussions Numerical calculation Exercises	4
4.	<b>Aerial Photography Planning</b>	<ul style="list-style-type: none"> <li>- Aerial Cameras: Structure and Types</li> <li>- Photo Control Points, Their Types and Selection Criteria</li> <li>- Pre-Marking and Post Marking of Control Points</li> <li>- Properties of Ideal GCP</li> <li>- Planning for Aerial Photography and Factors to be Considered (With Numerical Examples)</li> <li>- Indexing of Aerial Photographs on a Map</li> </ul>	<ul style="list-style-type: none"> <li>- Recognize different parts of an aerial camera and understand their functions.</li> <li>- Familiarize with working mechanism and output of digital and analog cameras.</li> <li>- Explain about nature and types of photo control points</li> <li>- Identify suitable GCP for photogrammetric mission.</li> <li>- Plan aerial photography missions by considering different factors.</li> </ul>	Lectures Interactive Discussions Numerical calculation Exercises	3
5.	<b>Photogrammetric Process</b>	<ul style="list-style-type: none"> <li>- Analogue/ Analytical Photogrammetry           <ul style="list-style-type: none"> <li>• Coordinate Systems and Orientation</li> <li>• Types of Coordinate System: Photo, Camera, Ground</li> <li>• Orientation: Interior, Relative, Absolute</li> <li>• Process of Analog and Analytical Photogrammetry:</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Differentiate between different coordinate systems on photogrammetry.</li> <li>- Understand the different orientation techniques in analog / analytical photogrammetry.</li> <li>- Describe Aerial Triangulation Process in Analog / Analytical Photogrammetry and its importance</li> <li>- Identify the difference of digital</li> </ul>	Lectures Interactive Discussions	6

	<ul style="list-style-type: none"> <li>• Aerial Triangulation Process and Resulting Photogrammetric Products</li> <li>- Digital Photogrammetry <ul style="list-style-type: none"> <li>• Digital Photogrammetry and its Advantages</li> <li>• Process of Digital Photogrammetry</li> <li>• 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</li> </ul> </li> </ul>	<p>photogrammetry from Analog / Analytical photogrammetry</p> <ul style="list-style-type: none"> <li>- Know the basic usage of digital photogrammetric workstation.</li> <li>- Describe different steps / process involved in Digital photogrammetry</li> <li>- Familiarize with the products of Digital Photogrammetry</li> </ul>		
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**Part B: Remote Sensing**

	<ul style="list-style-type: none"> <li>- Definition and concept</li> <li>- Brief history of Remote Sensing</li> <li>- Electromagnetic Radiation and Spectrum</li> <li>- Process of Remote Sensing</li> <li>- Atmospheric window and its significance</li> <li>- Energy interaction in atmosphere</li> <li>- Energy interaction with earth surface</li> <li>- Spectral reflectance and spectral reflectance curve</li> <li>- Spectral signature of different materials (water, soil, vegetation)</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the definition, concept of RS and identify differences between photogrammetry and RS</li> <li>- Know about the evolution and history of RS</li> <li>- Familiarize with process of RS</li> <li>- Gain knowledge about atmospheric window and its significance in RS</li> <li>- Understand about the energy interaction in atmosphere and with earth surface.</li> <li>- Know about the Spectral reflectance and spectral reflectance curve</li> <li>- Identify the differences in spectral signature plot of different materials</li> </ul>	<p>Brainstorming Lectures Interactive Discussions</p>	3
7. <b>Sensor and Platform</b>	<ul style="list-style-type: none"> <li>- Sensors: Passive and Active,</li> <li>- Platforms: Ground-based, Airborne and Space borne remote sensing</li> <li>- Resolution: Spatial, Spectral, Radiometric and Temporal</li> <li>- Multispectral Remote Sensing: Introduction, Types and some operational MS Sensors</li> </ul>	<ul style="list-style-type: none"> <li>- Explain the differences between: passive &amp; active</li> <li>- Understand types of remote sensing based on platforms</li> <li>- Familiarize with the concept of multispectral RS and its types</li> </ul>	<p>Lectures Interactive Discussions</p>	2

8.	<b>Digital Image Processing</b>	<ul style="list-style-type: none"> <li>- Visualization of image data: Types of image interpretation, Elements of image interpretation, Color composites</li> <li>- Image enhancement: Contrast enhancement, Spatial feature manipulation, multi-image manipulation-spectral rationing</li> <li>- Radiometric distortion and corrections</li> <li>- Geometric distortion and correction</li> </ul>	<ul style="list-style-type: none"> <li>- Interpret images by analyzing image interpretation elements</li> <li>- Visualize multi-band images using different color composites</li> <li>- Understand the concept of image enhancement and its types and applications</li> <li>- Understand the sources of radiometric and geometric distortions and recognize the ways to correct these distortions</li> </ul>	Lectures Interactive Discussions Numerical calculation Exercises	4
9.	<b>Digital Image Classification</b>	<ul style="list-style-type: none"> <li>- Types of image classification techniques</li> <li>- Pixel based classification: unsupervised and supervised Validation and accuracy assessment</li> </ul>	<ul style="list-style-type: none"> <li>- Explain and compare different types of image classification techniques</li> <li>- Familiarize with the concepts of and algorithms used in supervised and unsupervised classification</li> <li>- Understand the ways to perform accuracy assessment of classified image and interpret the results of classification</li> </ul>	Lectures Interactive Discussions Numerical calculation Exercises	3
10.	<b>Applications and Recent Developments in RS</b>	<ul style="list-style-type: none"> <li>- Freely available image data</li> <li>- Surveying and Mapping, Agriculture, forestry, Land covers and land use and others</li> <li>- Active RS: LIDAR, RADAR and their applications</li> </ul>	<ul style="list-style-type: none"> <li>- Familiarize with the applications of Remote sensing in several sectors of Nepal</li> <li>- Explore and download freely available images</li> <li>- Understand about active RS such as LIDAR, RADAR and know about its applications</li> <li>- Familiarize with the recent developments of RS in context of Nepal</li> </ul>	Lectures Interactive Discussions Case Studies Demonstration Exercise	2

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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 Geo-information 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 रिसोट सेन्सिंड इमेजको pixel size 30\*30m रहेको हुन्छ। यसलाई 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. K-mean

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

1. Define Photogrammetry. Discuss the types of photogrammetry on the basis of historical development. (Photogrammetry परिभाषित गर्नुहोस्। ऐतिहासिक विकासको आधारमा Photogrammetry का प्रकारहरू छलफल गर्नुहोस्।)
2. What is image interpretation? Explain elements of Image interpretation. (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.

## **Module X: Cartography**

### **JSTL 410**

#### **Introduction**

This module has been developed for partial fulfillment of the Junior Survey Training Local Level/Province Course. The course is targeted at imparting 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 / Outdoor Practical

Duration of the Course: 3 Weeks

Sessions per day: 4 Sessions (Sunday-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 for 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 Gazetteer
- 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 Introduction to web cartography
- 7.2 Evolution from traditional to web cartography
- 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 techniques: 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	1	1*4	-	
2	2	2*1	2	2*4	1	1*8
3	2	2*1	1	1*4	1	1*8
4	2	2*1	2	2*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			
<b>Total</b>	<b>20</b>	<b>20</b>	<b>8</b>	<b>24</b>	<b>3</b>	<b>16</b>

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Introduction to Cartography</b>	<ul style="list-style-type: none"> <li>– Introduction: Definitions, History, Scope</li> <li>– Cartography, GIS, and Information Technology</li> <li>– Map Characteristics and Uses</li> <li>– Map Classification: Scale, Purpose, Contents: General and Thematic</li> <li>– Enlargement and Reduction of Map Scales</li> <li>– Map as an Interface to Data</li> </ul>	<ul style="list-style-type: none"> <li>– Understand the concept, milestones, and innovations in cartography</li> <li>– Demonstrate how cartography and GIS can be integrated to convey information</li> <li>– analyze how changes in scale impact the map's readability, size, and application.</li> </ul>	Lecture Interactions	4
2.	<b>Cartographic Design</b>	<ul style="list-style-type: none"> <li>– Map Design</li> <li>– Perception Properties</li> <li>– Cartographic Communication Process</li> <li>– Symbol Design</li> <li>– Visual Variables</li> <li>– Understanding Color</li> <li>– Typography Design</li> <li>– Map Layout</li> </ul>	<ul style="list-style-type: none"> <li>– Understand how the map design principles enhance the effectiveness in information interpretation</li> <li>– Demonstrate the effect of human understanding with the use of different visual variables</li> <li>– Design the map graphics using colors, text, symbols, and visual variables.</li> <li>– Emphasize the use of Map graphics to communicate with map user</li> <li>– Prepare the various types of well-designed map balancing all map layout elements</li> </ul>	Brainstorming Group Discussion Exercise	9
3	<b>Map Projection and Sheet Numbering</b>	<ul style="list-style-type: none"> <li>– Concept and definitions</li> <li>– Map Projection Classification</li> <li>– Scale Factor</li> <li>– UTM and MUTM</li> <li>– Sheet Numbering: Small and Large Scale in Nepal</li> </ul>	<ul style="list-style-type: none"> <li>– Understand how the earth's features are projected on a 2D surface.</li> <li>– Understand Map projection system used in Nepal for different types of Map</li> <li>– Able to Number and index the topographic map sheets</li> </ul>	Lecture Brainstorming Exercises Group Discussions	7
4	<b>Map Making Process</b>	<ul style="list-style-type: none"> <li>– Conventional map-making process</li> <li>– Digital Map Making Process</li> <li>– Map Printing</li> </ul>	<ul style="list-style-type: none"> <li>– Differentiate the map-making and dissemination process</li> </ul>	Interactive Presentations Task	4

5	Map Generalisation	<ul style="list-style-type: none"> <li>- Concept and Definitions</li> <li>- Conceptual and Graphic Generalisation</li> <li>- Guidelines of Map Generalisation</li> </ul>	<ul style="list-style-type: none"> <li>- Gain an idea on how to simplify large-scale spatial database to visualize in small scale, while maintaining essential features and readability.</li> </ul>	Interactions Demonstration	2
6	Thematic Data Visualisation	<ul style="list-style-type: none"> <li>- Thematic Data and Framework/Foundation Data</li> <li>- Qualitative and Quantitative Data and their Mapping</li> <li>- Measurement Scales: Nominal, Ordinal, Interval, Ratio</li> <li>- Different Types of Thematic Maps: Choropleth, Dot Density, Proportional Point Symbol, Chorochromatic, flowline, Isopleth</li> <li>- Atlas basic</li> </ul>	<ul style="list-style-type: none"> <li>- develop skills in designing different types thematic maps, by selecting appropriate symbols, colors, and legends that enhance the map's clarity and readability.</li> <li>- explore the use of GIS and other technological tools in the production of thematic maps</li> </ul>	Interactive Lectures Presentations	4
7	Web Cartography	<ul style="list-style-type: none"> <li>- Types of Web Map: Static, Dynamic, Interactive, Collaborative and Real Time</li> <li>- Exploring open software and data visualization: Google, QGIS, OSM</li> </ul>	<ul style="list-style-type: none"> <li>- Learn about various web mapping technologies and platforms (e.g. OSM Mapbox, Google Maps API).</li> <li>- Capable of converting and visualizing various data formats across multiple platforms.</li> </ul>	Interactions Demonstrations Group work	2

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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 (5\*1=5)

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. Neat line
  - c. Border line
  - 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 Questions (1\*4=4)

1. What do you understand by Map Generalization? Differentiate Conceptual and Graphic Generalization.  
Map generalization लाई परिभाषित गर्नुहोस् । Conceptual & Graphical generalization विचको फरकको व्याख्या गर्नुहोस् ।

### Section B: Short Questions (1\*4=4)

1. Describe any five methods of Thematic Visualization.  
Thematic data visualization का कुनै पाँच विधिहरूको संक्षेपमा वर्णन गर्नुहोस।

## **Module XI: Advanced Surveying Techniques**

### **JSTL 411**

#### **Introduction**

This module has been developed for partial fulfillment of Junior Survey Training (In-Service) 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:

- Acquiring 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 for 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, 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 vice-versa
- 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 Signal Propagation
- 6.2 Positioning Techniques: Static, Kinematic
- 6.3 Real-time Kinematic (RTK)

**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 and Quality Control

7.2 GNSS applications

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

8.1 Introduction to CORS network, its Function and Importance

8.2 Data collection, and distribution from CORS

**9. UAV survey [3]**

9.1 Introduction to UAV, and its application

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	Class room lectures	34	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	3	Practical Exam	20
Case Study and Presentation		8	To be presented in class	10
Lab Assignments, 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	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			
<b>Total</b>	<b>20</b>	<b>20</b>	<b>8</b>	<b>24</b>	<b>3</b>	<b>16</b>

### Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Control Survey</b>	<ul style="list-style-type: none"> <li>- Triangulation</li> <li>- Trilateration</li> <li>- Theodolite Resection and Intersection</li> </ul>	<ul style="list-style-type: none"> <li>- Understand concepts on Trilateration, triangulation, resection and intersection.</li> </ul>	Lecture Interactions	5
2.	<b>Elementary Geodesy</b>	<ul style="list-style-type: none"> <li>- Figure of Earth</li> <li>- Terms used in Geodesy</li> <li>- Geometry of Ellipsoid, its characteristics</li> <li>- Conversion of Rectangular to Geodetic coordinate system and vice-versa.</li> <li>- Height System</li> </ul>	<ul style="list-style-type: none"> <li>- Assess basic concepts of Figure of the earth.</li> <li>- Understand the terms used in Geodesy</li> <li>- Understand ellipsoid, its properties.</li> <li>- Grasp the fundamentals of conversion of coordinate system</li> <li>- Acquire knowledge on different height system, text, symbols, and visual variables.</li> </ul>	Lecture Interactions	6
3	<b>Gravimetry Survey</b>	<ul style="list-style-type: none"> <li>- Introduction to Gravity, Gravimetry, Gravimeter instruments</li> <li>- Principle of Gravimetry</li> <li>- Gravimetry Data acquisition, processing and analysis</li> <li>- Scope and application</li> </ul>	<ul style="list-style-type: none"> <li>- Acquire knowledge on Gravitational force, gravity and laws related to it.</li> <li>- Grasp the fundamentals of height systems</li> <li>- Understand Gravimetry and gravimeters and their scope and applications</li> </ul>	Presentations Interactions Exercise	2
4	<b>LiDAR survey</b>	<ul style="list-style-type: none"> <li>- Introduction to LiDAR surveying</li> <li>- Principles of LiDAR operation</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the basic principles and components of LiDAR systems.</li> </ul>	Presentations Task	2
5	<b>Basics of GNSS Survey</b>	<ul style="list-style-type: none"> <li>- Introduction to GNSS</li> <li>- Principle of GNSS</li> <li>- Satellite orbits, Kepler's law</li> <li>- GNSS signals</li> <li>- Components of GNSS system, and segments</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamentals of GNSS, and its principle</li> <li>- Understand satellite orbits, their types, Kepler's orbit and orbital elements</li> <li>- Acquire knowledge on GPS signals</li> </ul>	Presentations Interactions	5
6	<b>GNSS Positioning Techniques</b>	<ul style="list-style-type: none"> <li>- Signal Propagation and errors</li> <li>- Positioning Techniques: Static,</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamentals of propagation of signal and</li> </ul>	Presentations Interactions	3

		<ul style="list-style-type: none"> <li>- Kinematic</li> <li>- Real-time Kinematic (RTK)</li> </ul>	<ul style="list-style-type: none"> <li>- errors associated to it.</li> <li>- Understand different positioning techniques</li> <li>- Acquire knowledge on RTK</li> </ul>		
7	<b>Accuracy, Errors in GNSS and GNSS applications</b>	<ul style="list-style-type: none"> <li>- Accuracy, errors and precision in GNSS</li> <li>- GNSS applications</li> </ul>	<ul style="list-style-type: none"> <li>- Acquire knowledge on accuracy, errors and precision in GNSS</li> <li>- Learn GNSS applications</li> </ul>	Presentations Interactions	3
8	<b>Continuously Operating Reference Stations (CORS)</b>	<ul style="list-style-type: none"> <li>- Introduction to CORS network</li> <li>- Function and importance of CORS</li> <li>- Data collection and distribution from CORS</li> <li>- Establishing and managing a CORS network</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamentals of CORS</li> <li>- Understand its functions and its importance</li> <li>- Acquire knowledge on data collection and distribution of CORS</li> </ul>	Presentations Interactions	2
9	<b>UAV survey</b>	<ul style="list-style-type: none"> <li>- Introduction to UAV, and its applications</li> <li>- UAV components and types, GCPs and operating UAV in Nepal: legal procedures</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamentals of UAV survey</li> <li>- Understand its components and types, GCPs and operating UAV in Nepal: its legal procedures</li> </ul>	Presentations Interactions	3
10	<b>Basics of Astronomy</b>	<ul style="list-style-type: none"> <li>- Definitions of Astronomical terms</li> <li>- Coordinate system in Astronomy</li> <li>- Concept of time, applications in field astronomy</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamentals of astronomical terms</li> <li>- Understand coordinate system in Astronomy</li> <li>- Acquire knowledge on concept of time, applications in field astronomy</li> </ul>	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)

#### Answer any Two of the following

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

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

#### Answer any One of the following questions (तलका मध्य कुनै १ प्रश्नको उत्तर दिनुहोसा)

1. Convert rectangular coordinates  $(x, y, z)$  to geodetic coordinate  $(r, \theta, \lambda)$ . Rectangular coordinate  $(x, y, z)$  लाई geodetic coordinate  $(r, \theta, \lambda)$  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 सर्वेक्षणमा त्रुटिका श्रोतहरू के के हुन्?)

## Module XII: Cadastre

JSTL 412

## Introduction

This course is developed as a module for partial fulfilment of Junior Survey Training Local Level/Province 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 carry out cadastral survey and data updating and record maintenance both in conventional and digital environment.

## Objectives

Upon the successful 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, 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 for some unavoidable condition) will disqualify the candidate for the completion of the course

## Course Content

## Part A: Theory [36 Sessions]

## Theory [36]

## 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
- 4.6 मौजुदा दर्ता श्रेस्ता भिडाउने

## 5. Legal Framework [6]

- 5.1 जग्गा नाप जाँच ऐन, २०१९ तथा नियमवाली २०५८
- 5.2 जग्गा नाप जाँच तथा नक्सा श्रेस्ता अधिकारिक 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 नापजाँच सम्बन्धि निर्देशिका, २०७७
- 5.8 द्रुन्द्वाट भूमि लगत क्षति भएका क्षेत्रको नापजाँच गरी पुर्नस्थापना गर्ने सम्बन्धि 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: SAEx, Parcel Editor, 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 Discussion-FGD, and Role plays Technique

## 10. Field Parcel Demarcation (फिल्ड रेखांकन) [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	36	Direct supervised by instructor in the class	-
Practical Exercises	Supervised	28	Supervised by instructors in class	-
Exam	Final exam	2	Comprises with subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
Revision and Presentation		3	Lab Exam	20
Lab Exercises, Home Assignments and Discipline			To be presented in class	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 (16)
	(Attempt All)		(Attempt Any Six)		(Attempt Any Two)	
1	2	2*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	3	3*1	2	2*4	-	-
7	2	2*1	2	2*4	-	-
8	2	2*1	2	2*4	-	-
<b>Total</b>	<b>20</b>	<b>20</b>	<b>8</b>	<b>24</b>	<b>3</b>	<b>16</b>

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Introduction and Basic Concepts</b>	<ul style="list-style-type: none"> <li>- Definition, concept and Importance of Cadastral Survey</li> <li>- Historical Background of Cadastral survey</li> <li>- Principle of Cadastral Survey</li> <li>- Types of Cadastral Survey (In terms of Objective, Technology)</li> <li>- Concept of Sporadic and Systematic Cadastral survey</li> <li>- Cadastral Survey Technological Evolution (Chain Survey to Lidar Survey in Nepal)</li> <li>- Parcel and Boundary</li> <li>- Parcel Numbering</li> <li>- Cadastral Documents: Cadastral map, Field Book, Plot register, Land Ownership Registration Book (Shrestha), Title Document (Purja) and other related documents</li> <li>- Application and use of Cadastre</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the principle,</li> <li>- origin and theory behind cadastre</li> <li>- Assess basic concepts of cadastre and its types.</li> <li>- Develop theory on different types of archiving</li> </ul>	Exercise Interactions Presentation	6
2.	<b>Cadastral Survey Methods</b>	<ul style="list-style-type: none"> <li>- Analogue Method</li> <li>- Chain Survey</li> <li>- Compass Survey</li> <li>- Plane table Survey</li> <li>- Introduction and Application of Digital Method</li> <li>- Total station</li> <li>- Photogrammetry/Remote Sensing</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the types of cadastral survey.</li> <li>- Knowledge on trends and technology.</li> <li>- Explain the different principle behind the technology.</li> </ul>	Presentation Exercise Interactions	6

		<ul style="list-style-type: none"> <li>- GNSS method (RTK)</li> <li>- UAV Method (Photogrammetric Method)</li> <li>- Hybrid method</li> <li>- Comparison (Principle, Application, Use and Impact) of different methods</li> </ul>			
3	<b>Cadastral Survey Procedure</b>	<ul style="list-style-type: none"> <li>- Preparation for cadastral survey</li> <li>- Need Assessment for Cadastral Survey</li> <li>- Notification Process and public awareness</li> <li>- Formation of Cadastral Survey Team</li> <li>- Cadastral Survey and Mapping Process</li> <li>- Analogue (Plane table and accessories, plane table setting, surveying and mapping, inking maps, area computation and validation, field book and other necessary documents preparation.</li> <li>- 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)</li> <li>- Land registration Process</li> <li>- Preparation and issue of land title (Land registration Ownership Certificate)</li> <li>- Arrangement for addressing incomplete task</li> <li>- Handover of Map and Documents</li> <li>- Verification Process of New Records with existing)</li> </ul>	<ul style="list-style-type: none"> <li>- Understand and apply the concept of cadastral survey</li> <li>- Learn professional and societal norms, values and human behavior on cadastre</li> <li>- Embrace professionalism in practice through understanding and execution.</li> </ul>	Presentation Exercise Group Discussion	8
4	<b>Business Service Delivery at Survey Office</b>	<ul style="list-style-type: none"> <li>- लिखत</li> <li>- कित्ताकाट, टायल चेक</li> <li>- कित्ता एकीकरण, कित्ता खण्डकरण</li> <li>- फिल्ड रेखांकन, दुरी अंकित, नक्सा प्रिन्ट</li> <li>- नक्सा सुधार</li> <li>- मौजुदा दर्ता श्रेस्ता भिडाउने</li> </ul>	<ul style="list-style-type: none"> <li>- Understand and apply the concept of cadastral survey</li> <li>- Learn professional and societal norms, values and human behavior on cadastre</li> <li>- Embrace professionalism</li> </ul>	Presentation Exercise Group Discussion	2
5	<b>Legal Framework</b>	<ul style="list-style-type: none"> <li>- जग्गा नाप जांच ऐन, २०१९ तथा नियमवाली २०५८</li> <li>- जग्गा नाप जांच तथा नक्सा श्रेस्ता अधिवाधिक सम्बन्धि निर्देशिका, २०८१</li> </ul>	<ul style="list-style-type: none"> <li>- Understand major provisions of the acts and directives.</li> </ul>	Case Studies Presentation	6

		<ul style="list-style-type: none"> <li>- डिजिटल प्रणाली मार्फत जग्गाको नापनकसा तथा जग्गा प्रशासन सम्बन्धी सेवा प्रवाह. निर्देशिका २०७८</li> <li>- भू-उपयोग ऐन २०७६, भू-उपयोग नियमावली २०७९, भू-उपयोग कार्यक्रम कार्यान्वयन निर्देशिकाहरू २०८१</li> <li>- मानवरहित हवाई उपकरण (Unmanned Aerial Vehicle) मार्फत डिजिटल कित्तानापी कार्य संचालन विधि २०७९</li> <li>- डिजिटल कित्तानापीकार्य संचालन विधि (Digital Cadastral Standard Operation Procedure,,SOP) २०८१</li> <li>- गाउँब्लक क्षेत्रको नापजाँच सम्बन्धी निर्देशिका, २०७७</li> <li>- द्रन्दवाट भूमि लगत क्षति भएका क्षेत्रको नापजाँच गरी पुनर्स्थापना गर्ने सम्बन्धी निर्देशिका २०७९</li> </ul>	<ul style="list-style-type: none"> <li>- Recognize the significance of</li> <li>- Rules and regulations in fostering professionalism.</li> <li>- Knowledge on regulations, norms and acts</li> </ul>		
6	<b>Institutional Framework</b>	<ul style="list-style-type: none"> <li>- Concerned Ministry</li> <li>- Survey Department, Department of Land Management and Archived</li> <li>- District Survey Offices and Land Revenue Offices</li> <li>- Update section</li> <li>- Surveying and Mapping Section</li> <li>- Special Survey Offices</li> <li>- Role of Province government and local government</li> <li>- Land management and land issues related Commissions</li> </ul>	<ul style="list-style-type: none"> <li>- Grasp the fundamental concepts, principles, functions, and roles of different organization.</li> <li>- Knowledge of organogram.</li> <li>- Efficiently organize tasks and resources to achieve organizational goals.</li> </ul>	Interactions Presentations	2
7	<b>Archiving Cadastral Documents and Updating</b>	<ul style="list-style-type: none"> <li>- Map tracing, Digitization</li> <li>- Parcel Fragmentation and integration</li> <li>- Parcel history maintenance; Field Book, Plot register, Kittakat Trace etc.</li> <li>- Concept of Index map, File map, parcel map etc.</li> <li>- Parcel delineation; Process and technique archiving of Cadastral Documents</li> </ul>	<ul style="list-style-type: none"> <li>- Identify the gap between existing cadastre system.</li> <li>- Recognize different medium of updating cadastre.</li> </ul>	Interactive Lectures Presentations	2
8	<b>Land Information System</b>	<ul style="list-style-type: none"> <li>- Introduction to LIS, Components, Importance, and Applications</li> <li>- Introduction, Application, Importance and use of NeLIS and Merokitta</li> <li>- Introduction, Application, Importance and use of LRIMS and PAMS</li> <li>- Introduction to SAEx, Parcel Editor etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Develop effective and enhance computer abilities.</li> <li>- Improve digital tools and technology. proficiency.</li> <li>- Enhance Self-Skill</li> </ul>	Exercise Presentation	4

## References

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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)

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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 हुँदैन?)
  - 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 रूप?)
  - 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 जग्गा 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 कागजातहरूको आवश्यक पर्दछ ? छोटकरिमा वर्णन गर्नुहोस ।
2. What is UAV Cadastral Survey Method? Write down the importance of UAV survey.  
UAV कित्तानापी भन्नाले के बुझनुहुन्छ? 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 प्रकारहरू वर्णन गर्दै यसलाई थप प्रभावकारी र गुणस्तरीय बनाउन के कस्तो पक्षमा ध्यान दिनुपर्ला विवेचना गर्नुहोस ।
2. List out the acts and polices of present cadastre of Nepal. Explain what are the drawback of Land Measurement Act 2019?  
नेपालको कित्तानापीको लागि आवश्यक पर्ने ऐन, कानूनहरू List गर्नुहोस? जग्गा नाप जांच ऐन २०१९ को कमिकमजोरीहरू वर्णन गर्नुहोस?

## **Module XIII: Land Administration**

### **JSTL 413**

#### **Introduction**

This course is developed as a module for partial fulfilment of Junior Survey Training (In-Service) Course. The course incorporates 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 principle 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 सम्बन्ध 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 सम्बन्धी आदेशहरू

## **6. Land Administration Services in Nepal [9]**

- 6.1 Land Ownership Transfer Process in Nepal

- 6.1.1 अंशवण्डा, बकसपत्र, राजिनामा, अदालतको फैसला, लगतकद्वा
- 6.1.2 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
- 6.5 Land Market
- 6.6 Land Banking Initiatives
- 6.7 Different Tools and Approaches in Land Administration

#### **Part B: Case Study [8 Sessions]**

##### **7. Office Visit and Case Study**

- 7.1 Visit to Land Administration and Management Institution
- 7.2 Visit to Survey Offices
- 7.3 Case Study
- 7.4 Use of PAM, LRIMS for Land Records Management
- 7.5 Group Presentation

#### **Part C: Practical [22 Sessions]**

##### **8. Land Records Preparation and Management [8]**

- 8.1 जग्गा प्रशासनमा प्रयोग हुने विभिन्न प्रकारका लिखत
- 8.2 लिखत तयार गर्ने प्रक्रिया
- 8.3 मिसिल अध्ययन
- 8.4 मोठ भिडाउने
- 8.5 रोक्का, फुकुवा, दृस्टी बन्धक
- 8.6 अदालतको निर्णय कार्यान्वयन
- 8.7 मुचुल्का लेखन, प्रतिवेदन लेखन

##### **9. Application of GIS Tools for Land Management [10]**

- 9.1 Land Use Mapping
- 9.2 Land Pooling
- 9.3 Land Compensation Model

##### **10. Parcel Demarcation(रेखांकन) 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	Class Room 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
	Practical Exam	3	Lab Exam	20
Case Study and Presentation		8	To be presented in class	10
Lab Assignments, Home Assignments, and Discipline				10
<b>Total</b>		<b>69</b>		<b>100</b>

*\*\*\*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	2	2*4	-	-
5	4	4*1	1	1*4	1	1*8
6	4	4*1	2	2*4	1	1*8
7	1	1*1	Case Study and Presentation			
8	2	2*1	Lab Assignments and Lab Exam			
9,10	2	2*1				
<b>Total</b>	<b>20</b>	<b>20</b>	<b>8</b>	<b>24</b>	<b>3</b>	<b>16</b>

## Detail Curriculum

S. N	Topics	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1	<b>Introduction to Land Administration</b>	<ul style="list-style-type: none"> <li>- Definition</li> <li>- Terms</li> <li>- Elements</li> <li>- Importance</li> <li>- Functions</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the definition, terms and elements of cartography</li> <li>- Realize the importance and functions of Land Administration</li> </ul>	Lecture Interactions	2
2	<b>Land Administration System</b>	<ul style="list-style-type: none"> <li>- Definition, Types of Land Administration System (LAS): (Traditional and Modern LAS), Characteristics Features of LAS</li> <li>- Concepts of Land Governance</li> <li>- International practices and Vision</li> </ul>	<ul style="list-style-type: none"> <li>- Understand about traditional and modern LAS</li> <li>- Understand the characteristics features of LAS</li> <li>- Understand the concept of Land Governance</li> <li>- Learn the international practices and vision of LAS</li> </ul>	Lecture Interactions	4
3	<b>Land Tenure, Ownership and Rights</b>	<ul style="list-style-type: none"> <li>- Land Tenure</li> <li>- Land Tenure System in Nepal</li> <li>- Administration of Guthi Land</li> <li>- Basic Concepts of Land Ownership and its Types</li> <li>- Basic Concepts of Land Rights (Including 3R)</li> <li>- Land Registration</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the basic concept of Land Tenure</li> <li>- Recognize the different Land Tenure Systems in Nepal from ancient time</li> <li>- Understand the basic concept of Land Ownership and its types</li> <li>- Understand the concept of Land Rights</li> <li>- Understand the concept, principles and types of Land Registration System</li> </ul>	Lectures Group Discussions	6
4	<b>Concept of Land Reform and Land Management</b>	<ul style="list-style-type: none"> <li>- Definition and Concept</li> <li>- Land Reform Approaches</li> <li>- Land Reform Initiatives in Nepal</li> <li>- Land Management</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the definition and concept of Land Reform and Land Management</li> <li>- Grasp knowledge about different approaches of Land Reform and Land Reform initiatives in Nepal</li> <li>- Understand about different land Management tools</li> </ul>	Interactive Lectures Presentations	6
5	<b>Legal Provisions for Land Administration in Nepal</b>	<ul style="list-style-type: none"> <li>- Basic Concept of Policies</li> <li>- Laws, Acts, Regulations, Directives, Manuals and Circulars</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the major legal provisions for Land Administration in Nepal</li> </ul>	Interactive Lectures Presentations	7

6	<b>Land Administration Services in Nepal</b>	<ul style="list-style-type: none"> <li>- Land Ownership Transfer Process in Nepal</li> <li>- Issues of Land Registration in Nepal</li> <li>- Land Acquisition Process in Nepal</li> <li>- Land Valuation Process in Nepal</li> <li>- Land Disputes in Nepal</li> <li>- Different Tools and Approaches in Land Administration</li> <li>- Land Market and Land Banking Initiatives</li> </ul>	<ul style="list-style-type: none"> <li>- Understand the process of ownership transfer in Nepal</li> <li>- Recognize different issues of Land Registration in Nepal</li> <li>- Understand the land acquisition process in Nepal</li> <li>- Understand different tools and approaches of Land Administration</li> <li>- Understand the concept of Land Market and Land Banking</li> <li>- Grasp knowledge about Land Banking Initiatives in Nepal</li> </ul>	Interactive Lectures	9
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## References

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

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जग्गा प्रशासन सम्बन्धी मौजुदा कानूनी प्रावधानहरू

## Model Questions

### Objective

1. स-साना तथा छरिएर रहेको कित्तारुलाई एकतृत गरि खेति प्रणालिमा सुधार ल्याउने विधिलाई 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 राख्न पाउने जग्गाको हद कति रहेको छ?
  - a. १० रोपनी
  - b. १५ रोपनी
  - c. २० रोपनी
  - d. २५ रोपनी
4. GLTN को पूरा रूप 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.  
जग्गा प्रशासन भनेको के हो ? जग्गा प्रशासनको महत्व बारे चर्चा गर्नुहोस ।
2. What do you mean by Land Registration? Write the principles of Land Registration.  
जग्गा दर्ता भन्नाले के बुझिन्छ ? जग्गा दर्ताका सिद्धान्तहरू लेख्नुहोस ।
3. What do you mean by Land Tenure? Mention various types of land tenure systems that exist in Nepal.  
भू-सम्बन्ध भन्नाले के बुझिन्छ? नेपालमा रहेका विभिन्न प्रकारका भू-सम्बन्ध 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 context of Nepal and write the measures of solution.  
जग्गा प्राप्ति तथा जग्गा मुल्यांकनको परिभाषा दिनुहोस? नेपालमा जग्गा मूल्यांकन मा देखिएका विभिन्न समस्याहरू उल्लेख गरी समाधानका उपायहरू लेख्नुहोस?
2. a. What do you mean by Land Registration? Write the principles of Land Registration.  
जग्गा दर्ता भन्नाले के बुझिन्छ ? जग्गा दर्ताका सिद्धान्तहरू लेख्नुहोस ।  
b. 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 ।
3. What do you mean by Land Tenure? Mention various types of land tenure systems that exist in Nepal.  
भू-सम्बन्ध भन्नाले के बुझिन्छ? नेपालमा रहेका विभिन्न प्रकारका भू-सम्बन्ध बारे उल्लेख गर्नुहोस्?

## Module XIV: Engineering Survey

JSTL 414

## Introduction

This course is developed as a module for partial fulfilment of Junior Survey Training Local Level/Province course. This comprehensive module is tailored to equip junior-level participants with both theoretical insights and hands-on 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:

- 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: Engineering Survey [43 Sessions]

## Theory [43]

## 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 co-ordinate,
- 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 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, Superelevation
- 5.4 Vertical Curve: Brief introduction, Gradient and Slope

**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, L-Section and X-Section 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 Bathymetric techniques
- 7.5 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
- 8.5 Concept of geological, geomorphological and mineral maps and symbols

#### **9. Building Design and Survey [2]**

- 9.1 Basic terms and components of a building and construction
- 9.2 Large scale mapping for building design
- 9.3 Selection and Demarcation of Building Site

#### **10. Setting 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 cross-section, 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:*

<b>Activities</b>		<b>Time Allocated (Sessions)</b>	<b>Description</b>	<b>Marks allocated for evaluation</b>
<b>Theory</b>	Classroom lectures	43	Direct supervision by the instructor in the class	-
<b>Practical Exercises</b>	Supervised	16	Supervised by instructors in class	-
<b>Exam</b>	Final exam	2	Comprises subjective and objective questions	Total marks: 60 Subjective: 40 Objective: 20
	Practical exam	2	Lab exam	20
<b>Case Study and Presentation</b>		6	To be presented in class	10
<b>Lab Exercises, Home Assignments and Discipline</b>				10
<b>Total</b>		<b>69</b>		<b>100</b>

**\*\*\*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	Sub-Topics	Learning Outcomes	Learning Activities	Session Hour
1.	<b>Introduction to Engineering Survey</b>	<ul style="list-style-type: none"> <li>Introduction: Definition, Purpose, Importance, Applications</li> </ul>	<ul style="list-style-type: none"> <li>Understand the fundamental definitions and purposes of engineering surveys.</li> <li>Recognize the critical role these surveys play in the planning, design, and construction of engineering projects.</li> </ul>	Interactive Lectures Presentations	1
2	<b>Relief Representation</b>	<ul style="list-style-type: none"> <li>Contour <ul style="list-style-type: none"> <li>Definition and terms: Contour interval, Horizontal equivalent, contour gradient</li> <li>Characteristics of contours</li> <li>Use of contour maps</li> </ul> </li> <li>Brief introduction of Spot Height, Hill shading, Layer Tinting, Hachures, Rock Drawing</li> </ul>	<ul style="list-style-type: none"> <li>Learn about the various methods of relief representation.</li> <li>Understand the contour interval, horizontal equivalent and contour gradient.</li> <li>Understand the principles and characteristics of contouring.</li> <li>Learn the various methods of locating contour.</li> <li>Identify the uses of contour</li> </ul>	Interactive Lectures Presentations Exercise	2

3.	<b>Area and Volume Calculation</b>	<ul style="list-style-type: none"> <li>Area of irregular figure: Average-ordinate rule, Mid-ordinate rule, Trapezoidal rule, Simpson rule, Area by co-ordinate,</li> <li>Area determination by graphical method: By square grids, By planimeter</li> <li>Determination of earthwork volumes: By contour maps, By section (one level section)</li> <li>Numerical problems</li> </ul>	<ul style="list-style-type: none"> <li>Understand and apply the average-ordinate rule, mid-ordinate rule, trapezoidal rule, and Simpson's rule for calculating the area of irregular shapes.</li> <li>Learn how to determine areas using square grids and planimeters.</li> <li>Understand different methods of determining earthwork volumes</li> </ul>	Interactive Lectures Exercise	4
4.	<b>Route Survey</b>	<ul style="list-style-type: none"> <li>Introduction <ul style="list-style-type: none"> <li>Definition, Purpose</li> <li>Field procedure: Planning, Reconnaissance, Preliminary survey, Location survey, Construction survey</li> <li>Concept of L-section and X-section</li> </ul> </li> <li>Road Survey: Introduction, Different terms used and Field procedure</li> <li>Bridge Survey: Introduction, Different terms used and Field procedure</li> <li>Irrigation and Water Supply Survey: Introduction, Different terms used and Field procedure</li> <li>Transmission Line Survey: Definition, Types, Importance, Different terms used, Field procedure</li> </ul>	<ul style="list-style-type: none"> <li>Understand the fundamental principles and objectives of route surveying in engineering projects, including roads, transmission, etc.</li> <li>Learn systematic approaches to planning route surveys, starting with reconnaissance to gather initial data and proceeding through preliminary and location surveys.</li> <li>Learn the L-section and X-section analysis in route survey.</li> <li>Understand the concept of road, bridge and irrigation survey in engineering projects.</li> <li>Learn the fundamental concept of canal and transmission line survey.</li> </ul>	Interactive Lectures Presentations Exercise	9
5.	<b>Curves</b>	<ul style="list-style-type: none"> <li>Introduction: Definitions, Types of curves</li> <li>Circular Curve <ul style="list-style-type: none"> <li>Radius and degree of curve, Elements of simple circular curves</li> <li>Methods of setting out: Tape method, Method of offset from the chord produce, Tape and theodolite method, Two theodolite method, Total station instrument method,</li> <li>Problems in setting out curve</li> </ul> </li> <li>Transition Curve: Brief introduction, Superelevation</li> <li>Vertical Curve: Brief introduction, Gradient and slope</li> </ul>	<ul style="list-style-type: none"> <li>Understand the fundamental concept and types of curves.</li> <li>Learn about the elements of a simple circular curve, including tangent points, curve points, and intersection points.</li> <li>Learn various methods used to set out circular curves in the field.</li> <li>Gain a basic understanding of transition and vertical curve.</li> </ul>	Interactive Lectures Presentations Exercise	9
6.	<b>Hydropower Survey</b>	<ul style="list-style-type: none"> <li>Introduction: Definitions, Components, Different terms used in hydropower survey</li> <li>Field procedure: Planning</li> </ul>	<ul style="list-style-type: none"> <li>Understand the concept of hydropower survey in engineering projects.</li> <li>Learn systematic approaches</li> </ul>	Interactive Lectures Exercise	4

		<ul style="list-style-type: none"> <li>Reconnaissance, Monumentation, Detailing</li> <li>Canal survey: Gradient determination, L-Section and X-Section data capturing</li> </ul>	<ul style="list-style-type: none"> <li>to planning hydropower survey, starting with reconnaissance to gather initial data and proceeding through detailing and plotting the collected data.</li> </ul>		
7.	<b>Hydrographic Survey</b>	<ul style="list-style-type: none"> <li>Introduction</li> <li>Different term used in Hydrographic survey</li> <li>Provision of control [Horizontal and Vertical]</li> <li>Method of Sounding [Horizontal and Vertical position]</li> <li>Bathymetric techniques</li> <li>Methods of discharge measure: Bucket method, Area velocity method, Weir method, Salt dilution method</li> </ul>	<ul style="list-style-type: none"> <li>Understand the concept of hydrographic survey in engineering projects.</li> <li>Understand the different terms used in hydrographic survey.</li> <li>Learn the different sounding methods.</li> <li>Understand various methods used to measure discharge</li> </ul>	<ul style="list-style-type: none"> <li>Interactive</li> <li>Lectures</li> <li>Presentations</li> <li>Exercise</li> </ul>	3
8.	<b>Mining and Geological Survey</b>	<ul style="list-style-type: none"> <li>Introduction: Definitions, Different terms used in mining</li> <li>Surface and underground surveying</li> <li>Basics of tunnel surveying</li> <li>Instruments used for mining</li> <li>Concept of geological, mineral maps and symbols</li> </ul>	<ul style="list-style-type: none"> <li>Understand the fundamental concept of mining and geological survey.</li> <li>Learn the different terms used in mining and geological survey.</li> <li>Learn about instruments used in mining.</li> </ul>	<ul style="list-style-type: none"> <li>Interactive</li> <li>Lectures</li> <li>Exercise</li> </ul>	2
9.	<b>Building Construction</b>	<ul style="list-style-type: none"> <li>Basic terms and components of a building and construction</li> <li>Large scale mapping for building design</li> </ul>	<ul style="list-style-type: none"> <li>Learn various components and terms used in building construction.</li> <li>Understand large scale mapping for building design.</li> </ul>	<ul style="list-style-type: none"> <li>Interactive</li> <li>Lectures</li> <li>Demonstration</li> <li>Exercise</li> </ul>	2
10.	<b>Setting out survey</b>	<ul style="list-style-type: none"> <li>Introduction</li> <li>Techniques of setting out</li> <li>Concept of as built drawings</li> </ul>	<ul style="list-style-type: none"> <li>Understand the fundamental concept of setting out survey.</li> <li>Learning the equipment and techniques used for setting out.</li> </ul>	<ul style="list-style-type: none"> <li>Interactive</li> <li>Lectures</li> <li>Exercise</li> </ul>	2
11.	<b>Survey Management</b>	<ul style="list-style-type: none"> <li>Understanding terms of reference (TOR), Technical standards, specification</li> <li>Basic concepts and introduction of safety management</li> <li>Care and precautions to be taken during field surveys</li> <li>Professional ethics and code of conduct of surveyor</li> </ul>	<ul style="list-style-type: none"> <li>Understand the fundamental principles and importance of survey management.</li> <li>Understand the professional ethics and code of conduct expected of surveyors.</li> <li>Equipped with the skills and knowledge necessary to manage surveying projects effectively, ensuring they are completed safely and accurately</li> </ul>	<ul style="list-style-type: none"> <li>Interactive</li> <li>Lectures</li> <li>Exercise</li> <li>Presentations</li> </ul>	5

## References

Surveying Volume-1 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 Delhi

3. Fundamental of Surveying, S.K Roy, Prentice Hall of India, New Delhi

Surveying, A. Bannister and S. Raymond, ELBS

Surveying for Engineers, J. Uren and W.F. Price, ELBS

Surveying for Construction, William Irvine, McGraw-Hill

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

## Model Questions

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

1. Which of the following instrument can be used to compute area in plotted plan?  
Plot गरिएको योजनामा क्षेत्र गणना गर्न तलका मध्ये कुन उपकरण प्रयोग गर्न सकिन्छ?
  - a. Area meter
  - b. Passometer
  - c. Planimeter
  - d. Tellometer
2. तलका मध्ये कुन statement ठिक छैन?
  - a. The contour are closed curves.
  - b. Contour line cross ridge line at right angle.
  - c. Contours are always parallel to the direction of the steepest slope.
  - d. Contour line never splits.
3. Forebay देखि turbine सम्म पानी पुर्याउने संरचना लाई के भनिन्छ?
  - a. Canal
  - b. Intake
  - c. Tailrace
  - d. Penstock
4. Most accurate method for setting out horizontal curve is.....  
Horizontal curve सेट गर्नको लागि सबैभन्दा सही विधि हो.....
  - a. Rankine method
  - b. Two theodolite method
  - c. Deflection angle method
  - d. Three theodolite method
5. A vertical (or nearly vertical) passage to the mine through portal is known as
  - a. Vein
  - b. Adit
  - c. Shaft
  - d. Cross-cut

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

1. What do you mean by relief representation? Write down the major characteristics of contour. (1+3)  
Relief representation भनेको के हो? Contour का प्रमुख विशेषताहरूको बारेमा विस्तृत रूपमा लेखुहोस्।
2. Write down the difference between Surface Surveying and Mine Surveying (Underground survey).  
Surface Surveying र Mine Surveying (Underground survey) को विचमा केके भिन्नताहरू छन्? (4)
3. Briefly write the different components of hydropower. (4)  
Hydropower का विभिन्न component हरु उल्लेख गरि छोटकरीमा वर्णन लेखुहोस।

### **Section C: Long Questions**

1. Horizontal and transition curve को व्याख्या गर्नुहोस। Horizontal curve को विभिन्न elements हरूको वर्णन गर्नुहोस। Transition curve design गर्न आधारभूत मापदण्डहरू list out गर्नुहोस। (2+3+3)
2. Route Surveying भनेको के हो? Route surveying को field procedure हरूको बारेमा विस्तृत रूपमा लेखुहोस। Irrigation भनेको के हो? सिंचाइ आयोजनाको सर्वेक्षण कसरी गर्नुहुन्छ? (1+3+1+3)

## Module XV: Project Work

JSTL 415

## Introduction

This module is a part of the Junior Survey Training Local Level/Province, aiming to provide exciting opportunities 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 to Friday)

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 [25 days]

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

The number of days allocated to the activities may differ according to 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. Socio-economic surveys and mapping.
12. 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
			Project Proposal	5
Overall Project Execution	Project Supervisor	40	Coordination with Supervisor	15
			Involvement in Teamwork	15
			Discipline and Sincerity	5