CURRICULUM

DIPLOMA
Geomatics Engineering

(Three Years Program- Semester System)

Council for Technical Education and Vocational Training
Curriculum Development and Equivalence Division
Sanothimi, Bhaktapur

2000
First Revision 2010
Second Revision 2018
Third Revision 2022

Table of Content

Introduction

The course was initiated as Diploma in Survey Engineering in 2000. With regard to various developments in this sector and also the field of application, the need of revision of this course has become prominent. Most of the international institutions and universities currently recognize this subject of study as Geomatics. Also, in view of the Kathmandu University initiative in this subject by starting the Bachelor of Engineering in Geomatics Engineering in Nepal has prompted for change in the course title as ***Diploma in Geomatics Engineering.*** The course is aimed at producing middle level technical human resource in the field of Geomatics.

This course is based on the job required to perform by a Geomatics technician at different related industries and organizations in Nepal and abroad. The Diploma in Geomatics Engineering program extends over three years. Each year is divided into two semesters. There are six semesters in total within the period of three years. It is designed to produce middle level competent Geomatics technicians equipped with knowledge and skills related to the land surveying, engineering/ construction surveying and Geographical Information System and applications. The study of Geomatics Engineering provides the ample opportunities of employment and self-employment in the field of surveying, mapping and GIS.

This curriculum includes the basic science subjects like physics, chemistry, and mathematics applicable in the field of Geomatics Engineering. It also includes language subjects like Nepali and English applicable for the communication in the field of Geomatics technology. The course structure and the subject-wise contents that follow reflect the details of this curriculum. In short, this curriculum guides its implementers to produce competent and highly employable middle level technical human resources in the field of Geomatics Engineering.

The contents of individual subjects prescribed in the curriculum are incorporated in the light of "must to know and must to do" principle.

Rational of Revision

Diploma in Automobile Engineering curriculum was last revised in 2013. This is the second revision after the implementation of its first revision. The rationales behind its revision are as follows:

- It crossed the 3 years period of its implementation after the 2nd revision and similarly the implementing agencies/college have requested to revise this curriculum based on their teaching experiences.
- The year-wise re-adjustments of the existing subjects are felt necessary.
- Some new subjects seem to be introduce as per the advancement in technology.
- It is needed to revisit its weightage in both theory and practical marks and contents to make it more practical oriented.
- The duration of 3rd year Industrial Attachment needs to be increased.
- The technologies invented in the field of automobile are necessary to incorporated.

Furthermore, technology of automobile occupation upgraded rapidly and new technology are introducing in the recent year. With the advent in technology trained technicians are needed throughout the world. To cope with the national and international demand, the knowledge and the skills should be updated to make the skills relevant and pertinent to the industry. Hence this curriculum is revised to equip the students as per the changing technology in changing environmental context.

Curriculum Title

Diploma in Geomatics Engineering (DGE)

Aim
The program aims to produce mid-level technical human resource equipped with knowledge and skills in allied field of study.

Objectives
This curriculum has following objectives:

- Prepare mid-level competent workforce in the related field.
- Prepare the technicians who are capable for undertaking works in spatial data acquisition using field survey methods, processing and visual presentation.
- Interpret image data acquired through Air survey, GIS and remote sensing.
- Serve local level land planning, land resource management and natural resource planning works.
- Help in meeting the demands of required Surveyors in the sector of land survey.
- Prepare technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values.
- Prepare technical workforce demonstrating positive attitude and respect for the profession and socio-cultural values.
- Create self-employment opportunities Create self-employment opportunities.

Group Size
The group size is a maximum of 48 students.

Entry Criteria

- SLC pass or SEE or equivalent with minimum C Grade (2.0 Grade Point) in Mathematics and Science and 1.6 Grade Point or equivalent in English and as per the provisions mentioned in the admission guidelines of Office of the Controller of Examinations, CTEVT.
- Pre-diploma in related subject or equivalent with minimum 68.33%.
- Pass entrance examination administered by CTEVT.

Duration
The total duration of this curricular program is three academic years [six semesters]. The program is based on semester system. Moreover, one semester consists of 19.5 academic weeks including evaluation period. Actual teaching learning Hrs. will be not less than 15 weeks in each semester.

Medium of Instruction
The medium of instruction will be in English and/or Nepali.

Pattern of Attendance
Minimum of 90% attendance in each subject is required to appear in the respective final examination.

Teacher (Instructor) and Student Ratio
The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:12 (at the institution level)
- 1:48 for theory and tutorial classes
- 1:12 for practical/demonstration
- 1:6 for bench work
- 75 % of the technical teachers must be full timer

Qualification of Instructional Staff

- The program coordinator should be a master's degree holder in the related subject area.
- The disciplinary subject related teachers should be a bachelor's degree holder in the related subject area.
- The demonstrators should be a bachelor's degree holder or diploma or equivalent with 3 years work experience in the related subject area.
- The foundational subject related teacher (refer to course codes SH and MG) should be master's degree holder in the related subject area.

Instructional Media and Materials

The following instructional media and materials are suggested for the effective instruction and demonstration.

- ***Printed media materials:*** Assignment sheets, case studies, handouts, performance checklists, textbooks etc.
- ***Non-project media materials:*** Displays, models, photographs, flipchart, poster, writing board etc.
- ***Projected media materials****:* Slides, Multimedia Projector.
- ***Audio-visual materials:*** Audiotapes, films, slide-tapes, videodisc, etc.
- ***Computer based instructional materials:*** Computer based training, interactive video etc.
- **Web-Based Instructional Materials** (Online learning)
- **Radio/Television/Telephone**
- **Education-focused social media platform**

Teaching Learning Methodologies

The methods of teachings for this curricular program will be a combination of several approaches such as; illustrated lecture, tutorial, group discussion, demonstration, simulation, guided practice, fieldwork, block study, industrial practice, report writing, term paper presentation, heuristic and other independent learning exercises.

- **Theory**: Lecture, Group discussion, assignment and group work etc.
- **Practical**: Demonstration, observation and self-practice.
- **Internship**: Industrial Practice.

Approach of Learning

There will be inductive, deductive and learner-centered approaches of learning.

Examination and Marking Scheme

a. Internal assessment

- There will be a transparent/fair evaluation system for each subject both in theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in course structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

b. Final examination

- Weightage of theory and practical marks are mentioned in course structure.
- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject, s/he will appear in the re-examination administered by CTEVT.

- Students will be allowed to appear in the final examination only after completing the internal assessment requirements.

c. Requirement for final practical examination

- Professional of relevant subject instructor must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 24 students.
- Practical examination should be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned or affiliating institute led by external evaluator nominated by CTEVT.
- Provision of re-examination will be as per CTEVT policy.

d. Final practicum evaluation will be based on

- Institutional practicum attendance - 10%
- Logbook/Practicum book maintenance - 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
- Viva voce :
    - Internal examiner - 20%
    - External examiner - 20%

e. Pass marks

- The students must secure minimum 40% marks in theory and 50% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

Provision of Back Paper

There will be the provision of back paper but a student must pass all the subjects of all semester within six years from the enrollment date; however, there should be provision of chance exam for final semester students as per CTEVT rules.

Disciplinary and Ethical Requirements

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms in institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

Grading System

The grading system will be as follows:

Grading	**Overall marks**
• Distinction:	80% and above
• First division:	65% to below 80%
• Second division:	50 % to below 65%
Pass division:	Pass marks to Below 50

Certificate Awarded

- Students who pass all the components of all subjects of all six semesters are considered to have successfully completed the course.

- Students who have successfully complete the curricular program will be awarded with a degree of **"Diploma in Geomatics Engineering".**

Career Path

The graduates will be eligible for the position equivalent to Non-gazetted 1st class/Level 5 (technical) as prescribed by the Public Service Commission of Nepal and other related agencies.

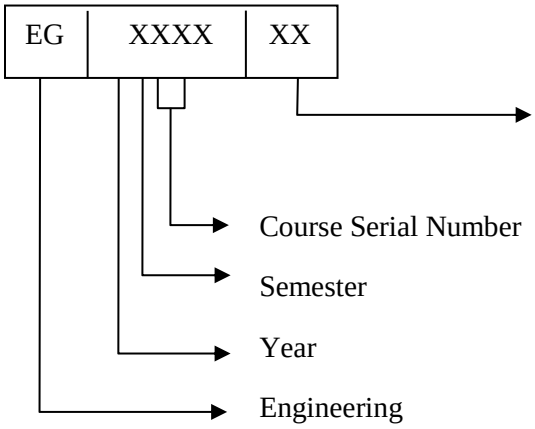
General Attitudes Required

A student should demonstrate following general attitudes for effective and active learning.

Acceptance, Affectionate, Ambitious, Aspiring, Candid, Caring, Change, Cheerful, Considerate, Cooperative, Courageous, Decisive, Determined, Devoted, Embraces, Endurance, Enthusiastic, Expansive, Faith, Flexible, Gloomy, Motivated, Perseverance, Thoughtful, Forgiving, Freedom, Friendly, Focused, Frugal, Generous, Goodwill, Grateful, Hardworking, Honest, Humble, Interested, Involved, Not jealous, Kind, Mature, Open minded, Tolerant, Optimistic, Positive, Practical, Punctual, Realistic, Reliable, Distant, Responsibility, Responsive, Responsible, Self-confident, Self-directed, Self-disciplined, Self-esteem, Self-giving, Self-reliant, Selfless, Sensitive, Serious, Sincere, Social independence, Sympathetic, Accepts others points of view, Thoughtful towards others, Trusting, Unpretentiousness, Unselfish, Willingness and Work-oriented.

Subjects Codes

Each subject is coded with a unique number preceded and followed by certain letters as mentioned in following chart:



Code of Offering Diploma Programmes:

1. AGE: Agricultural Engineering
2. AR: Architecture Engineering
3. AE: Automobile Engineering
4. BM: Biomedical Engineering
5. BM: Biomedical Equipment Engineering
6. CE: Civil Engineering
7. CT: Computer Engineering
8. EE: Electrical Engineering
9. EEX: Electrical & Electronics Engineering
10. EX: Electronics Engineering
11. GE: Geomatics Engineering
12. HE: Hydropower Engineering
13. IT: Information Technology
14. MG: Management
15. ME: Mechanical Engineering
16. MX: Mechatronics Engineering
17. RAE: Refrigeration & Air Conditioning Engineering
18. SH: Science and Humanities

CURRICULUM STRUCTURE

Diploma in Geomatics Engineering

YEAR: I **PART: I**

S.N.	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Time Hours	*Assmt Marks	Final Marks	Time Hours		
1	EG 1101 SH	Applied Nepali	4				4	4	20	80	3				100	*Continuous assessment
2	EG 1102 SH	Applied English	4				4	4	20	80	3				100	
3	EG 1103 SH	Engineering Mathematics I	4	2			6	4	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	4	2		2	8	5	20	60	3	10	10	2	100	
5	EG 1105 SH	Engineering Chemistry I	4	2		2	8	5	20	60	3	10	10	2	100	
6	EG 1101 AR	Engineering Drawing I	1		4		5	3	0	0		60	40	4	100	
7	EG 1101 CT	Computer Application	2		2		4	3	10	40	1.5	30	20	3	100	
TOTAL			**23**	**6**	**6**	**4**	**39**	**28**							**700**	

YEAR: I **PART : II**

S.N.	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Time Hours	*Assmt Marks	Final Marks	Time Hours		
1	EG 1201 SH	Engineering Mathematics II	4	2			6	4	20	80	3				100	*Continuous assessment
2	EG 1202 SH	Engineering Physics II	4	2		2	8	5	20	60	3	10	10	2	100	
3	EG 1203 SH	Engineering Chemistry II	4	2		2	8	5	20	60	3	10	10	2	100	
4	EG 1201 CE	Workshop Practice I	2		6		**8**	**5**				60	40	4	100	
5	EG 1201 AR	Engineering Drawing II	0		4		4	2				60	40	4	100	
6	EG 1202 CE	Applied Mechanics	3	2		2/2	6	4	20	60	3	20			100	
TOTAL			**17**	**8**	**10**	**5**	**40**	**25**							**600**	

Diploma in Geomatics Engineering

YEAR: II **PART: I**

SN	Course Code	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			Asst Marks	Final Marks	Exam Hours	Asst Marks	Final Marks	Exam Hours		
1	EG 2101 GE	Fundamentals of Surveying and Geomatics	6			2	8	7	20	80	3	25			125	*Continuous assessment
2	EG 2102 GE	Control Survey	6		9		15	11	20	80	3	150	100	6	350	
3	EG 2103 GE	Survey Instrument and Concepts	1		6		7	4				120	80	6	200	
4	EG 2104 GE	Survey Mathematics and Computation	4				4	4	20	80	3				100	
5	EG 2105 GE	GIS Basics	3		3		6	5	20	80	3	60	40	4	200	
TOTAL			**20**		**18**	**2**	**40**	**31**							**975**	

YEAR: II **PART: II**

SN	Course Code	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			Asst Marks	Final Marks	Exam Hours	Asst Marks	Final Marks	Exam Hours		
1	EG 2201 GE	Cartography	4		2		6	5	20	80	3	30	20	3	150	*Continuous assessment
2	EG 2202 GE	Cadastral Surveying	4		8		12	8	20	80	3	120	80	6	300	
3	EG 2203 GE	Geodesy and Astronomy	4			2	6	5	20	80	3	25			125	
4	EG 2204 GE	Land Development and CAD	1		3		4	3				60	40	4	100	
5	EG 2205 GE	Topographical Survey	4		8		12	8	20	80	3	120	80	6	300	
TOTAL			**17**		**21**	**2**	**40**	**29**							**975**	

Diploma in Geomatics Engineering

YEAR: III **PART: I**

SN	Course Code	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			Asst Marks	Final Marks	Exam Hours	Asst Marks	Final Marks	Exam Hours		
1	EG 3101 GE	Photogrammetry and Remote Sensing	6		6		12	9	20	80	3	100	50	4	250	*Continuous assessment
3	EG 3102 GE	Survey Camp			9		9	5				150	100	6	250	
4	EG 3103 GE	GIS Applications	4		6		10	7	20	80	3	100	50	4	250	
2	EG 3104 GE	Land Administration and Land Laws	4			2	6	5	20	80	3	25			125	
5	EG 3105 GE	Survey Project Management	3				3	3	20	80	3				100	
TOTAL			**17**		**21**	**2**	**40**	**29**							**975**	

YEAR: III **PART: II**

SN	Course Code	Subject	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Exam Hours	*Assmt Marks	Final Marks	Exam Hours		
1	EG 3201 GE	Engineering Survey	4		8		12	8	20	80	3	120	80	6	300	*Continuous assessment
2	EG 3201 MG	Entrepreneurship Development	3		2		5	4	20	60	3	10	10	2	100	
3	EG 3202 GE	Civil Construction and Quantity Estimation	4		2		6	5	20	80	3	30	20	3	150	
5	EG 3203 GE	Project Work			13		13	7				230	120	8	350	
4	EG 3204 GE	Fundamental of Social Science and Environment	4				4	4	20	80	3				100	
TOTAL			**15**		**25**		**40**	**28**							**975**	

L=Lecture, T=Tutorial, P=Practical

First Year (First and Second Semester)

[See Separate Curriculum]
First Year Engineering All
(Year I Part I and Year I Part II)

Second Year
Part I & II
(Third and Fourth Semesters)

Third Semester
Year II Part I

Subjects:

1	EG 2101 GE	Fundamental of Surveying and Geomatics
2	EG 2102 GE	Control Survey
3	EG 2103 GE	Survey Instruments & Concepts
4	EG 2104 GE	Survey Mathematics and Computation
5	EG 2105 GE	GIS Basics

Fundamental of Surveying and Geomatics

EG 2101 GE

Year: II **Total: 8 Hrs/week**
Part: I **Lecture: 6 Hrs/week**
Tutorial: Hrs/week
Practical: Hrs/week
Lab: 2 Hrs/week

Course Description:

This part of the course is intended to give an introduction to the History of surveying, basic Surveying concepts and principles, different Types of surveying, Linear and Angular Measurements, Map reading, and Measurement Errors.

Course Objectives:

Upon completion of this course, the students will be able to:

- Acquire the concept of basic surveying
- apply the principles of surveying in surveying projects
- get acquainted with Linear and Angular measurements and skilled in utilizing different techniques of linear and angular measurements
- carry out surveying works to the required level of accuracy
- acquire Map Reading skill

Course Contents:

Unit 1: Historical Background [4 Hrs]

1.1 Brief history of Surveying
1.2 Development of Surveying and Mapping Science
1.3 Surveying and Mapping in Nepal

Unit 2: Introduction to Surveying [15 Hrs]

2.1 Surveying and Mapping
2.2 Functions of a Surveyor
2.3 Need importance and scope of surveying
2.4 Objectives of surveying
2.5 General procedure of Survey and Methods used
2.6 Surveying Concepts:
- Distance and Direction;
- Shape and size of the earth;
- Curvature of earth
- Spheroid and Geoid;
- Earth figure elements- Axis of earth, Great Circle, Equator, Parallels and Meridians, Flattening;
- Coordinates and Coordinates systems;
- Latitude, Longitude, Height above MSL
- Projection
- Relief representation

2.7 End products of surveying

Unit 3: Principles and Classifications [6 Hrs]

3.1 Basic Principles of surveying
3.2 Primary division of surveying
3.3 Classification of Surveys: basis of classification and types of surveys

Unit 4: Measurement Units [6 Hrs]

4.1 Significance of measurement units
4.2 Standardization of Units
4.3 Linear, Angular, Area and Volume units
4.4 Conversion of units

Unit 5: Map Scale [10 Hrs]

5.1 Introduction
5.2 Expression of map scale and Types of scale
5.3 Construction of Graphical scale
5.4 Scale and graphical error
5.5 Shrunk scale and shrinkage factor,
5.6 Importance and uses of map scale
5.7 Effect of measurement from wrong measuring scale
5.8 Enlargement and reduction of scale

Unit 6: Linear Measurements [14 Hrs]

6.1 Introduction and Principles
6.2 Slope, Horizontal and Vertical distances
6.3 Direct and indirect linear measurement methods
6.4 Optical Distance Measurement
6.5 Electronic Distance Measurement
6.6 Linear Survey
6.7 Linear Survey: Field Procedure and Plotting
6.8 Obstacles in Linear survey and their solution
6.9 Errors in linear measurement

Unit 7: Angular Measurements [18 Hrs]

7.1 Principle of direction measurement
7.2 Angles and Bearings
7.3 Terminologies in compass surveying
7.4 Computation of included angles from bearing and vice versa
7.5 Magnetic variation and declination
7.4 Horizontal and Vertical angles
7.5 Local attraction and its solution
7.6 Compass Survey field procedure
7.7 Plotting and adjustment of compass traverse, plotting of detail
7.7 Theodolites Survey
7.6 Theodolite: Introduction, parts
7.7 Theodolite: basic axes and their relation,
7.8 Field procedures for angular measurement by Theodolite
7.7 Test and Adjustments of theodolite

Unit 8: Map Reading **[6 Hrs]**

8.1 Introduction: Maps, Plans and Profiles, Different types of maps
8.2 Maps and Photographs
8.3 Map Reading: Map components, Map information, Map setting, Position finding, Map interpretation
8.4 Map update: principle and methods

Unit 9: Measurement Errors **[11 Hrs]**

9.1 Introduction to Theory of error
9.2 Significant figure and rules
9.3 Sources of errors
9.4 Types of Errors
9.5 Precision and Accuracy
9.6 Laws of accidental error
9.7 Propagation of Errors
9.8 Tolerance and permissible error

Practical/Laboratory: ***[30 Hrs]***

Unit 1: Apply Tape and Compass for field work and plotting [10 Hrs]
Unit 2: Measurement of angles using Theodolites by various methods [10 Hrs]
Unit 3: Map reading and updating. [5 Hrs]
Unit 4: Coordinate computation exercise on Map [5 Hrs]

Reference Books

1. *Fundamental of Surveying by S.K Roy*
2. *Surveying volume 1 and 2 by S.K. Duggal*
3. *प्रारम्भिक नापी, महेश्वर भट्टराई (त्रि.वि.वि., पाठ्यक्रम विकास केन्द्र)*
4. *Principles and use of Surveying Instruments, J. Clendinning, J.G Oliver*
5. *Introduction to Surveying, by Anderson & Mikhail*
6. *A Text Book of Advance Surveying, R. Agor (4th Edition)*
7. *Surveying Handbook – Brinker and Minnick. CBS Publication of India*

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Historical Background	4	4
2	Introduction to Surveying	15	12
3	Principles and Classifications	6	6
4	Measurement Units	6	6
5	Map Scale	10	8
6	Linear Measurements	14	12
7	Angular Measurements	18	16
8	Map Reading	6	6
9	Measurement Errors	11	10
	Total	**90**	**80**

Note: There might be minor deviation on the above specified marks

Control Survey
EG 2102 GE

Total: 15 Hrs/week
Year: II **Lecture: 6 Hrs/week**
Part: I **Tutorial: Hrs/week**
Practical: 9 Hrs/week
Lab: Hrs/week

Course *Description:*
This subject deals with methods of establishing horizontal and vertical controls, Levelling, Traversing, Triangulation, Trilateration, Resection and Intersection, which are the fundamental techniques to establish and densification of control points in geodetic as well as engineering survey works.

Course Objectives:
After the completion of this course, students will be able to

1. Explain the concepts of the control surveying and apply in the field of Surveying and Geomatics.
2. Understand and use different types of levelling techniques for establishing vertical control points and height calculations.
3. Understand and use theodolite traversing techniques for establishing horizontal control points.
4. Acquire knowledge on Triangulation and Trilateration methods for establishing horizontal controls.
5. Distinguish among different technique of establishing control points.
6. Understand different sources of error and their adjustment in leveling, traversing, triangulation, trilateration, etc.

Course Contents:

Theory

Unit 1: Levelling **[30 Hrs]**

1.1 Introduction

1.1.1. Introduction & Principle of leveling
1.1.2. 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
1.1.3. Levelling instruments and accessories

1.2 Methods of Levelling

1.2.1 Direct Levelling (Spirit Levelling): Simple Levelling, Differential Levelling, Check Levelling, Fly Levelling, Reciprocal Levelling, Precise Levelling, Profile Levelling, Cross Sectioning
1.2.2 Indirect Levelling: Barometric, Hydrostatic, Trigonometric, Hypsometric, GPS

1.3 Field Procedure

1.3.1 Testing *levels* and Checking collimation error
1.3.2 Field Procedure: Reconnaissance, Monumentation, Observation, Recording, Computation (Rise and fall Method & Height of Instrument method).
1.3.3 Precautions to be taken in the field

1.4 Errors and adjustment in Levelling

1.4.1 Specification adopted by Survey Department of Nepal for establishment of various order Bench marks
1.4.2 Types of error
1.4.3 Sources of error
1.4.4 Permissible error in different order of levelling
1.4.5 Adjustment

Unit 2: Traverse **[30 Hrs]**

2.1 Introduction

2.1.1 Introduction to Traverse
2.1.2 Definition of terms
2.1.3 Principles of traversing
2.1.4 Classification of traverse and use
2.1.5 Standard and Specification

2.2 Method of traversing

2.2.1 Chain, Compass, Plane Table Traverse
2.2.2 Stadia Traverse and Theodolite Traverse
2.2.3 Traverse Route: Open and Closed

2.3 Field procedure

2.3.1 Field operation: Reconnaissance, Monumentation, and Signaling, Selection of Traverse Station, Types of Monumentation, Construction of monument, D-Cards, Traverse Chart/ Sketch,
2.3.2 Angle measurement: Horizontal angles, zenithal/vertical angle, bearing computation
2.3.3 Distance Measurements: Distance Measurement by Tapes, Substense Bar, Stadia Method, and EDM,
2.3.4 Field Precautions
2.3.5 Recording, Computation and Plotting

2.4 Error and Adjustment in Traverse

2.4.1 Types of error
2.4.2 Sources of error
2.4.3 Traverse Adjustment by Bowditch, Transit, Graphical, Axis rule

Unit 3 Triangulation **[18 Hrs]**

1. Introduction

3.1.1 Definition
3.1.2 Purpose
3.1.3 Principle
3.1.4 Scope
3.1.5 Types of Triangulation figures and stations
3.1.6 Classifications of Triangulation and their Specifications
3.1.7 Strength of Figure

3.2 Field Procedure

3.2.1 Reconnaissance and Monumentation
3.2.2 Signals
3.2.3 Observation and Recording
3.2.4 Field Precautions
3.2.5 Computation and adjustment

3.3 Error and Adjustment in Triangulation

3.3.1 Types of error
3.3.2 Sources of error
3.3.3 Error adjustment and Accuracy Assessment

Unit 4 Trilateration **[6 Hrs]**

4.1 Definition and Principles
4.2 Purpose and Scope
4.3 Field Operation (Reconnaissance, Monumentation, Signaling, Observation, Recording, Computation and Adjustment)
4.4 Field Precautions

Unit 5 Resection and Intersection **[6 Hrs]**

5.1 Definition and Principles
5.2 Purpose and scope
5.3 Field Operation (Reconnaissance, Monumentation, Signaling, Observation, Recording, Computation and Adjustment)
5.4 Field Precautions

Practical/Laboratory:
[135 Hrs]

LEVELLING PRACTICAL
[40 Hrs]

Field work

1: Collimation Checking
2: Reconnaissance and Benchmark Establishment
3: Levelling field work (Different methods)
4: Computation and plotting of profiles
5: Cross-section and Profile
6: Reciprocal Levelling

TRAVERSE SURVEY
[60 Hrs]

Field work

1: Instrument Checking
2: Reconnaissance and Monumentation
3: Theodolite/total station Traverse (open and closed loop)
4: Computation, adjustment and plotting

TRIANGULATION, TRILATERATION, RESECTION AND INTERSECTION [35 Hrs]
Field work

1: Reconnaissance and Monumentation
2: Observation, Recording
3: Computation and adjustment

Reference Books:

1. *Surveying (Volume 1 and 2) by Dr. K.R. Arora: Rajons Publication Pvt. Ltd.*
2. *Surveying (Volume 1 and 2) by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain: Laxmi Publication (P) Ltd.*
3. *The Text book of Surveying & Levelling, by R. Agor*
4. *Levelling Instruction Book, Survey Department of Nepal*
5. *Tringulation Instruction Book, Survey Department of Nepal*

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Levelling	30	30
2	Traverse	30	30
3	Triangulation	18	10
4	Trilateration	6	5
5	Resection and Intersection	6	5
	Total	**90**	**80**

Note: There might be minor deviation on the above specified marks

Survey Instruments and Concepts

EG 2103 GE

Year: II **Total: 7 Hrs/week**
Part: I **Lecture: 1 Hrs/week**
Tutorial: Hrs/week
Practical: 6 Hrs/week
Lab: Hrs/week

Course Description:
This part of the course deals with Ranging equipment, Surface Distance measuring instruments, Direction measurements by compass and Graphical surveying instruments

Course Objectives:
After the completion of this course, students will be able to

1. explain the use of different instruments used for aligning, making linear and angular measurements
2. use those instruments for making basic linear measurements
3. explain the elements of Direction measurements and Bearings.

Course Guidelines
The students shall be required to carry out the following tasks for each instrument / equipment listed in the course content:

1. Practice with the instrument in the field.
2. Prepare drawing/s of the instrument/equipment in the form of neat labelled diagram/s
3. Prepare practical sheets document containing
   Relevant drawing/s, Description, Components, Types, Accessories, Principle, Adjustments, Functions and Use, Care, Operational/Field procedure and observation record.

Course Contents:

Theory **[15 Hrs]**

1. Signals and Ranging Rod **[1 hr]**

2. Survey Instruments: Construction and uses **[14 Hrs]**

- 2.1 Chain
- 2.2 Tape
- 2.3 Line Ranger and Optical Square
- 2.4 Computing Scale
- 2.5 Compass
- 2.6 Plane Table and its accessories
- 2.7 Telescopic Alidade
- 2.8 Theodolite
- 2.9 Level
- 2.10 Total Station
- 2.11 Handheld GPS
- 2.12 Differential GPS

Practical/Laboratory: ***[90 Hrs]***

1. Fix and set up ranging rod verticality using eye judgment and plumb bob (4 Hrs)
2. Range a line by direct ranging using line ranger and eye judgment (4 Hrs)
3. Set up Reciprocal ranging (4 Hrs)
4. Measure distance by using tape /chain (6 Hrs)
5. Measure horizontal distance on slope using tape by stepping method (6 Hrs)
6. Determine horizontal distance from slope distance and vertical angle with Abney level (4 Hrs)
7. Measure bearing of line with compass (6 Hrs)
8. Perform Temporary Adjustment of plane table (8 Hrs)
9. Measure horizontal and vertical angle with theodolite (14 Hrs)
10. Level instrument and its temporary adjustment (4 Hrs)
11. Determine height difference between two points by leveling (10 Hrs)
12. Total station for basic measurements (12 Hrs)
13. Handheld GPS/Mobile GPS Application (6 Hrs)
14. Demonstration of Differential GNSS Instruments (2 Hrs)

Reference Books

1. *Surveying Vol. I & II Dr. B.C Punmia, Laxmi Publication Pvt.Ltd*
2. *Surveying Vol. I & II S.K. Duggal, Tata McGraw- Hill Publishing Company Ltd. New Delhi*
3. *Principles and use of Surveying Instruments, J. Clendinning, J.G Oliver*

Survey Mathematics and Computation

EG 2104 GE

Total: 4 Hrs/week
Year: II **Lecture: 4 Hrs/week**
Part: I **Tutorial: Hrs/week**
Practical: Hrs/week
Lab: Hrs/week

Course Description:

This course deals with computation and adjustment of field survey data related to control surveying and applied mathematical foundation used in surveying and mapping. (Partial differentiation, Numerical integration, Spherical trigonometry and basics of analytical geometry)

Course objectives

On completion of this course, students will be able to

1. Use Sine law and Cosine law in the field of surveying.
2. Perform partial differentiation and numerical integration.
3. Understand basics of analytical geometry and its application in field of surveying
4. Understand the methods of computation used for surveying controls.
5. Apply the techniques of adjustment commonly used in engineering surveying.

Course contents

Section A: Mathematical Foundation for Surveying and Mapping

Unit-1 Partial Differentiation **[8 Hrs]**

1.1. Introduction
  1.1.1. Definition
  1.1.2. Symbol
1.2. Formula of Partial Differentiation
1.3. Rules (Product Rule, Quotient Rule, Power Rule, Chain Rule)

Unit-2 Numerical Integration **[8 Hrs]**

2.1. Introduction
2.2. Definite Integral and Area Computation
2.3. Trapezoidal Rule
2.4. Simpson's rules
2.5. Estimation of errors

Unit-3 Statistics **[8 Hrs]**

3.1. Measure of central tendency (Mean, Median, Mode)
3.2. Measure of Dispersion (Standard Deviation and Coefficient of Variation)
3.3. Normal distribution

Unit-4 Spherical Trigonometry **[8 Hrs]**

4.1. Spherical triangle
4.2. Properties of spherical triangle
4.3. Spherical excess
4.4. Solution of spherical triangle; Sine and Cosine Rule
4.5. Napier's Rule

Section B: Survey Computation and Adjustment

Unit-5 Theory of Measurement Errors and Adjustments **[13 Hrs]**

5.1. Introduction
  5.1.1. Basic concept of errors
  5.1.2. Classification of errors
  5.1.3. Error propagation
5.2. Error Analysis
  5.2.1. Arithmetic mean
  5.2.2. Standard error
  5.2.3. Law of normal distribution of random error
5.3. Error adjustment
  5.3.1. Concept of least square adjustment

Unit-6 Survey Computation **[15 Hrs]**

6.1. Traverse Computation
  6.1.1. Bearing computation
  6.1.2. Computation of consecutive coordinates
  6.1.3. Computation of coordinates in closed loop and link traverse
  6.1.4. Linear error and angular error in Traverse
  6.1.5. Accuracy assessment
6.2. Triangulation and Trilateration Computation
  6.2.1. Solution of triangle using Sine and Cosine Law
  6.2.2. Error adjustment in Braced quadrilateral
6.3. Intersection and Resection computation
  6.3.1. Intersection computation
  6.3.2. Resection computation

Reference books

1. Higher Secondary Level Mathematics Vol II by Bajrachara B.C. RM Shrestha, Sukunda Pustak Bhawan
2. Element of mathematics Part II, D.B Adhikari, Himalaya Books Stall
3. Surveying Volume I and II, Dr. Punmia, Laxmi Publications (P). Ltd, New Delhi, India
4. Surveying Vol. I and II, S.K Duggal, Tata McGraw-Hill Publishing Company Ltd. New Delhi, India
5. Fundamental of Surveying, S.K Roy, Prentice –Hall of India, New Delhi

6. Practical Field Surveying & Computations, A.L ALLAN,J.R. HOLLEY
7. Theory of errors & Adjustment, M.G Arur

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Partial Differentiation	8	10
2	Numerical Integration	8	10
3	Statistics	8	10
4	Spherical Trigonometry	8	10
5	Theory of Measurement Errors and Adjustments	13	20
6	Survey Computation	15	20
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

GIS Basics
EG 2105 GE

Total: 6 Hrs/week

Year: II **Lecture: 3 Hrs/week**

Part: I **Tutorial: Hrs/week**

Practical: Hrs/week

Lab: 3 Hrs/week

Course Description:

The primary objective of this course is to impart fundamental concepts of Database Management system and Geographical Information System. This course aims to introduce various applications of GIS and related technologies in Survey Engineering field. This course focus on practical approach in handling spatial and attribute data for spatial problem solving.

Course Objectives:

After the completion of this course, students will be able to:

1. Understand concept of database management system and design simple databases.
2. Understand the basic concept of GIS and its applications in various fields
3. Operate GIS software for handling spatial and attribute data.
4. Prepare data for GIS operation
5. Perform basic queries in databases
6. Prepare result maps

Course Contents:

Unit 1: Database Management System **[10 Hrs]**

1.1 Introduction to Database Management System

- Data, information & Knowledge
- Databases and databases management system (DBMS)
- Component of database management system
- Define: tables, form, Query, relationship, reports
- Various DBMS softwares

1.2 Logical Data concept and Relationships

- Logical data concept :entities, data value, field/ attribute, records and relationships
- Types of relationships (one to one, one to many, many to many)
- Tables and field data types
- Primary key, candidate key and foreign key

1.3 Data models and DBMS applications

- Relational Data Model & types
- Importance and use of Database Management System (DBMS)
- Benefits of DBMS compared to file system

Unit: 2 GIS and Spatial Data Models **[13 Hrs]**

2.1. Introduction to GIS

- Geographic phenomena
- Definition of GIS,
- Component of GIS (Hardware, Software, People, Data, Method)
- Stages of GIS workflow (Data Preparation/ Acquisition, Data storage & Management, Data Analysis, and Visualization)
- Spatial and non-spatial data, Relation, tuple & attribute.
- Application area of GIS
- Various types of GIS users

2.2. Spatial Data Models

- Vector Data Model
  - ☞ Define Vector Data Models
  - ☞ Define Scale
  - ☞ Various vector file formats
  - ☞ Introduce Geometry types of vector data (Point, Line & Polygon)
  - ☞ Various applications of vector data model
  - ☞ Advantages and disadvantages of vector data model
- Raster data Model
  - ☞ Define Raster Data Models
  - ☞ Resolution of raster dataset
  - ☞ Make familiar with file format of Raster data
  - ☞ Introduce the raster data structure (Grid Cells): Regular and Irregular Tessellation
  - ☞ Applications of vector data models
  - ☞ Advantages and disadvantages of the use of Vector data model
- TIN Data Models
  - ☞ Define TIN data model
  - ☞ Data Structure of TIN model
  - ☞ Applications of TIN data model

Unit: 3 Spatial Data Acquisition and Preparation [11 Hrs]

3.1 Sources of Spatial Data

a. Primary Data Sources

- Field based technique: Plane Table, Total Station, GPS, DGPS
- Air-based Technique: Photogrammetry, UAV, LiDAR
- Space based Technique: Remote Sensing

b. Secondary Data Sources

- Existing paper maps (Base and thematic maps)
- Data available in Web (Clearinghouse and online sources)

3.2 Data Entry and Data Preparation

a. Map scanning process & Scanning Resolution
b. Geo-referencing and map projection (Coordinate system)
c. Process of map Digitization (manual, semi-automatic and automatic)
d. Process of inserting attribute data in digitized data
e. Create attribute data of digitized features
f. Checking and repairing Geometry of spatial data
g. Data Topology GIS Operations and Map Composition and topological rules

Unit: 4 GIS Operations and Map Composition [11 Hrs]

4.1 Querying Databases

- Define querying database
- Understand structure of query language (SQL)
- Define and explain The terms: attribute query, Spatial query (location based query)
- Differentiate Spatial and database query

4.2 Overlay Operation and Geo-processing

- Define and explain following overlay operation with examples
  - Clipping
  - Intersection

- Union
- Merge
- Dissolve

4.3 Data Visualization

- Output map preparation
- Map symbolization
- Map design and map elements

Practical/Laboratory: ***[45 Hrs]***

Unit: 1 Database Management System **[9 Hrs]**

1.1 Working with Existing databases

- Explore Existing Databases
- Understand the information stored in existing database
- Understand relationships
- Querying existing database (simple query)
- Querying database using logical operators
- Generate reports

1.2 Database Design

- Draw database schema
- Design database tables (design view, Datasheet views),
- Establish relationships among database tables
- Querying database

Unit 2: Exploring spatial data and data preparation **[9 Hrs]**

2.1 Exploring Spatial Data using GIS software

- Familiarize with GIS software using existing data
- View Layer Properties
- Off/On/ remove data layers
- View and understand attribute table
- Change Symbology & Color
- Label features
- Navigate digital maps (Zoom In/Zoom out, Fixed Zoom in/ Fixed Zoom out, Panning)
- Selection and Export of spatial data
- Define data layers

2.2 Geo-referencing & Map Projection

- Geo-reference scanned maps/ images
- Define projection system (Local and Global system)
- Transform one projection to other (coordinate transformation)

Unit: 3 Creating data layers and table operation **[9 Hrs]**

3.1 Creating Layer (Features)

- Explore data in software
- Create Vector layers (point, line polygon)
- Metadata view and preparation

3.2 Table Operations

- Attribute table: add remove data
- Relate and join tables
- Add/ remove fields

- Use of field calculator /Field Calculation
- Summarize Attribute table
- Calculate Geometry (Area, Length, and position)
- Export tables

3.3 Digitization

- Digitize raster map/ Satellite image
- Check and edit topology
- Add Attribute information in digitized data

Unit: 4 Query and Overlay Operation [9 Hrs]

4.1 Querying Databases

- Perform Attribute query
- Perform location query (spatial query)

4.2 Overlay Operation

- Perform following Overlay operation
  - Clip
  - Intersection
  - Union
  - Merge
  - Buffer / Multi ring buffer

Unit: 5 Visualization [9 Hrs]

- Map visualization process
- Layout preparation (legends, heading, North arrow, scale)
- Export maps indifferent formats (Pdf, Jpeg)
- Print maps (page setting)

References:

1. An Introduction to Geographical Information System - Ian Heywood, Sarah Cornelius, Steve Carver, Pearson Education Publication: Pearson Education (Fourth Edition) 2005
2. Principles of Geographic Information System - Rolf A. de By (ed.) (ITC Education Text Book Series; 1)
3. GIS for Beginners - B. Shrestha, B. Bajracharya, Sushil Pradhan (ICIMOD)
4. Principles of Geographical Information System, Peter. A. Burrough and Rachael A. McDonnnell (4^{th} Edition)

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Database Management System	10	16
2	GIS and Spatial Data Models	13	24
3	Spatial Data Acquisition and Preparation	11	20
4	GIS Operations and Map Composition	11	20
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks

Forth Semester
Year II Part II

Subjects:

1	EG 2201 GE	Cartography
2	EG 2202 GE	Cadastral Surveying
3	EG 2203 GE	Geodesy and Astronomy
4	EG 2204 GE	Land Development and CAD
5	EG 2205 GE	Topographical Survey

Cartography
EG 2201 GE

Total: 6 Hrs/week
Year: II **Lecture: 4 Hrs/week**
Part: II **Tutorial: Hrs/week**
Practical: 2 Hrs/week
Practical: Hrs/week

Course Description:
This subject consists of fundamental principles and techniques of map making and map reproduction.

Course Objectives:
After the completion of this course, students will be able to;

1. Understand the concept of Cartography
2. Apply the conventional and digital Cartographic Process in map making
3. Explain different aspects of Cartography
4. Understand Map Sheet Numbering System of Nepal
5. Apply the techniques of Map Reproduction and Printing
6. Understand the concept of Digital Cartography

Course Contents:

Unit 1 Introduction **[4 Hrs]**

1.1. Definition
1.2. History of Cartography
1.3. Scope and uses of Cartography

Unit 2 Map **[6 Hrs]**

2.1. Definition
2.2. Types of Map and Classification of Maps
2.3. Map Scale
2.4. Introduction to Drawing and Scribing
2.5 Semiology
2.6 Map Design and Layout
2.7 Typonomy and Typography
2.8 Enlargement and Reduction of Map
2.9 Uses of Map

Unit 3. Branches of Cartography **[6 Hrs]**

3.1. Map Compilation
- Steps of Map Compilation
- Method of Compilation for Base Map, Derived map and Special Purpose (Thematic) Map

Unit 4. Graphic Variables **[3 Hrs]**

4.1. Definition
4.2. Importance of Graphic Variables
4.3. Concept of Visual Perception
4.4. Types of Graphic Variables

Unit 5. Map Projection [8 Hrs]

5.1. Introduction
5.2. Classification of Map Projection
5.3. Map distortion and Scale Factor
5.4 Choice of Map Projection
5.5. Universal Transverse Mercator (UTM) Projection
5.6. Modified Universal Transverse Mercator (MUTM) Projection & Grid System used in Nepal

Unit 6. Map Sheet Numbering [8 Hrs]

6.1. Introduction
6.2. International Small Scale Sheet Numbering system
6.3 Map Sheet Numbering for Topographical Base Maps in Nepal
6.4. Map Sheet Numbering for Cadastral Maps in Nepal

Unit 7. Generalization [4 Hrs]

7.1. Definition
7.2. Different Aspects of Generalization
7.3. Some Directives for Generalization
7.4 Exaggeration
7.5. Displacement
7.6. Different Methods of Generalization

Unit 8. Relief Representation [4 Hrs]

8.1. Definition of Relief
8.2. Importance of Relief Representation in Maps
8.3. Methods of Relief Representation
- Spot Height
- Hachuring
- Contouring
- Hill Shading
- Layer Tinting
- 3D Models

8.4. Rock Drawing

Unit 9. Colour [3 Hrs]

9.1. Introduction
9.2. Nature of light
9.3. Additive and Subtractive Colours
9.4. Colour Triangle
9.5. Choice of Colours (Colour Charts)

Unit 10. Digital Cartography [7 Hrs]

10.1. Introduction
10.2. Raster and Vector Data Model
10.3 Steps of Digital Method of Map Making
10.4. Difference between Conventional and Digital Cartography
10.5. Digital Landscape Model (DLM) and Digital Cartographic Model (DCM)

Unit 11. Map Reproduction **[7 Hrs]**

11.1 Introduction
11.2 Terms used in map reproduction: Positive, Negative, Dia-positive, Tone, Screen and Film
11.3 Contact Photography
11.4 Camera Photography
11.5 Diazo Reproduction
11.6 Open Window Mask
11.7 Plate Making Process (Positive and Negative System and Digital Plate Making System)
11.8 Quality Control (Colour Proof and Registration)
11.9 Map Printing: Flat Bed Printing, Rotary Offset Printing and Digital Printing

Practical/Laboratory: ***[30 Hrs]***

1. Prepare Layout in A4 size Paper for Cadastral Map Sheet [4 Hrs]
2. Prepare Layout in A4 size Paper for Topographic Map Sheet [4 Hrs]
3. Identify and List the different Visual Variables in the Topographic Map of Nepal [2 Hrs]
4. Show the Sheet Numbering System of Topographic Map of Nepal [4 Hrs]
5. Show the Sheet Numbering System of Cadastral Map of Nepal [8 Hrs]
6. Generalize the boundary of given District/ Municipality Polygon [4 Hrs]
7. Observation for Colour Separation Sheets (2' 30" X 2' 30" Topographic Map; Four Colours) for Plate Making [2 Hrs]
8. Map Reproduction and Printing Process: Observation of Map Printing Press [2 Hrs]

References:

1. *Cartography and Geographic information system, Suresh Man Shrestha, Nepal*
2. *Elements of Cartography, H. Robinson*
3. *Cartography for Mapping, Rabin Kaji Sharma*
4. *Cartography Visualization of Geospatial Data, Menno Kraak & Ferhan Ormeling*
5. *Basic Cartography Vol I, International Cartographic Association*
6. *Triangulation Instruction Book, Survey Department*
7. *Cartography, ITC Publication, 1970, L. Van Zuylan and J. W. Shearer*

Marks Specification for final evaluation

Unit	Content	Course Hours	Marks
1	Introduction	4	6
2	Map	6	8
3	Branches of Cartography	6	8
4	Graphic Variables	3	4
5	Map Projection	8	10
6	Map Sheet Numbering	8	10
7	Generalization	4	6
8	Relief Representation	4	6
9	Color	3	4
10	Digital Cartography	7	10
11	Map Reproduction	7	8
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

Cadastral Surveying

EG 2202 GE

Total: 12 Hrs/week

Year: II **Lecture: 4 Hrs/week**

Part: II **Tutorial: Hrs/week**

Practical: 8 Hrs/week

Lab: Hrs/week

Course Description:

The course is designed for the students pursuing diploma in Geomatics Engineering. The focus of the course is to fulfill the requirement of survey technicians involving in the sector of cadastral surveying and mapping in Nepal.

Course Objectives:

After the completion of this course, students will be able to:

1. Explain and apply the Concept of cadastral surveying and mapping
2. Conceptualize the Importance of cadastral surveying
3. Apply Step by step approach to be followed for cadastral surveying
4. Explain and apply the Advancement in the sector of cadastral surveying

Course contents: ***[60 Hrs]***

Unit 1: Introduction **[10 Hrs]**

1.1 Cadastre
1.2 Types of Cadastre: Fiscal, Legal and Multipurpose Cadastre,
1.3 Graphical and digital cadastre,
1.4 Cadastral Components in Nepalese context (map, terij, field book, plot register, title documents, database)
1.5 Importance of Cadastre,
1.6 Cadastral Surveying,
1.7 Basic principle of cadastral surveying
1.8 Historical development of Cadastral Surveying in Nepal,
1.9 Definition of parcel,
1.10 Parcel numbering system,
1.11 Parcel boundary
1.12 Types of parcel boundary: General and fixed boundary

Unit 2: Cadastral Surveying Techniques **[5 Hrs]**

2.1 Annotation on existing map/image,
2.2 Cadastral surveying by using chain/tape, Cadastral surveying by using compass,
2.3 Cadastral surveying by using Plane table alidade,
2.4 Cadastral surveying by using Total station,
2.5 Cadastral surveying by using Aerial photograph/ Orthophoto/Satellite imagery/ UAV
2.6 Cadastral surveying by using GNSS Technology
2.7 Hybrid method,
2.8 Comparison of different methods

Unit 3: Cadastral Maps **[5 Hrs]**

3.1 Map Projection and sheet numbering of cadastral maps,
3.2 Establishments of geodetic control points for cadastral surveying and mapping,
3.3 Different types and scale of cadastral maps (index map, file map, parcel map),
3.4 Plotting Error and tolerance in area computation
3.5 Various kinds of Parcel numbering practices in Nepal
3.6 Specifications and Standards of cadastral maps.

Unit 4: Graphical Cadastre **[5 Hrs]**

4.1 Plane Table and Accessories,
4.2 Plane table setting,
4.3 Surveying and mapping,
4.4 Inking and tracing of cadastral maps,
4.5 Area Computation and checking,
4.6 Sources of errors and its correction in the field

Unit 5: Digital Cadastre **[5 Hrs]**

5.1 Equipment (Total Station), tools and accessories for data acquisition,
5.2 Preparation for data acquisition,
5.3 Parcel boundary survey and measurements,
5.4 Sketch preparation,
5.5 Data download,
5.6 Map making
5.7 Database preparation,
5.8 Field book and other documents (report) preparation,
5.9 Use of satellite and aerial images for cadastre development

Unit 6: Cadastral Surveying and Registration Procedure in Nepal **[10 Hrs]**

6.1 Notification,
6.2 Densification of Control Points,
6.3 Adjudication (Sporadic and Systematic),
6.4 Field book preparation,
6.5 Land Classification,
6.6 Area Computation,
6.7 Registration of Ownership,
6.8 Registration system adopted in Nepal
6.9 Ownership certificate and other document Preparation,
6.10 Handing Over of cadastral data

Unit 7: Updating and Archiving Cadastral Documents **[5 Hrs]**

7.1 Parcel subdivision,
7.2 Parcel history maintenance,
7.3 Plot register maintenance,
7.4 Database updating and maintenance,
7.5 Procedures at Survey offices

Unit 8: Cadastral organizations and their roles in Nepal **[5 Hrs]**

8.1 Concerned Ministry,

8.2 Survey Department,
8.3 Department of Land Reform and Management
8.4 District Survey Offices,
8.5 District Land Reform and Revenue Offices,
8.6 Judicial and Quasi-judicial bodies
8.7 Local Governments
8.8 Role of 3 levels of governments in cadastre development

Unit 9: Modern Cadastre and Case Studies of Some Countries [10 Hrs]

9.1 3D Cadastre: introduction and current legal provisions in Nepal
9.2 General Introduction to Modern Cadastre
9.3 Modern Cadastre around the world (Dutch Cadastre, LINZ, Singapore Cadastre)
9.4 FIG Cadastral vision 2014 and its achievement in Nepal
9.5 Future cadastre envisioned by cadastral vision 2034: Survey Accurate Cadastre, Object Oriented Cadastre, Global Cadastre, 4D/5D cadastre…

Practical/Laboratory: ***[120 Hrs]***

1. Field Work: **[80 Hrs]**

- Cadastral data acquisition on the scale of 1:500 using Plane Table (Step by step approach to be followed by Nepalese cadastral surveying)
- Digital cadastral survey of selected land parcels using Total station
- Parcel Identification and Boundary demarcation or layout

2. Class Room Exercise **[40 Hrs]**

- Inking and Tracing Exercise of Graphical Cadastral Map
- Area Computation in Analogue Environment
- Using tiles and computing scale
- Using triangle formula
- Using coordinates
- Documentation of cadastral activities: field book, notice, land registration records, land registration certificates,
- Parcel subdivision
- Organization of Field Data
- Data Download
- Plotting and mapping
- Creating database
- Generating forms and reports
- Performing parcel split, merge and other functions of survey office

References:

1. Cadastral Survey within the commonwealth P.F Dale, MA ARICS (1976)
2. Land Registration and Cadastral System, Gerhard Hursson
2. Surveying Vol I and II,S.K DUGGAL
3. भूमिलगत रजिष्ट्रेशन र कित्तानापी, बेखालाल श्रेष्ठ
5. जनउपयोगिताको लागी कित्तानापी : बुद्धि नारायण श्रेष्ठ
6. Plane Surveying, David Clark
७। जग्गा नाप जाँच तथा नक्सा श्रेस्ता अद्यावधिकसम्बन्धी निर्देशिका ,२०७३
8. Standard Operation Procedure for Digital Survey by Survey Department of Nepal
९। गाउँब्लक क्षेत्रको नापजाँचसम्बन्धी निर्देशिका ,२०७७
१०। द्वन्दबाट भूमिलगत क्षति भएका क्षेत्रको नापजाँच गरी श्रेस्ता पुनःस्थापना गर्नेसम्बन्धी निर्देशिका ,२०७१
११। डिजिटल प्रविधिबाट सेवा प्रवाह गर्नेसम्बन्धी निर्देशिका, २०७८

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Introduction	10	14
2	Introduction	5	6
3	Cadastral Maps	5	6
4	Graphical Cadastre	5	6
5	Digital Cadastre	5	8
6	Cadastral Surveying and Registration Procedure in Nepal	10	14
7	Updating and Archiving Cadastral Documents	5	6
8	Cadastral organizations and their roles in Nepal	5	6
9	Modern Cadastre and Case Studies of Some Countries	10	14
	Total	**60**	**80**

Note: There might be minor deviation on above specified marks

Geodesy and Astronomy

EG 2203 GE

Total: 6 Hrs/week
Year: II **Lecture: 4 Hrs/week**
Part: II **Tutorial: Hrs/week**
Practical: Hrs/week
Lab: 2 Hrs/week

Course Description:
The course content is focused on elementary knowledge on Geodesy, Astronomy and GPS. It includes the application of GPS in surveying and mapping.

Course Objectives:
After the completion of this course, students will be able to

1. understand the basic concept of Geodesy, Astronomy and GPS
2. determine the position and direction using solar and polar observation
3. use handheld GPS for data capture

Course Contents:

A. Elementary Geodesy **[14 Hrs]**

Unit 1. Figure of the Earth **[5 Hrs]**
- 1.1 Shape and Size of the Earth
- 1.2 Spheroid and Geoid
- 1.3 Global and Local spheroid and its parameters

Unit 2. Coordinate Systems **[6 Hrs]**
- 2.1 Geographical Coordinates
- 2.2 Rectangular Coordinates
- 2.3 Concept of coordinate conversion: Geographical to rectangular and vice versa

Unit 3. Gravimetry **[3 Hrs]**
- 3.1. Introduction Gravity
- 3.2. Terms used in gravimetry
- 3.3. Application area

B. Satellite Geodesy **[28 Hrs]**

Unit 4: Introduction **[3 Hrs]**
Satellite Geodesy definition, Scope and Application

Unit 5. Satellite Orbits **[4 Hrs]**
Different types of satellite, Orbits and Types of orbit, Keplers law, Orbital elements

Unit 6: Basics of GNSS **[4 Hrs]**
Introduction to GNSS, History and Development of GNSS, Different components of GNSS, Types of navigation system: GPS, GLONASS, Galileo etc.

Unit 7: GPS Signal Structure **[2 Hrs]**
GPS signal structures, Pseudo range, Code (P, C/A), Carrier frequencies and data message

Unit 8: Positioning Technique **[7 Hrs]**

Various techniques of positioning; Single point positioning, relative/differential positioning, Code phase measurements, Carrier phase measurement, Static and Kinematic measurement, RTK methods and Post processing

Unit 9: Field Survey Procedures **[4 Hrs]**

Planning, Reccee, Monumentation, Observation and errors in GPS

Unit 10: GPS Data Transformation **[4 Hrs]**

Basic concepts on Geoid, ellipsoid, local datum, global datum, Introduction to Datum transformation, Transformation parameters

C. Astronomy **[18 Hrs]**

Unit 11. Introduction **[4 Hrs]**

Definition of Astronomy, Solar System, Kepler's Laws of Planetary motion

Unit 12. Definitions of the Terms **[6 Hrs]**

Terrestrial sphere, celestial and terrestrial equator, great and small circle, Zenith, nadir, horizon and it's types, celestial meridian, vertical circle, prime vertical, observer's meridian, cardinal points, ecliptic, vernal equinox, autumnal equinox, summer solstice, winter solstice, altitude and co-altitude, declination and co-declination, latitude and co-latitude, hour angle, right ascension, hour angle, azimuth, etc

Unit 13: Application of Spherical Trigonometry in Astronomy **[8 Hrs]**

Spherical triangle, Astronomical triangle and its solution: Sine Law, Cosine Law, right angled spherical triangle and Napier's Rule, Spherical Excess.

Practical/Laboratory:: ***[30 Hrs]***

1. Global Positioning System **[24 Hrs]**

1.1. Operate Handheld GPS
1.2. Capture positional data
1.3. Navigation to point
1.4. Tracking routes
1.5. Plotting GPS data
1.6. Differential GPS (Static and differential positioning -Demo)
1.7. Post processing of DGPS- Demo

2. Solar/Polar observation for Bearing Computation **[6 Hrs]**

Reference Books

2. *Surveying Volume III, Dr. B.C Punmia, A.K Jain, Laxmi Publication Pvt. Ltd. India*
3. *Surveying Vol. I and II, S.K Duggal, Tata McGraw-Hill Publishing Company Ltd. New Delhi, India*
4. *Engineering Surveying, W. Schofield, Butter Worth, Heinemann*
5. *Triangulation Instruction Book, Geodetic Survey Branch, Nepal*
6. *Fundamental of Surveying, S.K Roy, Prentice –Hall of India, New Delhi*
7. *GPS Theory & Practice, B. Hofmann, J. Collion et al.*

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Figure of the Earth	5	6
2	Coordinate Systems	6	6
3	Gravimetry	3	4
4	Introduction (Satellite Geodesy)	3	6
5	Satellite Orbits	4	4
6	Basics of GNSS	4	6
7	GPS Signal Structure	2	2
8	Positioning Technique	7	10
9	Field Survey Procedures	4	6
10	GPS Data Transformation	4	4
11	Introduction (Astronomy)	4	4
12	Definitions of the Terms	6	10
13	Application of Spherical Trigonometry in Astronomy	8	12
	Total	**60**	**80**

Note: There might be minor deviation on above specified marks

Land Development and CAD
EG 2204 GE

Year. II **Total: 4 Hrs/week**
Part: II **Lecture: 1 Hrs/week**
Tutorial: Hrs/week
Practical: 3 Hrs/week
Lab: Hrs/week

Course Description:
This course provides students with a broad introduction into 2 dimensional Computer Aided Drawing and Drafting (CADD) with a focus on geomatics engineering drawing. This course is an intensive introduction to the use of a Computer Aided Design and Drafting (CADD) system for the development of construction/survey drawing, mapping and documentation.

Course objectives:
After the completion of this course student will be able to:
1. use popular CAD software program and some of its extensions to model construction projects
2. create base map from point data, create basic Civil and Architectural drawings
3. Calculate the quantity regarding the earthworks (cutting and filling) from survey data using the software

Course contents:

Unit 1: Starting a New Drawing/ Opening an existing drawing [3 Hrs]
- 1.1. Setting up a drawing starting from scratch, using a Wizard, using and creating a template file, drafting aids.
- 1.2. Opening an existing drawing
- 1.3. Screen layout, pull down menus, screen icons, command line and dialogue boxes, toggles keys, Screen organization.
- 1.4. Setting preferences (Setting Units and Scale, managing drawing area by using MV-setup and Limits.)

Unit 2: Drawing Commands [15 Hrs]
- 2.1. Co-ordinate input methods (directive, absolute, relative and polar)
- 2.2. Point, Lines, Polyline, Multiline, Construction Lines
- 2.3. Circle, Arc, Ellipse, Donut
- 2.4. Polygon, Rectangle, Spline, solids etc.
- 2.5. Hatching
- 2.6. Text (mold line & single line / true type fonts
- 2.7. Dimensions

Unit 3: Modify Commands [10 Hrs]
- 3.1. Object selection
- 3.2. Erase, Trim, Break
- 3.3. Copy, Minor, Offset, Array,
- 3.4. Move, Rotate, Scale, Stretch,
- 3.5. Lengthen, Extend,
- 3.6. Chamfer, Fillet, etc.

Unit 4: Features [4 Hrs]
- 4.1. Layers concept, match and change properties.
- 4.2. Measure and divide
- 4.3. Inquiry commands
- 4.4. Model Space View/ports and Template Drawings

4.5. Uses of Script tiles
4.6. Drawing Exchange (convert to other format from drawing format and into drawing format)

Unit 5: Application of CAD and LD software **[20 Hrs]**

5.1. Create projects.
5.2. Plotting co-ordinates from a file and create point group.
5.3. Create a layers of different properties from point groups.
5.4. Contour generation
5.5 Create alignment, profile and cross section
5.6 Excavation and filling quantity calculation from the created cross-section
5.7 create a map and connect a shapefile to LD.
5.8 coordinate extraction from the existing civil drawing

Unit 6: Plotters and plotting of CAD drawing **[6 Hrs]**

6.1 Symbols and legends
6.2 Designing and layout
6.2 Export and print

References:

1.Users' manual of AutoCAD, Autodesk
2. Users' manual of AutoCAD Land Development, Autodesk
3. Mastering AutoCAD 2013 and AutoCAD LT 2013, George Omura

Topographical Survey
EG 2205 GE

Total: 12 Hrs/week
Year: II **Lecture: 4 Hrs/week**
Part: II **Tutorial: Hrs/week**
Practical: 8 Hrs/week
Lab: Hrs/week

Course Description:

This subject consists of four units related to topographical surveying background including graphical and numerical methods helpful for the understanding and practicing the related engineering works.

Course Objectives:

After the completion of this course, students will be able to

1. explain the basic concepts, principles and methods of topographical surveying graphically
2. explain the basic concepts, principles and methods of topographical surveying numerically
3. apply the concept of topographical surveying in the field of related engineering area.

Course Contents:

Unit 1: Introduction to Topographical Survey **[12 Hrs]**

1.1 Define:
- Topographical survey
- Planimetric and altimetric detail
- Natural and artificial feature
- Contour and contour interval
- Identify other methods of representing relief

1.2 Explain the methods of topographical surveying**:**
- Ground survey method
- Aerial survey method

1.3 Introduction to contour survey:
- Factors deciding contour interval
- Methods of contouring (Direct and indirect methods0
- Characteristics of contour
- Uses of contour

Unit 2: Plane Table (PT) Surveying **[22 Hrs]**

2.1 Introduce Graphical surveying and define
- Plane tabling
- Plottable error

2.2 Explain the following accessories of Plane Table Survey:
- Plane Table
- Alidade: Simple Alidade and Telescopic Alidades (Simple Telescopic alidade and Micro optic Telescopic alidade)
- Plumb bob
- Plane table Level
- U-fork
- Magnetic Compass
- Clinometer

- Checking and adjustment of equipment
- Preparation of Plane Table Sheet

2.3 Define Control net for PT survey and auxiliary points
2.4 Explain the following steps for Setting up for Plane Table Survey
- Stabilization
- Centering
- Leveling
- Orientation

2.5 Explain the following Methods of Plane Tabling
- Radiation
- Intersection
- Traversing
- Resection: Two-point problem and Three-point problems (Lehmann's rules, Bessel's method and Tracing paper method)

2.6 Define Danger Circle
2.7 Explain the following steps of Field work for Surveying details
- Preparation
- Reconnaissance
- Picking details

2.8 Identify Errors in plane tabling
2.9 Identify Advantages and disadvantages of Plane tabling

Unit 3: Tacheometric Surveying [16 Hrs]

3.1 Introduction to tachometry
3.2 Instrument used in tachometry
3.3 System of tachometric measurements – Stadia system, Tangential System, and Subtense Bar System
3.4 Stadia method - Principle of Stadia method, Distance and elevation formula for horizontal line of sight and inclined line of sight with staff vertical
3.5 Determination of instrumental constants K and C
3.6 Tangential method - Distance and elevation formula for different cases: Both angles are angles of elevation, both angles are angles of depression, One angle of elevation and other angle of depression
3.7 Subtense bar method – Introduction and distance formula
3.8 Errors in tachometry
3.9 Tacheometry Survey Procedure

Unit 4: Numerical Survey using Digital Instruments [10 Hrs]

4.1 EDM
4.2 Total Station
4.3 GNSS

Practical/Laboratory: ***[120 Hrs]***

1. **Indoor**
   a. **Map Compilation [10 Hrs]**

2. **Outdoor [110 Hrs]**

Unit 1: Establishment of Controls for Plane Table
Unit 2: Plane Table Traverse Survey and adjustment
Unit 3: Large Scale Topographical Mapping by Plane Table Survey in the scale of 1:1000/1:500

Unit 4: Planning for Numerical Surveying

a. Preparation for field work and arrangement of necessary equipment
b. Organization of field data
c. Calculation and adjustment
d. Plotting and drawing
e. Exercise for calculation of area based on numerical data

Unit 5: Carry out following steps of Numerical Survey in the Field

1.1. Reconnaissance
1.2. Observation/Data Capture for Topographical/Cadastral/Engineering Mapping (1:500)

Reference Books

4. *The Principles of Surveying, J. Clendnning and J.G. Olliver, The English Language Book Society (ELBS)*
5. *A Text Book of Surveying C. Venkatramaiah, University Press (India) Limited*
6. *Fundamental of Surveying S.K Roy, Prentice Hall of India*
7. *Plane Surveying, David Clark*
8. *Surveying volume I, II S.K. Duggal*
9. *Surveying volume I, II Dr. B.C. Punmia*

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Introduction to Topographical Survey	12	16
2	Plane Table (PT) Surveying	22	28
3	Tacheometric Surveying	16	22
4	Numerical Survey using Digital Instruments	10	14
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

Fifth Semester
Year III Part I

Subjects:

1 EG 3101 GE Photogrammetry and Remote Sensing
2 EG 3102 GE Survey Camp
3 EG 3103 GE GIS Applications
4 EG 3104 GE Land Administration and Land Laws
5 EG 3105 GE Survey Project Management

Photogrammetry and Remote Sensing

EG 3101 GE

Total: 12 Hrs/week
Year: III **Lecture: 6 Hrs/week**
Part: I **Tutorial: Hrs/week**
Practical: 6 Hrs/week
Lab: Hrs/week

Course Description:

The course is targeted to impart knowledge on analog, digital and UAV photogrammetry as well as remote sensing system. The students are capable to work with the photographic images and satellite images and make some analysis. The photogrammetry portion contains general overview of photogrammetry, its theory, and general working principles with an emphasis on concept process and technique with practical demonstration. Furthermore, the remote sensing part contains general introduction of remote sensing, its process and principles with process of applying remote sensing imagery for different applications.

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Course Objectives:

After the completion of this course, students will be able to

1. Understand the basic concepts, principle, working methodologies and application of photogrammetry
2. Explain traditional and digital photogrammetric procedures,
3. Handle basic photogrammetric instruments and software
4. Understand the concepts of remote sensing, its process and application.
5. Know different collection techniques of remote sensing images.
6. Obtain working knowledge in interpreting image data acquired.
7. Understand and perform basic digital image processing.
8. Understand the concepts, principle and uses of unsupervised and supervised image classification techniques, and perform land cover classification.

Course Contents:

Theory **[90 Hrs]**

A. Photogrammetry **[35 Hrs]**

Unit 1: Introduction to Photogrammetry **[3 Hrs]**

1.1. Definition of Photogrammetry
1.2. Principle of Photogrammetry
1.3. Types of Photogrammetry
1.4. History of Photogrammetry
1.5. Scope of Photogrammetry
1.6. Application of Photogrammetry

Unit 2: Human Eye and Stereoscopic Vision **[3 Hrs]**

2.1. Human eye and its characteristics
2.2. stereoscopic vision
2.3. Parallax
2.4. application of stereovision and parallax in photogrammetry

Unit 3: Basic Photogrammetry **[8 Hrs]**

3.1. Difference between aerial photographs and maps
3.2. Types of aerial photographs
3.3. Geometrical Properties of aerial Photographs
3.4. Terms used in Photogrammetry
3.5. Principle of perspective geometry, bundle of rays, collinearity condition, forward and side overlaps, concept of model
3.6. Scale of a vertical aerial photograph
3.7. Distortion in a photograph
3.8. Effect of relief and tilt displacement
3.9. Rectification
3.10. Oblique photography
3.11. Photo mosaics and photo maps

Unit 4: Aerial Camera **[4 Hrs]**

4.1. Structure of aerial camera and their functions
4.2. Different types of analogue and digital camera

Unit 5: Aerial Photography Planning **[8 Hrs]**

5.1. Extension of control for photogrammetry
5.2. Pre pointing and post pointing
5.3. Properties of ideal GCP
5.4. Planning for aerial photography and factors to be considered (with numerical examples)
5.5. Indexing of aerial photographs on a map

Unit 6: Analogue/Analytical Photogrammetric Process **[5 Hrs]**

6.1. Orientation: Interior orientation, relative orientation, absolute orientation
6.2. Aerial Triangulation
6.3. Mapping : Concepts and photo interpretation elements, feature extraction and compilation

Unit 7: Digital Photogrammetry **[8 Hrs]**

7.1. Digital Photogrammetry and its advantages
7.2. Digital photogrammetric workstations
7.3. Orientation (Interior orientation, Exterior orientation)
7.4. Measurements of GCPs
7.5. Image matching: Area based and Feature Based Image Matching
7.6. Aerial triangulation
7.7. DEM generation, DTM generation
7.8. Orthophoto production
7.9. 2D and 3D feature extraction

Unit 8: UAV Photogrammetry **[6 Hrs]**

8.1. Introduction to UAV Photogrammetry
8.2. Field Procedure of UAV
8.3. Application area of UAV
8.4. UAV data processing

B: Remote Sensing **[45 Hrs]**

Unit 9: Introduction to Remote Sensing **[6 Hrs]**

9.1. Definition and concept
9.2. Brief history of Remote Sensing
9.3. Processes of Remote Sensing
9.4. Applications, advantages and limitations of Remote Sensing

Unit 10: EMR Interaction with Atmosphere and Earth Materials **[8 Hrs]**

10.1. Electro Magnetic Radiation (EMR)
10.2. EMR spectrum
10.3. Atmospheric characteristics
10.4. Atmospheric Scattering: Rayleigh, Mie & Non-selective
10.5. EMR Interaction with Water vapor and ozone
10.6. Atmospheric Windows
10.7. Significance of Atmospheric windows
10.8. EMR interaction with Earth Surface Materials
10.9. Radiance, Irradiance, Incident, Reflectance
10.10. Absorbed and Transmitted Energy Reflectance
10.11. Specular and Diffuse Reflection Surfaces
10.12. Spectral Signature curves
10.13. EMR interaction with water, soil and Earth Surface

Unit 11: Sensor and Platform **[8 Hrs]**

11.1. Platforms
11.2. Passive and Active sensors
11.3. Resolution: Spatial, Spectral, Radiometric and Temporal
11.4. Satellite Orbits
11.5. Orbit Parameters
11.6. Types of satellite orbits
11.7. Some operational multispectral sensors

Unit 12: Pre-Processing **[10 Hrs]**

12.1. Image Enhancement
12.2. Visualization of image data
12.3. Histogram and histogram operations
12.4. Filtering
12.5. Radiometric distortion and corrections
12.6. Geometric distortion and correction

Unit 13: Image Analysis **[13 Hrs]**

13.1. Visual Image Interpretation of Satellite Images
13.2. Digital Image Classification

- Principles of image classification: Image Space, Feature Space, Distances and clusters in the feature space
- Image Classification techniques
- Pixel based classification: Unsupervised and supervised
- Accuracy assessment
- Validation of the result

Practical/ Laboratory: ***[90 Hrs]***

A. Photogrammetry **[30 Hrs]**

1.1 Practice Stereoscopic Vision Using Pocket Stereoscope
1.2 Mark Principal Points in the Photographs
1.3 Practice Transfer of points on Adjacent Photographs using Mirror Stereoscope
1.4 Draw Principal Lines in the Photographs
1.5 Calculate Scale of the Photograph
1.6 Measure Forward and Lateral Overlap of the photographs
1.7 Prepare a Photo Mosaic
1.8 Identify Selected Features on Aerial Photograph

1.9 Digital Photogrammetry:
- 1.9.1 Software handling
- 1.9.2 Interior orientation- Demonstration
- 1.9.3 Exterior Orientation- Demonstration
- 1.9.4 Aerial Triangulation - Demonstration
- 1.9.5 DTM Generation- Demonstration
- 1.9.6 Ortho-photo Production- Demonstration
- 1.9.7 Feature Extraction- Demonstration

B. Remote Sensing **[60 Hrs]**

1. Observation of image and reading pixel data
2. Observe image bands of multi spectral images
3. Image Sub-setting
4. Mosaic images
5. Image Enhancement
6. Stacking layers and prepare multi spectral images
7. Geo-reference satellite image
8. Digital Image Classification and Accuracy Assessment

References:

2. B. Bhatta, Remote Sensing and GIS, Oxford University Press, 2010. (Unit 1, 2, 5, 7, 9 & 10).
3. Elements of Air Survey, W. K. Kilford
4. Lecture Note on Photogrammetry, School of Geomatics
5. Manual of Aerial Photography: ISPRS Publication
6. Manual of Photogrammetry: ISPRS Publication
7. Surveying (Field Astronomy and Photogrammetric Surveying) Volume III, B. C. Punmia

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Introduction to Photogrammetry	3	2
2	Human Eye and Stereoscopic Vision	3	2
3	Basic Photogrammetry	8	8
4	Aerial Camera	4	2
5	Aerial Photography Planning	8	8
6	Analogue/Analytical Photogrammetric Process	5	4
7	Digital Photogrammetry	8	8
8	UAV Photogrammetry	6	6
9	Introduction to Remote Sensing	6	8
10	EMR Interaction with Atmosphere and Earth Materials	8	6
11	Sensor and Platform	8	6
12	Pre-Processing	10	8
13	Image Analysis	13	12
	Total	**90**	**80**

Note: There might be minor deviation on the above specified marks

Land Administration and Land Laws

EG 3104 GE

Total: 6 Hrs/week

Year: III **Lecture: 4 Hrs/week**

Part: I **Tutorial: Hrs/week**

Practical: Hrs/week

Lab: 2 Hrs/week

Course Description:

The subject consists of major two parts: First part deal with general aspect of land administration and its components and the second part deals with different land related laws of Nepal.

Course Objectives:

After completing this course, students will be able to:

1. Explain the general concept of land administration and management
2. Acquire the knowledge regarding the types of land registration system and different land tenure types
3. understand land valuation, land taxation, Land tenure and LIS
4. understand the Procedure of land and property transfer procedure in Nepal
5. conceptualize the Knowhow on current land related laws of Nepal

Course contents: ***[60 Hrs]***

Unit 1: Introduction **[5 Hrs]**

1.1 Land: Definition and concept
1.2 Importance of land for human being
1.3 Importance of land in national development
1.4 Land Administration: Definition and concept
1.5 General function of land administration
1.6 Importance of land administration
1.7 Components of land administration

Unit 2: Basics of Land Tenure and Rights **[4 Hrs]**

2.1 Land tenure: Definition and concept,
2.2 History of land tenure and practices (*Raikar, Guthi, Kipat, Birta, Jagir, Rakam, Kipat, Jhora, Ukhada, Swabasi, Benissa, Bahal Bitauri*, Community land, state land)
2.3 Land tenure system in Nepal; Informal, Non-formal and formal,
2.4 Land right: Basic Concept
2.5 Different types of right on property: freehold, use right, lease, access right
2.6 Security of land tenure and its importance

Unit 3: Land Registration System **[6 Hrs]**

3.1 Concepts and definitions,
3.2 Different Land Registration Systems: Conveyancing, Deeds, Title,
3.3 Difference between various registration systems,
3.4 Merits and demerits of different types of registration system,

3.5 Land registration system in Nepal: Historical Background, Existing Registration System, Processes

3.6 Registration of various types of land (*Raikar, Guthi, Birta, Swabasi, Benissa, Bahalbatauri, Chhutjagga, Gaun block*)

Unit 4: Land and Property Right Transfer Process in Nepal [5 Hrs]

4.1 Different types of land transactions (*Rajinama, Anshabanda, Bakaspatra)* and their process,

4.2 Whole parcel transaction,

4.3 Parcel subdivision,

4.4 Individual/ Multiple / Institutional ownership

Unit 5: Land Conflicts and Their Resolutions [3 Hrs]

5.1 Land disputes related to parcel boundary,

5.2 Land disputes caused by the mismatch among map, records and ground.

5.3 Land disputes caused by dual ownership,

5.4 Resolving the land disputes during cadastral resurveying

5.5 Mediation and its role in land dispute settlement

Unit 6: Basics of Land Management [10 Hrs]

6.1 Concept, meaning and definition of land management

6.2 Land Use: Concepts and determinants

6.3 land use policy

6.4 land use planning

6.5 land use zoning and its importance

6.6 Land Pooling

6.7 Land Consolidation

6.8 Land Acquisition

6.9 Sustainable land management

Unit 7: Land Reform [6 Hrs]

7.1 Concepts, and Types of land reform

7.2 History of land reform in Nepal

7.3 Land ceilings

7.4 Dual ownership

7.5 Managing informal settlements and landlessness

7.6 Knowhow on previous and current land related issues resolving commissions formed in Nepal and their roles and achievements

Unit 8: Land Valuation and Land Market [4 Hrs]

8.1 Land Value

8.2 Land Valuation Parameters

8.3 Land Valuation techniques

8.4 Different Land valuation Practices in Nepal

8.5 Land Market

8.6 Land Banking

8.7 Land Taxation

Unit 9: LIS and Modernizing Land Administration Services **[5 Hrs]**

9.1 LIS: concept and definition,
9.2 Components of LIS
9.3 Importance of LIS
9.4 LIS development in Nepal
9.5 Record digitization
9.6 Application of ICT in LA
9.7 Overview of Online services from government organizations: LRIMS, NeLIS, MeroKitta, PAMS etc.

Unit 10: Land Policies and Land Related Laws in Nepal **[12 Hrs]**

10.1 Fundamentals of law making and development of land laws
10.2 General introduction to National land policy and land use policy
10.3 Constitution of Nepal (Related sections),
10.4 Three (3) Tiers of government and their concurrent and exclusive rights related to land administration and management
10.5 Land (Survey and Measurement) Act and Rules,
10.6 Land Related Act and Rule,
10.7 Land Revenue Act and Rule,
10.8 Land Acquisition Act and Rules,
10.9 Land Use Act and Rules
10.10 *Muluki Dewani Sanhita* (related section),
10.11 *Local Government Operation Act (Related Sections)*
10.12 *Guthi Sambandhi* Ain (related sections)
10.13 Directives and working procedures related to land administrations and Cadastral Survey

Practical/Laboratory: Observations: ***[30 Hrs]***

१. जग्गा दर्ता, मोठ श्रेस्ता, लिखत, रोक्का, फुकुवा, नामसारी, अंशवण्डा, दाखिला खारेज, लिखत बमोजिम नक्शामा कित्ताकाट, टायल चेक, नक्शा ट्रेस, फिल्डबुक उतार, प्लट रजिष्टर अध्यावधिक, फिल्ड रेखांकन, हालसाबिक, फायल नक्शा, पार्सल नक्शा, लगतकट्टा, कित्ता एकिकरण, नक्शामा घरबाटो जनाउने, घरबाटो प्रमाणित गर्ने, सूचना लेख्ने, म्याद काट्ने, म्याद तामेल गराउने, तारेख पर्चा लेख्ने, मुचुल्का उठाउने, सनाखत गराउने, भर्पाइ बनाउने, बयान गराउने, टिप्पणी उठाउने, फिल्ड प्रतिवेदन लेख्ने, फायल पन्जिका बनाउने । [20 Hrs]
२. नापी तथा मालपोत कार्यालयहरुको अवलोकन भ्रमण गराउने । [5 Hrs]
३. विभिन्न सेवा प्रवाह हुने कार्यहरुको डमी फायल बनाएर प्राक्टिस गराउने । [5 Hrs]

References:

1. Land law and registration: S.R. Simpson
2. Land registration: B. L. Shrestha
3. भूमि लगत, रजिष्ट्रेशन र कित्तानापी,: B.L. Shrestha
4. Constitution of Nepal
5. मुलुकी देवानी संहिता,२०७४ *(related sections)*
6. Land (Survey and Measurement) Act ,2019 and Rules
7. Land Related Act, 2021 and Rule
8. Land Revenue Act 2034 and Rule
9. Land Acquisition Act, 2034 and Rules,
10. Land Use Act, 2076 and Rules
11. Local Government Operation Act,2074 (Related Sections)
12. गुठी सम्बन्धी ऐन, २०३३ (related sections)
13. Official Websites of land related ministry and departments of Nepal
14. जग्गा प्रशासन कार्यविधिः भाग १, २ र ३
15. जग्गा नाप जाँच तथा नक्सा श्रेस्ता अद्यावधिक सम्बन्धी निर्देशिका, २०७३

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Introduction	5	6
2	Basics of Land Tenure and Rights	4	4
3	Land Registration System	6	8
4	Land and Property Right Transfer Process in Nepal	5	8
5	Land Conflicts and Their Resolutions	3	4
6	Basics of Land Management	10	12
7	Land Reform	6	8
8	Land Valuation and Land Market	4	6
9	LIS and Modernizing Land Administration Services	5	8
10	Land Policies and Land Related Laws in Nepal	12	16
	Total	**60**	**80**

Note: There might be minor deviation on above specified marks

Survey Camp

EG 3102 GE

Total: 9 Hrs/week
Year: III **Lecture: Hrs/week**
Part: I **Tutorial: Hrs/week**
Practical: 9 Hrs/week
Lab: Hrs/week

Course Description:

This course focuses on technical skill required for carrying out Control Surveying, Detail Surveying and mapping works related to various engineering projects.
The contents of the course emphasize mainly on

1. Control Survey (Horizontal and Vertical)
2. Various Engineering Surveying
    a. Road Survey
    b. Bridge Survey
    c. Hydropower Survey (Intake, Canal, Powerhouse)
3. Computation and Plotting

Course Objectives:

After the completion of this course, students will be able to

1. Perform Control Survey
2. Collect Survey data for different Engineering Works
3. Compute Collected Survey Data
4. Plot the data

Course Contents:

Practical:

1. **Control Point Extension and densification** **[18 Hrs]**
   (Closed loop traverse/Link traverse/DGPS/Levelling to establish control points for other engineering surveys)

2. **Road and Bridge Survey** **[30 Hrs]**
   (Alignment fixing and Detail Surveying)

3. **Hydropower Survey** **[45 Hrs]**
    a. Intake (Selecting intake area and Detail Surveying)
    b. Canal (Alignment fixing and Detail Surveying)
    c. Powerhouse (Selecting power house area and Detail Surveying)

4. **Cadastral Survey** **[42 Hrs]**
   (Digital Data Collection for cadastral map and mapping, parcel identification)

As it is closed Survey Camp, Computation and Plotting works must be conducted on the evening of respective surveying days.

Reference Books

1. *Surveying Volume 1 and Volume 2, B.C Punmia,* Laxmi Publications
2. *A Text Book of Surveying and Levelling R. Agor, Khanna Publishers*
3. *Fundamental of Surveying S.K Roy, Prentice Hall of India*
4. *Surveying Volume 1 and Volume 2, S. K. Duggal, Mc Graw Hill Education*
5. *Triangulation Instruction Book Part 1, Geodetic Survey Branch, Survey Department*
6. *Levelling Instruction Book, Geodetic Survey Branch, Survey Department*

Evaluation Scheme:

Internal Assessment:

Continuous assessment throughout the 15 days as well as viva should be taken. The weightage of internal assessment will be 60% (150 marks).

S.N	Evaluation	Marks
1	Course Instructor	60%
2	Field Incharge	25%
3	College Supervision	15%

Final Assessment:

Each group must submit survey camp report in standard format. During compilation of report, data must be submitted content wise including maps, reference sketches. Original data and drawings must be presented during final viva voce. The weightage of final assessment will be 40% (100 marks).

S.N	Evaluation	Marks
1	Report	60%
2	Presentation and Viva voce	40%

GIS Applications
EG 3103 GE

Total: 10 Hrs/week
Year: III **Lecture: 4 Hrs/week**
Part: I **Tutorial: Hrs/week**
Practical: 6 Hrs/week
Lab: Hrs/week

Course Description:

The primary objective of this course is to impart the knowledge of GIS applications as a planning and decision making tool. The course focuses on spatial analysis and visualization of analysis results. The courses aim to introduce various applications of GIS in various sectors.

Course Objectives:

After the completion of this course, students will be able to:

1. Perform simple spatial analysis
2. Map design and use of proper visual variables
3. Visualize different types of data in forms of maps
4. Conceptualize GIS as a decision support tool
5. Understand the basic application of GIS in spatial planning
6. Perform task for using GIS for service delivery in Survey offices of Nepal

Course Contents:

Unit 1: Data Integration **[6 Hrs]**

1.1 Concept of data Integration
1.2 Importance of spatial data integration
1.3 Process of data integration
1.4 Join and relate spatial and attribute data
1.5 Projection and transformation of spatial data
1.6 Integration of cadastral data

Unit 2: Spatial Analysis **[18 Hrs]**

2.1 Introduction:
- Spatial analysis
- Importance of spatial analysis
- Types of spatial analysis (Functions of spatial analysis)

2.2 Classification and Measurement function
- Measurement of coordinates and distance in raster and vector data
- Spatial selection queries
- Classification of data (manual and automatic classification of data)
- Application of classification and measurement function

2.3 Overlay functions and Neighborhood Analysis
- Vector and raster overlay operations and use
- Neighborhood function (Generating buffer zone)
- Application examples of overlay and network function

2.4 Network analysis function
- Introduction to Network analysis
- Types and Related Terminology
- Application of network analysis (Route- shortest route)

2.5 3D Analysis

- Define 3D representation of Earth surface
- Explain the methods for Generating contours and 3D surface from 3D points
- Introduce followings:
  - Slope/Aspect/Hill-shade
  - Surface area and volume
  - Contour and profile generation
- Define Digital Elevation Model (DEM) and Digital Surface Model (DSM)
- Application of Digital Elevation Model (DEM) in spatial planning

Unit 3: Visualization of Data **[12 Hrs]**

3. 1 Introduction
- Define visualization
- Various visualization technique (Hard and softcopy)

3.2 Map Data Types
- Types of data (qualitative and quantitative)
- Visual variables
- Use of visual variables for spatial data visualization.

3.3 Types of Maps and Map design Principles
- Types of map for visualization (Static, dynamic and interactive maps)
- Base and thematic map
- Map Design Concept and importance
- Web map and digital map

Unit 4: Data Quality **[8 Hrs]**

4.1 Data Quality
- Define Data quality
- Data quality components
  - Spatial accuracy
  - Attribute accuracy
  - Temporal Accuracy
  - Logical Consistency
  - Lineage etc.

4.2 Accuracy Assessment
- Accuracy and precision of data
- Error propagation
- RMSE error during accuracy assessment (user accuracy and producer's accuracy)

Unit 5: GIS Project Development **[8 Hrs]**

5.1 Project definition
- Define problem related to spatial planning

5.2 Project Design
- Conceptual Design
- Logical design
- Physical design
  - Design data models required for the project
  - List the resources required for the project
  - Discuss the possible problems
  - List out the expected project outcomes

5.3 Project Implementation
- Prepare the project implementation schedule

5.4 Project Evaluation

- Define project Evaluation
- Setting evaluation criteria

Unit 6: Spatial Data Infrastructure (SDI) **[8 Hrs]**

6.1 Concept of SDI
6.2 Components and importance of SDI
6.3 Meta data and Clearinghouse
6.4 Different level of SDI (Local, Regional and Global SDI)
6.5 Present Situation and Challenges of NSDI (Nepal)

Reference Books:

1. An Introduction to Geographical Information System - Ian Heywood, Sarah Cornelius, Steve Carver, Pearson Education, Pearson Education (Fourth Edition) 2005
2. Principles of Geographic Information System - Rolf A. de By (ed.) (ITC Education Text Book Series; 1)
3. Cartography Visualization of Geospatial Data – Menno Kraak & Ferhan Ormeling
4. Principles of Geographical Information System - Peter. A. Burrough and Rachael A. McDonnnell
5. Geographical Information system and computer Cartography - Christopher S. Jones
6. Elements of Cartography, H. Robinson

Practical/ Laboratory: ***[90 Hrs]***

Unit 1: Spatial Analysis **[10 Hrs]**

1.1 Integrate spatial data from different sources (join attribute tables, import external data into GIS)
1.2 Conversion of coordinate and projection
1.3 Calculate Geometry of raster and vector data
1.4 Query databases
1.5 Perform Geo-processing and Computation
1.6 Generate Buffer Zone (point, line, Polygon buffer)
1.7 Convert Vector to raster and raster to vector

Unit 2: 3D Analysis **[10 Hrs]**

2.1 Create TIN surface from 3D points of Features
2.2 Generate DEM from different data sources (3D points, Contours)
2.3 Create Counters using 3D point data and DEM
2.4 Generate Slope/Aspect/Hill shade raster
2.5 Calculate Surface area and volume from DEM
2.6 Generate profiles

Unit 3: Visualization and map cartography **[10 Hrs]**

3.1 Layout preparation
3.2 Generalize map elements
3.3 Apply Cartographic principles of map design
3.4 Use appropriate Color in maps
3.5 Symbolize features
3.6 Place features and Geographic names
3.7 Label features
3.8 Insert legend north arrow, grid, scale, title, projection information, map notes
3.9 Export maps in to different formats

Unit 4: Thematic Mapping **[10 Hrs]**

4.1 Visualize themes in maps (Using Graduated Color, Graduated symbols, Proportional symbols, and dot density)

4.2 Compose maps and show the thematic information using appropriate Graphs and charts

Unit 5: Application of GIS in Surveying and parcel Mapping **[20 Hrs]**

1.1 Handling cadastral application software used by Survey offices

1.2 Cadastral data management and preparation

1.3 Parcel Subdivision and parcel map printing

1.4 Report generation and printing (field book, plot book, land owner certificate)

Unit 6: Project Work **[30 Hrs]**

Project work relevant to GIS application will be assigned to the student(s) and they are required to submit their project report. Different case study will be provided to the students and they can choose a case of their interest. The project work supposed to be completed in group or individually. Student will complete project work under the minimum supervision of instructor. Relevant data and guidelines for given case study will be provided by the course instructor.

The project work will be based on the following cases.

1. Topographic mapping
2. Digitization and map preparation
3. TIN and 3D analysis
4. Land use planning/ plotting and mapping
5. Thematic mapping
6. Suitability analysis (site suitability)
7. Socio-economic analysis
8. Hazard map preparation
9. Cadastral mapping
10. Change analysis (urban expansion)
11. Database Design (municipal)

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Data Integration	6	8
2	Spatial Analysis	18	24
3	Visualization of Data	12	16
4	Data Quality	8	10
5	GIS Project Development	8	12
6	Spatial Data Infrastructure (SDI)	8	10
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

Survey Project Management
EG 3105 GE

Total: 3 Hrs/week
Year: III **Lecture: 3 Hrs/week**
Part: I **Tutorial: Hrs/week**
Practical: Hrs/week
Lab: Hrs/week

Course Description:
This course is designed to provide basic idea of survey management. The main focus lies on the management of surveying and mapping projects. The course includes some important aspects of survey management such as terms of reference, specification, project planning, resource allocation, costing, executing surveying projects and reporting.

Course Objective:
After the completion of this course, students will be able to:
1. Understand the various aspects of surveying and mapping projects
2. Formulate a surveying and mapping project proposal
3. Plan of a minor surveying and mapping projects
4. Identify needs for surveying and mapping projects
5. Understand the terms of reference and specifications of a particular project
6. Estimate the cost of minor surveying and mapping projects
7. Report minor surveying and mapping projects

Course Content:

Unit 1: Introduction and Basic Concept of Project **[5 Hrs]**
- 1.1 Concept and definition of project,
- 1.2 Characteristics of project,
- 1.3 Importance of project,
- 1.4 Feasibility study of project,
- 1.5 Various phases of project,
- 1.6 Project cycle

Unit 2: Basics of Management **[4 Hrs]**
- 2.1 Definition of management,
- 2.2 Basic principles of Management,
- 2.3 Management functions (POSDCORB),
- 2.4 Role of a Manager in organization,
- 2.5 Concept of Leadership,
- 2.6 Concept **Survey Projects Management** of Motivation,
- 2.7 Importance of motivation,

Unit 3: Survey Projects Management **[6 Hrs]**
- 3.1 Identification of needs
- 3.2 Feasibility study
- 3.3 Terms of Reference,
- 3.4 Technical Standards and Specifications
- 3.5 Project Planning
- 3.6 Tools, Equipment and Accessories,
- 3.7 Checking and adjustment of instrument

Unit 4: Proposal and Report Writing Skill **[8 Hrs]**

4.1 Understanding proposal,
4.2 Objective of proposal,
4.3 Language Proficiency in Writing -English/Nepali,
4.4 Writing Technical Proposal: Structure and Contents,
4.5 Basics of report writing,
4.6 Objectives of report writing,
4.7 Report Writing: Structure and Contents,
4.8 Presentation Skills

Unit 5: Public Relation **[4 Hrs]**

5.1 Introduction to public relation
5.2 Dealing with community,
5.3 Organizing meetings,
5.4 Communicating skills,

Unit 6: Professionalism **[8 Hrs]**

6.1 Profession and professionalism,
6.2 Moral principles and ethics,
6.3 Code of conducts,
6.4 Role of a Surveyors, code of conduct for a surveyor (By FIG, RICS),
6.5 Professional organizations and their role,
6.6 Basic introduction to international organizations (AARS, PCGIAP, FIG, ISPRS)
6.7 Survey Licensing,
6.8 Licensing practice in Nepal

Unit 7: Safety Management **[6 Hrs]**

7.1 Personal safety,
7.2 Safety of instruments and equipment,
7.3 Managing stress
7.4 Data safety,
7.5 Emergency situation and rescue measures,
7.6 Insurance,

Unit 8: Basics of First Aid **[4 Hrs]**

8.1 First aid: Preserving life, prevent further injury, Promoting recovery,
8.2 Basic Definition, Symptoms and Preventive Measures of: Altitude sickness, swelling of brain or lungs, Alergens, such as insect bites, Bone fractures, Burns, Chocking, Cramps, Heart attacks, Hyperglycemia, Hypothermia, Poisoning, Insect and animal bites, Muscle strains, Snake bite, Wounds and bleeding.

References:

1. *Effective Performance in Project Management, Jan Wisen and Orje Lindblom*
2. *books from Civil engg.*
3. *health related chap 7-8*

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Introduction and Basic Concept of Project	5	8
2	Introduction and Basic Concept of Project	4	8
3	Introduction and Basic Concept of Project	6	10
4	Proposal and Report Writing Skill	8	14
5	Public Relation	4	8
6	Professionalism	8	14
7	Safety Management	6	10
8	Basics of First Aid	4	8
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks

Sixth Semester

Year III Part II

Subjects:

1	EG 3201 GE	Engineering Survey
2	EG 3201 MG	Entrepreneurship Development
3	EG 3202 GE	Civil Construction and Quantity Estimation
4	EG 3204 GE	Fundamental of Social Science and Environment
5	EG 3203 GE	Project Work

Engineering Survey

EG 3201 GE

Total: 12 Hrs/week

Year: III **Lecture: 4 Hrs/week**

Part: II **Tutorial: Hrs/week**

Practical: 8 Hrs/week

Lab: Hrs/week

Course Description:

This course focuses on Theoretical knowledge and technical skill required for carrying out Surveying and mapping works related to various engineering projects.

The contents of the course emphasize mainly on

1. Precise understanding of Engineering surveying and methods
2. Construction related to physical infrastructure such as Road, Canal, Hydropower
3. Site surveys
4. Hydrographic survey

Course Objectives:

After the completion of this course, students will be able to

1. Understand the concept of engineering surveying
2. Perform surveying related to different construction project for Infrastructure planning, Design layout, Monitoring ongoing construction and Update map as-built
3. Produce spatial data and information required by construction engineers (coordinates, Control network layout, large scale maps and Ground profiles

Course Contents:

Unit 1: Introduction to Engineering Survey **[8 Hrs]**

1.1 Definition of Engineering survey

1.2 Survey component in various engineering construction projects

- Control survey
- Topographic survey
- Construction survey
- As-built survey
- Referencing with National geodetic network

1.3 Establishment/ extension of Ground survey controls (Horizontal and Vertical)

1.4 Choice of instruments and methods of surveying

Unit 2: Route Survey **[8 Hrs]**

2.1 Meaning and concept of Routes

2.2 Surveying for different types of Routes

- Road/ Railway
- Canal
- Transmission line

2.3 Strip Topographic mapping (Details and Contours)

2.4 Profile (Longitudinal and Cross Sections)

Unit 3: Curve **[12 Hrs]**

3.1 Introduction and classification of curve

3.2 Designation of Curve

3.3 Elements of Simple Circular curve

3.4 Setting out Simple circular curve:

- Method of offset from long chord
- Method of offset from Tangent
- Rankin's Method of deflection angle
- Two Theodolite Method
- Coordinates method

3.5 Super elevation
3.6 Concept and Computation of Vertical curve

Unit 4: Area and Volume **[12 Hrs]**

4.1 Area of regular geometrical figures
4.2 Area of Irregular figure
- Mid ordinate method
- Average ordinate method
- Trapezoid method
- Simpson's method

4.3 Area measurement by coordinates
4.4 Area determination by graphical method (on the map)
- Square grids
- Planimeter

4.5 Volume of geometrical shapes (Cube, Parallelopiped, Sphere, Cylinder, and cone)
4.6 Determination of Volume/Earthwork quantity:
- Area of cross section (level section)
- Spot heights
- Contour maps

4.7 Mass Haul Diagram

Unit 5: Site Survey **[12 Hrs]**

5.1 Introduction
5.2 Procedure of Site Survey
- Site survey methods for Building, Bridge
- Establishment of control points and Bench Marks.
- Computation and Plotting field data
- Preparation of plans and profiles for different component of construction site
- Transfer of the map data on the ground
- Layout of designs (Building, Bridge)

5.8 Underground Survey
- Introduction
- Terms used
- Instruments
- Control Point Establishment (Horizontal and Vertical)
- Difference between underground survey and Surface Survey

Unit 6: Hydrographic Survey **[8 Hrs]**

6.1 Introduction
6.2 Horizontal and Vertical Control in Hydrographic Surveying
6.3 Sounding (different instrument used in surveying)
6.4 Sounding measurement by direct and indirect methods.
6.5 Measurement of the Velocity of the river by float method and current meter
6.6 Measurement of Discharge by Area of cross section method
6.7 Methods of locating the soundings

Practical/Laboratory: ***[120 Hrs]***

Unit 1: Outdoor (Field Work) **[80 Hrs]**

1.1 Route Survey (Road alignment, Details)
1.2 Bridge site Survey
1.3 Setting out simple circular curves.
1.4 Discharge measurement of a river (float and current meter)

Unit 2: Indoor **[40 Hrs]**

2.1 Computation of existing field data for engineering surveys
2.2 Plotting of existing data
2.3 Preparation of Plans and Profiles
2.4 Earth work estimation

References:

1. Surveying Vol. II, Dr. B.C Punmia, A.K Jain, Laxmi Publication Pvt. Ltd. New Delhi
2. 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
4. प्रारम्भिक नापी, महेश्वर भट्टराई, पाठ्यक्रम विकास केन्द्र, त्रिभुवन विश्वविद्यालय, काठमाडौं, नेपाल
5. Surveying, A. Bannister and S. Raymond, ELBS
6. Surveying for Engineers, J. Uren and W.F. Price, ELBS
7. Surveying for Construction, William Irvine, McGraw-Hill
8. Engineering Surveying Manual, American Society of Civil Engineering, Scientific Publishers, , India
9. Introduction to Surveying, Anderson and Mikhail
10. Elements of Plane Surveying, Arthur R. Benton, Jr. and Philip J Taetz, McGraw-Hill

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Introduction to Engineering Survey	8	10
2	Route Survey	8	10
3	Curve	12	16
4	Area and Volume	12	16
5	Site Survey	12	16
6	Hydrographic Survey	8	12
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

Entrepreneurship Development

EG 3201 MG

Year: III **Total: 5 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

Course Objectives:
After completion of this course students will be able to:
1. Understand the concept of business and entrepreneurship;
2. Explore entrepreneurial competencies;
3. Analyze business ideas and viability;
4. Learn to formulate business plan with its integral components and
5. Manage small business.

Course Contents:

Theory

Unit 1: Introduction to Business & Entrepreneurship: [9 Hrs.]
a. Overview of entrepreneur and entrepreneurship
b. Wage employment, self- employment and business
c. Synopsis of types and forms of enterprises
d. Attitudes, characteristics & skills required to be an entrepreneur
e. Myths about entrepreneurs
f. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and Developing Entrepreneurial Competencies: [9 Hrs.]
a. Assessing individual entrepreneurial inclination
b. Assessment of decision-making attitudes
c. Risk taking behavior and risk minimization
d. Creativity and innovation in business
e. Enterprise management competencies

Unit 3: Business identification and Selection: [4 Hrs.]
a. Sources and method of finding business idea(s)
b. Selection of viable business ideas
c. Legal provisions for MSMEs in Nepal

Unit 4: Business plan Formulation: **[18 Hrs.]**

a. Needs and importance of business plan
b. Marketing plan
    - Description of product or service
    - Targeted market and customers
    - Location of business establishment
    - Estimation of market demand
    - Competitors analysis
    - Estimation of market share
    - Measures for business promotion
c. Business operation plan
    - Process of product or service creation
    - Required fix assets
    - Level of capacity utilization
    - Depreciation & amortization
    - Estimation office overhead and utilities
d. Organizational and human resource plan
    - Legal status of business
    - Management structure
    - Required human resource and cost
    - Roles and responsibility of staff
e. Financial plan
    - Working capital estimation
    - Pre-operating expenses
    - Source of investment and financial costs
    - Per unit cost of service or product
    - Unit price and profit/loss estimation of first year
f. Business plan appraisal
    - Return on investment
    - Breakeven analysis
    - Risk factors

Unit 5: Small Business Management: **[5 Hrs.]**

a. Concept of small business management
b. Market and marketing mix
c. Basic account keeping

Practical

Unit 1: Overview of Business & Entrepreneurship [2 Hrs.]

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and Developing Entrepreneurial Competencies [2 Hrs.]

2. Generate innovative business ideas

Unit 3: Product or service Identification and Selection [2 Hrs.]

2. Analyze business ideas using SWOT method

Unit 4: Business Plan Formulation [22 Hrs.]

1. Prepare marketing plan
2. Prepare operation plan
3. Prepare organizational and human resource plan
4. Prepare financial plan
5. Appraise business plan
6. Prepare action plan for business startup

Unit 5: Small Business Management [2 Hrs.]

1. Prepare receipt and payment account
2. Perform costing and pricing of product and service

Civil Construction and Quantity Estimation

EG 3102 GE

Total: 6 Hrs/week
Year: III **Lecture: 4 Hrs/week**
Part: II **Tutorial: Hrs/week**
Practical: 2 Hrs/week
Lab: Hrs/week

Course Description:

This course includes basic introduction of construction materials, Building construction, Road Construction, Irrigation System, Water Supply System, River training works, Estimating.

Course Objectives:

After the completion of this course, students will be able to:

1. Explains the major items of work required for construction
2. Interpret simple road alignment geometry
3. Understand elements of simple irrigation system
4. Understand basics of Water Supply system
5. Explain the different units of measurements used for quantifying the item of construction works
6. Explain the major items of work required for construction like building, irrigation, road, water supply.

Course Contents:

Unit 1. Introduction **[2 Hrs]**

1.1 Definition of the construction works
1.2 Principles and Design of construction works

Unit 2. Construction Materials **[6 Hrs]**

2.1 Types of construction materials
2.2 Characteristics of brick, stones, aggregates, cement, steel and timber

Unit 3. Building Construction **[8 Hrs]**

3.1 Buildings elements – Foundation & Superstructure (walls, flooring, roofing, doors and windows)
3.2 Stones masonry – Coursed/Uncoursed, Random Rubble/Ashlar
3.3 Brick Masonry – English Bond, Flemish Bond, Stretcher Bond
3.4 Cement concrete – PCC, RCC
3.5 Formwork
3.6 Plastering / painting.

Unit 4. Road Construction **[6 Hrs]**

4.1 Classification of roads – National highways, Feeder roads, District roads/Village roads, City roads or streets
4.2 Road geometry – Horizontal and vertical alignments, Cross sectional elements (Camber, super elevation etc), Sight Distance characteristics (Stopping, overtaking sight distances)
4.3 Road pavement – Sub grade, Base, Sub base, Wearing Course
4.4 Structures – Bridge, Culvert, Retaining wall, breast walls)

Unit 5. Irrigation System **[8 Hrs]**

5.1 Concept of irrigation system
5.2 Types of irrigation system
5.3 Components of small scale irrigation system

5.4 Water Distribution management

Unit 6. River Training Works **[4 Hrs]**

6.1 Purpose of river training works
6.2 Methods of river training

Unit 7. Water Supply System **[10 Hrs]**

7.1 Sources of water
7.2 Discharge measurement by velocity-area method and bucket-stop watch method
7.3 Introduction to and type of water supply system
7.4 Gravity flow water supply system – Intake, Pipeline transmission, distribution, Interruption/ break pressure tank, Valve chambers, Distribution chambers, Reservoir tank, Stand posts
7.5 Pipe and pipe fittings
7.6 Tools and equipment used in plumbing works
7.7 Ferro cement technology and its application in reservoir construction

Unit 8. Estimation **[18 Hrs]**

8.1 Estimate and Its Types – Preliminary, Plinth area, Cubic rate estimate, approximate quantity estimate, Detailed estimates, Annual Repair and maintenance, Complete estimates
8.2 System of Units of Measurement
8.3 Analysis of Rates – Brickwork, Cement Plastering, PCC, PCC for RCC
8.4 Methods of Building Estimate – Long and short wall method, Center line method, Crossing method
8.5 Detailed Estimate

Reference Books:

1. *Building Construction - Sushil Kumar*
2. *Engineering Costing and Supervision (CTEVT)*
3. *भवन निर्माण- प्रा.शि.तथा व्या.ता.परिषद्*
4. *ग्रामीण खानेपानी प्रणाली निर्माण तथा व्यवस्थापन - हरिप्रसाद शर्मा*
5. *Engineering Materials, Surendra Singh*
6. *Lecture notes on Civil construction*
7. *Amarjit, Aggarwal "Civil Engineering quantity surveying and valuation", Kaston Publishing house Ludhiana, 1985.*
8. *M. Chakrawarti "Estimating costing and specification".*
9. *B.N. Dutta "Estimating and Costing".*
10. *Seymour Berger and Jules B. Godel, "Estimating and project management for small construction firms". Van Nostradn Reinhold Publishing Co. New york.*

Practical/Laboratory: **[22 Hrs]**

Unit 1. Drawing and Estimation of Engineering Structures **[22 Hrs]**

1.1 Technical drawings of various engineering structures
1.2 Drawing of simple building
1.3 Estimate of one room and double room building
1.4 Estimate of retaining wall
1.5 Estimate of Road Side Drain

Unit 2. Outdoor **[8 Hrs]**

2.1 One-day field visit of construction site

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Introduction	2	2
2	Construction Materials	6	8
3	Building Construction	8	10
4	Road Construction	8	12
5	Irrigation System	6	8
6	River Training Works	4	6
7	Water Supply System	8	10
8	Estimation	18	24
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

Fundamental of Social Science and Environment
EG 3204 GE

Total: 4 Hrs/week
Year: III **Lecture: 4 Hrs/week**
Part: II **Tutorial: Hrs/week**
Practical: Hrs/week
Lab: Hrs/week

Course Description:

This subject consists of nine units related to Society, Community Development and Environment necessary to develop background in Social Science and Environment that supports for the understanding and practicing the related engineering works.

Course Objectives:

After the completion of this course, students will be able to:

1. Explain the basic concept related to the society, social change, challenges to Nepali society and governance system in Nepal; and apply it in the field of the related engineering areas.
2. Explain the basic concept related to community development and apply it in the field of the related engineering areas.
3. Explain the basic concept related to environment, disaster risk management and climate change; and apply it in the field of the related engineering areas.

Course Contents:

Unit 1: Introduction to Society **[6 Hrs]**

1.1 Concept of Society
1.2 Essential Elements of Society
1.3 Types of Society
1.4 Elements of A Good Society

Unit 2: Process of Social Change and Integration **[6 Hrs]**

2.1. Meaning of Social Change
2.2. Theories of Social Change: Linear, Cycle and Contemporary
2.3. Causes of Social Change
2.4. Concept of Social Integration

Unit 3: Challenges to Nepali Society **[8 Hrs]**

3.1. Poverty and Underdevelopment
3.2. Authoritarianism
3.3. Unemployment
3.4. Conflict
3.5. Corruption
3.6. Morality and Ethics
3.7. Solutions of Challenges to Nepali Society

Unit 4: Basics of Governance System in Nepal **[8 Hrs]**

4.1. Elements of Good Governance
4.2. Salient features of Constitution of Nepal 2072
4.3. Structure of State and Distribution of State Power
4.4. Fundamental Rights and Duties
4.5. Executive, Legislature and Judiciary in all level

Unit 5: Community Development [6 Hrs]

5.1. Concept of Community Development
5.2. Stages of Community Development
5.3. Sustainable Development and Human Development
5.4. Environment & Development
5.5.

Unit 6: Resource Mobilization for Community Development [8 Hrs]

6.1. Local Resources: People, Institutions, Knowledge, Technology, Natural Resources,
6.2. Relationship
6.3. Institutions/ local organizations and their mobilization
6.4. Exploration of new resources for effective management: - local products, Technologies, Institutions
6.5. External Resource Management

Unit 7: Environment Protection [6 Hrs]

7.1. Meaning of Environment and Ecology
7.2. Elements and types of Environment
7.3. Need and Importance of Environment Protection
7.4. Major ways of Environment Protection

Unit 8: Disaster Risk Management 6 Hrs

8.1 Disaster terminologies: Hazard, Disaster, Risk, Vulnerability, Capacity, Resilience
8.2 Nepal: A Disaster Hotspot (Flood, Landslide, Epidemics, Fire, Earthquake, Climate Change, Glacier lake outburst flood)
8.3 Disaster Management Cycle: from Response to Reduction

Unit 9: Climate Change [6 Hrs]

9.1 Understanding the Climate Change and its impacts
9.2 Basic ideas of Climate Change Adaptation
9.3 Basic ideas of Climate Change Mitigation

References

1. Shrestha, Harikrishna & Rout, Mohan Kumar 2017, Contemporary Society, Highland publication, Bhotahity, Kathmandu.

ङ। अधिकारी देवबहादुर र भट्टराई डा.घनश्याम (२०६४) समकालीन नेपाली समाज ,आठराई प्रकाशन

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4. Bhattachan,K and C.Mishra, Development Practices in Nepal,1996, T.U. Kathmandu
5. Shrestha, Maheshwar Man,2058, Nepal's Development Experiences; An Evaluation, Akshalok Prakashan, Kathmandu
6. The Constitution of Nepal 2072
7. *Sharma, Rabin K. Maping My Professional Journey (Collection of Articles from the Author), 2069, Kathmandu.*
8. Environment Protection Act, 2053
9. Environment Protection Rules, 2054
10. Climate Change Policy 2067
11. Climate Change - Fact Sheet in Nepali Climate Change Network Nepal (CCNN)
12. Notes on Climate Change impacts and Adaptation & Mitigation Strategies, Khadga Sen Oli
13. Sendai Framework for Disaster Risk Reduction (SFDRR) 2015
14. *Environmental Resource Management in Nepal/U. M. Malla, C. B. Shrestha*

Marks Specification for final evaluation:

Unit	Content	Course Hours	Marks
1	Introduction to Society	6	8
2	Process of Social Change and Integration	8	10
3	Challenges to Nepali Society	8	12
4	Basics of Governance System in Nepal	8	10
5	Community Development	6	8
6	Resource Mobilization for Community Development	8	10
7	Environment Protection	6	8
8	Disaster Risk Management	6	8
9	Climate Change	4	6
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks

Project Work

EG 3203 GE

Total: 13 Hrs/week
Year: III **Lecture: Hrs/week**
Part: II **Tutorial: Hrs/week**
Practical: 13 Hrs/week
Lab: Hrs/week

Course Description:

In the end of the course students shall be given a project work related to one subject area for which they will employ their knowledge and skills in planning, executing and evaluating of project. Basic theoretical concept about project design, planning, implementation, evaluation and reporting will be provided at the outset of the project. The students shall carry out the project task on the basis of their acquired knowledge and skill in the field of Geomatics.

Course Objectives:

After the completion of project work, students will able to:

1. Employ the knowledge and skills in real work situation
2. Design a Survey Project Work and develop project proposal
3. Plan survey project and estimate the resources required
4. Execute the survey project on specified area
5. Evaluate the project outcomes
6. Prepare the project reports and present the project outcomes

Project Work:

1. The Project work will be based on any one of the following themes/topics
2. Development of proposal, Data acquisition, reporting part of the project work will be carried out by a group of specified number of students. Individual member of the group are required to submit their own performance on Computation/ data analysis, and mapping etc.

Topic 1. Bridge site Survey

Students will be required to carry out the bridge site surveying and for this student(s) will conduct field survey for data capture. Students will prepare the maps, profile, graphs and relevant out-put using field survey data. Available instruments in the institute shall have to be used.

Topic 2. Route survey

Students will be required to carry out the route surveying of specified feature and for this they will conduct field survey for data capture. Students will prepare the maps, profile, graphs and relevant out-put using field survey data. Available instruments in the institute shall have to be used.

Topic 4. Topographical Surveying

Students will be required to carry out the topographical survey of specified area. For this they will conduct field survey for data capture. Students will prepare the topographical maps using field survey data. . Available instruments in the institute shall have to be used.

Topic 5. Cadastral Surveying

Students will be required to carry out the cadastral survey of specified area and for this they will conduct field survey for data capture. Students will prepare the cadastral maps, other cadastral records using field survey data. Available instruments in the institute shall have to be used.

Topic 6. Map Digitization and updating through field verification

A hard copy of map section will be provided and the student will prepare the digital databases from the existing map and update the major changes using field surveying data.

Topic 7. Resource mapping

Digital Base map will be provided and the student will carry out the GPS surveying using hand held GPS and prepare the databases and maps showing the location of resources

Topic 8. Thematic Mapping

Digital Base map of study area will be provided and the student will obtain the relevant thematic information/data using primary or secondary sources. Students will tabulate, manage and analyze the data and they will visualize their analysis in different thematic maps, charts and tables. The analysis should link with spatial context of the selected theme. The study can be focused on one or more of the following themes.

- Population, Population density
- Poverty and spatial disparity
- Facilities and accessibility in the resources
- Education status
- Employment and economic condition
- Gender issues and domestic conflict etc.
- Disaster mapping

Topic 9. Remote Sensing and Photogrammetry

- Change Analysis
- Land Use/Land Cover Change
- Application of UAV (Orthophoto production, DEM generation, Mapping)

Evaluation of Project work:

The evaluation of the project work will be based on the project proposal, performance, final project report, presentation and viva.

Internal Evaluation:

The weightage of internal assessment will be 230 marks.

S. N.	Evaluation Criteria	Marks
1	Proposal with presentation	80
2	Performance	150
	Total	230

Final Evaluation:

Each group must submit project report in standard format. During compilation of report, data must be submitted content wise including maps, reference sketches. Original data and drawings must be presented during final viva voce. The weightage of final assessment will be 120 marks.

S. N.	Evaluation Criteria	Marks
1	Report	80
2	Presentation and Viva voce	40
	Total	**120**

References:

1. Technical Writing Process and Product - Sharon J. Gerson/ Steven M. Gerson, Pearson Education Asia.

Experts Involved in Curriculum Revision, 2022

S.N.	Name	Position	Organization
1	Tanka Prasad Dahal	Director	Survey Department, Kathmandu
2	Ramesh Gyawali	Director	Land Management Training Center
3	Damodar Dhakal	Director	Survey Department, Kathmandu
4	Harisharan Nepal	Chief Survey Officer	Survey Department, Kathmandu
5	Dr. Reshma Shrestha	Associate Professor	SoE, Kathmandu University
6	Maheshwar Bhattarai	Retired, Chief Survey Officer/ Former Lecturer	Survey Department, Kathmandu/ School of Geomatics, Kathmandu
7	Raj Kumar Chaulagain	Lecturer	IOE, Thapathali Campus
8	Buddhiman Jaishi	Lecturer	Himalayan College of Geomatics Engineering, Kathmandu
9	Sudarshan Gautam	Instructor	Land Management Training Center
10	Sharad Chandra Mainali	Instructor	Land Management Training Center
11	Niraj Adhikari	Instructor	Nepal Banepa Polytechnic Institute
12	Sujan Sapkota	Instructor	Nepal Banepa Polytechnic Institute
13	Shree Ram Bhandari	Instructor	Shankharapur Polytechnic, Kathmandu
14	Sandeep Gautam	Instructor	Shankharapur Polytechnic, Kathmandu