CONTROL SURVEY

ENGE 253

Lecture : 4 **Year : II**
Tutorial : 0 **Part : II**
Practical : 3

Course Objectives:
The objective of this course is to provide students with both theoretical understanding and practical skills necessary to conduct accurate and efficient control surveys for geodetic and engineering applications, using traditional methods such as levelling, traversing, and triangulation, as well as modern techniques with advanced surveying instruments.

1 Introduction (4 hours)

1.1 Overview of geodetic surveying
1.2 Horizontal and vertical controls
1.3 Importance of horizontal and vertical controls
1.4 Historical development and evolution of control surveys
1.5 Applications of control surveys in geomatics engineering

2 Vertical Control Survey (12 hours)

2.1 Definition and significance of vertical control
2.2 Types of vertical control surveys: Levelling, trigonometric, and GNSS-based vertical control
2.3 Techniques for vertical control survey
2.4 Obstacles in establishing vertical controls
2.5 Vertical control networks in Nepalese context
2.6 Modern height reference system and frame
2.7 Advantages of modern height reference system
2.8 Error Sources and adjustments in vertical control
2.9 Application of vertical control surveys
2.10 Vertical control standards in Nepal (Red book)

3 Triangulation and Trilateration (12 hours)

3.1 Introduction to triangulation
3.2 Triangulation figures and different framework/systems
3.3 Classification of triangulation and specifications in context of Nepal
3.4 Strength of figure
3.5 Field procedure in triangulation: Reconnaissance, monumentation, signaling, observation and recording

3.6 Different errors in base line measurement and their corrections
3.7 Satellite station and reduction to center
3.8 Trilateration and its principle
3.9 Field procedure in trilateration: Reconnaissance, monumentation, signaling, observation and recording
3.10 Errors in trilateration and field precautions

4 Traversing (12 hours)

4.1 Traverse and principle of traversing
4.2 Open and closed traverse
4.3 Classification of traverse and specification
4.4 Different methods of traversing
4.5 Observation of traverse angles and its different methods
4.6 Observation of traverse lengths
4.7 Angle adjustment and bearing computation
4.8 Departure, Latitude and its computation (Gale's traverse table)
4.9 Traverse adjustment (Bowditch, transit, axis and graphical method)
4.10 Omitted measurements in its different case

5 Resection and Intersection (8 hours)

5.1 Definition, principles, purpose and scope
5.2 Analytical intersection and resection
5.3 Two points and three-point resection and their significance
5.4 Instruction on field application
5.5 Field Operation (Reconnaissance, monumentation, signaling, observation, recording, computation and adjustment)
5.6 Field precautions

6 Geodetic Control Networks (8 hours)

6.1 Geodetic control networks overview
6.2 Datum and reference systems
6.3 Horizontal datum (WGS84, NAD83)
6.4 Vertical datum (NAVD88)
6.5 Establishment and maintenance of geodetic control networks
6.6 Use of global navigation satellite systems (GNSS) in geodetic control surveys
6.7 History of geodetic network in Nepal
6.8 Establishment of Laplace station
6.9 Processing and adjustment of geodetic data

7 National Gravity Network (4 hours)

7.1 History
7.2 Nagarkot datum

7.3 Gravity stations in Nepal
7.4 Use and extension of national gravity station

Practical **(45 hours)**

1. Leveling: Trigonometric levelling; Precise levelling; Profile and cross section levelling; Reduction of level
2. Traversing: Reconnaissance and selection of stations; Preparation of description card (D-Card); Angle observation; Traverse computation; Traverse adjustments
3. Triangulation: Reconnaissance and selection of stations; Observation and recording; Computation and adjustment
4. Intersection and resection

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	4	5
2	12	12
3	12	12
4	12	10
5	8	8
6	8	8
7	4	5
Total	**60**	**60**

* There may be minor deviation in marks distribution.

References

1. Arora, K.R. (2019). Surveying (Volume 1 and 2). Rajons Publication Pvt. Ltd.
2. Punmia, B.C., Jain, A.K., Jain, A.Kr. (2016). Surveying (Volume 1 and 2). Laxmi Publication (P) Ltd.
3. Agor, R. (1980). The Text book of Surveying & Levelling. Khanna Publisher.
4. Levelling Instruction Book. Department of Survey, Nepal.
5. Triangulation Instruction Book. Department of Survey, Nepal.
6. Wolf, P.R., Ghilani, C.D. (2014). Adjustment Computations: Spatial Data Analysis. United Kingdom: Wiley.
7. Leick, A., Rapoport, L., Tatarnikov, D. (2015). GPS Satellite Surveying. John Wiley & Sons.
8. Ghilani, C.D. (2017). Elementary Surveying: An Introduction to Geomatics.
9. Bannister, A., Raymond, S., Baker, R. (1998). Surveying. Pearson Publication.