

# ENGINEERING SURVEY II

ENCE 203

**Lecture** : 3  
**Tutorial** : 1  
**Practical** : 4

**Year : II**  
**Part : I**

## Course Objectives:

The objective of this course is to familiarize surveying methods and techniques used for design and construction of civil engineering projects. This course will provide basic knowledge of land measurement and surveying techniques giving specific emphasis to plane surveying. The course will make students able to learn and understand the theory and field procedures by applying suitable surveying methods to prepare engineering maps.

### **1 Traversing and Area Calculation (8 hours)**

- 1.1 Needs, significance and types of traversing
- 1.2 Specification for horizontal and vertical control of traverse
- 1.3 Fieldworks for traversing and traverse field notes
- 1.4 Traverse computation
- 1.5 Plotting of traverse, concept of map integration
- 1.6 Field problems and instructions
- 1.7 Area calculation by coordinate and double meridian distance method

### **2 Indirect Leveling and Contouring (5 hours)**

- 2.1 Principle of plane trigonometric surveying
- 2.2 Determination of heights and distances of inaccessible objects
- 2.3 Reciprocal trigonometrical leveling
- 2.4 Instruction on field works
- 2.5 Introduction to contouring
- 2.6 Establishment of controls
- 2.7 Contour interval and characteristics of contour
- 2.8 Methods of locating contours
- 2.9 Interpolation of contours
- 2.10 Uses of contour maps
- 2.11 Volume calculation by average-end-area and prismatic methods

- 3 Orientation and Field Astronomy (5 hours)**
- 3.1 Introduction to datum system
  - 3.2 Analytical intersection and resection
  - 3.3 Two points and three-point resection and their significance
  - 3.4 Instruction on field application
  - 3.5 Introduction of astronomy, definition of terms
  - 3.6 Geographical coordinate system
  - 3.7 Map projection system of Nepal
  - 3.8 Use of astronomy in surveying and mapping
- 4 Route Survey (10 hours)**
- 4.1 Types of curves and their uses
  - 4.2 Simple circular curves and elements
  - 4.3 Layout of simple circular curve by linear and angular method
  - 4.4 Transition curve, characteristics, types and its elements
  - 4.5 Layout of transition curve by linear and angular method
  - 4.6 Elements of composite curves and setting out techniques
  - 4.7 Vertical curve, requirements, equation of parabolic curve
  - 4.8 Vertical curve layout by parabolic method
- 5 Photogrammetry and Drone Surveying (5 hours)**
- 5.1 Photogrammetric as a branch of surveying
  - 5.2 Scale of vertical photograph, relief displacement
  - 5.3 Merits and limitation of photogrammetry
  - 5.4 Drones and their development; drone types
  - 5.5 Drone regulation in Nepal and flight permission
  - 5.6 Features of drone mapping and surveying
  - 5.7 Drone survey planning and techniques
  - 5.8 Post processing and data analysis of drone survey
  - 5.9 Application of drone survey
- 6 Geospatial Technologies in Civil Engineering (4 hours)**
- 6.1 Global positioning system (GPS)
  - 6.2 Components, working principles and uses of GPS
  - 6.3 Differential GPS and its uses in civil engineering for mapping
  - 6.4 Instructions to field applications
  - 6.5 Types of remote sensing and electromagnetic radiation (EMR)
  - 6.6 Interaction of EMR with earth surface features
  - 6.7 Field application and instruction of remote sensing
  - 6.8 Geographic information system (GIS) and types of GIS
  - 6.9 Application of GIS to civil engineering projects

**7 Hydrographic Surveying (4 hours)**

- 7.1 Hydrographic survey, its terminology and application
- 7.2 Vertical and horizontal control
- 7.3 Measurement of depth and velocity of flow and discharge
- 7.4 Location of a point by orientation

**8 Specialized Civil Engineering Surveys (4 hours)**

- 8.1 Principle, stage and requirements of setting out
- 8.2 Horizontal and vertical control for setting out works
- 8.3 Building setting out by linear and angular method
- 8.4 Bridge and sewer line layout work
- 8.5 Norms and standards for road alignment survey
- 8.6 IP and corridor method of alignment surveying
- 8.7 Basics of tunnel surveying
- 8.8 Uses of gyroscope for tunnel surveying
- 8.9 Methods of transferring centerline in tunnel
- 8.10 Basics of water supply and canal surveying

**Tutorial (15 hours)**

1. Traversing and area calculation; computation of major and minor traverse; calculation of area by coordinate and DMD method
2. Indirect leveling, calculation and interpolation of contour
3. Orientation and field astronomy problems related to intersection, two point and three point problems by Collins and Tienstra's methods
4. Different problems related to simple circular, transition, composite and vertical curves
5. Calculation of flow velocity and discharge obtained by different measurement techniques
6. Calculations of chainage of route alignments, horizontal and vertical control

**Assignments**

1. Digital data recording plotting by software to produce the topographic map

**Practical (60 hours)**

1. Traverse survey by digital data recording using total station (Record horizontal angle and mention manual calculation), plotting of detailing by manual and any computer software; RL transfer to station
2. Intersection and resection using total station
3. Trigonometric leveling
4. Contouring - Indirect method
5. Setting out of simple circular, transition, composite and vertical curves
6. Minimum three room building setting out by linear and angular methods
7. Establishment of control points by using DGPS nearby working area

8. Flying of drone, taking image by using drone and image processing for terrain generation
9. Demonstration on application of GPS and GIS
10. Photogrammetry lab visit

### 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	Mark distribution*
1	8	12
2	5	6
3	5	6
4	10	16
5	5	6
6	4	5
7	4	5
8	4	4
<b>Total</b>	<b>45</b>	<b>60</b>

\* There may be minor deviation in marks distribution.

### References

1. Bannister, A., Raymond S., Baker R. (1998). Surveying (7th edition). Pearson.
2. Punmia B.C., Jain A.Kr., Jain A.K. (2005). Surveying VOL I, VOL II & VOL III. Laxmi publication.
3. Wolf, P.R., Brinker, R.C. (2010). Elementary Surveying. Harper Collins college publishers.
4. Basak N.N. (2004). Surveying and Levelling. Tata McGraw-Hill.
5. Agor R. (1980). A Text Book of Surveying and Levelling. Delhi: Khanna publisher.
6. Duggal S.K. (2013). Surveying: Volume 1& 2. Tata McGraw-Hill.
7. Dhakal B.B., Karki B.K. (2019). Engineering Surveying I & II, Second edition. Kathmandu: Heritage publication and distributors.
8. Basnet N., Basnet M. (2011). Basic Surveying I & II. Kathmandu: National Book Center.