

4.2 SURVEYING – II

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RATIONALE

The important functions of a civil engineer includes the jobs of detailed surveying, plotting of survey data, preparation of survey maps and setting out works. While framing the curriculum for the subject of surveying, stress has been given to the development of knowledge and skill in theodolite surveying, tachometry surveying, curves and use of minor and modern instruments have been included in this subject. Field work should be a selected one so that student can check his work and have an idea of the results the extent of error in the work done by him. As far as possible, the surveys done should be got plotted, as this will also reveal errors in the work and develop skill in plotting.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- CO1: Prolong a line with theodolite.
- CO2: Conduct closed traversing
- CO3: Measure horizontal and vertical angles.
- CO4: Set out simple circular curve
- CO5: Prepare maps for closed traverse and open traverse with Total Station
- CO6: Draw a contour plan of an area with Total station and DGPS
- CO7: Calculate earth work for a road with Total station and DGPS

DETAILED CONTENTS

UNIT I

Electronic Digital Theodolite and Tachometric surveying

- 1.1 Concept/Difference of Transit Theodolite and Electronic Digital Theodolite
- 1.2 Temporary adjustments of an Electronic Digital Theodolite, Concept of transiting, swinging, face left, face right and changing face.
- 1.3 Prolonging a line (forward and backward)
- 1.4 Traversing by included angles and deflection angle method.

- 1.5 Plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected)
- 1.6 Errors in theodolite survey and precautions taken to minimize them
- 1.7 Height of objects with and without accessible bases
- 1.8 Concept, general principles of stadia tachometry and methods of tachometry and (with numerical problems)
- 1.9 Instruments to be used in tachometry

UNIT II

Curves: (Horizontal, Vertical and Transition Curve)

- 2.1 Definition and types of horizontal curve
 - **2.1.1 Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. (With numerical problems)
- 2.2 Transition Curve:
 - 2.2.1 Definition of transition curve
 - 2.2.2 Requirements of transition curve
 - 2.2.3 Length of transition curve for roads; by cubic parabola
 - 2.2.4 Need (centrifugal force and super elevation).
 - 2.2.5 Calculation of offsets for a transition curve
- 2.3 Definition and types of vertical curve
 - 2.3.1 Types of vertical curves
 - 2.3.2 Setting out of a vertical curve

UNIT III

Introduction of Advanced Surveying Equipment and Techniques.

- 3.1 Principle of EDM, its component parts and their functions
- 3.2 Uses of EDM
- 3.3 Distomat
- 3.4 Remote sensing system
- 3.5 Application of remote sensing system in civil engineering, land uses/land cover, mapping, and disaster management
- 3.6 GPS, DGPS and GIS applications and software used (introduction only)
- 3.7 Planimeter (Digital)
- 3.8 Introduction of Drones Survey

UNIT IV**Total Station (TS)**

- 4.1 Concept and uses of TS
- 4.2 Uses of function keys, various parts of TS
- 4.3 Accessories used in TS survey
- 4.4 Applications of TS in various engineering area.
- 4.5 Temporary adjustments of TS
- 4.6 Measurement of horizontal angle, vertical angle distance and coordinates using Total station, Traversing, profile survey and contouring with TS
- 4.7 Errors in TS
- **4.8 Layout of any building, school, college, factory etc. with total station showing topographic map also

UNIT V**DGPS (Differential Global Positioning System)**

- 5.1 Concept of DGPS, various parts, applications and software used for DGPS
- 5.2 Comparison between DGPS and TS
- 5.3 Temporary adjustments of a DGPS
- 5.4 How does DGPS work
- 5.5 Errors in DGPS
- **5.6 Periodic field visits to Survey of India and other government agencies.
- **5.7 Layout of drain, canal, road with DGPS.
- **5.8 Demarcation of roads, plots, commercial spaces and agricultural land etc. with DGPS

NOTE: ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES

- I. Digital Theodolite:
 - i) Study of a transit vernier theodolite; temporary adjustments of theodolite
 - ii) Reading the Vernier and working out the least count, measurement of horizontal angles by repetition and reiteration methods
 - iii) Measurement of vertical angles and use of tachometric tables
 - iv) Measurement of magnetic bearing of a line
 - vi) Running a closed traverse with a theodolite (at least five sides) and its plotting
 - v) Height of objects with and without accessible bases

- II. Curves
 - i) Setting out of a simple circular curve with given data by the following methods
 - a) Offsets from the chords produced by Digital Theodolite
 - b) One theodolite method
 - ii) Setting out of simple circular curve by tangential angles using a Digital Theodolite.
 - iii) Setting out of a transition curve by tangential offsets using a Digital Theodolite.
- III Total Station
 - i) Temporary adjustments of a Total station
 - ii) Measurement of distance, horizontal angle and vertical angle.
 - iii) To plot an area with the help of Total Station
 - iv) Layout of any building, school, college, factory etc. with total station showing topographic map also
(Draw at least one sheet using AutoCAD software)
- IV DGPS (Differential Global Positioning System)
 - i) Computation of earth work and reservoir capacity with DGPS
 - ii) Layout of drain, canal, road with DGPS.
 - iii) Demarcation of roads, plots, commercial spaces and agricultural land etc. with DGPS
(Draw at least one sheet using AutoCAD software)
 - iv) Periodic field visits to Survey of India and other government agencies.

RECOMMENDED BOOKS

1. SK Hussain, and MS Nagraj, "Text Book of Surveying", S Chand and Co Ltd., New Delhi.
2. RS Deshpande, "A Text Book Surveying and Levelling", United Book Corporation, Pune.
3. CL Kocher, "A Text Book of Surveying", Katson Publishing House Ludhiana.
4. TP Kanetkar, and SV Kulkarni, "Surveying and Leveling-Vol.2", AVG Prakashan, Pune.
5. BC Punima, "Surveying and Leveling", Standard Publishers Distributors, Delhi.
6. Sanjay Mahajan, "Surveying-II", Satya Prakashan, Delhi.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students. Extract data from Total Station and DGPS all civil engineering students train to use AutoCAD software. If a student aspires to be successful in the civil engineering, design, field surveyor etc. then AutoCAD may be an essential tool to learn. This subject contains five units of equal weightage.