

**Subject – Surveying**  
**Subject Code :-CIV 303**  
L T P  
3 0

**Total Contact hrs. :**

*Theory : 42*

**Total marks : 100 (80+20)**

### **RATIONALE :**

Surveying is an essential component of the day to day work of a Civil Engineering Technician. The job includes conducting detailed surveying, plotting of survey data, preparation of survey maps etc. In view of its importance the course content has been divided into 2 parts and introduced sequentially as Surveying – 1. Each theory course is accompanied by practical course work to provide hands on experience.

The course content of Surveying –I includes the basic concept of surveying, horizontal linear and angular measurements and conducting surveys involving horizontal linear and angular measurements with stress on familiarization with various equipment used. It also includes vertical linear measurements to indicate the profile of the land surface by levelling has also been covered in details.

### **AIM :**

The course content of Surveying – I has been designed to provide adequate information to develop competency in a learner to-

1. Comprehend the concepts of surveying,
2. Carry out horizontal linear and angular measurements using appropriate equipment,
3. Conduct survey work in field using horizontal linear and angular measurements,
4. Record the data observed during the survey work,
5. Plot the survey map from the recorded data,
6. Compute the data required for plotting,
7. Interpret the plotted survey map and compute data from it,
8. Determination of elevations of points on the earth surface, using appropriate equipment,
9. Record the data observed during leveling,
10. Compute the data required for plotting.

### **1.0 Introduction:**

**02 hrs**

- 1.1 Definition of surveying and related terms
- 1.2 Aims and objectives of surveying
- 1.3 Primary division of surveying with their purposes
- 1.4 Classification of surveying
- 1.5 Principles of surveying
- 1.6 Field work-essential feature and organization
- 1.7 Office work-feature, plotting, scales, effect of erroneous scale
- 1.8 Maintenance and adjustments of instruments
- 1.9 Precision and accuracy of measurements

## **2.0 Linear measurement:**

**10 hrs**

- 2.1 Method of measuring distance, their merits and demerits.
- 2.2 Instruments for measuring distance:
  - Tape and Chains
- 2.3 Equipment and accessories for chaining-description only
- 2.4 Use of chain- unfolding & folding, use of arrows, reading a chain, testing and adjusting of chain .
- 2.5 Ranging – purpose, signalling, direct and indirect ranging, line ranger-features and use, error due to incorrect ranging.
- 2.6 Method of chaining- Role of leader and follower, Chaining on flat ground, chaining on sloping ground-stepping method, Clinometers- feature and use, slope correction. (Demonstration in field)
- 2.7 Field problems- Setting perpendicular with chain & tape, chaining across different type of obstacles-
  - a) Chaining around obstacle possible:
    - Vision free but chaining obstructed both vision and chaining obstructed.
  - b) Chaining around obstacle not possible:
    - Vision free but chaining obstructed, chaining free but vision obstructed.
- Numerical problem on chaining across obstacles
- 2.8 Error and mistakes in linear measurement-classification, sources of error and remedies.
- 2.9 Correction to measured length due to-incorrect length, temperature variation, pull, sag, numerical problem applying corrections
- 2.10 Precaution during chaining.
- 2.11 Principle of chain surveying-well conditioned and ill conditioned triangles
- 2.12 Field books-single line & double line entry, field book recording
- 2.13 Selection of survey station, base line, Tie line, Check lines
- 2.14 Offsets-necessity, perpendicular and Oblique offsets, Setting offsets with chain & tape, Instruments for setting offset- Cross staff, optical Square, feature, use & handling , suitability, sources of error & remedies.
- 2.15 Error in chain surveying- causes & remedies, Precautions during chain surveying.

## **3.0 Compass Surveying :**

**08 hrs**

- 3.1 Compass- types- surveyor's compass, Prismatic compass, feature, parts, merits & demerits, suitability of different types.
- 3.2 Concept of meridians-magnetic, true, arbitrary. Concept of bearings-whole circle bearing, Quadrantal bearing / Reduced bearing, numerical problems on conversion of bearings.
- 3.3 Use of compass- setting in field- centering, levelling, taking readings, concept of fore-bearing, Back bearing, Numerical problems on computation of interior & exterior angles from bearings.
- 3.4 Effect of earth's magnetism- dip of needle, magnetic declination, variation in declination, numerical problems on application of correction for declination.
- 3.5 Local attraction- causes, detection, error, corrections, numerical problems on application on application of correction due to local attraction.

- 3.6 Principle of traversing- open & closed traverse, advantage & disadvantages over chain surveying.
- 3.7 Method of traversing- locating objects, field book entry.
- 3.8 Plotting of traverse- check of closing error in closed & open traverse.
- 3.9 Computations of area from plotted survey, planimeter, feature, use of menstruation techniques- average ordinate rule. Trapezoidal rule, Simpson's rule.

#### **4.0 Levelling:**

**08**

- 4.1 Purpose of levelling
- 4.2 Definition of terms used in levelling- concept of level surface, Horizontal surface, vertical surface, datum, RL, Bench mark, Concept of line of collimation, axis of bubble tube, axis of telescope, vertical axis, BS, IS, FS, CP, HI.
- 4.3 Types of levels and Levelling staff, auto level.
- 4.4 Temporary adjustment of level, taking reading with level
- 4.5 Principle of levelling- simple levelling, Different types of levelling, use and method- Fly levelling, check levelling- longitudinal section and cross-sections
- 4.6 Field data, entry of level Book- Height of collimation method and rise & fall method, comparison, Numerical problems on reduction of level applying both methods, Arithmetic checks.
- 4.7 Effect of curvature and refraction, numerical problems on application of correction.
- 4.8 Reciprocal levelling- principle, method, numerical problems, precise levelling.
- 4.9 Difficulties in levelling, error in levelling and precautions
- 4.10 Contouring: Counter interval, horizontal interval, characteristics of counter lines, interpolation of contour , uses of contour maps

#### **5. Theodolite Survey**

**10 hrs**

- 5.1 Types of theodolite and terminologies in theodolite survey
- 5.2 Temporary and permanent adjustment of theodolite
- 5.3 Relation between fundamental lines of theodolite
- 5.4 Measurement of horizontal and vertical angles, base line, extension of base line
- 5.5 Features and use of Total Station and modern survey equipments.
- 5.6 Tachometry survey for determination of horizontal distance of plane and slope ground. ( numerical problems)
- 5.7 Latitude, departure and computation of length and bearing of closed traverse. Bowditch and transit rule.

#### **6. Plane Table Survey**

**4 hrs**

- 6.1 Different instruments used
- 6.2 Different Methods

## **Sub: Surveying Lab**

### **Subject Code CIV 307**

**ALL PRACTICAL FIELD WORKS ARE ATTACHED WITH FIELD BOOK AND DRAWING WORK ON FULL IMPERIAL SIZE DRAWING SHEETS.**

**(Minimum experiments to be performed should be 10 )**

1. Measurement of distances with chain & tape on ground with direct or in Direct Ranging.
2. Use of Optical Square for setting out perpendicular and running survey line for locating details.
3. Measuring Fore bearing and Back bearing of 5-6 sided closed polygon. Identifying stations affected by local Attraction and their corrections.
4. Measuring for bearing and back bearing for an open traverse (5 to 6 sided). Calculate direct angles between successive lines.
5. Use of Dumpy Level, temporary adjustments and recording readings in Field Book.
6. Differential levelling practice, reduction of level by H.I. method/ Rise and fall method.
7. Carrying Benchmark from one point to another point about 200m by fly levelling with auto level.
8. Preparation of Contour Map of a small area by direct levelling
9. Locating details with plain table by method of Radiation and intersection.
10. Measurement of Horizontal Angle by Transit Theodolite (repetition method)
11. Measurement of Vertical Angles by theodolite.
12. To find reduced level and horizontal distances using Theodolite as a Tacheometer.
13. Use of Total Station for finding Horizontal and Vertical distances and reduced levels.
14. Use of Digital Planimeter for determination of area

#### **REFERENCE BOOKS:**

1. Surveying & levelling – by T.P. Kanetkar & S.V. Kuljarni; Griha prakash , Pune
2. Surveying – by B.C Punmia; Laxmi publication, Delhi-6
3. A text book of surveying and levelling- by R. Agor; Khanna Publishers, delhi-6
4. Surveying and levelling - by Hussain and Nagraj; S. Chand & co, Delhi
5. Surveying & levelling – by S.C Rangawal; Charotar Book Stall, Pune
6. Surveying & levelling –by N.N Basak; Tata Mc. Grave Hill
7. Plane Surveying –by A. De; S chand & co.