SURVEYING

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Surveying

1 INTRODUCTION

IMPORTANT DEFINITIONS

Survey

- It is an art of determining relative positions of objects.

  On the ground - Land Survey

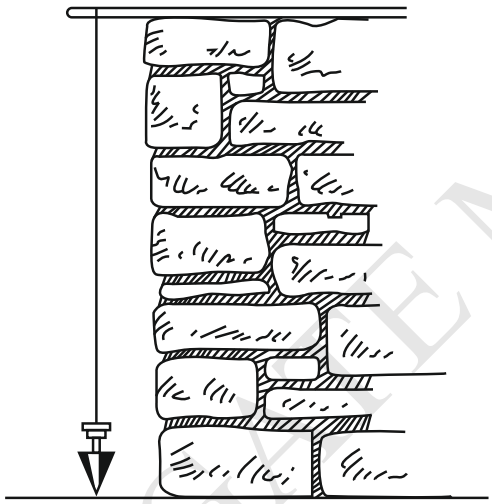
  Above the ground - Astronomical Survey

  Below the ground - Hydrographic Survey,

  by direct or indirect measurements (which includes linear, angular, elevation etc..,)

Plumb line

- The line or path made by the plumb bob when it is dropped from certain height.



Level line

- A line lying in a level surface is a level line and is a curved line normal to the plumb bob at all the points.

Level Surface

- A level surface is the equipotential surface of the earth's gravity field. It is a curved surface and every element of which is normal to plumb line.

  Eg: A body of still water.

Horizontal Line

- A line which is perpendicular to the plumb line & tangential to a level surface is horizontal line.

Horizontal Plane

- It is a plane which is perpendicular to the plumb line and tangential to level surface at a particular point.

TYPES OF SURVEY

Land Survey

- **Control survey:**

  Establishing horizontal and vertical positions of widely spaced control points.

- **Topographical Survey:**

  It tells about natural features of the area like rivers, hills, lakes etc.,

Note :

Large scale	1cm = 10m (or) less
Medium scale	1cm = 10m - 100m
Small scale	1cm = 100m (or) Above

Note :

Building Site	1cm = 10m (or) less
Town plan Schemes	1cm = 50m - 100m
Cadastral Survey	1cm = 5m -500m
Topographical Survey	1cm = 250m - 2,500m
Geographical Maps	1cm = 5km - 150km

- **Cadastral Survey:**

  It defines boundaries, building lines and property lines.

Hydrographic Survey

- It tells about features under the water and is useful for determination of channel depth.

Astronomical Survey

- To know about positions of Stars, Planets, latitudes, longitudes etc.,

Engineering Surveys

- To obtain data for designing projects such as roads, railways etc.,

Geological Survey

- To obtain information of different strata inside the earth crust.

Plane Surveying

- It is the most commonly practiced form of surveying which assumes earth to be FLAT. The curvature of earth is not considered and is useful for small areas (up to 195.5 km^2). In this survey, the level lines (or) plumb lines are straight lines and are parallel to each other.

Geodetic Survey

- In this survey, the curvature (or) shape of earth is considered. Plumb lines are taken as 'arcs' and will intersect at the centre of earth. Geodetic survey is useful for large areas (survey of a country).

PRINCIPLES OF SURVEYING

Location of a Point is w.r.to Two Points of Reference

At least two points are required to locate third point.

Working from Whole to Part

It is very essential to establish first system of control points & fix them with higher precision. Minor control points can be established by less precise methods.

The idea of working in this way is to prevent the accumulation of errors and control and localize minor errors which would expand to greater magnitudes if the reverse process is followed, thus making the work uncomfortable at the end.

METHODS OF SURVEYING

S.No.	METHOD	INSTRUMENTS	PRINCIPLE	NOTE
01	Chain Surveying	Chain, Tape, Arrows, Ranging rod etc.,	Triangulation	‣ Only linear measurements are taken ‣ Used where high accuracy is not required
02	Compass Surveying	Compass, Chain, Tape etc.,	Traversing	‣ Linear and angular measurements are taken ‣ More Precise than chain surveying
03	Levelling	Levelling staff, Dumpy level, Tilting level etc.,	Obtain horizontal line of sight with respect to which vertical distance of the points above (or) below are found	‣ Finding difference in elevations and determining elevation. ‣ More precise than compass survey
04	Plane Table Survey	Tripod Stand, Alidade etc.,	Parallelism	‣ Less accurate method ‣ Plotting and taking measurements is simultaneous ‣ Suitable in areas with magnetic material where compass is not reliable
05	Theodolite Survey	Theodolite	Triangulation	‣ Useful for finding horizontal and vertical angles
06	Tacheometry	Theodolite with stadia diaphragm, Subtense bar etc.,	Isosceles triangle	‣ Useful to find horizontal and vertical positions of points without using chain (or) tape ‣ Rapid but not very accurate
07	Photogrammetry	Camera, Tripod etc.,	Triangulation	‣ Useful for vast areas
08	Electromagnetic Distance Measurement (EDM) Surveys	Total station	Triangulation	‣ Useful for very vast areas ‣ Used to measure horizontal angles, vertical angles and distances

Practice Questions

Level - 1

1. Two plumb lines will
   a) Intersect at the centre of the earth in geodetic survey
   b) Remains parallel in plane survey
   c) Both a and b
   d) None
2. The survey carried out to delineate natural features such as hills, rivers, forests and man - made features such as towns, villages, buildings, roads, transmission lines and canals is classified as
   a) Engineering survey
   b) Geological survey
   c) Land survey
   d) Topographic survey
3. While surveying a plot of land by the method of plane tabling, the field observations **(ISRO 2019)**
   a) And plotting proceed simultaneously
   b)And plotting do not proceed simultaneously
   c) Are recorded in field books to be plotted later
   d) None of the above
4. When the curvature of earth is taken into account, the surveying is called as **(SSC-JE - 2012)**
   a) Plane surveying
   b) Preliminary surveying
   c) Geodetic surveying
   d) Hydrographic surveying
5. The main principle of field surveying is to work from **(SSC-JE - 2013, 14)**
   a) Higher level to lower level
   b) Lower level to higher level
   c) Part to whole
   d) Whole to part
6. The type of surveying which requires least office work is (least calculation): **(SSC-JE - 2014)**
   a) Theodolite surveying
   b) Tacheometry
   c) Trigonometric levelling
   d) Plane table surveying
7. A level line is a **(SSC-JE - 2013)**
   a) Line parallel to the mean spheroidal surface of the earth
   b) Line passing through centre of cross hairs and centre of eye-piece
   c) Line passing through objective lens and the eye-piece
   d) Horizontal line
8. The surface which is normal to the direction of gravity at all the points, as indicated by plumb line is known as **(APPSC 2008)**
   a) Datum surface b) Level surface
   c) Horizontal surface d) Vertical surface
9. Equipotential gravity surface is called **(AEE 1996)**
   a) MSL b) Geoid
   c) Level surface d) None
10. Surface of still water in a lake is **(AEE 1996)**
    a) Level surface b) MSL
    c) Horizontal surface d) None
11. A plane which is perpendicular to the plumb line through a point and is tangential to the level surface at that point is called a **(ESE : 2014)**
    a) Tangential plane b) Vertical plane
    c) Level plane d) Horizontal plane

Level - 2

1. Match List -I (Type of survey) with List-II (Purpose) and select the correct answer using the codes given below :

   List - I

   A. Topographical survey

   B. Reconnaissance survey

C. Cadastral survey

D. Archeological survey

List - II

1. To determine boundaries of fields, houses etc.
2. To find relics of antiquity
3. To determine natural features
4. To determine possibility and rough cost of the surveying system to be adopted

Codes :

	A	B	C	D
a)	3	4	1	2
b)	3	1	4	2
c)	2	4	1	3
d)	2	1	4	3

2. Consider the following statements :

The general principles of surveying are

1. To work from part to whole
2. To locate a new station by measurements from at least two fixed reference points already established and /or identifiable

Which of the above statements are correct ?

a) 1 only b) 2 only

c) Both 1 and 2 d) Neither 1 nor 2

Level - 1

KEY 01. c 02. d 03. a 04. c 05. d 06. d 07. a 08. b 09. b 10. a 11. d

Level - 2

KEY 01. a 02. b

2 CHAIN SURVEY AND ERRORS

IMPORTANT DEFINITIONS

Scale

It is a technique to represent ground on a paper or map. It is a fixed proportion that every distance on map bears corresponding distance between points on ground surface.

i. **Linear Scale** = $\frac{\text{Plan (or) Map distance}}{\text{Ground distance}}$

Eg : Linear scale = $\frac{1\,\text{cm}}{10\,\text{km}}$

i.e., 1cm on map = 10km on ground.

ii. **Area Scale :** 1 cm^2 = 100 km^2

i.e., 1cm^2 on map = 100km^2 on ground.

Note :

In general, the following two rules should be observed at the time of making choice of scale for a map

- The scale should be large enough so that in plotting or in scaling the distances from the finished map, it will not be necessary to read the scale closer than **0.25mm**.
- The scale should be small enough so that a clear outline of the smallest detail is available on the drawing.

Representative fraction : (R.F)

It is an another form of scale representation, bringing all (map & ground) distances into a one single unit. It is the ratio of map distance to corresponding ground distance and is independent of unit of measurement. The numerator is always **unity** and both numerator & denominator are reduced to same units.

Scale = $\frac{1\,\text{cm}}{10\,\text{km}}$

$\text{R.F} = \frac{1\,\text{cm}}{10\times1000\times100\,\text{cm}}$ $\text{R.F} = \frac{1}{1000000}$

Note :

Out of $\frac{1}{10}$ & $\frac{1}{100}$ R.F. values, $\frac{1}{10}$ is larger scale.

Note :

The common scales adopted for various types of survey maps are as follows:

- Cadastral maps
  1cm = 5m to 0.50 km.
- Cross-sections
  1cm = 1m to 2m. (horizontal & vertical)
- Forest maps
  1cm = 25km.
- Geographical maps
  1cm = 5km to 160km.
- Longitudinal sections
  1cm = 10m to 200m (Horizontal)
  1cm =1m to 2m. (Vertical)
- Topographic survey
  a. Building sites
  1cm =10m or less
  b. Location surveys
  1cm = 50m to 200m
  c. Small scale topographic maps
  1cm =0.25km to 2.5km
  d. Town planning scheme, reservoirs,
  1cm = 50m to 100m

Map

It is a representation of features on, above or below the earth surface with " **smaller scale** ".

Eg : India Map, World map etc.

Plan

It is a representation of features on, above or below the earth surface with " **larger scale** ".

Eg : Town plan, House plan etc.

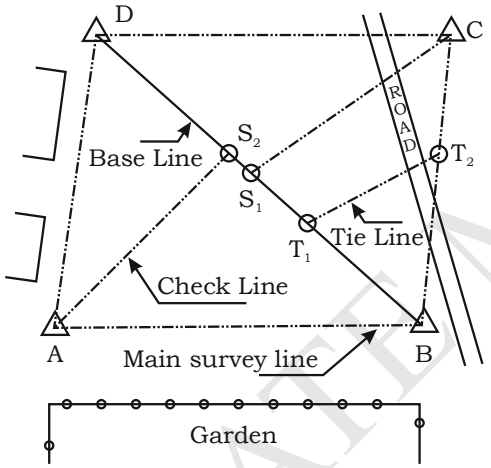
Important lines in chain survey

i. **Main line :** It joins Main stations. Main stations are the boundaries of an area. The main survey which is lines should cover the whole area to be surveyed.

ii. **Base line :** It is the biggest central line which divides the whole area into two parts. It controls the entire survey.

iii. **Check line :** It is taken to check accuracy of survey work.

iv. **Tie line :** Any line taken to collect the details of the object in the area is called as Tie line. These are taken to locate small details and avoid long offsets.



SHRINKAGE PROBLEMS

It is necessary to monitor and eliminate shrinkage problems in the map study otherwise actual dimensions of the features would be changed.

Steps To Solve Shrinkage Problems

Step 1: Find Shrinkage Factor (S.F)

$$S.F = \frac{\text{Shrunk Length}}{\text{Original Length}}$$

Step 2: Find Shrinkage Scale

$$\text{Shrinkage Scale} = S.F \times \text{Original Scale}$$

After finding Shrinkage scale, use shrinkage scale instead of original scale to get exact or actual dimensions.

Note :

$$\text{Correct distance} = \frac{\text{Measured distance}}{S.F}$$

INSTRUMENTS USED IN CHAIN SURVEY

Chain (or) Tape

i. **Chain :** There are number of chains available in the market.

S.No.	Type	Length	Links
01	Metric Chain 20 m 30 m	 20 m 30 m	 100 150
02	Engineers Chain	100 Feet	100
03	Gunters Chain	66 Feet	100
04	Revenue Chain	33 Feet	16

Note :

Minimum tolerance (due to temperature effect):

i. 5 m chain = $\pm$ 3 mm

ii. 10 m chain = $\pm$ 3 mm

iii. 20 m chain = $\pm$ 5 mm

iv. 30 m chain = $\pm$ 8 mm

ii. **Tape :**

- **Cloth tape :**

  Easily affected by atmospheric conditions, likely to twist and therefore is very rarely used.

- **Metallic tape :**
  - Water proof and Better than cloth tape.
  - Composition = Brass +Bronze + Copper

- **Steel tape :**
  - Much superior to cloth & metallic tape.
- **Invar tape :**
  - Gives very exact results and is made up of alloy of Nickel.

    i.e., Steel $\rightarrow$ 64%

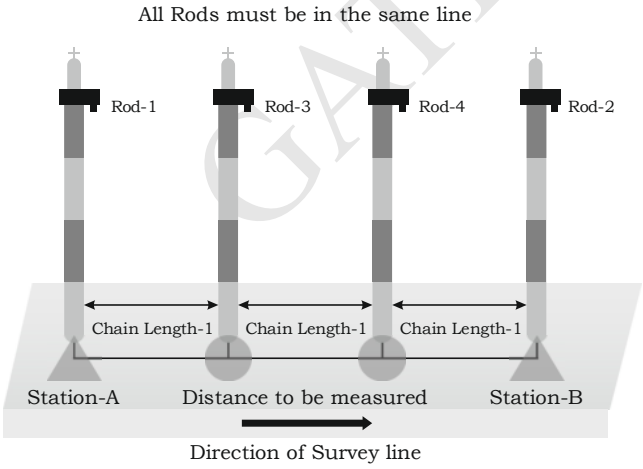
    Nickel $\rightarrow$ 36%
  - This tape is used where high degree of precision is required and it has less thermal expansion coefficient.

Ranging Rods

- Used in the case of very long survey lines
- Height of these rods will be around 2 m to 3 m.

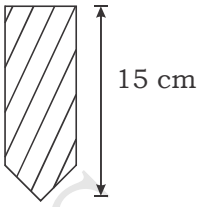
Note :

When a survey line is longer than a chain length, it is necessary to align intermediate points on chain line so that the measurements are along the line. The process of locating intermediate points on survey line is called as ranging (or) process to make chain line straight.



Pegs

- Used to position the main stations in the survey.
- Height of each peg is approximately 15 cm.



Arrows

- Used to position the intermediate station in the survey.
- Height of each arrow is approximately 40 cm.

Offset Rod

- It is used to draw offset to the lines.
- Offsets are the lateral measurements taken from an object to the chain line. These are taken to locate objects. These are of two types;
  i. Perpendicular offset
  ii. Oblique offset
- For setting out perpendicular lines (or offsets) the equipments used are ;
  i. Cross staff
  ii. Optical square
  iii. Prism square
- Prism square is more precise & modern than cross staff and optical square.
- The angle between the mirrors in the optical square is 45^0.

Clinometer

- It is used in the measurement of the ground slope and angles by indirect methods.

ERRORS & CORRECTIONS IN CHAIN SURVEY

Note :

True Value (TV) = Measured Value (MV) $\pm$ Correction (C)

Correction due to incorrect length of Tape or Chain

Let :

L = True length (or) Designated length of tape

L' = Wrong length of tape

l = Actual length of line

l' = Wrong length of line measured

Shortcut:

Correct $\times$ Correct = Wrong $\times$ Wrong

$$L \times l = L' \times l'$$

$$\boxed{l = \left(\frac{L'}{L}\right) \times l'} \rightarrow \text{True length of line}$$

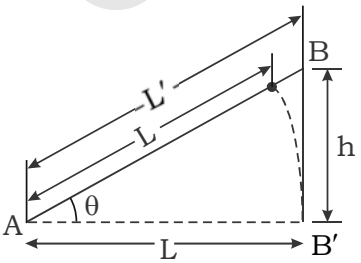
Observations:

- If area A' has been measured using wrong tape or chain,

$$\boxed{A = \left(\frac{L'}{L}\right)^2 \times A'}$$ A - True Area

- $$\boxed{V = \left(\frac{L'}{L}\right)^3 \times V'}$$ V' - Wrong volume, V - Actual volume
- If $L' > L \rightarrow$ Correction is Positive
- If $L' < L \rightarrow$ Correction is Negative.

Correction Due To Slope



$AB' = L$ = Actual length

$AB = L'$ = Measured wrong length along slope

Correction due to slope (C_{slope}) = $L' - L$

$$\boxed{C_{slope} = L' - \sqrt{(L')^2 - h^2}}$$

(or) $C_{slope} = L'(1 - \cos\theta)$

$$\boxed{C_{slope} = \frac{h^2}{2L'}} \rightarrow \text{Approximate formula}$$

Note :

Correction for ground slope is always Negative

Correction due to Temperature

$$C_{temp} = L\alpha\,\Delta T$$

$$\boxed{C_{temp} = L\alpha\left(T_m - T_o\right)}$$

L = Length of the tape

T_m = Temperature at the time of measurement

T_O = Temperature at the time of standardization.

Observations:

i. If $T_m > T_o \rightarrow$ Correction is positive.

ii. If $T_m < T_O \rightarrow$ Correction is negative.

Correction for Pull

$$\boxed{C_{pull} = \frac{(P_m - P_o)l}{A_t . E_t}}$$

P_m = Pull at the time of measurement

P_o = Pull at the time of standardization

A_t = c/s area of tape

E_t = Modulus of Elasticity of tape

Observations:

i. $P_m > P_0 \rightarrow$ Correction is positive

ii. $P_m < P_0 \rightarrow$ Correction is negative

Correction for Sag

$$\boxed{C_{sag} = \frac{W^2 L}{24\,P_m^2}}$$

$$C_{Sag} = \frac{(w.L)^2 . L}{24\,P_m^2} \qquad (\because W = w.L)$$

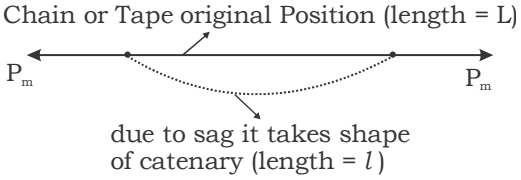
$$C_{Sag} = \frac{w^2 L^3}{24 P_m^2}$$

Where ;

W = Weight of tape between supports

L = Distance between supports

P_m = Applied tension (or) pull

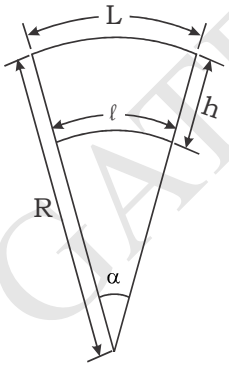


Note :

- Due to sag effect $l > L$;
- Sag correction is always Negative

Correction due to Reduction to MSL

- The measured horizontal distance should be reduced to MSL to obtain Geodetic Survey.
- The necessity of reducing distance to a common datum arises when the surveys are to be connected to national grid.



$$C_R = \left(\frac{h}{R}\right) L$$

Where :

R = Radius of the earth

h = Height from the mean sea level

$$C_R = L - l$$

$$\text{Total Correction} = \pm C_{IL} - C_{Slope} \pm C_{Temp} \pm C_{Pull} - C_{Sag} - C_{MSL}$$

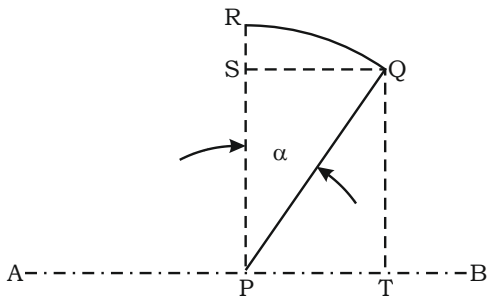
Note :

- In any case, to get well proportional or well - conditioned triangle, no angle should be less than 30^0 and greater than 120^0.
- A triangle of such shape, in which any error in angular measurement has a minimum effect in calculation of sides.

LIMITING LENGTH OF OFFSET

- In general, the length of offset should not be more and it should be such that no appreciable effect is developed while plotting on paper the measured length of offset on ground. The length of offsets depends on the following factors
  - i. Degree of accuracy required
  - ii. Maximum permissible error in measuring length or in layout of perpendiculars to chain line
  - iii. Nature of ground to be surveyed
  - iv. Scale of plotting etc..,
- The limiting length of offset will be studied from the following two aspects:
  - i. Error in direction
  - ii. Combined error due to length and direction.

Error in Direction



i. Displacement in the direction parallel to the chain line will be given by

$$QS = PQ \sin\alpha \ (or) \ \frac{L \sin\alpha}{x} \text{ cm}$$

on paper

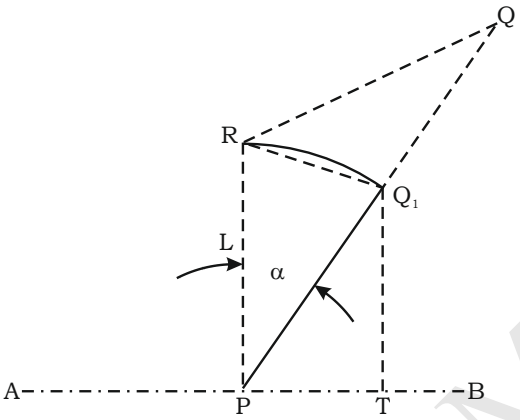
L = Measured offset length PQ

1cm = x m on paper = the scale.

ii. Displacement in the direction perpendicular to chain AB

$$RS = \frac{L(1-\cos\alpha)}{x} \text{ cm}$$ on paper

Combined Error Due To Length & Direction



Total displacement on the paper

$$\frac{\sqrt{2} \times L}{xy} = 0.025 \text{ cm}$$

1cm = x m on paper = the scale

1 in y = the accuracy in measurement of the offset.

Eg :

An offset is measured with an accuracy of 1 in 30. If the scale of plotting is 1cm =15m, find out the limiting length of offset so that the total displacement due to both the errors does not exceed 0.025cm

Solution :

Total displacement on paper $= \frac{\sqrt{2} \times L}{xy} = 0.025$

$$\frac{\sqrt{2} \times L}{15 \times 30} = 0.025$$

$$L = \frac{0.025 \times 450}{1.414} = 7.96\text{m}$$

VERNIER SCALE

- The vernier scales are of the following five types:
  1. Direct vernier
  2. Retrograde vernier
  3. Extended vernier
  4. Double vernier
  5. Double-folded vernier

Direct Vernier

- In case of direct vernier, both the scales namely, vernier and main, move in the same direction and they are graduated in same direction. (n-1) parts of the main scale are taken and they are divided into "*n*" equal parts on the vernier scale.

$$\text{Least count of vernier} = \frac{d}{n}$$

d = Value of the smallest division on main scale.

v = Value of the smallest division on vernier scale.

n = Number of equal parts on the vernier scale

Retrograde Vernier

- In case of Retrograde vernier, the main scale and vernier scale move in opposite directions and graduations are also marked opposite directions. (n+1) parts of the main scale are taken and they are divided into "*n*" equal parts on the vernier scale.

$$\text{Least count of vernier} = \frac{d}{n}$$

d = Value of the smallest division on main scale.

v = Value of the smallest division on vernier scale.

n = Number of equal parts on the vernier scale

Extended Vernier

- This type of vernier is just similar to the direct vernier scale except that every second division is omitted. It, therefore, follows that in case of extended vernier scale, (2n-1) divisions of the main scale are taken and they are divided into "*n*" equal parts of vernier.

$$\text{Least count of vernier} = \frac{d}{n}$$

d = Value of the smallest division on main scale.

v = Value of the smallest division on vernier scale.

n = Number of equal parts on the vernier scale

Double Vernier

- When the main scale is running in both the directions with common zero, it becomes easier to employ a single vernier scale with common zero, such cases usually occur when vertical angles are to be measured with a common horizontal plane.

Double-Folded Vernier

- To reduce the length of double vernier to one-half, both the pieces of verniers are folded in a single piece and figures are written in both the directions of the vernier, such a vernier is know as double folded vernier and it is used on the vernier circle of the theodolite.

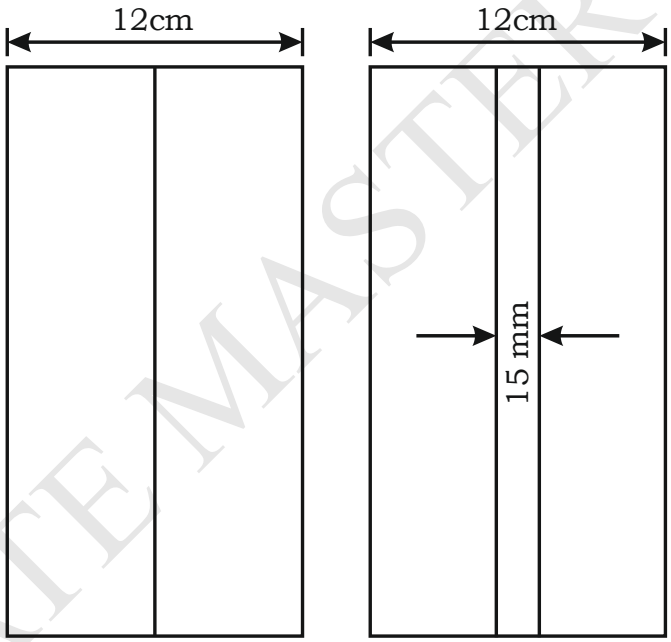
Code Signals of Hand Movements

No.	Code	Meaning
1.	Rapid sweeps of right hand	Move considerably to the right
2.	Rapid sweeps of left hand	Move considerably to the left
3.	Slow sweeps of right hand	Move slowly to the right
4.	Slow sweeps of left hand	Move slowly to the left
5.	Right arm extended	Continue to move to the right
6.	Left arm extended	Continue to move to the left
7.	Right arm up and moved to the left	Move the ranging rod to the left from the top or plumb the rod to the left
8.	Left arm up and moved to the right	Move the ranging rod to the right from the top or plumb the rod to the right
9.	Both hands above head and then brought down	Correct
10.	Both arms extended forward horizontally and the hands depressed briskly or sharply	Fix the rod

- Following precautions should be taken while using these signals:
- The arms should be extended clear of the body
- The signals should be made with a handkerchief when they are to be read from a considerable distance.
- The signals should be so made that they can be seen clearly.
- The signals to move to the left should not be made with the right hand.

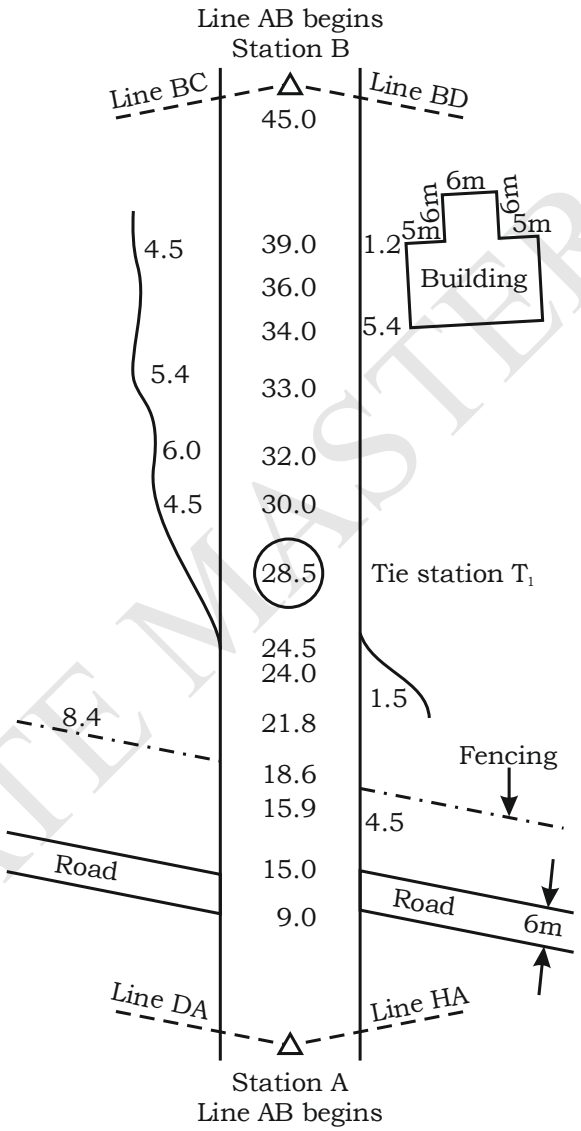
FIELD BOOK

- A field book is used to record the measurements taken in the field. A field book is rectangular blank book of size about 20 cm x 12 cm and it opens lengthwise with pages machine numbered. There are two forms of field book, namely, single line and double line, as shown in



- In case of single line field book, a single red line is drawn through the centre of the page and it represents the survey or chain line. The distances are written along the single line and offsets on right hand side and left hand side are recorded accordingly.This type of field book is used for large scale work and for surveys involving detailed dimen-sion work.
- In case of double line field book,there are two blue lines in the centre of book at a distance of about 15mm. The space between the lines represents the survey or chain line. The distances are written in this space or column and offsets on right hand side and left hand side are recorded accordingly. This type of field book is used for ordinary routine survey work.
- Following points are to be observed while entering the contents of a field book:

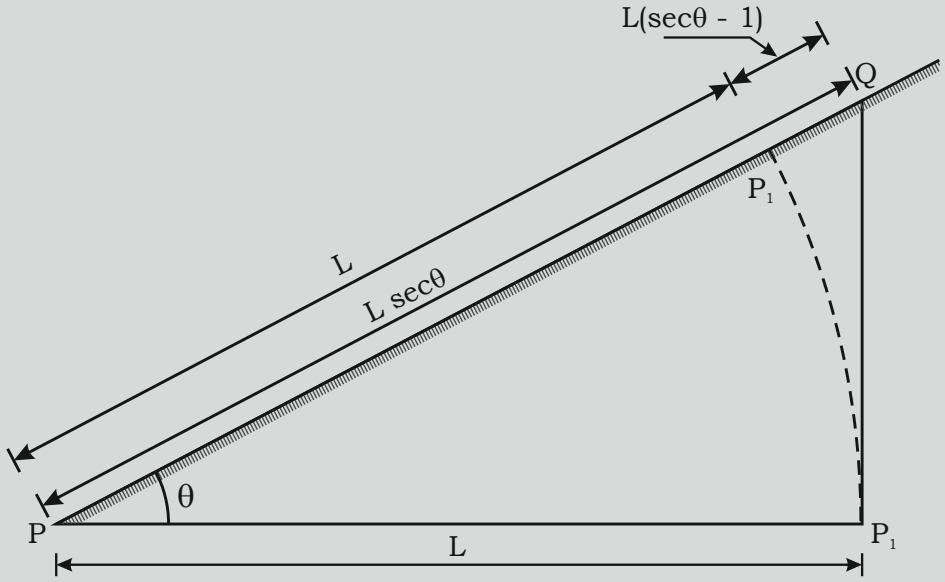
- All the entries should be made in neat hand-writing and all the figures should be legible. It is necessary to avoid over-writing and for wrong entries, they should be crossed out and the correct entries should be written above them.
- If there are references to other pages, they should be clearly mentioned.
- The entries should not be crowded and they should be spaced at reasonable distances apart.



- The sketch of the object should not be shown in advance but should be drawn as the work of taking offsets proceeds.
- The stations should be indicated by symbol of a triangle and the tie stations should be indicated by a circle or an oval round.
- The writing in the field book should be commenced from bottom to the top

Note :

Hypotenusal Allowance: L represents the length of chain and θ represents the angle of slope of the ground. As seen from it is quite evident that to measure horizontal distance L, the equivalent distance on slope is L secθ. Hence, in this method, PP_1 is measured by the chain and then, it is prolonged or extended to point Q by a distance equal to $P_1Q = L(\sec\theta - 1)$. The care should however be taken to see that the point prolonged is in line PQ. As the distance P_1Q is measured along hypotenuse, the amount L (secθ-1) is known as hypotenusal allowance.



CLASSWORK

1. Which of the following scales is largest one ?
   a) 1cm = 50m b) 1 : 42000
   c) R.F = $\frac{1}{300000}$ d) 1cm = 50 km
2. Which of the following instruments is generally used for base line measurements ?
   a) Chain b) Metallic tape
   c) Steel tape d) Invar tape
3. An invar tape is made of an alloy of
   a) Copper and steel b) Brass and nickel
   c) Brass and steel d) Nickel and steel
4. "Ranging" is the process of
   a) Fixing ranging rods on the extremities of the area
   b) Aligning the chain in a straight line between two extremities
   c) Taking offsets from a chain line
   d) Chaining over a range of mountains
5. The main difference between an optical square and a prism square is
   a) Difference in principle of working
   b) That optical square is more accurate than prism square.
   c) That no adjustment is required in a prism square since the angle between the reflecting surfaces cannot be changed
   d) All of the above
6. The angle of intersection of the two plane mirrors of an optical square is
   a) 30^0 b) 45^0 c) 60^0 d) 90^0
7. The maximum tolerance in a 20m chain is
   a) ±2 mm b) ±3 mm c) ±5 mm d) ±8 mm
8. Offsets are
   a) Lateral measurements made with respect to main survey lines
   b) Perpendicular erected from chain lines
   c) Taken to avoid unnecessary walking between stations
   d) Measurements which are not made at right angles to the chain line
9. A line of true length 500 m when measured by a 20m tape is reported to be 502m long. The correct length of the tape is
   a) 19.92m b) 20.08m c) 20.80m d) 21m
10. Match List - I(corrections) with List-II (Name) and select the correct answer using the codes given below the lists

List - I

A. $\pm L\left(1-\frac{h}{R}\right)$ B. $-\frac{\ell}{24}\left(\frac{W}{P}\right)^2$

C. $\pm\alpha(T_f - T_S)L$ D. $\pm\frac{(P_f - P_S)L}{AE}$

List - II

1. Sag correction
2. Pull correction
3. Temperature correction
4. Mean sea level correction

Codes :

	A	B	C	D
a)	4	1	3	2
b)	1	4	3	2
c)	4	1	2	3
d)	1	4	2	3

11. What is the slope correction for a length of 30.0 m along a gradient of 1 in 20 ?
    a) 3.75 cm b) 0.375 cm
    c) 37.5 m d) 0.0375 cm
12. A 30m metric chain is found to be 10cm to short throughout a measurement. If the distance measured is recorded is recorded as 300m, what is the actual distance ?
    a) 300.0m b) 301.0m
    c) 299.0m d) 310.0m

Practice Questions

Level - 1

1. The angles of a triangle are 55^0, 60^0 and 65^0. The triangle is a **(AEE 1987)**
   a) great triangle
   b) small triangle
   c) well-conditioned triangle
   d) ill conditioned triangle

2. The shrinkage of an old map is 24/25 and the R.F is 1/2400, then the corrected scale for the map is **(AEE 2007)**
   a) 1/2400 b) 1/2500
   c) 1/600 d) 1/60000

3. When 1 cm on a map represents 10 m on the ground, the representative fraction of the scale is **(Polytechnic Lecturers- 2007)**
   a) $\frac{1}{10}$ b) $\frac{1}{100}$ c) $\frac{1}{1000}$ d) $\frac{1}{10000}$

4. Measurements taken with a wrong scale can be corrected by using the relation **(Polytechnic Lecturers- 2007)**
   a) True length $= \frac{\text{Correct scale}}{\text{Wrong scale}} \times$ measured length
   b) True length $= \left(\frac{\text{Correct scale}}{\text{Wrong scale}}\right)^2 \times$ measured length
   c) True length $= \left(\frac{\text{Correct scale}}{\text{Wrong scale}}\right)^3 \times$ measured length
   d) None of these

5. The errors measured due to the incorrect holding of chain is **(Managers-2008)**
   a) Cumulative error
   b) Compensating error
   c) Curvature error
   d) Isolated error

6. The smallest scale adopted for topographical surveys is: **(AEE 2008)**
   a) 1 : 25,000 b) 1 : 50,000
   c) 1 : 2,50,000 d) 1 : 5,00,000

7. A line joining some fixed points on the main survey lines is known as **(Managers-2008)**
   a) Base line b) Check line
   c) Contour line d) Tie line

8. The working from whole to the part is done in surveying in order to ensure that **(TSPSC AEE 2015)**
   a) number of errors is minimum
   b) plotting is done more quickly
   c) survey work is completed more quickly
   d) errors and mistakes of one portion do not affect the remaining portion

9. In order to determine the natural features such as valley, rivers, lakes etc., the surveying preferred is **(TS GENCO 2015)**
   a) City surveying
   b) Location surveying
   c) Cadastral surveying
   d) Topographical surveying

10. Example of an obstacle to both chaining and ranging is **(AEE 1987)**
    a) Hill b) Pond
    c) River d) Tall building

11. The number of links in a 30m chain is **(AEE 1987)**
    a) 100 b) 150 c) 50 d) 75

12. Offset rods are useful to **(AEE 2003)**
    a) measure distances
    b) test chains or tapes
    c) mark stations
    d) measure the short offset

13. Systematic errors in surveying **(AEE 2003, APPSC 2006)**