

Details of a Metric Chain

Experiment - I (A)

Object :- Linear measurement by Tape: Ranging & fixing of Survey station along straight line and across obstacles.

Apparatus :- Chain, arrows, Tapes, Ranging rods, offset rods, Cross staff or optical square, Plumb bob, wooden mallet, pegs.

Theory :- Linear measurement by surveying refers to the process of measuring the horizontal distance between two points on the earth's surface.

These measurements are used to establish land maps and boundaries for ownerships or government purpose or to design civil engineering project such as roads and bridges.

Ranging is the process of establishing many intermediate points to measure the survey line in linear measurement. This can be done by ranging rods, offset rods, and ranging poles.

Types of Chain of surveying:-

- (1) Metric chain :- It may be of different lengths. It may be 30m, 20m, 10m, 5m. The length of one link is 20cm.

For 30m chain number of links = 150 links

For 20m chain number of links = 100 links.

Gunter's chain (Surveyor chain) :- It was developed by a civil engineer Gunter. So, this chain was named gunter's chain. It is 66 feet long and has 100 links in one chain tape. Then the length of one link becomes 0.66 feet.

$$\begin{aligned} \text{80 chains} &= 80 \times 66 \text{ feet} = 5280 \text{ feet} = 1 \text{ mile} \\ &= 1.61 \text{ km.} \end{aligned}$$

$$1 \text{ acre} = 4840 \text{ sq. yard.}$$

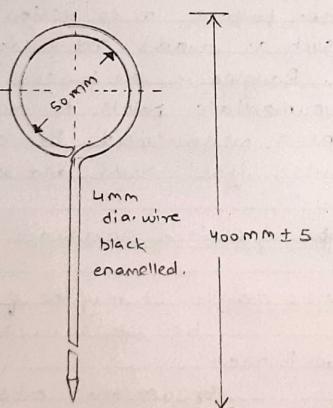
Engineer's chain :- The engineer's chain is mostly used in the civil engineering field in survey. Its length is 100 feet and has 100 links. Then the length of one link becomes 1 foot.

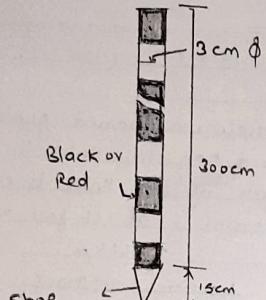
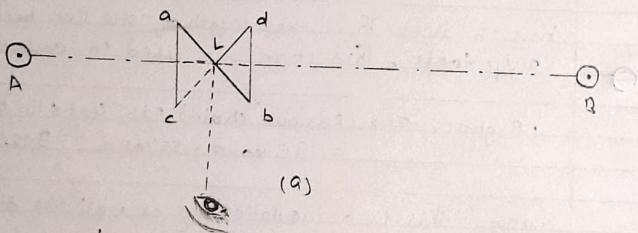
$$80 \text{ chains} = 80 \times 100 \text{ feet} = 8000 \text{ feet.}$$

Revenue chain (Patwari chain) :- The length of the revenue chain is 72 feet. It has 16 links. Then the length of one link becomes $\frac{33}{16}$ feet. This chain is used in cadastral survey.

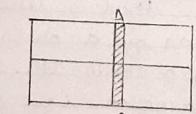
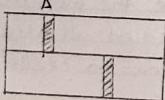
$$\begin{aligned} 1 \text{ Bigha} &= 25 \times (\text{Revenue chain}) = 165 \text{ feet} \times 165 \text{ feet} \\ &= 55 \text{ yard} \times 55 \text{ yard} = 3025 \text{ sq. yard.} \end{aligned}$$

Arrow :- This is a metallic-peg or nail like structure that is used to indicate the measured distance taken by a chain. It is buried at all distances taken by a chain. Its length is about 40 centimeter and diameter is 4 millimeter.



Ranging Rod.

(b) Incorrect Alignment



(c) Correct Alignment

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Ranging Rod :- If the measuring distance is too long then it difficult to measure from one point to another point in straight-way. So, ranging Rod can be placed at the center of chaining to take straight measurement from one point to another.

Its length is 9 meter to 3 meter and diameter is 30 mm.

Offset Rod :- This Rod is used to take offset of the measuring line. Offset is the line exactly parallel to the reference line at some distance. It is used to take offset when some obstacle appears at the line of measurement while chaining.

Pegs :- Pegs is marking equipment for measurements. It is buried on the ground at some distance to indicate the measuring lines & measuring reading. It is made up of wood. It is generally square in shape. Its length varies from 15 cm to 60 cm. & cross-section varies from 2cm^2 to 5cm^2 .

← Line Ranger

Procedure:-

Opening or Unfolding of Chain :- The chain has two handles to measurement. Both handles are attached at both ends of the chain. To unfold chain, first of all, catch both handles with one hand (left hand) and all the chain with other hand (Right hand).

After that throw chain as far as possible so that it can unfold taking two lines of the chain. Because you have taken both ends of the chain.

Folding of chain :- To fold the chain find the center point of that chain. You can find a metallic tag at the center of the chain. Now fold all the chain individually in both directions of the chain. Don't mix the chain with each other from center of the chain.

Two men are required for chaining operation; the chain man at the forward end of the chain is called the leader while the other man at the rear end is known as the follower. Duties of leader & follower -

- Leader
- (i) To put the chain forward
 - (ii) To fix arrow at the end of chain.
 - (iii) To follow the instructions of follower.

- Follower :-
- (i) To direct the leader to the line with Ranging Rod
 - (ii) To carry the rear end of the chain.
 - (iii) To pick up the arrows inserted by the leader.

- Chaining :-
- (i) The follower holds the zero handle of the chain against the peg to direct the leader to be in line of the ranging rod.
 - (ii) The leader usually with the arrows drags the chain along the line.
 - (iii) Using code of signals the follower directs the leader as required to be exactly in the line.
 - (iv) The leader then fixes the arrows at the end of chain the process is repeated.

- Ranging :-
- (i) Place ranging rods or poles vertically behind each point.
 - (ii) Stand about 2m behind the ranging rod at the beginning of the line.
 - (iii) Direct the person to move the rod to right or left until the three ranging rods appear exactly in the straight line.
 - (iv) Sight only the lower portion of rod in order to avoid error in non-vertically.
 - (v) After ascertaining that three rods are in a straight line, ask the person to fix up the rod.

Result:- By chaining to ranging the total distance is found to 60 m.

Viva Question (A)

Q1 What do you mean about ranging?

Ans The process of establishing an intermediate point on a straight line between two endpoints is known as ranging.

Q2 What is the use of line ranger?

Line ranger is an optical instrument used in surveying for ranging. Line Ranger is used in the process of locating an intermediate point in a straight line between two endpoints of the survey line.

Q3 What is ranging rod in surveying?

Ans Ranging rods are vertical rods used to mark survey points having 2-3 m height. It is painted with bands of Red & white 20 cm each.

Q4 Briefly explain types of chain in surveying?

- Ans
1. Metric chain \Rightarrow 5m, 10m, 20m, (or 30m) 1 link = 20cm
 2. Revenue chain \Rightarrow 33 feet, no of links = 16
 3. Gunter's chain \Rightarrow 66 feet, no of links = 100 = 22 yard
 4. Engineering chain \Rightarrow 100 feet, no of links = 100
 5. Steel band or Band chain \Rightarrow 20 m & 30m

Q5 What are basic principle of surveying?

- To work from whole the part
- Locating new points by measurement of minimum two reference points.

Experiment No 1 103

Object - Laying perpendicular offset along the survey with the help of cross staff.

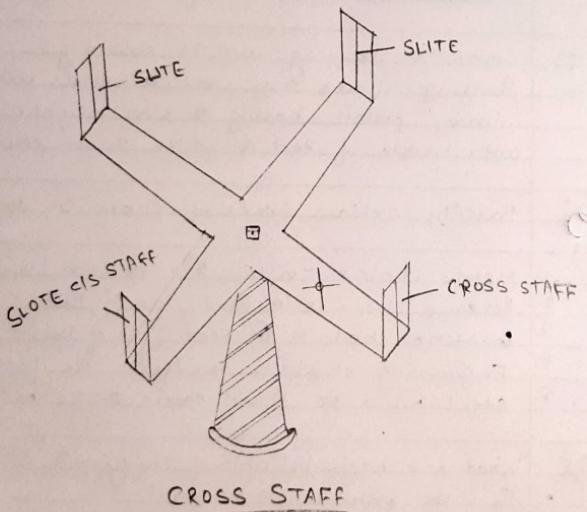
Apparatus - Chain, Ranging rod, Arrow, Cross-staff, tape

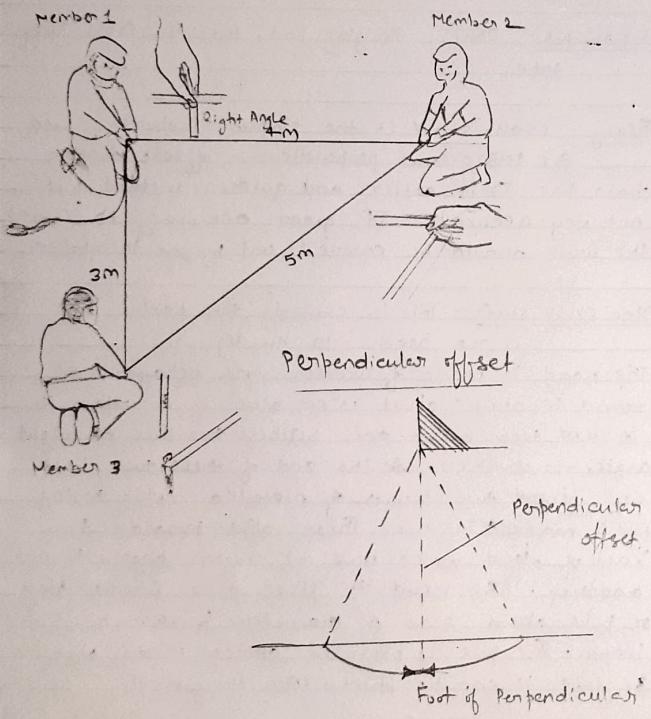
Theory - Cross-staff is the simplest instrument used for setting out perpendicular offsets from a chain line. It is easier and quicker method but not very accurate. If great accuracy is desired, the work should be carried out by the theodolite.

Open cross staff - This consists two parts.

• The head • the leg.

The head is made of wooden block octagonal or round in shape about 15 cm side of or diameter be 4 m deep on it are scribed two lines at right angles to another. At the end of these two lines are fixed two points of metallic strip having slits made in them. These slits provide two lines of sight which are at right angles to one another. The head is fixed on a wooden staff or pole about 3 cm in diameter & 1.2 m to 1.5 m length. The pole is provided conical metal shoe so that it can be driven into the ground.



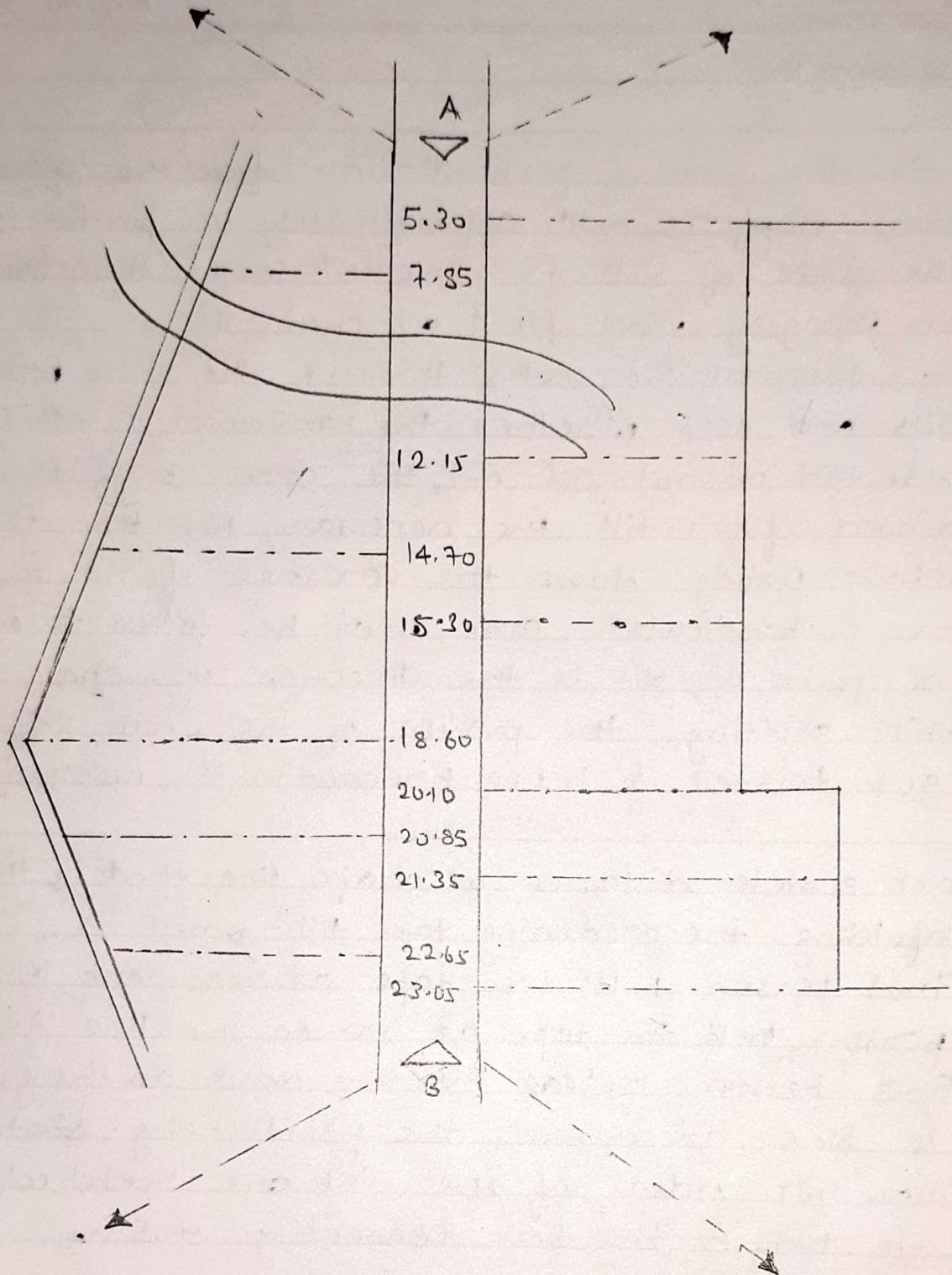


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Procedure :-

- 1) To find the front of perpendicular from the object the cross staff is held approximately in position & one pair of slits is directed in the direction of the ranging rod fixed at chain line.
 - 2) The observer then walks through the other pair of slits and sees whether the particular object is bisected or not. If not, the cross staff is moved to and fro till the necessary direction is obtained.
 - 3) Before noting down the chainage of the front of the perpendicular care must be taken to see the one pair of slit is the direction of chain or not.
 - 4) While shifting the position of the cross-staff it may get twisted so hence precaution is necessary.
- Mark 3 meter distance on chain line that is the AB.
 - Unfolding the measuring tape till 9 pm.
 - First person holds the tape at zero mark and second person hold the tape at 3m on the line AB.
 - Third person holds the 5m mark on the ground in place an arrow, the point being station c.
 - When all sides of the tap are stretched, the angle between the line connecting stations

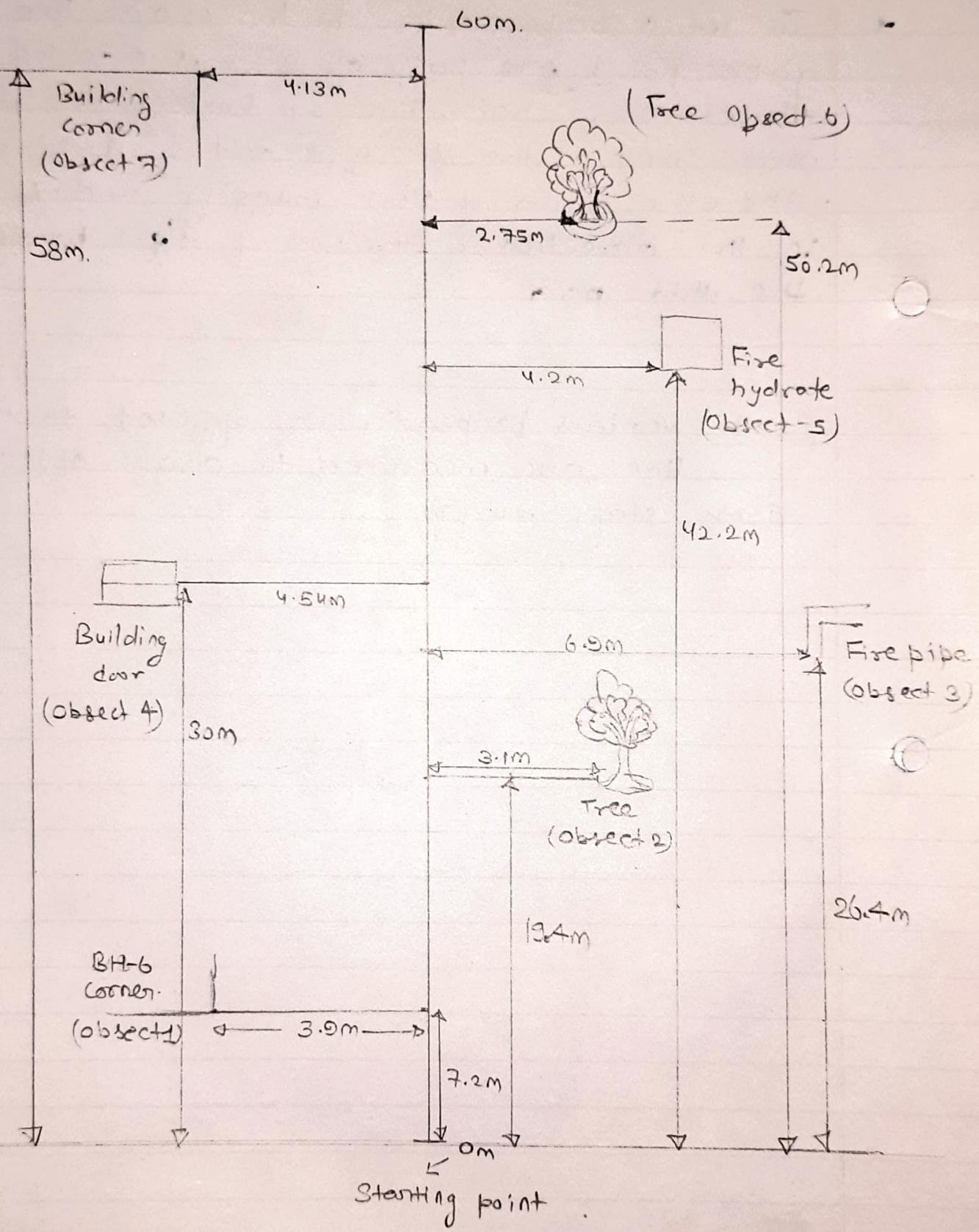


A typical Example of Perpendicular offset

To setting out perpendicular offset:-

- 1) To set a perpendicular to the chain line at a given point one pair of slits is oriented in the direction of chain line by looking at the ranging rod fixed at the forward and by looking through the other pairs of slits ranging rod is fixed in the direction of the line of sight provided by the this pair.

Result Various perpendicular offset to the chain line are measured to draw object using cross-staff survey.



Viva Question (B)

Q1 What do you mean about offset?

Ans The lateral measurement taken from an object to the chain line is known as 'offset'. Offsets are taken to locate objects with reference to the chain line.

Q2 Define Perpendicular offset?

Ans When the angle of offset is 90 degree, then it is called perpendicular offset.

Q3 Define oblique offset?

Ans Any offset not perpendicular to the chain is said to be oblique offset.

Q4 To classify offset according to length?

Ans Based on length, the offsets are classified into short offset & long offset. The offsets are called short when they are less than 15m in length and long when their length exceed 15 m.

Q5 What is the use of cross-staff in surveying?

Ans Cross staff is used for setting out a right angle at a given point on the chain line.