UNIT -4

LECTURE 16

THE PRISMATIC COMPASS

This is an instrument used for the measurement of magnetic bearings. It is small and portable usually carried on the hand. This Prismatic Compass is one of the two main kinds of magnetic compasses included in the collection for the purpose of measuring magnetic bearings, with the other being the Surveyor's Compass. The main difference between the two instruments is that the surveyor's compass is usually larger and more accurate instrument, and is generally used on a stand or tripod.

- The prismatic compass on the other hand is often a small instrument which is held in the hand for observing, and is therefore employed on the rougher classes of work. The graduations on this prismatic compass are situated on a light aluminum ring fastened to the needle, and the zero of the graduations coincides with the south point of the needle. The graduations therefore remain stationary with the needle, and the index turns with the sighting vanes. Since the circle is read at the observer's (rather than the target's) end, the graduations run clockwise from the south end of the needle (0^o to 360^o), whereas in the surveyor's compass, the graduations run anti-clockwise from north.

- The prismatic attachment consists of a 45^o reflecting prism with the eye and reading faces made slightly convex so as to magnify the image of the graduations. The prism is carried on a mounting which can be moved up and down between slides fixed on the outside of the case.

- The purpose of this up-and-down movement is to provide an adjustment for focusing. The image of the graduations is seen through a small circular aperture

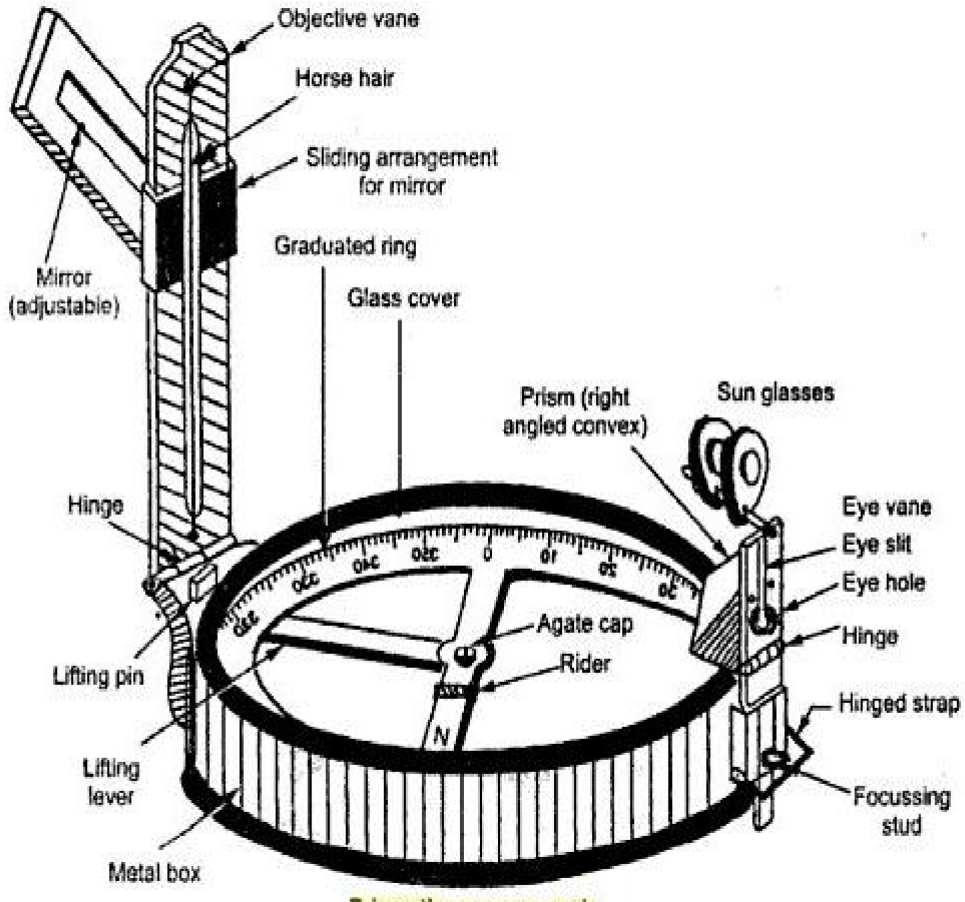
in the prism mounting, and immediately above this aperture is a small V cut on

top of the mounting, over which the vertical wire in the front vane may be viewed. Using the V cut, the vertical wire and the station whose bearing is required are viewed in one line, the bearing is directly read off the graduated arc at the point immediately underneath the vertical wire.

- The mirror located in front of the forward vane slides up and down the vane, and is hinged to fold flat over it or to rest inclined at any angle with it. This mirror is used for solar observations, or for viewing any very high object, and is not a normal fitting to a compass. The two circular discs in front of the back vane are dark glasses which can be swung in front of the vane when solar observations are being taken.

COMPONENTS OF A PRISMATIC COMPASS

Prismatic compass consists of a non-magnetic metal case with a glass top and contain the following:



Prismatic compass parts

Elements of prismatic compass

- **<u>Cylindrical metal box</u>**: Cylindrical metal box is having diameter of 8to 12 cm. It protects the compass and forms entire casing or body of the compass. It protect compass from dust, rain etc.

- **Pivot:** pivot is provided at the center of the compass and supports freely suspended magnetic needle over it.

- **lifting pin and lifting lever:** a lifting pin is provided just below the sight vane. When the sight vane is folded, it presses the lifting pin. The lifting pin with the help of lifting lever then lifts the magnetic needle out of pivot point to prevent damage to the pivot head.
- **Magnetic needle:** Magnetic needle is the heart of the instrument. This needle measures angle of a line from magnetic meridian as the needle always remains pointed towards north south pole at two ends of the needle when freely suspended on any support.
- **Graduated circle or ring:** This is an aluminum graduated ring marked with 0^o to 360^o to measures all possible bearings of lines, and attached with the magnetic needle. The ring is graduated to half a degree.
- **Prism :** prism is used to read graduations on ring and to take exact reading by compass. It is placed exactly opposite to object vane. The prism hole is protected by prism cap to protect it from dust and moisture.
- **Object vane:** object vane is diametrically opposite to the prism and eye vane. The object vane is carrying a horse hair or black thin wire to sight object in line with eye sight.
- **Eye vane:** Eye vane is a fine slit provided with the eye hole at bottom to bisect the object from slit.
- **Glass cover:** its covers the instrument box from the top such that needle and graduated ring is seen from the top.
- **Sun glasses:** These are used when some luminous objects are to be bisected.
- **Reflecting mirror:** It is used to get image of an object located above or below the instrument level while bisection. It is placed on the object vane.
- **Spring brake or brake pin:** to damp the oscillation of the needle before taking a reading and to bring it to rest quickly, the light spring brake attached to the box is brought in contact with the edge of the ring by gently pressing inward the brake pin

LECTURE 17

Temporary adjustment of prismatic compass

- The following procedure should be adopted after fixing the prismatic compass on the tripod for measuring the bearing of a line.
- **Centering :** Centering is the operation in which compass is kept exactly over the station from where the bearing is to be determined. The centering is checked by dropping a small pebble from the underside of the compass. If the pebble falls on the top of the peg then the centering is correct, if not then the centering is corrected by adjusting the legs of the tripod.
- **Leveling :** Leveling of the compass is done with the aim to freely swing the graduated circular ring of the prismatic compass. The ball and socket arrangement on the tripod will help to achieve a proper level of the compass. This can be checked by rolling round pencil on glass cover.
- **Focusing :** the prism is moved up or down in its slide till the graduations on the aluminum ring are seen clear, sharp and perfect focus. The position of the prism will depend upon the vision of the observer.

OPERATION PROCEDURE

- Remove the corner and open out the prism and window, holding the compass as level as possible.

- Then focus the prism by raising or lowering its case until the divisions appear sharp and clear. If necessary with the needle on to its pivot.

- Holding the compass box with the thumb under the prism and the forefinger near the stud, sight through the objector station lowering the eye to read the required bearing as soon as the needle comes to rest naturally.

- The bearing read will be a forward bearing and normally a “whole circle” bearing clockwise angle between 0^o to 360^o.

LECTURE 18

VARIATION IN DECLINATION

The position of the magnetic poles is not fixed and the North magnetic pole tends to wander more than the south causing alterations in the positions of the isogonic lines from time to time. The angle of declination at any point is therefore not constant subject to the following variations;

1. **Secular Variation:**

   This causes the largest variation in magnetic declination. It is a slow continuous swing with a cycle of about 400 to 500 years. Because of this large movement, the date, the declination and the approximate rate of annual change should be given for any magnetic orientation of survey.

2. **Diurnal Variation:**

   This is a swing of the compass needle about its mean daily position.

3. **Periodic Variation:**

   This is a minor variation of the magnetic meridian during the week, a lunar month, year, eleven years, etc.

4. **Irregular Variation:** These are caused by magnetic storms which can produce sudden variations of the magnetic meridian.

Magnetic Bearing

The magnetic bearing of a survey line is the angle between the direction of the line and the direction of the magnetic meridian at the beginning of the line.

Magnetic Meridian

- The magnetic meridian at any place is the direction obtained by observing the position of a freely supported magnetized needle when it comes to rest uninfluenced by local attracting forces.

- Magnetic meridians run roughly north –south and follow the varying trend of the earth's magnetic field. The direction of a magnetic meridian does not coincide with the true or geographical meridian which gives the direction of the true North pole except in certain places.

Angle of Declination:

It is defined as the angle between the direction of the magnetic meridian and the true meridian at any point.

LECTURE 19

Surveyor's Compass:

Similar to the prismatic compass but with few modifications, the surveyors compass is an old form of compass used by surveyors. It is used to determine the magnetic bearing of a given line and is usually used in connection with the chain or compass survey.

Bearing

The bearing is the angular direction measured clockwise starting from North with reference to the observer. The reference North may be true or magnetic. While the true bearing is the angular direction measured in a place with the direction of true or geographical north; the magnetic bearing is the angle which it makes with the direction of Magnetic North measured in the clockwise direction.

LECTURE 20

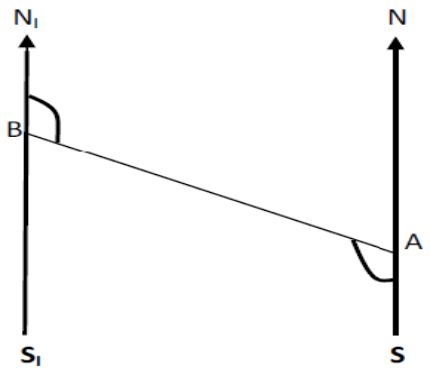
Back and Fore bearing:

Introduction:

In this section, we will examine the back and fore bearing; and the steps to be taken when traversing with compass survey.

Back and fore bearing

Fore bearing is the compass bearing of a place taken from a status to the other in the direction that the survey is being carried out. The back bearing in the other hand is the bearing in the opposite direction i.e. the bearing taken backwards from the next station to its preceding station that the fore bearing was taken. The difference between BB and FB is always 180^0.



Back and fore bearing

If B is sighted from an observer at A, and the NS and N_1S_1 are the magnetic NS lines, then Forward bearing (FB) = < N A S + < S A B

Back bearing BA = < N1 B A

:. Back Bearing BA = Forward Bearing AB - 180^0

If the observer relocates to B and observers B, then forward bearing (FB) BA = < N1 BA and back bearing (AB) = < NAS + SAB. Hence, we can conclude that Forward Bearing = < N1 B A + 180^0. As a general rule, if the Fore Bearing is less than 180^0, add 180^0 to get the Back. Bearing, and if the Fore Bearing is greater than 180^0, then subtract 180^0 to get the Back Bearing.