

# 3.

## COMPASS SURVEYING AND THEODOLITES

### UNITS OF ANGLE MEASUREMENT SYSTEMS

#### (i) Sexagesimal system

- 1 circumference = 360° degree
- 1 degree = 60 minutes
- 1 minute = 60 seconds

#### (ii) Centesimal system

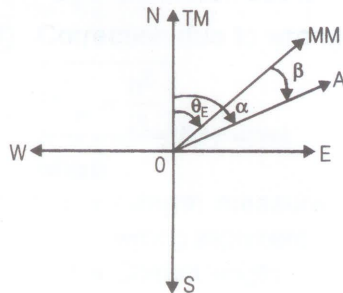
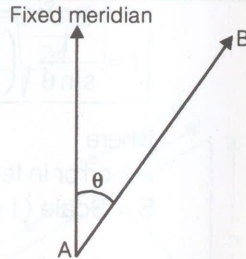
- 1 circumference = 400 grades
- 1 grade = 100 centigrades
- 1 centigrade = 100 centi-centigrades

#### (iii) Hour system

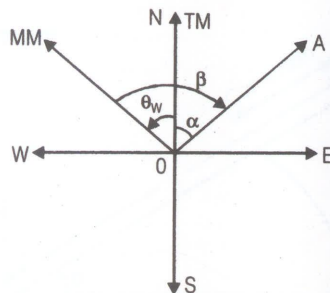
- 1 circumference = 24 hour
- 1 hour = 60 minute
- 1 minute = 60 seconds

### IMPORTANT TERMS

- (i) **Bearing** : Direction of a line w.r.t a fixed meridian is called bearing.
- (ii) **True meridian and true bearing**: True meridian is a line joining true north pole, true south pole and point of reference.  
Angle measured for any line w.r.t true meridian is called true bearing.
- (iii) **Magnetic meridian and magnetic bearing**: Line joining magnetic north pole, magnetic south pole and point of reference is called magnetic meridian.  
Bearing taken w.r.t magnetic meridian is called magnetic bearing.



Eastern Declination



Western Declination

- (iv) **Magnetic declination**: At any place horizontal angle between true meridian and magnetic meridian is called magnetic declination  
For Eastern declination

$$\alpha = \beta + \theta_E \quad \text{or} \quad T.B = M.B + \theta_E$$

Here,  $\alpha$  = true bearing or T.B  
 $\beta$  = magnetic bearing or M.B  
 $\theta_E$  = eastern declination

For western declination

$$\alpha = \beta - \theta_W \quad \text{or} \quad T.B = M.B - \theta_W$$

Here,  $\theta_W$  = western declination.

### DESIGNATION OF BEARING

#### (i) WCB (whole circle bearing system):

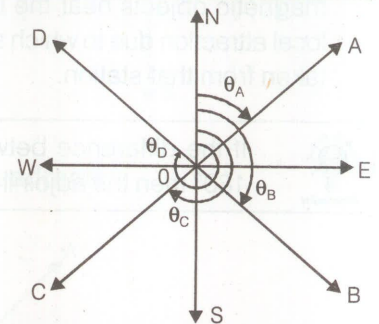
All bearings are taken wrt north direction, going in clockwise.

Bearing of line OA =  $\theta_A$

Bearing of line OB =  $\theta_B$

Bearing of line OC =  $\theta_C$

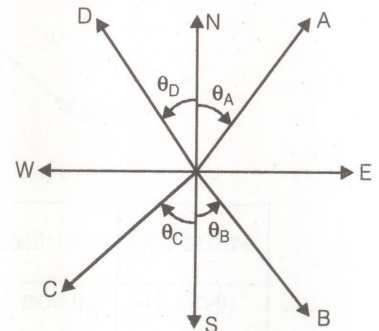
Bearing of line OD =  $\theta_D$



- These bearing are observed by Prismatic compass.

#### (ii) QSB (quadrantal system of bearing)

- In this system, the bearing of a line is measured eastward or westward from north or south pole whichever is nearer.
- These bearings are observed by surveyor compass.
- It is also called reduced bearing system.



Bearing of line 'OA' is N  $\theta_A$  E

Bearing of line 'OB' is S  $\theta_B$  E

Bearing of line 'OC' is S  $\theta_C$  W

Bearing of line 'OD' is N  $\theta_D$  W

- Fore bearing and back bearings

$$\text{B.B} = \text{F.B} \pm 180^\circ$$

Where,

B.B = Backbearing

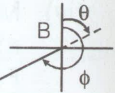
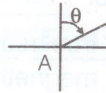
FB = Fore bearing

$\theta$  = F.B. of line AB

$\phi$  = F.B of line BA or B.B of line AB

+ve sign is used when F.B <  $180^\circ$

-ve sign is used when F.B. >  $180^\circ$



- Local attraction

Direction of magnetic needle can be diverted due to presence of some magnetic objects near the instrument set of a station. This will cause local attraction due to which same error will be there in all measurements taken from that station.



If the difference between fore bearing and back bearing is  $180^\circ$  then the adjoining stations are free from local attraction.

