

18CV35 Surveying IAT-03

01. Discuss the differences between Prismatic and Surveyor's Compass

Prismatic compass	Surveyor's Compass
(1) The needle is of broad needle type. It does not act as an index.	The needle is of edge bar type. The needle acts as an index also.
(2) The graduated ring is attached to the needle. The readings will be in WCB with graduations inverted.	The graduated card is attached to the box and not to the needle. The readings will be in QB system with the graduations engraved erect.
(3) Object vane will consist of metal vane with vertical hair. The eye vane consists of a small metal vane with slit.	Object vane will consist of metal vane with vertical hair. The eye vane consists of a small metal vane with fine slit.
(4) The reading is taken with the help of a prism provided at the eye slit. Sighting and reading can be done simultaneously.	The reading is taken by directly seeing thro' the top of the glass. Sighting and reading cannot be done simultaneously.
(5) Tripod may or may not be necessary.	The instrument cannot be used without a tripod.

02 x 5 = 10M

Q8. Find the magnetic declination at a place if the magnetic bearing of sun at Noon is

(i) 164° (ii) 254° (iii) 330°

At noon sun will be exactly on the true meridian of the place.

At noon, the sun transits $12 \times 15 = 180^\circ$

\therefore TB of the place at noon = 180°

$$TB = MB + \text{declination } \theta$$

$$180^\circ = 164^\circ + \theta$$

$$\theta = 16^\circ$$

\therefore Declination = 16° W

03M

(ii) TB = MB + declination θ

$$180^\circ = 254^\circ + \theta$$

$$\theta = 74^\circ$$

\therefore Declination 74° W

04M

(iii) 330°
since the magnetic bearing is 330° , obviously the sun transits are near to 360°

\therefore TB of sun = 360°

$$TB = MB + \text{declination } \theta$$

$$360^\circ = 330^\circ + \theta$$

$$\theta = 30^\circ$$

\therefore Declination = 30° E

03M

The following bearings were observed by a Surveyor's Compa. Mention the stations affected by local attraction and determine the corrected bearings.

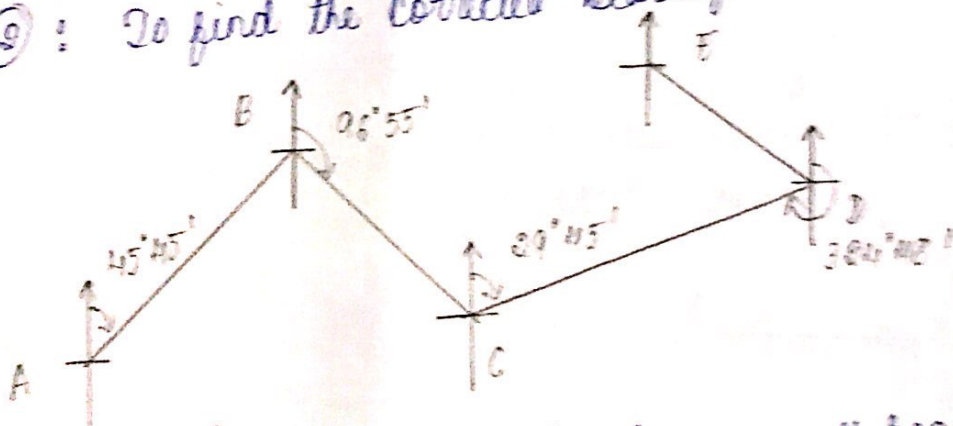
- (i) line AB \rightarrow N $45^{\circ}45'$ E, S $46^{\circ}10'$ W
 (ii) line BC \rightarrow S $83^{\circ}05'$ E, N $82^{\circ}55'$ W
 (iii) line CD \rightarrow N $29^{\circ}45'$ E, S $29^{\circ}10'$ W
 (iv) line DE \rightarrow N $35^{\circ}12'$ W, S $35^{\circ}12'$ E

Line	FB	BB
AB	N $45^{\circ}45'$ E	S $46^{\circ}10'$ W
BC	S $83^{\circ}05'$ E	N $82^{\circ}55'$ W
CD	N $29^{\circ}45'$ E	S $29^{\circ}10'$ W
DE	N $35^{\circ}12'$ W	S $35^{\circ}12'$ E

Step ① : To identify the affected stations.

By observation of given data, the difference between FB & BB of the survey line AB, BC, CD do not exactly differ by 180° . Therefore stations A, B, C are affected by local attraction

Step ② : To find the corrected bearings



Since the given plot is an open traverse, all readings of station D only are truly perfect. Therefore other readings need correction

(a) ~~BB of CD = FB of DC = 150° 50' is correct~~

~~$\therefore \text{FB of CD} = 150^\circ 50' - 180^\circ = -29^\circ 10'$~~

~~$\text{Error} = -29^\circ 10' - 0$~~

FB of CD = 29° 45' is correct

BB of CD = 29° 45' + 180° = 209° 45'

Error = 209° 45' - 209° 10' = 0° 35'

FB of BC = 96° 55' + 0° 35' = 97° 30'

BB of BC = 97° 30' + 180° = 277° 30'

Error = 277° 30' - 277° 5'

= 0° 25'

FB of AB = 45° 45' + 0° 25'

= 46° 10'

BB of AB = 46° 10' + 180° = 226° 10'

\therefore The corrected bearing:

Line	FB	BB
AB	46° 10'	226° 10'
BC	97° 30'	277° 30'
CD	29° 45'	209° 45'
DE	324° 48'	144° 48'

04M

03M

14. Discuss the various errors in Compass surveying

- (i) Instrumental errors
- (ii) Personal errors
- (iii) Errors due to Natural causes

Instrumental errors :

These errors arise due to faulty adjustments of instruments. They are due to the following reasons

- (a) Needle not being perfectly straight
- (b) Pivot being bent
- (c) Sluggish needle
- (d) Improper balancing weight

03M

Personal errors :

- * Inaccurate levelling of compass box
- * Inaccurate centring
- * Carelessness in reading and recording

03M

Natural errors :

- Variation in declination
- Local attraction due to ~~magnetic storm~~ local attraction forces of the place
- Irregular variations due to magnetic storms
- Magnetic changes in the atmosphere due to the clouds and storms

04M

05. Explain the temporary and Permanent adjustments of theodolite

Temporary adjustments :

These are made at every setup of the instrument.

They consist of

- (a) Setting over the station
- (b) Levelling up the instrument
- (c) Elimination of parallax

Setting up : This includes :

(i) Centring the instrument over the station mark by a plumb bob or an optical plummet.

(ii) appropriate levelling with the help of tripod legs

* Levelling up : Accurate levelling is done by the help of foot screws and with reference to plate levels

* Elimination of parallax : Parallax is a condition arising when the image formed by the objective is not in the plane of the cross hairs. It can be eliminated by 2 steps :

- (i) Focussing the eye piece
- (ii) Focussing the objective

Permanent adjustments of theodolite :

- (i) Adjustment of plate levels
- (ii) Adjustment of line of sight
- (iii) Adjustment of horizontal axis

iv) Adjustment of altitude bubble and vertical index frame

06. The following bearings were observed by a Prismatic compass
Balance the traverse by Bowditch rule

Line	Length (cm)	Bearing
AB	89.31	45° 45'
BC	219	83° 5'
CD	398	229° 45'
DE	438	335° 12'

Solution: Step ① :- To find closing error in the traverse

Line	Length (cm)	Bearing	Latitude ($l \cos \theta$) m	Departure ($l \sin \theta$) m
AB	89.31	45° 45'	62.31	63.97
BC	219	83° 5'	26.37	217.40
CD	398	229° 45'	-257.15	-303.76
DE	438	335° 12'	397.60	-183.72

$$\Sigma L = 1144.31$$

$$\Sigma L = 229.13$$

$$\Sigma D = -206.11$$

② 3m

Step ② :- To find correction to latitude and departure

$$C_L = \Sigma L \times \frac{l}{\Sigma L}$$

$$C_{LAB} = -229.13 \times \frac{89.31}{1144.31}$$

$$= -17.88$$

$$C_{LBC} = -229.13 \times \frac{219}{1144.31} = -43.85$$

$$C_D = \Sigma D \times \frac{l}{\Sigma L}$$

$$C_{DAB} = 206.11 \times \frac{89.31}{1144.31} = 16.08$$

$$C_{DBC} = 206.11 \times \frac{219}{1144.31} = 39.44$$

③ 4m

$$C_{LCD} = -229.13 * \frac{398}{1144.13} = -79.70$$

$$C_{DCD} = 206.11 * \frac{398}{1144.13} = 71.69$$

$$C_{LDE} = -229.13 * \frac{438}{1144.13} = -87.71$$

$$C_{DDE} = 206.11 * \frac{438}{1144.13} = 78.90$$

03M

Line	Length (cm)	Bearing	Latitude (m)	Correction (m)	Adjusted Latitude (m)	Departure (cm)	Correction (cm)	Adjusted Departure (cm)
AB	89.31	45°45'	62.31	-17.88	44.43	63.97	16.08	80.05
BC	219	83°5'	26.37	-43.85	-17.48	217.40	39.44	256.84
CD	398	229°45'	-257.15	-79.70	-336.85	-303.76	41.69	-232.07
DE	438	335°12'	397.60	-87.71	309.89	-183.72	78.90	-104.82

The following readings of the level were taken by a 4m leveling staff on a continuously sloping ground at intervals of 30m. The readings were: 0.385, 1.030, 1.925, 2.885, 3.730, 0.625, 2.005 & 3.110. Enter the readings into a level page and calculate the gradient of the line. Use HI method only.

B.S	I.S	F.S
0.385	1.030	
	1.925	
	2.885	
0.625		3.730
	2.005	
	3.110	

0.3M

$$\sum B.S = 1.01$$

$$\sum B.S - \sum F.S = -2.72$$

$$\sum F.S = 3.730$$

0.3M

$$\text{Gradient} = \frac{\text{level difference}}{\text{Distance}}$$

$$= \frac{-2.72}{180}$$

$$= \frac{-151}{66.2100}$$

0.4M

∴ The required gradient is 1 in 66.21 (fall)

End of Scheme

	Marks	OBE	
		CO	RB
5 Explain the temporary & Permanent adjustments of theodolite.	10	1.4	1.1.2
6 The following bearings were observed by a Prismatic Compass. Balance the traverse by Bowditch rule. (i) line AB $\rightarrow 45^\circ 45'$, 89.31m (ii) line BC $\rightarrow 83^\circ 05'$, 219m (iii) line CD $\rightarrow 229^\circ 45'$, 398m (iv) line DE $\rightarrow 335^\circ 12'$, 438m.	10	1.4	1.1.2
7. The following readings of the level were taken by a 4m leveling staff on a continuously sloping ground at intervals of 30m. The readings were: 0.385, 1.030, 1.925, 2.825, 3.730, 0.625, 2.005 & 3.110m. Enter the readings into a level page and calculate the gradient of the line. Use HI method only .	10	1.4	1.1

C.I. *[Signature]*
7/11/19

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C.C.I.

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H.O.D.