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CHAPTER

Compass Surveying

Q.1 In the prismatic compass
   (a) the magnetic needle moves with the box
   (b) the line of the sight does not move with the box
   (c) the magnetic needle and graduated circle do not move with the box
   (d) the graduated circle needle always remains in the N-S direction

Q.2 Local attraction in compass surveying may exist due to
   (a) incorrect levelling of the magnetic needle
   (b) loss of magnetism of the needle
   (c) friction of the needle at the pivot
   (d) presence of magnetic substances near the instrument

Q.3 The horizontal angle between the true meridian and magnetic meridian at a place is called
   (a) azimuth
   (b) declination
   (c) local attraction
   (d) magnetic bearing

Q.4 A negative declination shows that the magnetic meridian is to the
   (a) eastern side of the true meridian
   (b) western side of the true meridian
   (c) southern side of the true meridian
   (d) none of the above

Q.5 A positive declination shows that the magnetic meridian is to the
   (a) eastern side of the true meridian
   (b) western side of the true meridian
   (c) southern side of the true meridian
   (d) none of the above

Q.6 The temporary adjustments of a prismatic compass are

   1. Centering
   2. Levelling
   3. Focussing the prism
   The correct order is
   (a) 1, 3 and 2   (b) 1, 2 and 3
   (c) 2, 3 and 1   (d) 3, 1 and 2

Q.7 As compared to mirror stereoscope, lens stereoscope
   1. causes less strain to the eyes of the user
   2. is small in size
   Of these statements
   (a) Only 1 is correct
   (b) Only 2 is correct
   (c) Both 1 and 2 are correct
   (d) Both 1 and 2 are incorrect

Q.8 Which of the following variations of magnetic declination are correctly matched?
   1. Diurnal variation------Variation whose time period varies from 100-350 years
   2. Annual variation-----Annual rate of change of secular variation
   3. Secular variation----Variation of declination periodic in character
   4. Irregular variation------Caused due to magnetic storms in earth's magnetic field
   Select the correct answer using the codes given below:
   (a) 1, 3 and 4   (b) 2 and 3
   (c) 1 and 3   (d) 3 and 4

Directions: The following items consists of two statements; one labelled as 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below:

Codes:

(a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Q.9 Assertion A : If a place is in the western hemisphere, the magnetic needle will be to the west of the geographical meridian. If the place is in the eastern hemisphere, the needle will be to the east of the geographical meridian
Reason R : The magnetic needle does not remain on one side of the geographical meridian. It varies from place to place.

Q.10 Assertion A : The magnetic bearings of different lines cannot be regarded as fixed
Reason R : The magnetic meridian changes its direction due to variation from time to time, the magnetic bearings of survey line also change.

Q.11 Assertion A : The meridian distance of any line is equal to the meridian distance of its midpoint
Reason R : The meridian distance of any line is equal to the meridian distance of the preceding line plus half the departure of the preceding line plus half the departure of the line itself.

Q.12 If the quadrantal bearing of a line is N25°W, then the whole circle bearing of the line is
(a) S 25°E   (b) 205°
(c) 335°   (d) 295°

Q.13 If the forbearing of a line AB is 35° and that of line BC is 15°, then the included angle between the lines is
(a) 20°   (b) 50°
(c) 160°   (d) 230°

Q.14 The following bearings were observed while traversing with a compass:

Line	F.B.	B.B
AB	104° 30'	284° 30'
BC	48° 15'	226° 0'

CD	290° 30'	115° 15'
DA	180° 15'	357° 15'

Which stations were affected by local attraction?
(a) A and B   (b) B and C
(c) C and D   (d) A and D

Q.15 If the reduced bearing of a line AB is N60°W and length is 100 m, then the latitude and departure respectively of the line AB will be
(a) + 50 m, + 86.6 m
(b) + 86.6 m. – 50m
(c) + 50 m. – 86.6 m
(d) + 70.7 m, – 50 m

Q.16 If the sum of Northings of a traverse exceeds the sum of Southings by 1 m and sum of Eastings exceeds the sum of westings by 1 m, the resultant closing error and its true bearing respectively are
(a) 1 m, N45°E   (b) 2 m, N45°W
(c) $\sqrt{2}$ m, N45°E   (d) 0, N45°E

Q.17 A closed compass traverse PQRS is run with a prismatic compass in a clockwise direction:

Line	Fore bearing
PQ	50°
QR	170°
RS	230°
SP	310°

The value of the included angle S is
(a) 360°   (b) –260°
(c) 100°   (d) 50°

Q.18 If the declination is 5°40'W, which one of the following magnetic bearing would represent the true bearing of S 25° 20' E?
(a) S19° 20'E   (b) S31° 0'E
(c) S20° 0'E   (d) S19° 20'W

Q.19 ABCD is a regular parallelogram plot of land whose angle BAD is 60°. If the bearing of line AB is 30° then the bearing of line CD is
(a) 90°   (b) 120°
(c) 210°   (d) 270°

Q.20 In an old map a line was drawn to a magnetic bearing of 10°30', the magnetic declination being 2° East at that time. The magnetic bearing to which the line should be set now if the present magnetic declination is 4°30' west
(a) 17°   (b) 15°
(c) 10°   (d) 8°

Q.21 The coordinates of two endpoints A and B of a traverse line AB are
X_A = 1000.00 m, Y_A = 10000.00 m
X_B = 2000.00 m, Y_B = 1000.00 m
The bearing of the line AB will be
(a) 0°0' 00"   (b) 60°0'00"
(c) 90°0' 00"   (d) 180°0'00"

Q.22 If fore bearing of a line is S49°52'E (assuming there is no local attraction), the back bearing of the line will be
(a) S 52°49'E   (b) S 49°52'E
(c) N 49°08'E   (d) N 49° 52'W

Q.23 The prismatic compass and surveyor's compass
(a) give Whole Circle Bearing (WCB) of a line and Quadrantal Bearing (QB) of a line respectively
(b) both give QB of a line and WCB of a line
(c) both give QB of a line
(d) both give WCB of a line

Q.24 Agonic line is the line joining points having
(a) zero declination
(b) minimum declination
(c) maximum declination
(d) same declination

Q.25 What is the magnetic declination at a place if the magnetic bearing of the sun at noon is 184°
(a) 4°W   (b) 4°E
(c) 176°W   (d) 176°E

Q.26 The line drawn through the points of same declination is known as
(a) Isogonic line
(b) Agonic line
(c) Diurnal line
(d) None of these

Q.27 Match List-I with List-II and select the codes given below the lists:
List-I
A. Diurnal variation
B. Annual variation
C. Secular variation
D. Irregular variation
List-II
1. Declination of a place varies yearly
2. Daily variation of declination at a place
3. Variation of declination at a place varies in different ways at different period
4. "Magnetic storms" and variation is unpredictable
Codes:

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

Q.28 The direction of the magnetic meridian is established at each traverse station and the direction of the line is determined with reference to the magnetic meridian. This method of traversing is called
(a) fast needle method
(b) loose needle method
(c) bearing method
(d) fixed needle method

Q.29 Which one of the following figures indicates the principle of traversing?
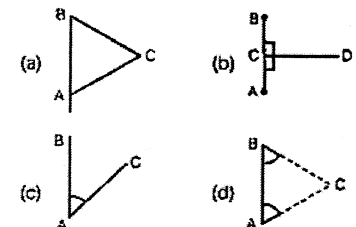
Q.30 If the coordinates of A are 100 N and 200 E and those of C are 100 S and 200 E, then the length AC is

(a) 400.00   (b) 282.84

(c) 244.94   (d) 200.00

Q.31 Transit rule of balancing a traverse is applied when

(a) the linear and angular measurements are of same precision.

(b) the linear measurements are more precise than angular measurements.

(c) the angular measurements are more precise than linear measurements.

(d) the linear measurements are proportional to l and angular measurements are proportional to $(1/l)$ where l is the length of the line.

Q.32 The horizontal angle between the true meridian and magnetic meridian at a place is known as

(a) azimuth   (b) declination

(c) local attraction   (d) magnetic bearing

Q.33 Read the following statements.

1. Dip of a magnetic needle is its inclination with the ground surface.

2. In the northern hemisphere, the north end of the magnetic needle is deflected downward.

3. In the southern hemisphere, the north end of the magnetic needle is deflected downward.

4. The amount of dip varies in different parts of the earth.

The correct statements are

(a) 1 and 2   (b) 1 and 3

(c) 3 and 4   (d) 2 and 4

Q.34 The bearings of the lines AB and BC are 146° 30' and 68° 30'. The included angle ABC is

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(a) 102°   (b) 78°

(c) 45°   (d) None of these

Q.35 Prismatic compass is considered more accurate than surveyor's compass because

(a) It is provided with better magnetic needle

(b) It is provided with a sliding glass in the object vane

(c) Its graduations are in whole circle bearings

(d) It is provided with a prism to facilitate reading of its graduated circle

Q.36 The bearings of lines OA and OB are 16° 10' and 332° 18', the value of the included angles BOA is

(a) 316° 10'   (b) 158° 28'

(c) 348° 08'   (d) 43° 52'

Q.37 The magnetic bearing of line in IIT Kanpur was found to be N 60° 30' W in 2001 when declination was N 5° 10' E. If the declination is 3° W, the present magnetic bearing is

(a) N 42° 40' W   (b) N 32° 40' W

(c) N 60° 20' W   (d) N 52° 20' W

Q.38 The different variation in magnetic declination at any place are as follows

1. Annual variation

2. Diurnal variation

3. Irregular variation

The correct sequence of their values in ascending order is

(a) 3 < 1 < 2   (b) 2 < 1 < 3

(c) 1 > 2 > 3   (d) 1 > 3 > 2

■■■■

Answers   **Compass Surveying**

1. (c)	2. (d)	3. (b)	4. (b)	5. (a)	6. (b)	7. (b)	8. (d)	9. (a)	10. (a)
11. (a)	12. (c)	13. (c)	14. (c)	15. (c)	16. (c)	17. (c)	18. (b)	19. (c)	20. (a)
21. (c)	22. (d)	23. (a)	24. (a)	25. (a)	26. (a)	27. (c)	28. (b)	29. (a)	30. (d)
31. (c)	32. (b)	33. (a)	34. (a)	35. (d)	36. (d)	37. (d)	38. (b)		

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Explanations   **Compass Surveying**

2.   **(d)**

Local attraction is a term used to denote any influence, which prevents the needle from pointing to the magnetic north in a given locality.

Difference of fore bearing and back bearing = 0

⟹ No local attraction.

12.   **(c)**
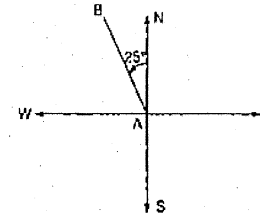
The whole circle bearing of a line is measured clockwise from the North direction.

∴ whole circle bearing of the line AB
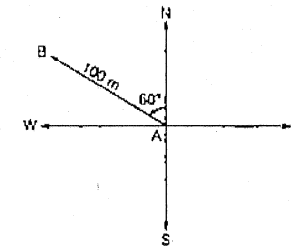
$= 360° - 25° = 335°$

13.   **(c)**
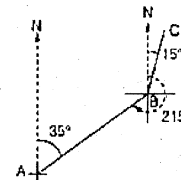
Given:

Forebearing of line $AB = 35°$

∴ Back bearing of $AB = 180° + 35° = 215°$

∴ Included angle between the lines,
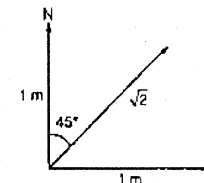
$360° - (215° - 15°) = 160°$

14.   **(c)**

As the difference between F.B and B.B of line AB is exactly 180°, stations A and B are free from local attraction which is not the case with line CD. Hence stations C and D are affected by local attraction.

15.   **(c)**

Latitude of line $AB = +100 \cos 60° = +50$ m

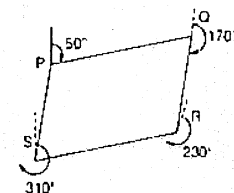Departure of line $AB = -100 \sin 60° = -86.6$ m

(As it is measured westward)

16.   **(c)**

True bearing = N45°E

17.   **(c)**

The given closed compass traverse $PQRS$ can be drawn as

FB of $RS = 230°$

∴ BB of $RS = 230° - 180° = 50°$

∴ Included angle,

$S = 360° - 310° + 50°$

$= 100°$

18. (b)

Note that negative (W) declination should be added to quadrantal bearing in second and fourth quadrant i.e. NØW or SØE and it should be subtracted from quadrantal bearing in first and third quadrant i.e., NØE and SØW. Reverse should be done for positive (E) declination.
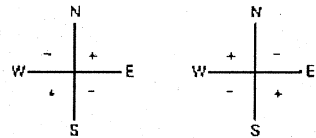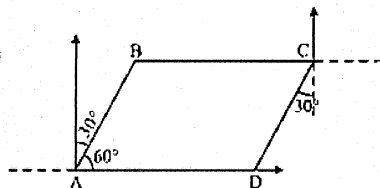
For Positive Declination   For Negative Declination

True bearing = S 25° 20′ E + 5° 40′
= S 31° 0′ E
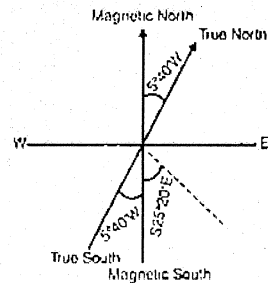
19. (c)

Bearing of CD = 180° + 30° = 210°

20. (a)

True bearing of drawing = 10°30′ + 2° = 12°30′.
TB = MB at present ± declination at present.
12°30′ = (MB)$_{present}$ − 4°30′
∴(MB)$_{present}$ = 12°30′ + 4°30′ = 17°
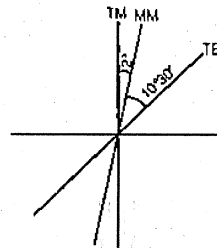
Alternate Method

TB = MB + Declination
= 2° + 10°30′ = 12°30′
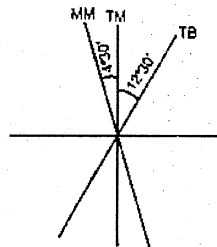
MB = TB + Declination
= 4°30′ + 12°30′ = 17°

22. (d)
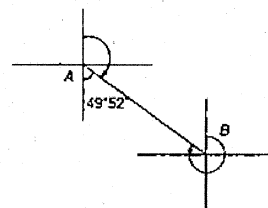
Fore bearing of
AB = 180° − 49° 52′ = 130° 8′ (> 180°)
∴Back bearing of BA
= 130° 8′ + 180° = 310° 8′
(whole circle) or N 49° 52′ W
Hence option (d) is correct.

25. (a)

True bearing = Magnetic bearing + Declination
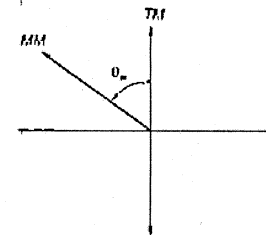∴180° = 184° + Declination
orDeclination = −4° = 4°W

28. (b)

In the loose needle method, the direction of the magnetic meridian is established at each traverse station and the direction of the line is determined with reference to the magnetic meridian. In other words, the magnetic bearing of each line is determined directly. A theodolite fitted with a compass is used for determining the magnetic bearing of the traverse line. The loose needle method is also known as free needle method.

29. (a)

The principles of traversing say that, a traverse should consist of a series of straight lines connected together to form an open or a closed polygon. The points defining the ends of the traverse lines are called traverse stations or traverse points.

32. (b)

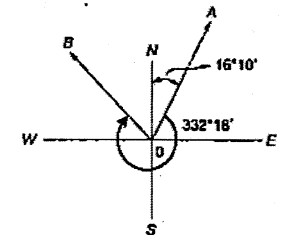The deflection of true meridian (N-S) and magnetic meridian (N-S) at a place is called 'magnetic declination'.

Here θ$_w$ = Magnetic declination

34. (a)

Included angle
= FB of next line − BB of previous line
= FB of BC − BB of AB
= 68° 30′ − 146° 30′
= −78° + 180°
= 102°

36. (d)

∠BOA = (360° − 332°18′) + 16°10′
= 43°52′

37. (d)

Magnetic bearing of line in 2001 = N 60° 30′ W
WCB = 360° − 60° 30′ = 299° 30′
True bearing = magnetic bearing ± magnetic declination
= 299° 30′ + 5° 10′ = 304° 40′
Present declination is 3° W
True bearing = magnetic bearing ± magnetic declination
⇒304° 40′ = magnetic bearing − 3°
⇒ Magnetic bearing = 304° 40′ + 3°
= 307° 40′ = N 52° 20′ W

38. (b)

Irregular variation > Annual variation > Daily variation
(value of order 1°)   (1 − 2 min)   (fraction of minute)

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