Class Test Solution (Surveying) 29-07-2018
Answer key

1.	(b)	**16.**	(d)	**31.**	(d)	**46.**	(c)	**61.**	(c)
2.	(b)	**17.**	(b)	**32.**	(b)	**47.**	(c)	**62.**	(d)
3.	(a)	**18.**	(c)	**33.**	(d)	**48.**	(b)	**63.**	(d)
4.	(d)	**19.**	(a)	**34.**	(d)	**49.**	(c)	**64.**	(a)
5.	(d)	**20.**	(c)	**35.**	(c)	**50.**	(c)	**65.**	(a)
6.	(b)	**21.**	(a)	**36.**	(c)	**51.**	(d)	**66.**	(b)
7.	(a)	**22.**	(b)	**37.**	(c)	**52.**	(c)	**67.**	(a)
8.	(d)	**23.**	(a)	**38.**	(c)	**53**	(c)	**68.**	(a)
9.	(a)	**24**	(b)	**39.**	(a)	**54.**	(a)	**69.**	(d)
10.	(d)	**25.**	(b)	**40.**	(b)	**55.**	(b)	**70.**	(c)
11.	(a)	**26.**	(c)	**41.**	(a)	**56.**	(b)	**71.**	(d)
12.	(b)	**27.**	(d)	**42.**	(d)	**57.**	(c)	**72.**	(d)
13.	(b)	**28.**	(d)	**43.**	(b)	**58.**	(c)	**73.**	(d)
14.	(d)	**29.**	(d)	**44.**	(c)	**59.**	(a)	**74.**	(a)
15.	(b)	**30.**	(a)	**45.**	(b)	**60.**	(a)	**75.**	(c)

CLASS TEST [SURVEYING] SOLUTIONS

1. (b)

2. (b)

Area measured = 350 cm^2

$$\text{shrunk factor} = \frac{\text{shrunk scale}}{\text{original length}}$$

$$\text{(S.F.) shrunk factor} = \frac{9}{10} = 0.90$$

$$\text{shrunk scale} = \text{S.F.} \times \text{original scale}$$

$$\text{shrunk scale} = \frac{0.9}{50 \times 100} = \frac{1}{5555.55}$$

$$\text{Actual area} = 350 \times (5555.55)^2$$

$$\boxed{A = 1.08\ km^2}$$

3. (a)

4. (d)

5. (d)

6. (b)

7. (a) $\text{Correct length} = \frac{\text{Actual length of tape}}{\text{Nominal length of tape}} \times \text{Measured length}$

$$500 = \frac{l}{20} \times 502$$

$$l = 19.92\ m$$

8. (d)

Included angles = Bearing of previous line – Bearing of next line

$\angle A$ = Bearing of AE – Bearing of AB
= (300º – 180º) – 60º30' = 59º30'

$\angle E$ = Bearing of ED – Bearing of EA
= (205º30' – 180º) – 300° + 360°

$\angle E$ = 85º30'

9. (a)

True bearing of the line
= 6º32′ + 1º = 7º32′

As the true bearing of the line never change, the present true bearing will also be 7º32′

present true bearing = maganetic bearing + 9º42′

$\therefore$ 7º32′ = magnetic bearing + 9º42′

$\therefore$ magnetic bearing = 7º32′ – 9º42′
= – 2º10′
= 360º – 2º10′
= 357º50′

10. (d)

Since latitude is +ve and departure is –ve, the line lies in the fourth quadrant

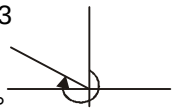
$l\cos\theta = 50$

$l\sin\theta = -86.6$

$\tan\theta = 1.732 = \sqrt{3}$

$\theta = 60°$

WCB = 360° – 60°
= 300°.



11. (a)

12. (b)

13. (b)

From the table it can be seen, fore and back bearings of line CD has a difference of 180° therefore station C and D are free from local attraction.

$\Rightarrow$ Station A and B are effected by local attraction.

Now, fore bearing of DA is correct and is equal to 309°50′

$\therefore$ B.B. of DA = $309°50' - 180° = 129°50'$

$\therefore$ Correction for station A
= $129°50' - 129°10' = 40'$

$\therefore$ Corrected F.B. of AB
= $77°30' + 40' = 78°10'$

$\therefore$ Correct B.B. of AB
= $78°10' + 180° = 258°10'$

14. (d)

Lines joining the locus of places having same

value of dip are known as isoclinic lines, whereas those joining the locus of places with no dip is called as aclinic line such as magnetic equator.

15. (b)

16. (d)

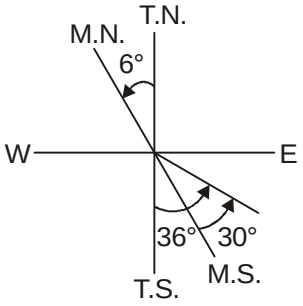
17. (b)

The line of collimation should be parallel to the axis of the tube when the vertical circle reading is zero.

The axis of the altitude level tube is truly horizontal when the bubble is in the centre.

18. (c)

19. (a)



T.B. = M.B. + Declination

T.B. = S 30°E + 6°

T.B. = S 36°E

20. (c)

in ΔABD AB = 25 m

AD = 50 m

$$\tan(\angle BDA) = \frac{25}{50} = 0.5$$

or $\angle BDA = 26°34'$

$\angle BDC = 320° - 230° = 90°$

$\angle ADC = 90° - 26°\ 34' = 63°\ 26'$

From ΔADC CA = AD tan (ADC)

CA = 50 × tan 63° 26′

$$\boxed{CA = 100 \text{ m}}$$

21. (a)

Latitude DA = – [lat. AB + lat. BC + lat. CD] = – 685.0

Dep. DA = – 685.0

22. (b)

23. (a)

24. (b)

25. (b)

$e_y = \Sigma L = +5.080$ m

$e_x = \Sigma D = -51.40$ m

L = 20.525 km

$\therefore$ Closing error, $e = \sqrt{5.080^2 + 51.406^2}$

= 51.656 m.

$\therefore$ relative error,

$$e = \frac{e}{L} = \frac{1}{(L/e)} = \frac{1}{\frac{20.525}{51.656} \times 10^3} = \frac{1}{397.34}$$

26. (c) True difference = 3.175 – 2.615

= 0.56 m

Reading at A = 1.905

Reading at B should be approx

= 1.905 + 0.56 = 2.465 m

As reading at B is lesser So 'α' is downwards

correct Reading at

A = 1.905 + 25 tan α .... (i)

correct reading at

B = 2.340 + 75 tan α .... (ii)

Substracting eq. (i) from (ii)

0.435 + 50 tan α = 0.56

tan α = 0.0025.

27. (d)

28. (d)

29. (d)

30. (a)

Station	B.S	I.S	F.S	Rise	Fall	R.L
A	1.545					140.605
B	2.695		0.575	0.970		141.575
C	1.415		1.235	1.460		143.035
D	2.925		0.595	0.820		143.855

31. (d)

32. (b) Distance between the stations

$$= 2 \times \sqrt{\frac{6.75}{0.0673}} = 20 \text{ km}$$

33. (d)

34. (d)

h = 250m, f = 25 cm, AB = 300m, ab = 15 cm, d = 0.5 cm, r = 10 cm, height of tower h_2 = ?

$$S = \frac{ab}{AB} = \frac{f}{H-h}$$

$$\frac{15}{300} = \frac{25}{H-250}$$

$$H = 750$$

$$d = \frac{rh_2}{H-h_1}$$

$$0.5 = \frac{10 \times h_2}{750-250}$$

$$h_2 = 25 \text{ m}$$

35. (c)

36. (c)

$$n = \frac{(l_1 - r_1) + (l_2 - r_2)}{2} = 2$$

$$R = \frac{ndL}{S} = \frac{2 \times 100 \times 0.002}{(2.022 - 1.890)}$$

$$R = 3.0303 \text{ m.}$$

37. (c)

38. (c)

In tacheometric survey, horizontal distance between the axis and staff

$$D = \frac{f}{i} \times S + (f + d)$$

$$f = 300 \text{ mm}$$

$$i = 6 \text{ mm}$$

staff intercept = (4 – 2)

$$S = 2 \text{ m}$$

$$d = 150 \text{ mm}$$

$$D = \frac{300}{6} \times 2 + (0.3 + 0.150)$$

$$\boxed{D = 100.45 \text{ m}}$$

39. (a)

Let the distance CA = D_1

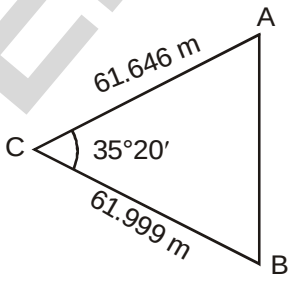
$$D_1 = kS\cos^2\theta$$

$$D_1 = 100 \times 0.620 \times \cos^2(4°20'\,0'')$$

$$= 61.646 \text{ m}$$

Let the distance between CB = D_2

$$\therefore \quad D_2 = 100 \times 0.620 \cos^2(0'10'40'')$$



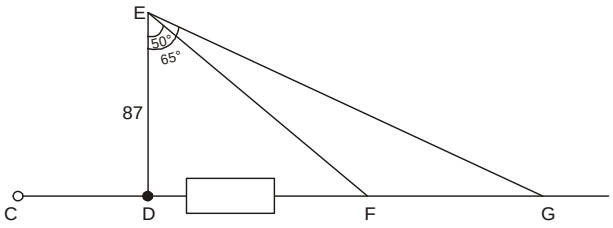
$$D_2 = 61.999 \text{ m}$$

The distance AB can be calculated from cosine law

$$\cos(35°20') = \frac{(61.646)^2 + (61.999)^2 - (AB)^2}{2 \times 61.646 \times 61.999}$$

AB = 37.52 m

40. (b)



$$EF = \frac{DE}{\cos 50°} = 135.345 \text{ m}$$

$$EG = \frac{DE}{\cos 65°} = 205.9 \text{ m}$$

$$DF = DE \tan 50° = 103.68 \text{ m}$$

41. (a)

42. (d)

On Map

$$\text{Scale} = \frac{\text{Length of line on plan or map}}{\text{Length of corresponding line on the ground}}$$

$$\therefore \quad \frac{1}{24000} = \frac{4\text{ cm}}{\text{Ground runway length}}$$

Ground runway length = 4 × 24000 cm

On photograph

∴ Scale for vertical photograph having 6 cm runway length.

$$\text{Scale} = \frac{6\text{ cm}}{24000 \times 4\text{ cm}} = \frac{1}{16000}$$

43. (b)

Length = 20 km

Breadth = 16 km

No. of photograph (in length side)

$$= 1 + \frac{20{,}000}{150 \times 25 \times 0.4} = 15$$

Similarly for Breadth = 8

Total = 15 × 8

= 120.

44. (c)

- **Principal Point :** It is a point where a perpendicular dropped from the front nodal point strikes the photograph.
- **Isocentre :** It is the point in which the bisector of the angle of tilt meets the photographs.
- **Crab :** It is the term used to designate the angle formed between the flight line and the edges of the photograph in the direction of flight.
- **Drift :** It is caused by the failure of the aeroplane to stay on the predetermined flight line.

45. (b) relief displacement of a point,

$$d = \frac{r.h}{H}$$

Where h = height of the object above datum,

H = flying height above the datum,

r = radial distance of the image of the top of the object from principal point.

$$\therefore \quad d = \frac{90 \times 500}{5000} = 9\text{ mm}$$

46. (c)

x = 620.5

y = 24.15

probable error in x = 0.025

probable error in y = 0.0025

$$\text{Probable error, } e_S = S\sqrt{\left(\frac{e_x}{x}\right)^2 + \left(\frac{e_y}{y}\right)^2}$$

$$e_S = 25.693 \times \sqrt{\left(\frac{0.025}{620.5}\right)^2 + \left(\frac{0.0025}{24.15}\right)^2}$$

$$e_S = 0.00285$$

47. (c)

48. (b)

Contour lines are imaginary lines passing throughpoints of equal elevations.

49. (c)

50. (c) 2A = 20º10' weight = 2 .....(1)

4A = 40º10' weight = 3 .....(2)

∴ Normal eqⁿ. for eqⁿ (1)

8A = 80º 40′ .....(3)

Normal eqⁿ. for eqⁿ (2)

48A = 482º .....(4)

Adding eqⁿ. (3) & (4)

56A = 562º40'

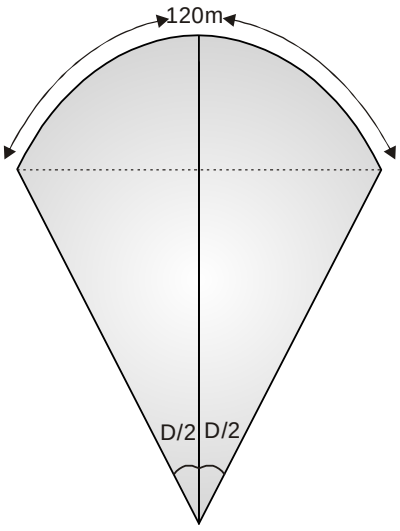
∴ A = 10º2' 51.43''

51. (d)

For $2\Pi R$ angle at the centre is = 360º

$$\text{for 120 m arch} = \frac{360}{2\Pi R} \times (120)$$

$$D^\circ = \frac{360}{2\Pi R} \times (120)$$



$$R = \frac{6879}{D}\text{m}$$

52. (c) The tangent length = R tan 30° = $\frac{570}{\sqrt{3}}$

= 329.089m = (10 full chain + 29.09m)

53. (c)

Chainge of starting point = (1060 – R tan 30)

= (1060 – 329.089) = 730.91 m

54.(a)

IRC recommends spiral as the transition curve because it fulfills the requirements of an ideal transition curve, that is:

(i) the rate of change or centrifugal acceleration is consistent (smooth) and

(ii) radius of the transition curve is infinity at the straight edge and changes to R at the curve point ($L_s \alpha \frac{1}{R}$) and calculation and field implementation is very easy.

55. (b)

56. (b)

∴ Volume of the prismoid,

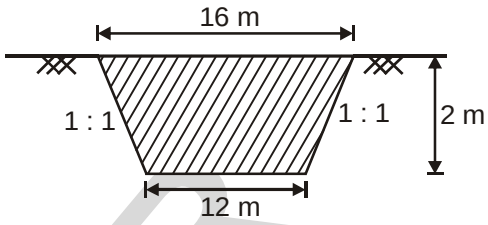
$$V = \frac{d}{3}\left(A_1 + A_2 + 4A_m\right)$$

∵ In prismoidal rule, ordinates required should be odd but here ordinates provided are even so taking average of the sides and then calculating the area

$A_1 = 24 \times 16 = 384\ m^2$

$A_2 = 20 \times 12 = 240\ m^2$

$$A_m = \left(\frac{24+20}{2}\right)\left(\frac{16+12}{2}\right) = 308\ m^2$$



$$\therefore\ V = \frac{1}{3}[384 + 4 \times 308 + 240]$$

$= 618.66\ m^3$

57. (c)

58. (c)

59. (a)

Lehmann's method or Trial and error method in the field is used to find out the position of the station of a plane table.

60. (a)

61. (c)

Weight of a quantity is the trust worthiness of that quantity. The weight of a quantity indicates relative precision of that quantity with in the set of observations.

Therefore weight are assigned depending upon the degree of precision.

$$\text{Weight} \propto \frac{1}{\text{Variance}}$$

62. (d)

We shall always follow whole to part for localizing preventing accumulation of error.

63. (d)

64. (a)

The direction of a survey line can either be established (i) with relation to each other or (ii) with relation to any meridian. The first will give the angle between two lines while the second will give the bearing of the line.

65. (a)

Method of reiteration is used to measure horizontal angles only, as there are two

number of rotation first one with telescope normal and another with telescope inverted.

But vertical angles cannot be measured by method of reiteration because only one rotation possible in the vertical plane.

66. (b)

67. (a)

The line of collimation of a theodolite must be perpendicular to the horizontal axis at its intersection with the vertical axis. If this condition exists, the line of sight will generate a vertical plane when the telescope is rotated about the horizontal axis.

If the line of sight is not perpendicular to the trunnion axis of the telescope, it will not revolve in a plane when the telescope is raised or lowered but instead, it will trace out the surface of a cone.

68. (a)

69. (d)

Tacheometer is a transit theodolite fitted with stadia diaphragm and anallactic lens.

Anallatic lens : Additional convex lens is provided between the eye piee and the object glass at a fixed distance from the object glass. The purpose of providing anallatic lens is to make additive constant (f+d) exactly zero.

Anallatic lens is provided in external focusing telescope, not required in internal focusing telescope.

Advantage

- It simplifies the calculation by making the additive constant zero.
- Therefore, there is only one constant which is multiplying constant.
- Distances are directly calcualted by multiplying the difference of stadia hair readings by 100.

Disadvantage

- Brightness of the image is much reduced due to absorption of light.
- The anallatic lens can not be cleaned easily
- It increases the cost of the instrument because of one extra lens.

70. (c)

Relief displacement : It is caused by changes in the distance between the ground and the camera as the plane flies over the ground.

Characteristics of relief displacement.

- Characteristics of aerial images over varied terrain.
- Objects that rise above the surface away from the principal point.
- Objects extending below the surface lean towards the principal point.
- Displacement increases with the height of the object and or distance from the principal point.

71. (d)

72. (d)

73. (d)

74. (a)

75. (c)