Model Answer: Summer 2018

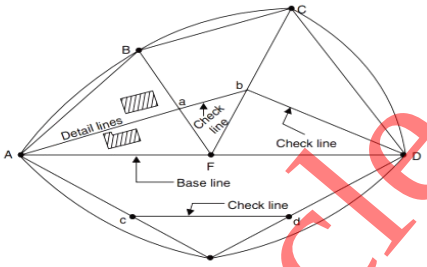
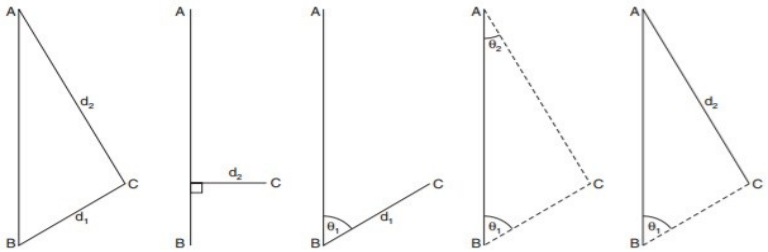
Subject: Basic Surveying | **Sub. Code: 22205**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills.)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by the candidate and those in the model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and the model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 1		**Attempt any five of the following:**		**10**
	(a) Ans.	**Define "Chain survey".** **Chain Survey:** The Survey in which only linear measurements are taken in the field with the help of chain and remaining work such as plotting, calculation etc. are done in the office, is called as chain survey.	**2**	**2**
	(b) Ans.	**Enlist various methods of levelling.** **Methods of leveling:** i. Simple levelling ii. Differential levelling iii. Longitudinal levelling iv. Cross section levelling v. Fly levelling vi. Check levelling vii. Reciprocal levelling viii. Profile levelling	**½ each (any four)**	**2**
	(c) Ans.	**Define plane survey and geodetic survey.** **Plane survey**: The survey in which curvature of the earth is not taken in to consideration is called as plane survey. **Geodetic survey**: The survey in which curvature of the earth is taken in to consideration is called as geodetic survey.	**1** **1**	**2**
	(d) Ans.	**State any two causes of local attraction.** **Local attraction caused due to attraction of magnetic needle by following sources:**		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 1		i. Iron or steel structure ii. Electric cable line iii. Wires iv. Iron poles v. iron ore vi. Bunch of key vii. Knife viii. Steel Tape ix. Earth's gravitational force of attraction	1 each (any two)	2
	(e) Ans.	**State meaning of i) A scale of plan ii) Drawing to scale.** **i. A Scale of plan:** A scale of plan is a ratio of linear dimensions of an object as represented in drawing to actual dimensions of the same object. **ii. Drawing to scale:** The proportion by which the drawing of an object is enlarged or reduced is called as drawing to scale.	1	2
	(f) Ans.	**Define "Contour" and "Contour line".** **Contour:** An imaginary line on the ground, joining the points of same elevation or same R.L's is called as 'Contour'. **Contour line:** A line passing through points of equal elevation or equal R.L's is called as contour line. **OR** The line of intersection of a level surface with ground surface is known as contour line.	1 1 1	2
	(g) Ans.	**Enlist the components of digital planimeter.** **Components of digital planimeter:** i. Digital display ii. Rolling wheel or Rollers iii. Tracing arm iv. Functional keys or buttons v. Sliding wheel	½ each (any four)	2
Q. 2		**Attempt any three:**		12
	(a) Ans.	**Define: i) Magnetic bearing ii) FB iii) BB iv) Bearing of line.** **i. Magnetic bearing;** The bearing of a line measured with respect to magnetic north in clockwise manner is called as magnetic bearing. **ii. Fore bearing:** The bearing observed in the direction of progress of survey with respect to north direction in clockwise manner is called fore bearing.	1 1	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
		iii. Back bearing : The bearing observed in the backward direction or opposite direction of survey with respect to north direction in clockwise manner is called back bearing.	1	4
		iv. Bearing of line: The horizontal angle made by survey line with respect to meridian (North direction) is known as bearing of line.	1	
	(b) Ans.	**Explain the principle of surveying.** Principle of surveying are as follows: **i. To work from whole to part.**  According to the first principle, the whole area is first enclosed by main stations and main survey lines as shown in figure above. The area is then divided into a number of parts by forming well conditioned triangles. A nearly equilateral triangle is considered to be the best well conditioned triangle. The main survey lines are measured very accurately with a standard chain. The sides of triangles are measured. The purpose of this process of working is to prevent accumulation of error.	2	
		ii. To locate a new station by at least two measurement from fixed reference points.  The new stations should always be fixed by at least two measurements from fixed reference points. Linear measurements refer to horizontal distance measured by chain or tape. Angular measurements refer to the magnetic bearing or horizontal angle taken by a prismatic compass or theodolite. The new station or ground point is located using linear measurement or angular measurement or both measurements.	2	4

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 2	(c) Ans.	**Explain temporary adjustment of dumpy level.** **Temporary adjustment of dumpy level:** **I. Setting up the level.** i. The level fixed on tripod. ii. The legs of tripod stand are well spread so that the level will remain stable on tripod. iii. Bring all the three foot screws in the Centre of their run so that they can be turned clockwise or anticlockwise as required, for Levelling purpose. iv. Adjust the height of the instrument so that the observer can Comfortably see through the telescope and note the readings. v. Fix two legs of tripod and adjust third leg in such a way that the levelling head will become as horizontal as possible by eye judgment. **II. Levelling up the level.** i. The base of the tripod is already leveled with the help of cross bubble. ii To make accurate adjustment of the level, the longitudinal level is adjusted in the Centre of its run, with the help of three foot screws. iii. Make the bubble parallel to the any selected pair of foot screws. Now; turn both the foot screws either inward or outward with the help of foot screws till the bubble appears in the center. iv. Turn the telescope through 90° and now with the help of third screw bring the bubble of levelling tube in the center. v. Repeat above process, until bubble will remain at centre in both position. Then levelling is said to be completed. **III. Focusing the eye piece.** i. Hold a sheet of white paper in front of the objective glass 4 to 6 cm away from objective glass and see through the eye piece. ii. Turn the eye piece inwards or outwards in the socket so that the cross hair on the diaphragm appears sharp and clear. **IV. Focusing the object glass.** i. Direct the telescope towards any object, say a levelling staff in the field which is kept at a distance. See through eyepiece whether the staff is visible, distinct or not. ii. If not, then turn the focusing screw till the image is distinct and clear. The cross hair on the diaphragm should also be seen clearly.	1 1 1 1	4

Q. 2 (d) Ans. **Convert the following bearings from WCB to QB**

i) 247°30' ii) 167°45' iii) 51°15' iv) 333°30'

Sr. No.	WCB	Conversion	QB	Marks
i.	$\Theta_1 = 247°30'$	As Θ_1 lies in IIIrd Quadrant RB = Θ_1 - 180° = 247°30' - 180° = S 67°30' W	S 67°30' W	1
ii.	Θ_2 = 167°45'	As Θ_2 lies in IInd Quadrant RB = 180°- Θ_2 = 180° - 167°45' = S 12°15' E	S 12°15' E	1
iii.	$\Theta_3 = 51°15'$	As Θ_3 lies in Ist Quadrant RB = WCB =N 51°15'E	N 51°15'E	1
iv.	Θ_4= 333°30'	As Θ_4 lies in IVth Quadrant RB = 360°- Θ_4 = 360° - 333°30' = N 26°30' W	N 26°30' W	1

Total Marks: 4

Q. 3 **Attempt any three:** — Total Marks: 12

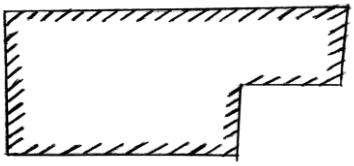
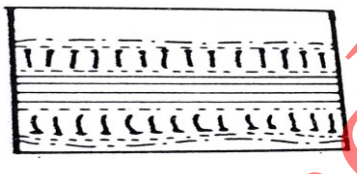
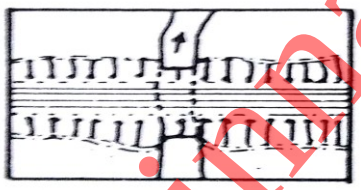
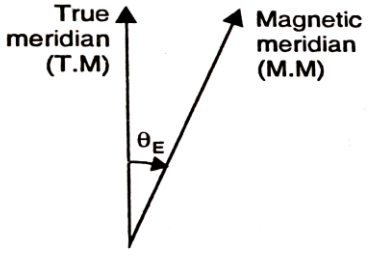
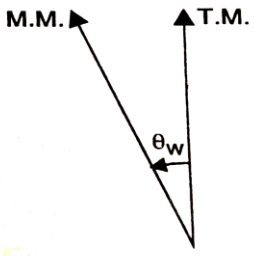
(a) Ans. **Explain importance of benchmark in levelling.** — 1 each — Total Marks: 4

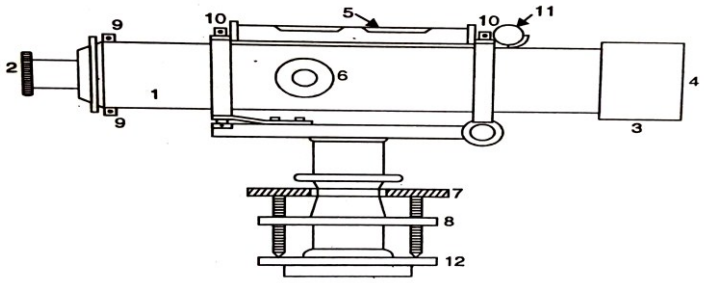
i. As bench mark is the ground point whose elevation or R.L. is known or preassumed; the back sight reading (first reading) is taken on it. This back sight (BS) reading is useful to calculate height of instrument (HI) in line of collimation. This HI is useful to calculate R.L.'s of other ground points, in all types of levelling.

ii. Thus bench mark (BM) is essential to commence the survey work. It is not possible to calculate reduced levels (RL's) of ground points without knowing BM.

iii. The BM is important to check the RL calculations by applying arithmetical checks in both methods i.e. HI method and Rise-fall method.

iv. The BM is useful to check the one day's observation through check levelling.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 3	(b) Ans.	**Draw conventional symbols for** **i) Compound wall ii) Pucca Building iii) Cutting iv) Embankment**  Compound Wall  Pucca Building  Cutting  Embankment	1 each	4
	(c) Ans.	**Explain declination of magnetic needle and give its types.** The horizontal angle between the magnetic meridian and true meridian is known as magnetic declination. When magnetic north gets deviated from true north towards east or west due to local attraction, then it is known as magnetic declination. Due to various local sources magnetic needle of prismatic compass does nor remains in true north position; such an error is called as declination of magnetic needle.	2	4
		 (a) Declination east  (b) Declination west	1	
		Depending upon declination towards east or north direction, there are two types of declinations. i) East declination ii) West declination.	1	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 3	(d) Ans.	**Draw sketch of dumpy level and name all parts.**  DUMPY LEVEL 1. TELESCOPE 2. EYE-PIECE 3. RAY SHADE 4. OBJECTIVE END 5. LONGITUDINAL BUBBLE 6. FOCUSING SCREWS 7. FOOT SCREWS 8. UPPER PARALLEL PLATE (TRIBRACH) 9. DIAPHRAGM ADJUSTING SCREWS 10. BUBBLE TUBE ADJUSTING SCREWS 11. TRANSVERSE BUBBLE TUBE 12. FOOT PLATE (TRIVET STAGE). *(Note: 3 marks for sketch and 1 mark for labelling.)*	4	4
Q. 4		**Attempt any three:**		12
	(a) Ans.	**Differentiate between height of instrument and rise and fall method.**	1 each (any four)	4

	Height of Instrument Method		Rise and Fall Method
I	This method is a fast method and is less tedious because it requires less calculations.	I	This method is a slower method than H.I. method as it involves more calculations.
II	There is no check on R.L.s of intermediate stations	II	There is a complete check on all calculation work.
III	Following check is applied, Σ BS – Σ FS = Last R.L. – First R.L.	III	Following check is applied, Σ BS – Σ FS = Σ Rise – Σ Fall = Last R.L. – First R.L.
IV	Error in calculations of RLs of intermediate stations is not carried forward.	IV	Error in calculations of RLs of intermediate stations is carried forward.
V	This method is less accurate.	V	This method is more accurate.
VI	It is used for calculations of profile levelling in construction works such as canals, roads etc.	VI	It is used for calculations of precise levelling works, check levelling.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 4	(b)	**Explain procedure for computing volume by** **i) Trapezoidal formula** **ii) Prismoidal formula**		
	Ans.	**I. Trapezoidal formula:** Procedure for computing the volume by trapezoidal formula is as follows: i. Divide the total length of plan (L-section) in to number of strips (cross sections). In this method areas are divided into series of trapezoids as shown in figure below. ii. Calculate the areas of each section (i.e. ends , intermediate from A_1 to A_n) iii. Calculate volume of earth work in cutting and embankment by using formula. Trapezoidal formula: $V = D/2 \times (A_0 + 2A_1 + 2A_2 + \ldots\ldots 2A_{n-1} + A_n)$ Where, $A_0, A_1, \ldots A_{n-1}\ A_n$ –Areas of cross sections.	2	4
		 		
		In this method areas are divided into series of prismoids as shown in figure below. **II. Prismoidal formula:** Procedure for computing the volume by prismoidal formula is as follows: i. Divide the total length of plan (L-section) in to number of strips (cross sections). In this method areas are divided into series of prismoids as shown in figure above. ii. Calculate the areas of each section (i.e. ends , intermediate from A_1 to A_n) iii. Calculate volume of earth work in cutting and embankment by using formula. iv. Prismoidal formula : $V = D/3 \times (A_0 + 4(A_1 + A_3 + \ldots.) + 2(A_2 + A_4 + \ldots.) + A_n)$	2	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
	(c) Ans.	**Explain four uses of contour map.** Following are uses of contour map: i To draw longitudinal section and plan of given map. ii To determine inter-visibility between two points. iii To trace contour gradient and to locate route for alignments of railways, roadways, canals etc. iv To measurement of drainage areas. v. To calculate reservoir capacity. vi To find intersection of surfaces and measurement of earth work. vii To determine nature of ground in proposed area.	1 each (any four)	4

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 4	(d)	**Following consecutive readings were taken with a level on 4 m staff on continuously slopping ground at common interval 30 m. 0.76, 1.515, 1.935, 2.400, 2.985, 3.650, 1.015, 1.855, 2.495, 3.57, 0.875, 1.085, 1.790, 2.450.** **RL of first point is 200.500 m.** **Calculate RL of all points by HI method.**		
	Ans.		3	4

Staff Stn.	BS	IS	FS	HI	RL	Remark
0	0.760			201.26	200.500	First RL
30		1.515			199.745	
60		1.935			199.325	
90		2.400			198.860	
120		2.985			198.275	
150	1.015		3.650	198.625	197.610	CP1
180		1.855			196.770	
210		2.495			196.130	
240	0.875		3.570	195.930	195.055	CP2
270		1.085			194.845	
300		1.790			194.140	
330			2.450		193.480	Last RL
Σ	**2.650**		**9.670**			

Check:
Σ BS – Σ FS = Last R.L. – First R.L.
2.65 – 9.67 = 193.48 – 200.50
- 7.02 = - 7.02

1

(e) Ans. **Describe procedure for measuring area using digital planimeter.**

The procedure of measurement of an area using digital planimeter is as follows:

i. Take the area on the plane surface of table and fix it with clips so that while measurement it does not move.

ii. Start the planimeter by pressing on button on key pad of it. Screen will be displayed.

iii. Set the scale by pressing scale button on key pad.

iv. Mark one starting point on boundary of that area and place the point of magnifier of tracing arm of digital planimeter.

v. Press the start button and move tracing arm on boundary of area and end it again at its starting point. Press the end button.

vi. The area of given figure is displayed in digital display of digital planimeter.

4 | 4

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5		**Attempt any two:**		12
	(a)	**Calculate included angle for closed traverse and apply usual check.**		

Line	FB	BB
AB	$46^0 30'$	$226^0 30'$
BC	$117^0 30'$	298^0
CD	168^0	349^0
DA	290^0	$112^0 30'$

Ans.

$\angle A$ = BB of DA – FB of AB = $112^0 30' - 46^0 30' = 66^0$

$\angle B$ = BB of AB – FB of BC = $226^0 30' - 117^0 30' = 109^0$

$\angle C$ = BB of BC- FB of CD = $298^0 0' - 168^0 = 130^0$

$\angle D$ = BB of CD - FB of DA = $(349^0 - 290^0) = 59^0$ — **2**

Check:

Sum of included angle = $(2n - 4) \times 90^0$

$\angle A + \angle B + \angle C + \angle D = (2n - 4) \times 90^0$ — **2**

$66^0 + 109^0 + 130^0 + 59^0 = (2 \times 4 - 4) \times 90^0$

$364^0 = 360^0$

Total error $= 364^0 - 360^0 = 4^0$

Correction for each angle $= 4^0 / 4 = 1^0$

Hence correction of -1^0 should be applied

Corrected $\angle A = 66^0 - 1^0 = 65^0$

Corrected $\angle B = 109^0 - 1^0 = 108^0$

Corrected $\angle C = 130^0 - 1^0 = 129^0$

Corrected $\angle D = 59^0 - 1^0 = 58^0$ — **2**

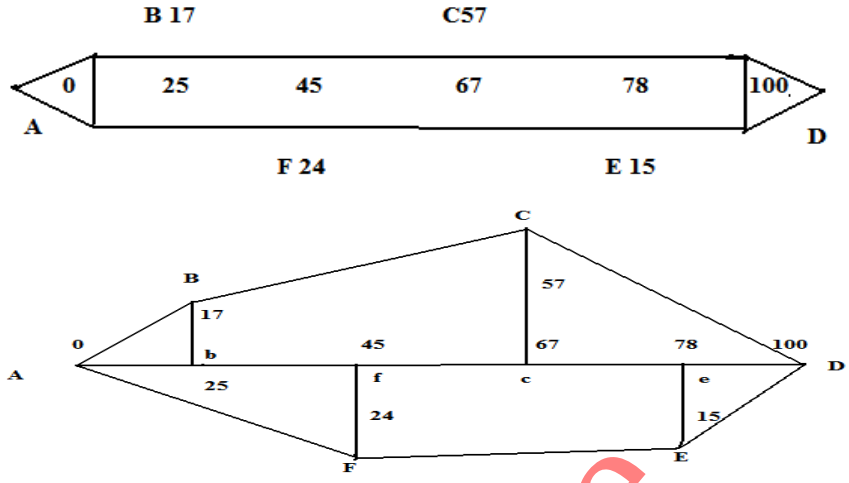
Sum of included angle = $(2n - 4) \times 90^0$

$\angle A + \angle B + \angle C + \angle D = (2n - 4) \times 90^0$

$65^0 + 108^0 + 129^0 + 58^0 = (2 \times 4 - 4) \times 90^0$

$360^0 = 360^0$

6

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5	(b)	**Plot the following cross staff survey of field and calculate area in m^2. All reading are in 'm'.**		
	Ans.		1	6

Sr. No.	Figure	Chainage	Base	Offsets	Mean Offset	Area
1	Δ AbB	0-25	25	0 & 17	8.5	212.5
2	□ bBCc	25-67	42	17 & 57	37	1554
3	Δ CcD	67-100	33	57 & 0	28.5	940.5
4	Δ DeE	78 - 100	22	15 & 0	7.5	165
5	□ EefF	45-78	33	24 & 15	19.5	643.5
6	Δ AfF	0-45	45	0 & 24	12	540
					Total Area	**4055.5 m^2**

5

	(c)	**Following consecutive readings are taken on leveling staff on continuous sloping ground at an interval 25m.** **0.950, 1.615, 1.925, 2.515, 2.895, 3.495, 1.125, 1.980, 2.450, 3.750, 0.925, 1.455, 1.750, 2.850.** **The RL of first point 100.000 m. Rule out page of level of field book and enter the above reading. Calculate RL of all points by rise and fall method. Also find gradient of line joining first and last point.**		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks

Q. 5 Ans.

Sr. No.	Chainage	BS	IS	FS	Rise	Fall	RL	Remark
1	0	0.950					100.000	First RL
2	25		1.615			0.665	99.335	
3	50		1.925			0.310	99.025	
4	75		2.515			0.590	98.435	
5	100		2.895			0.380	98.055	
6	125	1.125		3.495		0.600	97.455	C.P.1
7	150		1.980			0.855	96.600	
8	175		2.450			0.470	96.130	
9	200	0.925		3.750		1.300	94.830	C.P.2
10	225		1.455			0.530	94.300	
11	250		1.750			0.295	94.005	
12	275			2.850		1.100	92.905	Last RL
	∑	**3.000**		**10.095**	**0**	**7.095**		

Marks: 4 — **Total Marks: 6**

Check: Σ B.S.-Σ F.S. = Σ Rise -Σ Fall = Last R.L. – First R.L.

3.00 – 10.095 = 0 - 7.095 = 92.905 – 100.000

-7.095 = -7.095 = -7.095

Marks: 1

Gradient = (Last RL – First RL) / Distance

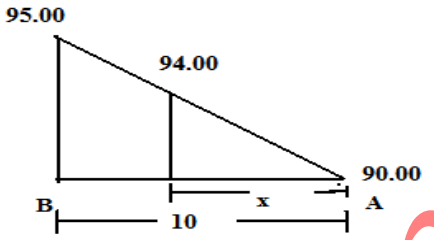
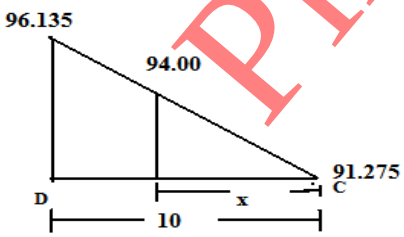
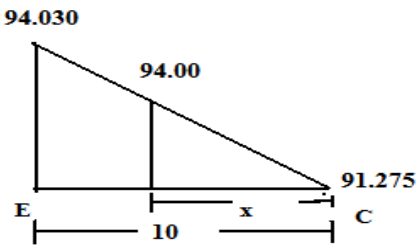
= (92.905 – 100.000) / 275

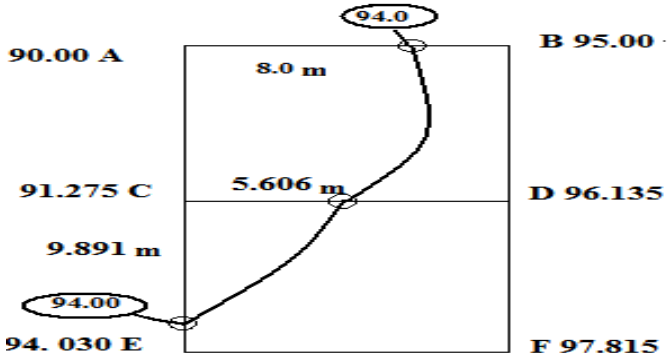
= -0.0258

= -1 / 38.75

i.e. 1 in 38.75 falling gradient.

Marks: 1

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6		**Attempt any two:**		12
	(a)	**Counter survey data of a field is shown in given figure. Draw 94.000 m contour line by linear interpolation method. Show all the calculations grid size is 10 m x 10 m.**		
				
	Ans.	 $\frac{95.00 - 90.00}{10} = \frac{94.00 - 90.00}{x}$ $\frac{5}{10} = \frac{4}{x}$ $x = 8.0$	1½	
		 $\frac{96.135 - 91.275}{10} = \frac{94.00 - 91.275}{x}$ $\frac{4.86}{10} = \frac{2.725}{x}$ $x = 5.606$ m	1½	6
		 $\frac{94.030 - 91.275}{10} = \frac{94.00 - 91.275}{x}$ $\frac{2.755}{10} = \frac{2.725}{x}$ $x = 9.891$ m	1½	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6			1½	6
	(b)	**Following bearing were recorded in running closed traverse ABCDE. Calculate included angle of the traverse.** **Line / Fore bearing / Back bearing** **AB: 110° 00' / 290° 00'** **BC: 30° 15' / 214° 15'** **CD: 244° 00' / 64° 00'** **DE: 310° 15' / 130° 15'** **EA: 192° 45' / 14° 45'**		
	Ans.	$\angle A$ = FB of AB – BB of EA = $110^0 0' - 14^0 45' = 95^0 45'$ $\angle B = 360^0 - (\text{FB of BC} - \text{BB of AB}) = 360^0 - (290^0 0' - 30^0 15') = 100^0 15'$ $\angle C$ = FB of CD – BB of BC = $244^0 0' - 214^0 15' = 29^0 45'$ $\angle D = (\text{FB of DE} - \text{BB of CD}) = (310^0 15' - 64^0) = 246^0 15'$ $\angle E$ = FB of EA – BB of DE = $192^0 45' - 130^0 15' = 62^0 30'$	2	
		Check: **Sum of included angle = (2n – 4) x 90^0** $\angle A + \angle B + \angle C + \angle D + \angle E = (2n - 4) \times 90^0$ $95^0 45' + 100^0 15' + 29^0 45' + 113^0 45' + 62^0 30' = (2 \times 5 - 4) \times 90^0$ $534^0 30' = 540^0$ **Total error** = $534^0 30' - 540^0 = -5^0 30'$ **Correction for each angle** = $-5^0 30'/5 = -1^0 6'$ Hence correction of $1^0 6'$ should be applied Corrected $\angle A = 95^0 45' + 1^0 6' = 96^0 51'$ Corrected $\angle B = 100^0 15' + 1^0 6' = 101^0 21'$	2	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6		Corrected $\angle C = 29^0 45' + 1^0 6' = 30^0 51'$ Corrected $\angle D = 246^0 15' + 1^0 6' = 247^0 21'$ Corrected $\angle E = 62^0 30' + 1^0 6' = 63^0 36'$ **Sum of included angle = (2n – 4) x 90^0** $\angle A + \angle B + \angle C + \angle D + \angle E = (2n - 4) \times 90^0$ $96^0 51' + 101^0 21' + 30^0 51' + 247^0 21' + 63^0 36' = (2 \times 5 - 4) \times 90^0$ $540^0 = 540^0$	2	
	(c)	**Find the missing readings marked as 'X' and apply the usual check.**		

Stn.	B.S.	I.S.	F.S.	Rise	Fall	R.L.	Remark
1	2.345					129.50	BM1
2	1.650		X	0.035			
3		2.210			X		
4	X		1.850	X			
5	1.850		1.925		0.455		C.P.
6			X	0.37		129.00	

	Ans.	2.345 – X = 0.035 **X = 2.310** 1.650 – 2.210 = X **X = 0.560** 2.210 – 1.850 = X **X =0.360** X – 1.925 = - 0.455 **X = 1.470** 1.850 –X = 0.37 **X = 1.480**	2½	

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6			1½	6

Stn.	B.S.	I.S.	F.S.	Rise	Fall	R.L.	Remark
1	2.345					129.500	First RL
2	1.650		**2.310**	0.035		**129.535**	CP1
3		2.210			**0.560**	**128.975**	
4	**1.470**		1.850	**0.360**		**129.335**	CP2
5	1.850		1.925		0.455	**128.880**	CP3
6			**1.480**	0.370		**129.250**	Last RL
∑	**7.315**		**7.565**	**0.765**	**1.015**		

Check : Σ B.S.-Σ F.S. = Σ Rise -Σ Fall = Last R.L. – First R.L.
7.315 –7.565= 0.765 - 1.015 = 129.50 – 129.25
- 0.25 = - 0.25 = - 0.25

2