

B.TECH. 4<sup>TH</sup> SEMESTER EXAMINATION, 2014

Answers to Short / Objective Questions

1. (i) (a)

(ii) (b)

(iii) (c)

(iv) (a)

(v) (e)

(vi) (c)

(vii) (a)

(viii) (a)

(ix) (d)

(x) (d)

a - (2)

b -  $z^2$

c -  $z^2z$

d - (2)

e -  $z^2z$

f -  $z^2z$

g -  $z$

h -  $z$

i -  $z^2$

j - (2v)

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1	2	3	4	5	6	7	8	9	10
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99
100	101	102	103	104	105	106	107	108	109

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B.Tech 4<sup>th</sup> Semester Examination, 2014

Model Answer

Subject:- Field measurement (Surveying)

Paper Code:- 011404

Sets (I) / (II)

Q.1(a)

Plane Surveying

Geodetic Surveying

- |  |   |
|--|---|
| (i) Curvature of earth is not considered.  | (i) Curvature of earth considered.                                  |
| (ii) It is used for relatively small areas.                                      | (ii) It is used for large areas.                                    |
| (iii) The direction of plumb lines at various points are assumed to be parallel. | (iii) The direction of plumb lines at various points are different. |
| (iv) The accuracy is very high.  | (iv) The standard of accuracy is lower.                             |
| (v) Plane triangle is used.  | (v) Spherical triangle is used.                                     |

(b)  $5 \text{ cm}^2 = 0.45 \text{ hectare}$

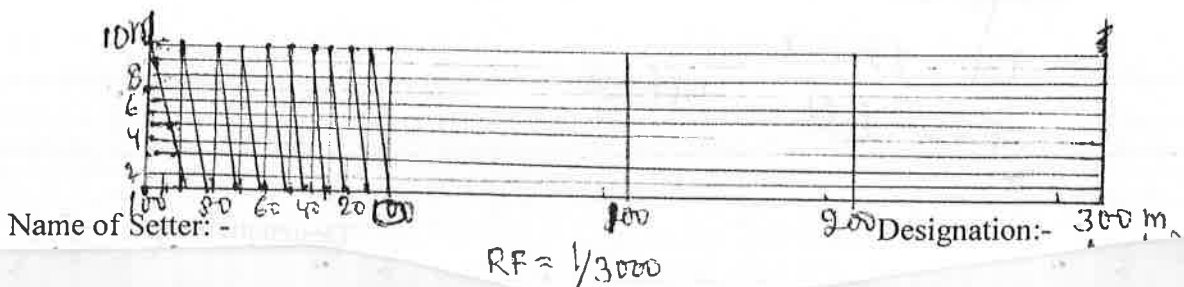
$1 \text{ cm}^2 = \frac{0.45 \times 10,000}{5} \text{ m}^2 = 900 \text{ m}^2$

$1 \text{ cm} = 30 \text{ m}$

$RF = 1/3000$

Maximum length to be shown = 400m

Length of scale =  $1/3000 \times 400 \times 100 = 13.33 \text{ cm}$



Subject:-

Sets (I) / (II)

3(a)

Main Station: Stations along the boundary of an area as controlling points are known as main station. The line joining the main stations are called main survey lines.

Subsidiary Station: Stations which are on the main survey lines or any other survey lines are known as subsidiary stations. These stations are taken to run subsidiary lines for dividing the area into triangles, for checking the accuracy of triangles and for locating interior details.

Tie Stations: These are also subsidiary stations taken on the main survey lines. Lines joining the stations are known as tie lines.

Base line: The line on which the framework of the survey is built is known as the base line. It is most important line of survey. Generally longest of the main survey lines is considered the base line.

3(b) Let the points P and Q be on the near bank and the tree T on the far bank of the river. From T, draw a perpendicular drawn to PQ.

$$\text{Let } PA = x$$

$$\text{then } AQ = 517 - x$$

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**Model Answer**

Paper Code:- 011407

Subject:-

Sets (I) / (II)

Correct FB of CD =  $215^{\circ}15' + 2^{\circ}30' = 217^{\circ}45'$

Actual BB =  $217^{\circ}45' - 180^{\circ}01' = 37^{\circ}45'$

But observed BB is  $36^{\circ}30'$

$\therefore$  Correction =  $37^{\circ}45' - 36^{\circ}30' = +1^{\circ}15'$  should be applied at D.

~~Correction~~ Correct FB of DE =  $208^{\circ}00' + 1^{\circ}15' = 209^{\circ}15'$

Correct BB =  $209^{\circ}15' - 180^{\circ}01' = 29^{\circ}15'$

But observed BB is  $29^{\circ}01'$

Correction =  $29^{\circ}15' - 29^{\circ}01' = +0^{\circ}15'$  should be applied at E.

Correct FB of EA =  $318^{\circ}30' + 0^{\circ}15' = 318^{\circ}45'$

actual BB of EA =  $318^{\circ}45' - 180^{\circ}01' = 138^{\circ}45'$  which tallies with the observed BB of EA


So, Station A is free from local attraction as stated at the beginning. The result is tabulated as follows:

Line	Observed		Correction	Correct		Remarks
	FB	BB		FB	BB	
AB	$59^{\circ}00'$	$239^{\circ}00'$	$0^{\circ}$ at A	$59^{\circ}00'$	$239^{\circ}00'$	Station A is free from local attraction
BC	$139^{\circ}30'$	$317^{\circ}00'$	$0^{\circ}$ at B	$139^{\circ}30'$	$317^{\circ}00'$	
CD	$215^{\circ}15'$	$36^{\circ}30'$	$+2^{\circ}30'$ at C	$217^{\circ}45'$	$37^{\circ}45'$	Station B is free from local attraction
DE	$208^{\circ}00'$	$29^{\circ}00'$	$+1^{\circ}15'$ at D	$209^{\circ}15'$	$29^{\circ}15'$	
EA	$318^{\circ}30'$	$138^{\circ}45'$	$+0^{\circ}15'$ at E	$318^{\circ}45'$	$138^{\circ}45'$	

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$$\alpha = 78^{\circ}0' - 33^{\circ}40' = \text{Sets (I)/(II)}$$

$$= 44^{\circ}20'$$

$$\beta = 180^{\circ} - (43^{\circ}20' + 78^{\circ}0')$$

$$= 58^{\circ}40'$$

From  $\Delta PTA$ ,  $\frac{TA}{PA} = \tan \alpha$

$$TA = x \tan 44^{\circ}20' \quad \text{--- (1)}$$

From  $\Delta QTA$ ,  $\frac{TA}{QA} = \tan \beta$

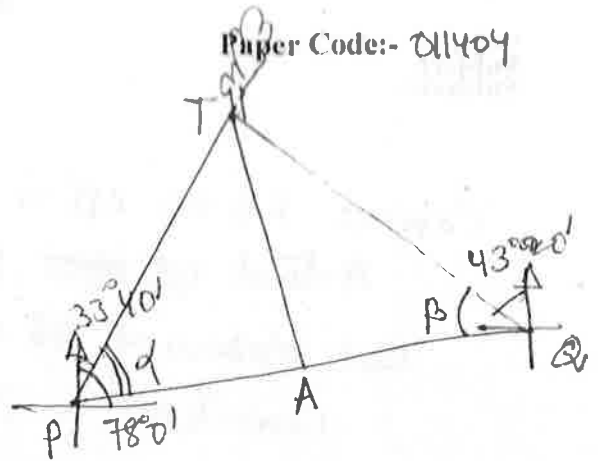
$$TA = (517 - x) \tan 58^{\circ}40' \quad \text{--- (2)}$$

From (1) and (2),  $x \tan 44^{\circ}20' = (517 - x) \tan 58^{\circ}40'$

$$x = 324.18 \text{ m.}$$

$$\therefore TA = 324.18 \times 0.9770 = 316.724 \text{ m.}$$

So, the width of the river is 316.724 m.



Q4. On verifying the observed bearings, it is found that the FB and BB of AB differ by exactly  $180^{\circ}$ . So station A and B are free from local attraction. Hence the observed FB and BB of AB are correct.

The observed FB of BC is also correct.

$$\text{The actual BB of BC} = 139^{\circ}30' + 180^{\circ} = 319^{\circ}30'$$

But the observed BB is  $317^{\circ}0'$

$$\text{Correction} = 319^{\circ}30' - 317^{\circ}0' = +2^{\circ}30' \text{ should be applied at C}$$

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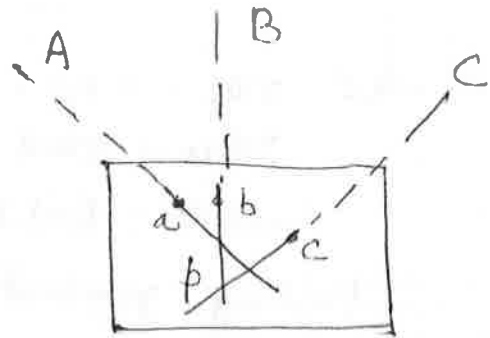
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Sets (I) / (II)

This point is transferred to the ground by U-fork and plumb bob.



6(a) From a contour map, the nature of the ground surface of an area can be known. So, for identifying a suitable site for a dam or reservoir and for making the tentative alignment of engineering projects involving roads, railways etc. a contour map is essential.

(b)

Stn point	Chainage	BS	IS	FS	Rise (+)	Fall (-)	RL	Remarks
A	0	0.855	<del>1.15</del>				380.500	
	30		1.545			0.690	379.810	
	60		2.335			0.790	379.020	
	90		3.115			0.780	378.240	
	120	0.455		3.825		0.710	377.530	CP
	150		1.380			0.925	376.605	
	180		2.455			0.675	375.930	
	210		2.855			0.800	375.130	
	240	0.585		3.455		0.600	374.530	CP
	270		1.015			0.430	374.100	
	300		1.850			0.835	373.265	
	330		2.755			0.905	372.360	
	360			3.845		1.090	371.270	

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Subject:-

Sets (I) / (II)

Check:  $\Sigma BS - \Sigma FS = 1.895 - 11.125 = -9.230$

$\Sigma Rise - \Sigma Fall = 0 - 9.230 = -9.230$

Last RL - First RL =  $371.270 - 380.500 = -9.230$

Falling gradient of AB =  $\frac{\text{difference of level}}{\text{horizontal distance}}$

$= \frac{9.230}{360} = 1/39$  or 1 in 39.

7(a) The traverse table in which all information related to the traverse including the relevant independent coordinates is tabulated is known as Gale's table.

The characteristics of Gale's table is that the independent coordinates of all traverse station are brought to the NE quadrant by suitably assuming the coordinates of the starting stations of the traverse.

7(b) The calculations of latitudes and departures of the traverse are arranged in tabular form as follows.

Line	Length	WCB	RB	Latitude $100 \cos \theta$	Departure $100 \sin \theta$
AB	100	—	0		
BC	80.5	$140^{\circ}30'$	$S39^{\circ}30'E$	$80.5 \cos 39^{\circ}30'$ $= -62.12$	$80.5 \sin 39^{\circ}30'$ $= 51.20$
CD	60	$220^{\circ}30'$	$S40^{\circ}30'W$	$60 \cos 40^{\circ}30'$ $= -45.62$	$60 \sin 40^{\circ}30' = -38.76$
DA	L	$310^{\circ}15'$	$N49^{\circ}45'W$	$L \cos 49^{\circ}45'$ $= +0.646L$	$L \sin 49^{\circ}45'$ $= -0.763L$

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Sets (I) / (II)

- The number of accessories required in such survey is large and they are likely to be lost.
- The instrument is very heavy and difficult to carry.
- The map cannot be replotted to a different scale as there is no field book.

5(b) Three point problem: In this problem, three well-defined points are selected whose positions have already been plotted on the map. Then, by perfectly bisecting these three well-defined points, a new station is established at the required position.

Method of Trial and Error

- (i) Suppose A, B and C are three well-defined points which have been plotted as a, b and c on the map. Now it is required to establish a station at P.
- (ii) The table is set up at P and levelled. Orientation is done by eye estimation.
- (iii) With the alidade rays Aa, Bb and Cc are drawn. As the orientation is approximate, the rays may not intersect at a point but may form a small triangle - the triangle of error.
- (iv) To get the actual point, this triangle of error is to be eliminated. By repeatedly turning the table clockwise or anticlockwise, the triangle is eliminated in such a way that the rays Aa, Bb and Cc finally meet at a point P. This is the required point on the map.

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Sets (I) / (II)

Line	Correct		Declination 10'W	True		Remarks
	FB	GB		FB	BB	
AB	59°00'	239°00'	-10'	49°00'	229°00'	True bearing is obtained by deducting declination from magnetic bearing as declination is west.
BC	139°30'	319°30'	-10'	129°30'	309°30'	
CD	217°45'	37°45'	-10'	207°45'	27°45'	
DE	209°15'	29°15'	-10'	199°15'	19°15'	
EA	318°45'	138°45'	-10'	308°45'	128°45'	

5(a) Advantages

- It is most rapid method of Surveying.
- There is no need of field book as plotting is done along with the field work.
- There is no possibility of overlooking any important object.
- Irregular objects may be represented accurately.
- It is suitable in magnetic areas.
- The map can be prepared easily, and does not require any great skill.
- Inaccessible points can be easily located by intersection.

Disadvantages

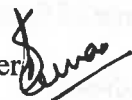
- The plane table is not suitable for accurate work as the fitting arrangement is not perfect.
- Plane table Surveying is not suitable in wet climate.

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**Sets (I) / (II)**

In closed traverse, the algebraic sum of latitudes must be equal to zero and so should that of the departures.

$$100 \cos \theta - 62.12 - 45.62 + 0.646L = 0$$

$$\text{or, } 100 \cos \theta = 107.74 - 0.646L \quad \text{--- (1)}$$

$$\text{Again } 100 \sin \theta + 51.20 - 38.97 - 0.763L = 0$$

$$100 \sin \theta = 0.763L - 12.23 \quad \text{--- (2)}$$

$$\text{Solving (1) \& (2), } L = \frac{157.86 \pm \sqrt{(157.86)^2 - 4 \times 1757.5}}{2}$$

$$= 145.8 \text{ m or } 12.04 \text{ m}$$

When length of DA,  $L = 145.8 \text{ m}$ .

$$\begin{array}{l} \cos \theta = 0.1355 \\ \& \sin \theta = 0.9901 \end{array} \quad \left| \quad \begin{array}{l} \tan \theta = 7.3070 \\ \theta = 82^\circ 12' = \underline{N 82^\circ 12' E} \end{array} \right.$$

When length of DA,  $L = 12.04 \text{ m}$ .

$$\begin{array}{l} \cos \theta = 0.9996 \\ \& \sin \theta = 0.0304 \end{array}$$

$$\tan \theta = 0.0304, \quad \theta = 1^\circ 44' \text{ or } \underline{N 1^\circ 44' W}$$

8(a) A tachometer in which the stadia hairs are fixed in a diaphragm and maintain a constant distance from the central hair is known as a fixed hair tachometer. But a tachometer which contains a special diaphragm where the stadia hairs can be moved by micrometer screws in a vertical plane is known as a subtense theodolite.

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Sets (I) / (II)

(8/b) The distance are calculated from the formula

$$D = \frac{L}{2} \times S \cos^2 \theta$$

$$AB = 100 (2.250 - 1.250 - 1.250) \cos^2 70^\circ = 96.98 \text{ m}$$

$$BC = 100 (2.500 - 0.950) \times \cos^2 50^\circ = 158.78 \text{ m}$$

$$CD = 100 (2.750 - 1.550) \times \cos^2 80^\circ = 117.67 \text{ m}$$

Latitude

$$AB = +96.98 \cos 30^\circ 30'$$

$$= +83.40 \text{ (N)}$$

$$BC = -158.78 \cos 40^\circ 0'$$

$$= -121.63 \text{ (S)}$$

$$CD = -117.67 \cos 45^\circ 0'$$

$$= -83.20 \text{ (S)}$$

$$DA = L \cos \theta$$

Departure

$$AB = +96.98 \sin 30^\circ 30'$$

$$= +49.22 \text{ (E)}$$

$$BC = +158.78 \sin 40^\circ 0'$$

$$= +102.06 \text{ (E)}$$

$$CD = +117.67 \sin 45^\circ 0'$$

$$= -83.20 \text{ (W)}$$

$$DA = L \sin \theta$$

For a closed traverse, the algebraic sum of latitude and departure must equal to zero.

$$\text{So, } +83.40 - 121.63 - 83.20 + L \cos \theta = 0 \Rightarrow L \cos \theta = 121.43$$

$$\text{and } 49.22 + 102.06 - 83.20 + L \sin \theta = 0 \Rightarrow L \sin \theta = -68.08$$

$$\therefore \tan \theta = \frac{68.08}{121.43} = 0.5605, \quad \theta = 29^\circ 16' 38''$$

$$\text{Bearing of DA} = \text{N } 29^\circ 16' 38'' \text{ W}$$

$$\text{Length of DA} = \sqrt{(121.43)^2 + (68.08)^2} = \underline{\underline{139.21 \text{ m}}}$$

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Sets (I) / (II)

9 (i) Field book: The notebook in which field measurements are noted is known as the field book. The size of the field book is 20cm x 12cm and it opens lengthwise. Field books may be of two types (i) single line & (ii) Double line. A single red line is drawn through the middle of each page. This line represents the chain line and the chainages are written on it. In double line field book, two red lines, 1.5cm apart, are drawn through the middle of each page. This column represents the chain line and the chainages are written in it.

(ii) offset: The lateral distance measurement taken from an object to the chain line is known as offset. Offsets are taken to locate objects with reference to the chain line. They may be of two kinds - perpendicular and oblique.

Perpendicular offsets: When the lateral measurements are taken perpendicular to the chain line, they are known as perpendicular offsets.

Oblique offsets: Any offsets not perpendicular to the chain line is said to be oblique. Oblique offsets are taken when the objects are at a long distance from the chain line or when it is not possible to setup a right angle due to some difficulties.

(iii) local attraction: A magnetic needle indicates the north direction when freely suspended or pivoted. But if the needle comes near some magnetic substances, such as iron ore, steel structures, electric cables conveying current etc.

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Subject:-

Sets (I) / (II)

It is found to be deflected from its true direction and does not show the actual north. This disturbing influence of magnetic substances is known as local attraction.

(iv) Fly levelling: The levelling operation in which only BS and FS readings are taken and no intermediate sights are observed is known as fly levelling. Fly levelling is done for connecting the BM to the starting point of any project. In such levelling, no horizontal distance are required to be measured.

(v) Bench Mark: These are fixed points or marks of known RL determined with reference to the datum line. These are very important marks. They serve as reference points for finding the RL of new points or for conducting levelling operation in projects involving roads, railway etc. Bench marks may be of four types (a) GTS (b) permanent (c) temporary (d) arbitrary.

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