CBCS SCHEME

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BCV302

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
Engineering Survey

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	What is Surveying? Briefly explain the classification of a survey based on the object of the survey.	8	L2	CO1
	b.	Explain briefly topographical survey and cadastral survey.	8	L1	CO1
	c.	Explain briefly laser distance meter.	4	L1	CO1
		OR			
Q.2	a.	What are the advantages and disadvantages of plane table surveying?	8	L2	CO1
	b.	Explain briefly various types of chain.	8	L1	CO1
	c.	How is surveying classified based on instrument used?	4	L2	CO1
		Module – 2			
Q.3	a.	The following consecutive readings were taken with a level and 3 meter leveling staff on a continuously sloping ground at a common interval of 20m: 0.602, 1.234, 1.860, 2.574, 0.238, 0.914, 1.936, 2.872, 0.568, 1.824, 2.722. The R.L of the first point was 192.122. Rule out the page of a level field book and enter the above readings. Calculate the reduced levels of the point.	10	L3	CO2
	b.	With a neat sketch, explain the measurement of horizontal angle by method of repetition with necessary, standard tabular format.	10	L2	CO2
		OR			
Q.4	a.	It is required to ascertain the elevations of two points P and Q and line of levels was run from P to Q. The lavelling was then continued to Bench mark. The readings obtained to being as shown below. Calculate the RL of P & Q.	10	L3	CO2

B.S.	I.S.	F.S.	R.L.	Remarks
1.622				P
1.874		0.354		
2.032		1.780		
	2.362			Q
0.981		1.122		
1.906		2.824		
		2.036	83.500	B.M

	b.	Explain temporary adjustment of dumpy level.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the characteristics of contours.	8	L1	CO3
	b.	What do you mean by contour? Explain the factors governing the choice of the proper contour interval.	8	L2	CO3
	c.	Differentiate between direct and indirect methods of contouring.	4	L2	CO3
		OR			
Q.6	a.	Explain the procedure of data refinement and plotting in CAD using total station.	8	L2	CO3
	b.	Define the following: Station, Turning point, Fore sight, Back sight.	8	L1	CO3
	c.	With a neat sketch, explain profile leveling.	4	L2	CO3
		Module – 4			
Q.7	a.	A railway embankment is 10m wide with side slope 1.5 to 1. Assuming ground to be level in a direction transverse to the centre line. Calculate the volume by prismoidal and trapezoidal formula. Contained in the length of 120m, the centre heights at 20m intervals being in meters 2.2, 3.7, 3.8, 4.0, 3.8, 2.8, 2.5.	10	L3	CO4
	b.	Obtain an expression for simple curve by Rankine's method.	10	L3	CO4
		OR			
Q.8	a.	Two tangents intersect at a chainage of 1000 meter, the deflection angle being 28°. Calculate all the data necessary to set out a curve of 250 meter radius by Rankine's method and tabulate the results. Peg interval = 20m, least count of instrument = 20".	10	L3	CO4
	b.	The following perpendiculars offsets were taken at 10m intervals from a survey line to an irregular boundary line: 3.25, 5.60, 4.20, 6.65, 8.75, 6.20, 3.25, 4.20 and 5.65. Calculate area by trapezoidal and Simpson's rule.	10	L3	CO4
		Module – 5			
Q.9	a.	List the GPS errors.	5	L1	CO5
	b.	What are the applications of Drones? Explain any one.	7	L2	CO5
	c.	Explain any two applications of remote sensing and GIS in Civil Engineering.	8	L2	CO5
		OR			
Q.10	a.	List the different types of drones.	5	L1	CO5
	b.	What are the advantages of drones? Explain any one.	7	L2	CO5
	c.	Explain any four drone surveying requirements.	8	L2	CO5

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Third Semester B.E Degree Examination, June/July 2024

ENGINEERING SURVEY

BCV302

Max Marks : 100

Q.No	MODULE -1	Marks
1a	**Surveying** :- Surveying is a fundamental technique used in various fields such as Civil Engineering, construction and geography to determine the positions and distances between points on the Earth's surface. It involves the measurement of angles, elevations, distances and other spatial parameters to create maps, establish property boundaries, design infrastructure and guide construction projects. Classification based on object of survey : * **Engineering Survey** :- It is also known as construction Surveying, is a specialized branch of surveying focused on the planning, design and execution of construction projects. * **Military Survey** :- Military surveying also known as military topography or military engineering surveying, is a specialized field of surveying that supports military operations. * **Mine Survey** :- The surveys which are carried out for Exploration of mineral wealth beneath the surface of the ground i.e, Coal, Copper, Gold, Iron ores etc are called mine surveys. * **Geological Survey** :- A geological survey involves the systematic collection and analysis of data related to the Earth's surface and subsurface to understand its composition, structure, processes and history.	08

*. **Archaeological Surveys :-** the surveys which are carried out to prepare maps of ancient culture i.e antiquities are called archaeological surveys.

1b **Topographical Survey :-** the surveys which are carried out to depict the topography of the mountainous terrain rivers, water bodies, wooded areas and other cultural details such as roads, railways, townships etc, are called topographical surveys. Topographic survey results in the production of maps showing the topography of an area i.e, the natural and man-made features on the surfaces of the earth. 08

Cadastral Survey :- the cadastral surveys are carried out for fixing the property lines, calculation of area of landed properties and preparation of revenue maps of States etc. these are also sometimes used for fixing the boundaries of municipalities, corporations & cantonments.

1c. **Laser Distance Meter (LDM) :-** A laser distance meter also known as a laser rangefinder or laser distance measurer, is a handheld device used to measure the distance between the device and a target using a laser beam. It is commonly used in construction, surveying, architecture and various other fields where precise distance measurements are required. 04

Advantages :-

High Precision :- Accuracy : Laser distance meters provide highly accurate measurements, typically within ±1-2 millimeters, which is often more precise than tape measurement.

Speed :-

* Quick measurements : Measurements are obtained almost instantaneously with a simple point and click, saving time compared to manual methods.
* Real-Time Readings : Continuous measurements modes allow for real-time distance tracking, which is particularly useful for finding the shortest or longest distance.

Q2.a Advantages and Disadvantages of plane table Surveying 08

Advantages :-

* the plan is drawn by the out-door surveyor himself while the country is before his eyes, and therefore, there is no possibility of omitting the necessary measurements.
* The surveyor can compare plotted work with the actual features of the area.
* Since the area is in curve, contour and irregular objects may be represented accurately.
* Direct measurements may be almost entirely dispensed with, as the linear and angular dimensions are both to be obtained by graphical means.
* It is particularly useful in magnetic areas where compass may not be used.
* It is simple and hence cheaper than the theodolite or any other type of survey.

Disadvantages :-

*. Since notes of measurements are not recorded, it is a great inconvenience if the map is required to be reproduced to some different scale.

*. The plane tabling is not intended for very accurate work.

* It is essentially a tropical instrument.

*. It is most inconvenient in rainy season and in wet climate.

*. Due to heavyness, it is inconvenient to transport.

*. Since there are so many accessories, there is every likelihood of these being lost.

2b. Various types of Chain :-

*. Metric Chain
*. Gunter's Chain (or) Surveyor Chain
*. Engineer's Chain
*. Revenue chain
*. Steel band.

1. Metric Chain :- The metric chain is a standard tool used in land surveying for measuring distances. It is essentially a chain of a specific length made up of linked metal segments and is used primarily in the field to measure linear distance. metric chains are typically available in lengths of 20 meters or 30meters. these lengths are convenient for measuring plots of land. The chain is divided into smaller units, usually decimeters (0.1 meters) and centimeters (0.01 meters) 08

2c. i) Chain Survey
ii) Compass Survey
iii) Theodolite Survey
iv) Traverse Survey
v) Tacheometric Survey
vi) Photogrammetric Survey
vii) Aerial Survey
viii) Levelling

04

MODULE - 2

3a.

BS	IS	FS	Rise	Fall	RL	Remarks
0.602					1.92.122	B.M
	1.234			0.632	191.490	
	1.860			0.626	190.864	
0.238		2.574		0.714	190.150	TP1
	0.914			0.676	189.474	
	1.936			1.022	188.452	
0.568		2.872		0.936	187.516	TP2
	1.824			1.256	186.260	
		2.722		0.898	185.362	

10

$\Sigma B.S - \Sigma FS = \Sigma Rise - \Sigma Fall = Last\ RL - First\ RL$

$-6.760 = -6.760 = -6.760$

2. **Gunter's Chain or Surveyor's Chain :-**

A Gunter's chain or Surveyor's chain is 66 ft. long & consists of 100 links, each link being 0.6 ft or 7.92 inch long. The length of 66ft was originally adopted for convenience in land measurement since 10 square chains are equal to 1 acre. 10 Gunter's chain = 1 furlong & 80 Gunter's chains = 1 mile.

3. **Engineer's Chain :-**

The engineer's chain is 100ft. long and consists of 100 links, Each link being 1 ft long. At every 10 links, brass tags are fastened, with notches on the tags indicating the number of 10 links segments between the tag and end of the chain

4. **Revenue Chain :-**

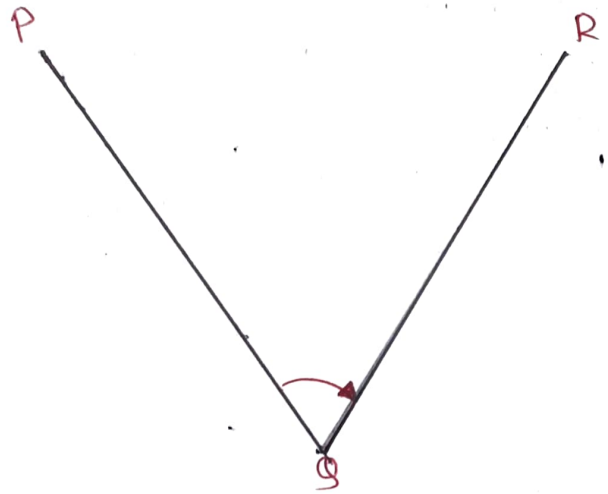
The revenue chain is 33.ft long and consists of 16 links Each link being $2\frac{1}{16}$ ft long. The chain is mainly used for measuring fields in cadastral survey.

5. **Steel band or band chain :-**

The Steel band consists of a long narrow strip of blue steel, of uniform width of 12 to 16mm and thickness of 0.3 to 0.6 mm. Metric Steel bands are available in lengths of 20 or 30m. It is divided by brass studs at every 20cm and numbered at every metre.

The first and last links (20cm lengths) are subdivided into cm and mm.

3b. **Measurement of horizontal angle by repitition method**



1. Set the instrument at Q and level it. With the help of upper clamp and tangent screw, set 0° reading on Vernier A. Note the reading of Vernier B.
2. Loose the lower clamp and direct the telescope towards the point P. Clamp the lower clamp and bisect point P accurately by lower tangent screw. 10
3. Unclamp the upper clamp and turn the instrument clockwise about the inner axis towards R. Clamp the upper clamp and bisect R accurately with the upper tangent screw
4. Unclamp the lower clamp and turn the telescope clockwise to sight P again. Bisect P accurately by using the lower tangent screw.
5. Unclamp the upper clamp, turn the telescope clockwise and sight R. Bisect R accurately by upper tangent screw.
6. Repeat the process until the angle is repeated the required number of times. The average angle with face left will be equal to final reading divided by three
7. Change face and make three more repetitions as described above. Find the average angle with face

right, by dividing the final reading by three.

8. The average horizontal angle is then obtained by taking the average of the two angles obtained with face left and face right.

Average horizontal angle	=	
	'	
	"	
Horizontal angle	=	
	'	
	"	
Face : Right Mean	=	
	'	
	"	
Face : Right B	=	
	'	
	"	
Face : Right A	=	
	'	
	"	
No. of repetitions		
Face left Mean	=	
	'	
	"	
Face left B	=	
	'	
	"	
Face left A	=	
	'	
	"	
Signed to		
Instrument at		

4a

B.S	I.S	F.S	H.I	RL	Remarks
1.622			84.820	83.198	P
1.874		0.354	86.340	84.466	
2.032		1.780	86.592	84.560	
	2.362			84.230	Q
0.984		1.122	86.454	85.470	
1.906		2.824	85.536	83.630	
		2.036		83.500	B.M

10

$\Sigma BS - \Sigma FS$ = Last RL - First RL

0.302 = 0.302

4b

Temporary adjustments of a level :-

i) Setting up

ii) Levelling up

iii) Elimination of parallax

a) focusing eyepiece

b) focusing objective

10

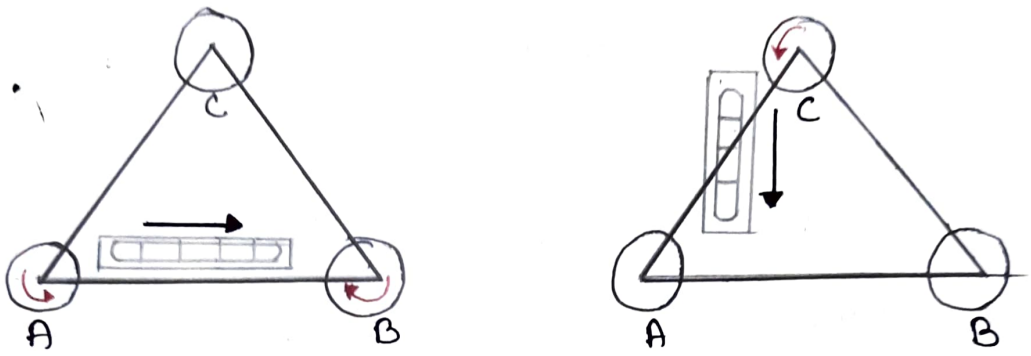
i) Setting up : The operation of setting up includes

a) fixing the instrument on the stand and

b) levelling the instrument approximately by leg adjustment.

To fix the level to the tripod, the clamp is released, instrument is held in the right-hand and is fixed on the tripod by turning round the lower part with the left hand.

iii) **Levelling up :** After having levelled the instrument accurate levelling is done with the help of foot screws and with reference to the plate levels. The purpose of levelling is to make the vertical axis truly vertical.



iii) **Elimination of Parallax :-** Parallax is a condition arising when the image formed by the objective is not in the plane of the cross-hairs.

a) **Focusing the eye-piece** – To focus the eye-piece for distinct vision of the cross-hairs. point the telescope towards the sky and move eye-piece in or out till the crosshairs are seen sharp and distinct.

b) **Focusing the objective :** The telescope is now directed towards the staff and the focusing screw in turned till the image appears clear and sharp. The image so formed is in the plane of cross-hairs.

MODULE -3

5a **Characteristics of Contours :**

1) Two contours lines of different elevations cannot cross each other. If they did, the point of intersection would have two different elevations which is absurd.

2) Contour lines of different elevations can unite to form one line only in the case of a vertical cliff.

3) Contour lines close together indicate steep slope.

4) A contour passing through any point is perpendicular to the line of steepest slope at that point.

5) A closed contour line with one or more highers ones inside it represents a hill

6) Two contour lines having the same elevation cannot unite and continue as one line. 08

7) A contour line must close upon itself, though not necessarily within the limits of the map.

8) Contour lines cross a watershed or ridge line at right angles.

5b Contour :- A contour is an imaginary line on the ground joining the points of equal elevation

Factors governing the choice of the proper contour interval :-

1) Scale of the map :- The scale of the map determines the level of detail that can be represented. Larger-scale maps, such as those used for local or site-specific purposes, can accommodate smaller contour intervals and provide more detailed elevation information.

2) Terrain characteristics : The nature of the terrain being mapped plays a significant role in determining the contour interval. 08

3) Purpose of the map : The intended use of the map influences the selection of the contour interval.

4) Time & Expense of field & office work : Smaller contour intervals often require more time and resources to survey & map. Budget & time constraints may influence the choice of a larger interval.

5c

Direct method	Indirect method
i) Most accurate	i) Not very accurate
ii) Expensive	ii) Very cheap
iii) Used in small project	iii) Used in large project
iv) Unsuitable for hilly area	iv) Suitable for hilly terrain
v) Calculation cannot be checked	v) Calculation can be checked

04

6a. **Data refinement :** Data refinement refers to the process of improving the quality, accuracy and usability of raw data to make it more suitable for analysis, decision-making or specific applications.

Plotting in CAD using total station :

1) **Collect data with the total station**

a) **Set up the total station :-** Ensure the total station is properly calibrated and set up at a known location

b) **Measure points :** Use the total station to record the coordinates (X, Y, Z) and angles for various points in the field.

c) **Download data :** Transfer the collected data from the total station to your computer. This data is typically in specific format supported by the total station.

08

2) **Prepare Data for CAD :**

a) **Convert Data :** Ensure the data is in a format that can be read by CAD software.

b) **Checks the data :** Open the file in a text editor or spreadsheet software to ensure the points are correctly recorded.

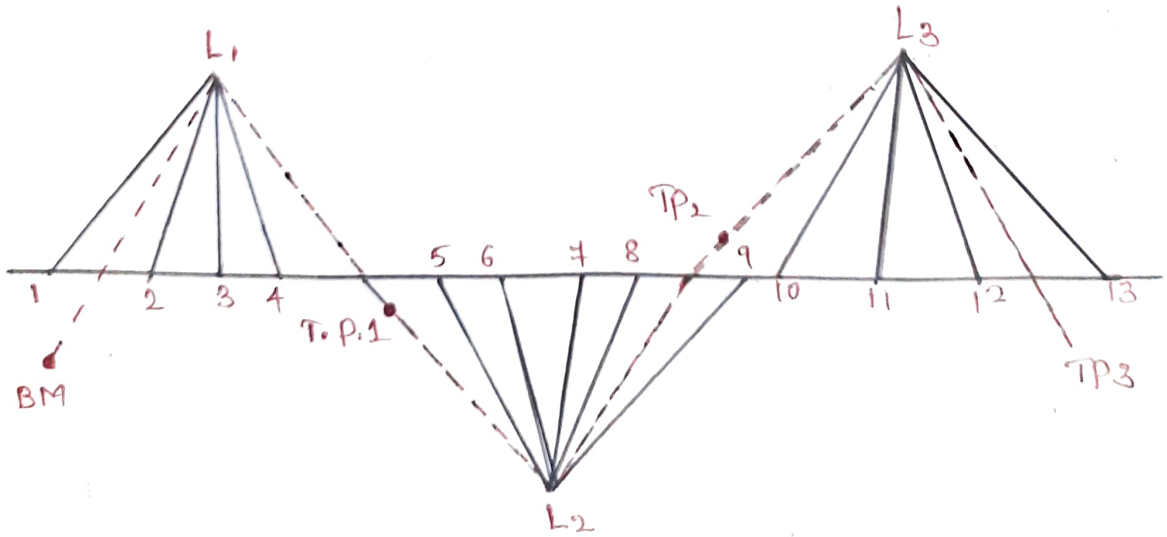
6b **Station :-** A survey station is a prominent point on the chain line and can be either at the beginning of the chain line or at the end. Such station is known as main station.

Turning point :- Turning point or change point is a point on which both minus sight and plus sight are taken on a line of direct levels.

Fore Sight :- Fore sight is a sight taken on a rod held at a point of unknown elevation, to ascertain the amount by which the point is below the line of sight and thus to obtain the elevation of the station. 08

Back Sight :- Back sight is the sight taken on a rod held at a point of known elevation. to ascertain the amount by which the line of sight is above the point & thus to obtain the height of the instrument.

6c **Profile levelling :-** Profile levelling is the process of determining the elevations of points at short measured intervals along a fixed line such as the centre line of a railway, highway, canal or sewer. 04



7a. $A = (b+nh)h$

$A_1 = 29.26\ m^2$, $A_2 = 57.54\ m^2$, $A_3 = 59.66\ m^2$

$A_4 = 64.00\ m^2$, $A_5 = 59.66\ m^2$, $A_6 = 39.76\ m^2$

$A_7 = 34.37\ m^2$

Prismoidal formula :

$$V = \frac{d}{3}\{(A_1+A_n) + 4(A_2 + A_4 + ---- + A_{n-1}) + 2(A_3 + A_5 + ---- A_{n-2})\}$$

$$\boxed{V = 6316.5\ m^3}$$

Trapezoidal formula :

$$V = d\left[\frac{A_1+A_n}{2} + A_2 + A_3 + A_4 + ---- + A_{n-1}\right]$$

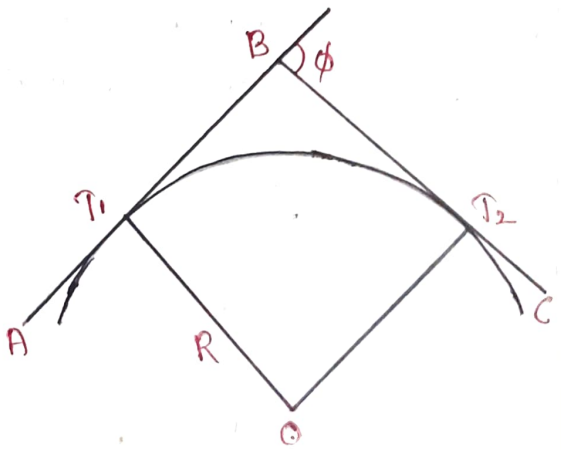
$$\boxed{V = 6348.9\ m^3}$$

10

7b

$$\lambda = \frac{1718.9C}{R}$$

$$\Delta_n = \Delta_{n-1} + \delta_n$$



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Rankine's method is based on the principle that the deflection angle to any point on a circular curve is measurement by one-half the angle subtended by the arc from P.C to the point. It is the angle subtended by the that the length of the arc is approximately equal to its chord.

Let us first derive expression for the tangential angles

Let T,V = Rear tangent

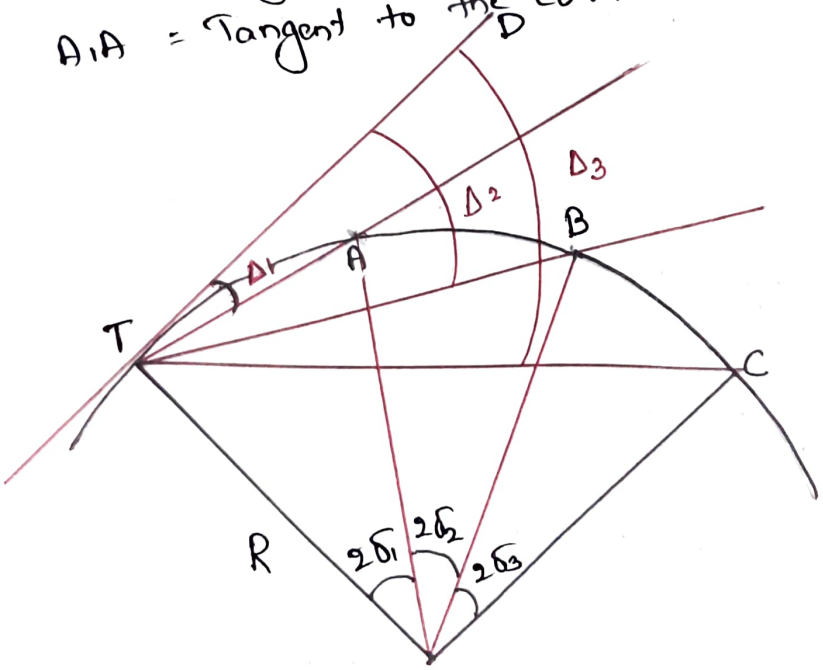
T, = Point of curve (P.C)

$\delta_1, \delta_2, \Delta_3$ = tangential angles or the angles which Each of the Sucessive Chords T,A, AB, Bc, etc.

$\Delta_1, \Delta_2, \Delta_3$ = Total tangential angles or the deflection angles to the points A, B, C etc

C_1, C_2, C_3 = length of the chords T,A, AB, Bc.

A,A = Tangent to the Curve at A.



From the Property of a Circle

$$\angle \text{at } T_1A = \frac{1}{2} \angle T_1OA$$

or

$$\angle T_1OA = 2\angle T_1A = 2\delta_1$$

Now $$\frac{\angle T_1OA}{C_1} = \frac{180^\circ}{\pi R}$$

or $$\angle T_1OA = 2\delta_1 = \frac{180^\circ C_1}{\pi R}$$

From which $$\delta_1 = \frac{90C_1}{\pi R} = \text{degrees}$$

$$= \frac{90 \times 60 C_1}{\pi R} = 1718.9 \frac{C_1}{R} \text{ minutes}$$

Similarly $\delta_2 = 1718.9 \frac{C_2}{R}$, $\delta_3 = 1718.9 \frac{C_3}{R}$

or in general $$\boxed{\delta_n = 1718.9 \frac{C}{R} \text{ minutes}}$$

where C is the length of the chord.

For the first chord T_1A the deflection angle = its tangential angle

or $\Delta_1 = \delta_1$

For Second Point B, let the deflection angle be Δ_2

δ_2 = tangential angle for the chord AB,

$$\angle AOB = 2\delta_2$$

$\therefore \angle AT_1B$ = Half the angle Subtended by AB at the Centre

$$= \delta_2$$

Now $\Delta_2 = \angle BT_1B = \angle BT_1A + \angle AT_1B$

$$\Delta_2 = \delta_1 + \delta_2 = \Delta_1 + \delta_2$$

$$\Delta_3 = \delta_1 + \delta_2 + \delta_3 = \Delta_2 + \delta_3$$

and $$\Delta_n = \delta_1 + \delta_2 + \cdots + \delta_n$$

$$\boxed{\Delta_n = \Delta_{n-1} + \delta_n}$$

8a

$T = R \tan\frac{\Delta}{2} = 62.33$

$C_1 = 2.33m$

$l = \frac{\pi R \Delta}{180} = 122.19m$

total no. of chords = 1 + 5 + 1 = 7 nos

$D = \frac{1718.9c}{R}$

$\Delta_1 = 0°16'1''$, Δ_2 to $\Delta_{n-1} = 2°17'30''$, $\Delta_n = 2°16'32''$

Peg No:	Chord length	Tangential angle	Deflection angle	Correction angle :
1	2.33	0°16'1''	0°16'1''	0°16'0''
2	20	2°17'30''	2°33'31''	2°33'40''
3	20	2°17'30''	4°51'1''	4°51'0''
4	20	2°17'30''	7°8'31''	7°8'40''
5	20	2°17'30''	9°26'1''	9°26'00''
6	20	2°17'30''	11°43'31''	11°42'40''
7	19.86	2°16'32''	14°0'3''	14°0'0''

10

8b

Simpson's rule :

$$\Delta = \frac{d}{3}\{(O_0 + O_n) + 4(O_1 + O_3 + \dots + O_{n-1}) + 2(O_2 + O_4 + \dots + O_{n-2})\}$$

$\Delta = 439.67 m^2$

Trapezoidal rule :

$$\Delta = d\left\{\left(\frac{O_0 + O_n}{2}\right) + (O_1 + O_2 + O_3 + \dots + O_{n-1})\right\}$$

$\Delta = 433 m^2$

10

9a. **List of GPS errors :-**

i) Satellite Geometry : when satellite are too close together
ii) Satellite Orbits : when satellite orbit changes control system
iii) Multipath effect : Error caused in signal from 2-or more path 05
iv) Atmospheric effect : The layer of atmosphere delays the signals
v) Clock inaccuracies : Error in clock result in position error

9b **Applications of Drones :-**

i) Aerial photography
ii) shipping & delivery
iii) Geographic mapping
iv) Disaster management
v) Precision agriculture
vi) Search & Rescue 07
vii) Weather forecast
viii) Wildlife monitoring etc.

i) **Aerial photography :-** Aerial photography refers to taking photographs from an elevated position, often using an airborne crafts such as airplanes, drones or satellites. It provides bird's-eye view images of landscapes and surface objects.

10b. i) Monitoring & Surveillance
ii) Affordability
iii) Aerial delivery System
iv) Aerial photograph. 07
v) Drone delivery system
vi) Agriculture etc.

10a. i) Multi-rotor drones
ii) Fixed wing drones
iii) Single-rotor drones
iv) Fixed-wing hybrid VTOL drones. 05

10.c Four drones Surveying requirements :
i) Flight planning
ii) DGPS markers
iii) Capturing images
iv) Post processing of images
v) Output maps.

DGPS markers - Differential Global Positioning System markers are essential components used in high precision surveying and geospatial applications. DGPS improves the accuracy of standard GPS by correcting errors. 08

Flight Planning - flight planning is a critical step in drone surveying, ensuring that the data collected is accurate, comprehensive and suitable for the intended analysis

Capturing images - Capturing images in drone Surveying is a critical task that requires careful planning & Execution to ensure high-quality data for subsequent processing and analysis

Post Processing of images - Post-processing is a step that involves transforming raw data in to usable outp-uts, such as orthomosaics, 3D models, digital Elevation models (DEMs) and Point Clouds.

9c Applications of Remote Sensing and GIS in Civil Engineering

1) Transportation
2) Town planning
3) Land use / Land cover
4) Environmental issues
5) Agricultural issues etc.

1) Transportation :-

Remote Sensing :- It provides accurate data on terrain and existing infrastructure, aiding in the design of roadways, railways and bridges. It helps in monitoring traffic patterns and road conditions

GIS :- GIS is used for routing optimization, traffic management and transportation network analysis. It also assists in planning new transportation projects and improving existing systems.

2) Town planning :-

Remote Sensing – Satellite imagery and aerial photography help in analyzing land use patterns. Urban sprawl, & changes over time. This data aids in effective urban planning and sustainable development

GIS - GIS integrates spatial data with attributes data allowing planners to assess land use suitability, manage zoning regulations and optimize land use collection.

08

HEAD
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