

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2022-23 (ODD)

Date: 25.07.2022

CIRCULAR

This is to inform, that our department is going to conduct a **REFRESHER COURSE on BASICS IN SURVEYING** on this academic year 2022-2023, Second year students are requested to enroll their name to Ms.S.GAYATHRI AP/CIVIL on or before **04.08.2022**.

S. Gayathri
25/7/22
Coordinator
(Ms.S.GAYATHRI AP/CIVIL)

R. Saravanan
25/07/2022
HOD/CIVIL
(DR.R.SARAVANAN)



DEPARTMENT OF CIVIL ENGINEERING

RFC-REFRESHER COURSE

BASICS IN SURVEYING

YEAR/SEMESTER: II/III

ACADEMIC YEAR: 2022-2023(ODD SEM)

PREPARED BY

MS.S.GAYATHRI/ AP /CIVIL

BASICS IN SURVEYING**SYLLABUS****OBJECTIVES :**

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING**5**

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Levelling.

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING**6**

Tacheometer - Stadia Constants - Analytic Lens - Tangential and Stadia Tacheometry surveying - Contour - Contouring - Methods of contouring - Tacheometric contouring - Contour gradient.

UNIT III CONTROL SURVEYING AND ADJUSTMENT**6**

Horizontal and vertical control - Methods - specifications - triangulation - baseline - satellite stations - Reduction to centre - trigonometrically leveling - single and reciprocal observations - traversing - Gale's table.

UNIT IV ADVANCED TOPICS IN SURVEYING**6**

Hydrographic Surveying - Tides - MSL - Sounding methods - Three point problem - Strength of fix - astronomical Surveying - Field observations and determination of Azimuth by altitude and hour angle methods.

UNIT V MODERN SURVEYING**7**

Total Station: Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure.

GPS Surveying: Different segments - space, control and user segments - satellite configuration - signal structure - Traversing and triangulation.

TOTAL: 30 PERIODS**OUTCOMES:**

At the end of the course the student will be able to understand

- The use of various surveying instruments and mapping
- Measuring Horizontal angle and vertical angle using different instruments
- Methods of Leveling and setting Levels with different instruments
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- Concept and principle of modern surveying.

S. Gayathri 11/8/22

STAFF INCHARGE
(Ms.S.GAYATHRI)

R. Saravanan
11/08/2022
HOD/CIVIL
(Dr.R.SARAVANAN)



**DEPARTMENT OF CIVIL ENGINEERING
 COURSE PLAN**

Sub.Name : Basics in Surveying	Branch / Year / Sem : B.E / II / III
Staff Name : Ms.S.Gayathri	Batch : 2021-2025
	Academic Year : 2022-23 (ODD)

Topic No	Topic	Teaching Methodology	No. of Hours Required	Cumulative No. of periods
UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING (5)				
1	Classifications and basic principles of surveying	BB	1	1
2	Equipment and accessories for ranging and chaining	BB	2	3
3	Methods of ranging - Compass Leveling.	BB	2	5
UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING (6)				
4	Tachometer - Stadia Constants	BB	1	6
5	Analytic Lens -Tangential and Stadia Tachometry surveying	BB	2	8
6	Contour - Contouring- Methods of contouring	BB/PPT	2	10
7	Tachometric contouring - Contour gradient	BB	1	11
UNIT III CONTROL SURVEYING AND ADJUSTMENT (6)				
8	Horizontal and vertical control - Methods	BB	1	12
9	specifications - triangulation- baseline - satellite stations	BB	2	14
10	Reduction to centre- trigonometrically leveling	BB/PPT	1	15
11	single and reciprocal observations	BB	1	16
12	Traversing -Gale's table.	BB	1	17
UNIT IV CONTROL SURVEYING AND ADJUSTMENTS (6)				
13	Hydrographic Surveying - Tides - MSL - Sounding methods	BB/PPT	2	19
14	Three point problem -Strength of fix	BB	2	21
15	Astronomical Surveying	BB/PPT	1	22
16	Field observations and determination of Azimuth by altitude and hour angle methods.	BB	1	23

UNIT IV		MODERN SURVEYING			(7)
17	Total Station: Advantages - Fundamental quantities measured	BB/PPT	1	24	
18	Parts and accessories - working principle - On board calculations - Field procedure.	BB	2	26	
19	GPS Surveying: Different segments - space, control and user segments - satellite configuration	BB/PPT	2	28	
20	Signal structure -Traversing and triangulation.	BB	2	30	

COURSE OUTCOME

At the end of the course the student will be able to understand

- The use of various surveying instruments and mapping
- Measuring Horizontal angle and vertical angle using different instruments
- Methods of Leveling and setting Levels with different instruments
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- Concept and principle of modern surveying.

S. Gayathri 11/8/22

Prepared by
Ms.S.GAYATHRI

S. Gayathri
11/8/2022
Verified By
HOD/CIVIL



ANNAAC Accredited Institution
KINGS
 COLLEGE OF ENGINEERING
 Registered under 2(f) & 12(B) of UGC
 Approved by AICTE, New Delhi
 Affiliated to Anna University, Chennai



DEPARTMENT OF CIVIL ENGINEERING
SPECIAL TIME TABLE (11.8.2022 - 20.8.2022, ODD SEM)
B.E - CIVIL (Regulation 2017) - With Effect from 11.8.2022

Batch: 2021 - 2025

Strength: 19

Year: II

Semester: III

Class Room : 234

Block: II

Session	1	2	10.45 am	3	4	12.30 pm	5	6	02.40 pm	7	8
Date	09.15am - 10.00am	10.00am - 10.45am	- 11.00 am	11.00am - 11.45am	11.45am - 12.30pm	- 01.10 pm	01.10pm - 01.55pm	01.55pm - 02.40pm	- 02.50 pm	02.50pm - 03.35pm	03.35pm - 04.20pm
11.8.22	ORIENTATION		BREAK	CC		LUNCH BREAK	RFC		BREAK	SDC	
12.8.22	RFC			CC			BC(I)			SDC	
16.8.22	BC(II)			RFC			CC			SDC	
17.8.22	BC(II)			RFC			BC(I)			CC	
18.8.22	BC(I)			CC			BC(II)			SDC	
20.8.22	SDC			RFC			BC(II)			BC(I)	

SUB CODE	NAME OF THE SUBJECT	CREDITS	NAME OF THE STAFF	DEPT	PERIODS/WEEK
VALUE ADDITION INITIATIVES (VAI)					
Orientation	Orientation Program	-	Mr.R.Ramchandrar	CIVIL	2
BC(I)	Bridge Course I (SOM)	-	Mr.R.Ramchandrar	CIVIL	8
BC(II)	Bridge Course II (EM)	-	Ms.D.Sharmila	CIVIL	8
RFC	Refresher Course	-	Ms.S.Gayathri	CIVIL	10
CC	Certification Course - AutoCADD	-	Mr.R.Chandrasekar	CIVIL	10
SDC	Skill Development Course (MS OFFICE)	-	Mr.R.Sundharam	CIVIL	10

CLASS CO-ORDINATOR	NAME OF THE REPRESENTATIVES	ROLL NO
Mr.R.Ramchandrar	S.Mohan	09
	G.V.Naaviniyaa	10

VALUE ADDITION INITIATIVES (VAI) - REGULAR HOURS				
CC	Certification Course - AutoCADD	VAI	Mr.R.Chandrasekar	CIVIL
LIB/NET	Library / Internet	VAI	Mr.R.Ramchandrar	CIVIL
NPTEL	NPTEL Swayam Courses	VAI	Mr.R.Ramchandrar	CIVIL
T&P (A)	Training & Placement - Aptitude	VAI	Dr.K.Sudhakar	T&P
T&P(SS)	Training & Placement - Softskill	VAI	Mr.B.Suresh Babu	T&P

D. Shrip
 DEPT. TTC 10/8/22

R. Sundaram
 HOD 10/08/2022

J. Mani
 10/8/2022
 PRINCIPAL



ACADEMIC YEAR 2022-23 (ODD SEM)

RFC-BASICS IN SURVEYING

ASSESSMENT MARKS

II YEAR CIVIL / V SEM

S.No.	Reg. Number	Student Name	Total marks(50)
1	821121103001	AKALYA J	50
2	821121103002	ANITHA B	50
3	821121103003	ARULPANDIYAN A	48
4	821121103004	ARUNKUMAR M	47
5	821121103005	HALITH A M	42
6	821121103006	MADHAN D S	43
7	821121103007	MANIKKARAJ R	42
8	821121103008	MATHANKUMAR S	42
9	821121103009	MOHAN S	50
10	821121103010	NAAVINIYAA G V	50
11	821121103011	NITHISH KUMAR T S	43
12	821121103012	PASHAGAN G (VOC)	45
13	821121103013	PRAGADISH M	45
14	821121103014	PRASANNA R	43
15	821121103015	SARAVANAN K	42
16	821121103016	SURYA.V	50
17	821121103017	TAMILARASAN T	50
18	821121103018	VENKATACHALAM D	50
19	821121103019	VIJAY S	50
20		SANJAIMANI M	47
21		SINDHU G	49
22		SURUTHI A	49
23		MOHAMMED RIYAZ J	48

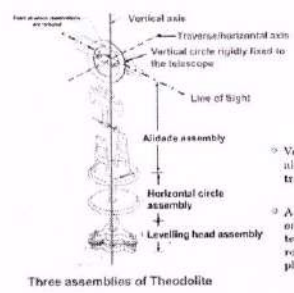
S. Gayathri 22/8/22

SUBJECT INCHARGE
 (MS.S.GAYATHRI)

R. Saravanan
 22/08/2022

HOD/CIVIL
 (DR.R.SARAVANAN)

THEODOLITE: INTRODUCTION

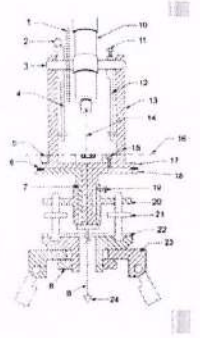


Three assemblies of Theodolite

- Vernier theodolite is also known as transit.
- A transit theodolite is one in which the telescope can be rotated in a vertical plane.

MAIN PARTS-3

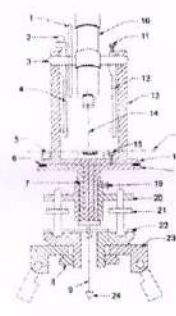
- **Clamps and tangent screws (15, 19):**
 - There are two clamps and associated tangent screws with the plate. These screws facilitate the motion of the instruments in horizontal plane.
 - Lower clamp screw locks or releases the lower plate. When this screw is unlocked both upper and lower plates move together. The associated lower tangent screw allows small motion of the plate in locked position.
 - The upper clamp screw locks or releases the upper vernier plate. When this clamp is released the lower plate does not move but the upper vernier plate moves with the instrument. This causes the change in the reading. The upper tangent screw allows the fine adjustment.



INTRODUCTION



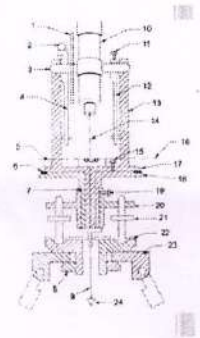
- Theodolite is used to measure the horizontal and vertical angles.
- Theodolite is more precise than magnetic compass.
- Magnetic compass measures the angle up to an accuracy of 30'. However a vernier theodolite measures the angles up to an accuracy of 10", 20".
- There are variety of theodolite vernier, optic, electronic etc.



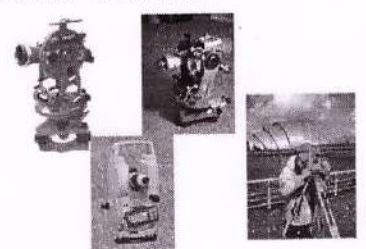
- **Main parts of a theodolite**
 - Levelling head (17): Levelling head is used to attach the instrument to tripod and attach the plumb bob along the vertical axis of the instrument.
- | | |
|----------------------------------|---|
| 1. Tripod block | 2. Alidade bubble |
| 3. Horizontal circle | 4. Vertical axis |
| 5. Plate bubble | 6. Graduation arc |
| 7. Levelling head | 8. Clamping bolt |
| 9. Vertical axis | 10. Telescope |
| 11. Vernier plate clamping screw | 12. Axis of the horizontal circle plate |
| 13. Alidade | 14. Line of sight |
| 15. Upper plate clamping screw | 16. Spirit level bubble |
| 17. Levelling head | 18. Lower plate |
| 19. Lower plate clamping screw | 20. Tangent |
| 21. Tangent | 22. Tangent |
| 23. Tripod block | 24. Plumb line |

MAIN PARTS-4

- **Plate level (5):**
 - Spirit level with the bubble and graduation on glass cover.
 - A single level or two levels fixed in perpendicular direction may be provided.
 - The spirit level can be adjusted with the foot screw (21) of the levelling head (7).
- **Telescope (10):** The essential parts of the telescopes are eye-piece, diaphragm with cross hairs, object lens and arrangements to focus the telescope.

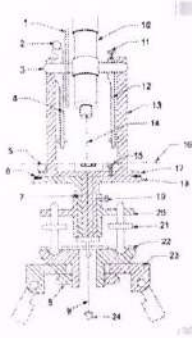


TYPE OF THEODOLITE



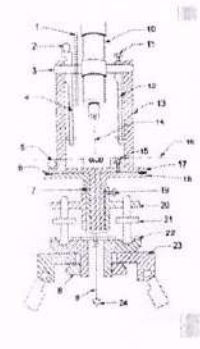
MAIN PARTS-2

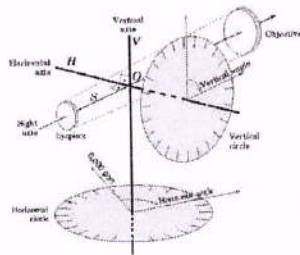
- **Lower plate/circle plate (15):** an another horizontal plate with the graduations provided all around, from 0 to 360°, in a clockwise direction. The graduations are in degree divided in to 3 parts so that each division equals to 20 min.
- Horizontal angles are measured with this plate.
- The size of the theodolite is defined by the diameter of horizontal circle.
- **Upper plate (17):** Horizontal plate of smaller diameter provided with two vernier on diametrically opposite parts of its circumference. These verniers are designate as A and B. They are used to read fractions of the horizontal circle plate graduations. The verniers are graduated in 30 min and each minute is divided in 3 to 5 parts make least count 20" or 10".



MAIN PARTS-5

- **Vertical circle (1):** circular plate supported on horizontal axis of the instrument between the A-frames. Vertical circle has graduation 0-90 in four quadrants. Vertical circle moves with the telescope when it is rotated in the vertical plane.
- **Vertical circle clamp and tangent screw (11):** Clamping the vertical circle restrict the movement of telescope in vertical plane.
- **Alidade level (2):** A highly sensitive bubble is used for levelling particularly when taking the vertical angle observations.





Adjustment of the theodolite

Temporary Adjustment

1. The levelling screws are at the centre of their run.
2. The shifting head of the theodolite is at its centre so that equal movement is possible in all the directions.
3. The wing nuts on the tripod legs are tight enough so that when raised, the tripod legs do not fall under their own weight.

Setting up the theodolite

Centring This involves setting the theodolite exactly over the station mark or on the station peg. It is done by the following steps:

1. The plumb bob is suspended from a small hook attached to the vertical axis of the theodolite.
2. The instrument is placed over the station mark with the telescope at a convenient height and with the tripod legs set well apart.
3. Two legs of the tripod are set firmly into the ground and the third leg is moved radially to bring the plumb bob exactly over the station mark. Then the third leg is also pushed into the ground.
4. If the instrument has a shifting head, the instrument is roughly centred over the station mark and then by means of the shifting head, the plumb bob is brought exactly over the station mark.

In the case of a three screw levelling head, the other plate level will then be parallel to the line joining the third foot screw and the mid-point of the line joining the first two foot screws, as shown in Fig. 4.4.

2. Bring the bubble of the longer plate level to the centre of its run by moving the two foot screws, say A and B, uniformly either inwards or outwards (Fig. 4.4(a)). It may be noted that the bubble always moves in the direction of the left thumb as the surveyor turns the screw.
3. Move the third foot screw C so that the bubble in the other plate level is centred (Fig. 4.4(b)).

4.9.3 Focussing

It consists of focussing the eyepiece and the objective.

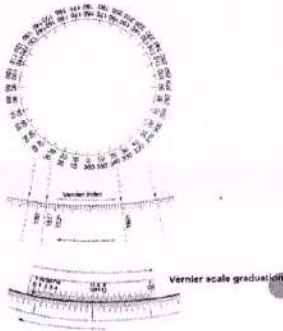
Focussing the eyepiece This operation is done to make the cross-hairs appear clearly visible. The following steps are involved:

1. The telescope is directed towards the sky or a sheet of white paper held in front of the objective.
2. The eyepiece is moved in or out until the cross-hairs appear clear and distinct.

Focussing the objective This operation is done to bring the image of the object in the plane of the cross-hairs. The following steps are involved:

1. The telescope is directed towards the object.
2. The focussing screw is turned until the image appears clear and sharp.

Reading a theodolite



Approximate levelling This implies levelling the instrument with the legs of the tripod, i.e. by bringing the small circular bubble provided on the trivet in the centre. To achieve this, two of the tripod legs are pushed firmly into the ground and the third leg of the tripod is moved to the right or to the left, i.e. in the circumferential direction until the bubble is centred. This leg is then pushed into the ground.



Measurement of horizontal angle

Measurement of Angle ABC

- The instrument is set over B.
- The lower clamp is kept fixed and upper clamp is loosened.
- Turn the telescope clockwise set vernier A to 0° and vernier B to approximately 180°.
- Upper clamp is tightened and using the upper tangent screw the vernier A and B are exactly set to 0° and 180°.
- Upper clamp is tightly fixed, lower one is loosened and telescope is directed towards A and bisect the ranging rod at A.
- Tightened the lower clamp and turn the lower tangent screw to perfectly bisect ranging rod at A.
- Loosen the upper clamp and turn the telescope clockwise to bisect the ranging rod at C tightened the upper clamp and do the fine adjustment with upper tangent screw.
- The reading on vernier A and B are noted. Vernier A gives the angle directly and vernier B gives the reading by subtracting the initial reading (180°) from final reading.



Important Definition

Face Right When the vertical circle of a theodolite is on the right of the observer, the position is called *face right* and the observation made is called *face right observation*.

Face Left When the vertical circle of a theodolite is on the left of the observer, the position is called *face left* and the observation made is called *face left observation*.

By taking the mean of both face readings, the collimation error is eliminated.

Telescope Normal The telescope is said to be *normal or direct* when its vertical circle is to the left of the observer and the bubble is up.

Telescope Inverted The telescope is said to be *inverted* when its vertical circle is to the right of the observer and the bubble is down.

Changing face

- Revolving the telescope by 180° in vertical plane about horizontal axis
- Again revolving the telescope in horizontal plane about vertical axis.



4.9.2 Levelling up

This means making the vertical axis truly vertical. This is done with the help of the foot screws. The procedure is as follows:

1. The longer plate level is brought parallel to any two foot screws.

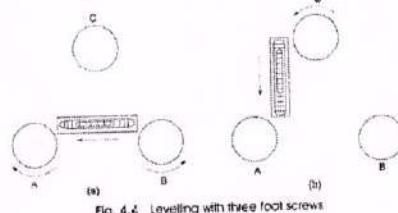
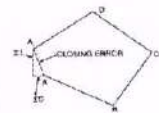


Fig. 4.4 Levelling with three foot screws

- Read these two method
- Repetition method
- Reiteration method

- Personal errors
- Natural errors
 - High temperature causes error due to irregular refraction.
 - High winds cause vibration in the instrument, and this may lead to wrong readings on verniers.

Closing error



Closing error, $AA' = \sqrt{L^2 + D^2}$
 where $L = \text{Latitude}$
 $D = \text{Departure}$
 Relative closing error = $\frac{\text{Closing error}}{\text{perimeter of traverse}}$
 Permissible angular error = $\text{less than } \frac{1}{3N}$
 where $N = \text{number of sides}$
 $\text{and } \theta = \frac{L}{L+D}$
 where θ indicates the direction of closing error.

PROBLEM

- Calculate the latitudes, departures and closing error for the following traverse conducted at Allahabad. Adjust also the traverse using Bowditch's rule.

Line	Length	Bearing
AB	89.31	45° 10'
BC	218.76	72° 05'
CD	151.18	161° 52'
DE	159.10	228° 40'
EA	289.26	300° 42'

Balancing of traverse

Bowditch's rule

- Total error is distributed in proportion to the lengths of the traverse legs.
 - Correction to latitude of any side = $\frac{\text{length of that side}}{\text{perimeter of traverse}} \times \text{total error in latitude}$
 - Correction to departure of any side = $\frac{\text{length of that side}}{\text{perimeter of traverse}} \times \text{total error in departure}$
- Small rule
 - Correction to latitude of any side = $\frac{\text{length of the side}}{\text{arithmetic sum of all latitudes}} \times \text{total error in latitude}$
 - Correction to departure of any side = $\frac{\text{departure of that side}}{\text{arithmetic sum of all departures}} \times \text{total error in departure}$

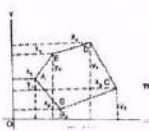
Line	Latitude	Departure
AB	+228.0	+188.5
BC	+218.0	+218.0
CD	-151.0	-151.0
DE	-159.0	-289.0

where the successive corrections are arranged in tabular form as follows:

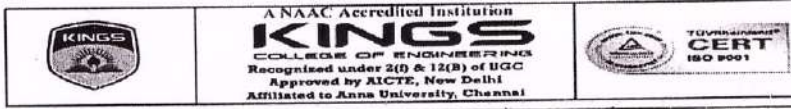
Station	Side	Corrective modification		Independent modification	
		Latitude	Departure	Latitude	Departure
A				+300.00	+128.28
B	AB	+228.0	+188.5	+228.00	+228.28
C	BC	+218.0	+218.0	+218.00	+436.28
D	CD	-151.0	-151.0	-151.00	+285.28
E	DE	-159.0	-289.0	-159.00	+126.28

(The independent corrections or independent errors are arranged in the same order as the first corrections.)
 The coordinates are now arranged in tabular form as follows:
 $228.00 \times 425.50 = 97010.00$
 $188.50 \times 310.00 = 58535.00$
 Sum of products of coordinates joined by solid lines.
 $\Sigma P = 228.0 \times 425.5 + 188.5 \times 310.0 = 97010.0 + 58535.0 = 155545.0$
 Sum of products of coordinates joined by dotted lines.
 $\Sigma Q = 151.0 \times 228.0 + 289.0 \times 151.0 = 34128.0 + 43639.0 = 77767.0$
 Required area = $\frac{1}{2} (\Sigma P - \Sigma Q) = \frac{1}{2} (155545.0 - 77767.0) = 38889.0 \text{ m}^2$

Calculation of traverse area



Then, the coordinates are arranged in tabular form as follows:
 $\begin{matrix} P_1 & P_2 & P_3 & P_4 & P_5 & P_6 & P_7 & P_8 & P_9 & P_{10} \\ A_1 & A_2 & A_3 & A_4 & A_5 & A_6 & A_7 & A_8 & A_9 & A_{10} \end{matrix}$
 The sum of the products of coordinates joined by solid lines.
 $\Sigma P = (A_1 P_2 + A_2 P_3 + A_3 P_4 + A_4 P_5 + A_5 P_6 + A_6 P_7 + A_7 P_8 + A_8 P_9 + A_9 P_{10} + A_{10} P_1)$
 The sum of the products of coordinates joined by dotted lines.
 $\Sigma Q = (A_2 P_1 + A_3 P_2 + A_4 P_3 + A_5 P_4 + A_6 P_5 + A_7 P_6 + A_8 P_7 + A_9 P_8 + A_{10} P_9 + A_1 P_{10})$
 Possible area = $\frac{1}{2} (\Sigma P - \Sigma Q)$



ACADEMIC YEAR 2022-23 (ODD SEM)
RFC-BASICS IN SURVEYING
STUDENTS ENROLLMENT

II YEAR CIVIL / III SEM

S.No.	Reg. Number	Student Name	Students Signature
1	821121103001	AKALYA J	J. Akalya
2	821121103002	ANITHA B	B. Anitha
3	821121103003	ARULPANDIYAN A	A. Arul
4	821121103004	ARUNKUMAR M	M. Arunkumar
5	821121103005	HALITH A M	A.M. Halith
6	821121103006	MADHAN D S	D.S. Madhan
7	821121103007	MANIKKARAJ R	R. Manikkaraj
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9	821121103009	MOHAN S	S. Mohan
10	821121103010	NAAVINIYAA G V	G.V. Naaviniyaa
11	821121103011	NITHISH KUMAR T S	T.S. Nithish Kumar
12	821121103012	PASHAGAN G (VOC)	G. Pashagan
13	821121103013	PRAGADISH M	M. Pragadish
14	821121103014	PRASANNA R	R. Prashna
15	821121103015	SARAVANAN K	K. Saravanan
16	821121103016	SURYA.V	V. Surya
17	821121103017	TAMILARASAN T	T. Tam
18	821121103018	VENKATACHALAM D	D. Venkatachalam
19	821121103019	VIJAY S	S. Vijay
20		SANJAIMANI M	M. Sanjaimani
21		SINDHU G	G. Sindhu
22		SURUTHI A	A. Suruthi
23		MOHAMMED RIYAZ J	J. Mohammed Riyaz

S. Gayathri
 11/08/22
 SUBJECT INCHARGE
 (MS.S.GAYATHRI)

(Signature)
 11/08/2022
 HOD/CIVIL
 (DR. R. SARAVANAN)

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DEPARTMENT OF CIVIL ENGINEERING
CERTIFICATE OF APPRECIATION

This is to certify that Mr./Ms. S.MOHAN of II YR Civil Engineering has completed REFRESHER COURSE in the topic BASICS IN SURVEYING organized by the Department of Civil Engineering, Kings College of Engineering, Thanjavur, during AUGUST 2022.

Ms.S.GAYATHRI
COURSE INCHARGE

Dr.R.SARAVANAN
HOD/CIVIL

Dr.J.ARPUTHA VIJAYA SELVI
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DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE OF APPRECIATION

This is to certify that Mr./Ms. G.V.NAAVINYAA of II YR Civil Engineering has completed REFRESHER COURSE in the topic BASICS IN SURVEYING organized by the Department of Civil Engineering, Kings College of Engineering, Thanjavur, during AUGUST 2022.

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