VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELGAVI-590018, KARNATAKA

A J INSTITUTE OF ENGINEERING & TECHNOLOGY

(A unit of Laxmi Memorial Education Trust. (R))
NH - 66, Kottara Chowki, Kodical Cross - 575 006

DEPARTMENT OF CIVIL ENGINEERING

(Accredited by NBA)

MASTER MANUAL

Course: Engineering survey
Course Code: BCV302
III-SEMESTER

Prepared by:

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ACADEMIC YEAR: 2023-24

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Civil Engineering

Scheme of Teaching and Examinations 2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022 - 23)

Integrated Professional Core Course (IPCC)

Refers to Professional Theory Core Course Integrated with Practical's of the same course

Course: ENGINEERING SURVEY
Course Code: BCV302

TABLE OF CONTENTS

VISION OF THE INSTITUTE

"To produce top-quality engineers who are groomed for attaining excellence in their profession and competitive enough to help in the growth of nation and global society."

MISSION OF THE INSTITUTE

M1: To offer affordable high-quality graduate program in engineering with value education and make the students socially responsible.

M2: To support and enhance the institutional environment to attain research excellence in both faculty and students and to inspire them to push the boundaries of knowledge base.

M3: To identify the common areas of interest amongst the individuals for the effective industry- institute partnership in a sustainable way by systematically working together.

M4: To promote the entrepreneurial attitude and inculcate innovative ideas among the engineering professionals.

VISION OF THE DEPARTMENT

"To produce competent and professional civil engineers with academic excellence and ethics to meet societal challenges at global level."

MISSION OF THE DEPARTMENT

M1: To impart students with strong theoretical and practical skills through the state-of-the-art concepts and fundamentals of various civil engineering subjects.

M2: To prepare the students to be competent and skilled enough to take up the challenges in research to meet the ever-changing needs of society and to continue learning.

M3: To promote active learning, critical thinking, industry - institute collaborative activities and contribute to social development with ethical conduct

M4: To nurture innovative ideas and develop entrepreneurial attitude among the engineering professionals.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After 4 years of graduation, graduates will be able to

PEO1: Apply concepts of interdisciplinary sciences and technology to solve any civil engineering problem.

PEO2: Execute civil engineering projects effectively by addressing the ever-changing needs of society and aim for continuous improvement.

PEO3: Competent enough to pursue higher studies and also to monitor and manage the research project with the effective utilization of resources to suit the needs and face the challenges involved to meet the global demands.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Should be able to understand the various domain concepts of civil engineering and execute the projects effectively.

PSO2: Demonstrate competency in the technical community and arrive at sustainable solutions to the real-world problems.

PSO3: Take up challenging roles by focusing on a systematic approach.

GENERAL LAB GUIDELINES

Do's

1. Maintain discipline in the Laboratory.
2. Proper dress code has to be maintained while entering the Laboratory.
3. Students should carry a lab observation book, student manual and record book completed in all aspects.
4. Enter the login book before using the instruments.
5. Students should be at their concerned places; unnecessary movement is restricted.
6. Students should maintain the same computer until the end of the semester.
7. Report any problems in the instruments to the faculty member in-charge/laboratory technician immediately.
8. The practical result should be noted down into their observation and the result must be shown to the faculty member in-charge for verification.
9. After completing the experiments, students should, enter logout time and leave the lab.

Don'ts

1. Do not come late to the Laboratory.
2. Do not enter the laboratory without an ID card, lab dress code, observation book and record.
3. Do not leave the laboratory without the permission of the faculty in-charge.
4. Never eat, drink while working in the laboratory.
5. Do not handle any equipment before reading the instructions/instruction manuals.
6. Do not misbehave in the laboratory.
7. Do not mishandle the equipment.
8. Do not leave the laboratory without verification of instruments handled.
9. Usage of Mobile phones, tablets and other portable devices are not allowed in restricted places.

INSTRUCTIONS TO STUDENTS

- Students must bring Observation book, record and manual along with pen, pencil, anderaser etc., no borrowing from others.
- Students must handle the instruments carefully, as they are expensive.
- After the completion of the experiment should return the instruments to the respective lab instructors.
- Be regular to the Lab Do not come late to the Lab
- Wear your college ID card Do not operate the IC trainer kits without permission
- Avoid unnecessary talking while doing the experiment
- Take the signature of the lab in charge before taking the instruments

RULES FOR MAINTAINING LABORATORY RECORD

- Put your name, USN and subject on the outside front cover of the record. Put that same information on the first page inside.
- Update Table of Contents every time you start each new experiment or topic
- Always use pen and write neatly and clearly
- Start each new topic (experiment, notes, calculation, etc.) on a right-side (odd numbered) page
- Obvious care should be taken to make it readable, even if you have bad handwriting
- Date to be written every page on the top right side corner
- On each right-side page
  - Title of experiment
  - Aim/Objectives
  - Components Required
  - Theory
  - Procedure described clearly in steps
  - Result
- On each left side page
  - Tables

  - Tabular columns
  - Graphs
- Use labels and captions for figures and tables
- Attach printouts and plots of data as needed. Stick printouts (A4 Size) on the rightside of the lab record
- Strictly observe the instructions given by the Teacher/ Lab Instructor.

SYLLABUS

ENGINEERING SURVEY LABORATORY

[As per Choice Based Credit System (CBCS) scheme](Effective from the academic year 2022 -2023)

SEMESTER – III

Course Code	**BCV302**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 T + 8-10 P	Total Marks	100
Credits	**04**	Exam Hours	03

Course objectives: This course enables students to:

- Ability to understand principles of both traditional and modern surveying applying knowledge of mathematics.
- Ability to handle surveying equipment's and software tools to carry out field surveying, plot topographical Drawings and construction drawing
- Ability to use Total station for data capture, data storage, data transfer.
- Ability to prepare construction drawing and setting out

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.

2. Arrange field visits to give brief information about the water and wastewater treatment plant.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.

5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1	
Laboratory Component: 1. Use of Various types of tapes, Laser distance meter, Distance measuring wheel. 2. Demonstration of Equipment's used for chain, compass, and plane table surveying	
Teaching-Learning Process	1. Demonstration of various basic instruments used for surveying and the conduction of experiments in the field. 2. For concepts, and discussion, use chalk and a whiteboard, as well as a PowerPoint presentation
Module-2	
Laboratory Component: 3. Measurement of horizontal and vertical angles by Theodolite. Method of repetition 4. Setting up of Total station. Features and components of Total station 5. Longitudinal sectioning and cross sectioning using level (Additional experiment) 6. Measurement of Distance, slope, vertical distance, horizontal and vertical angles using Total station	
Teaching-Learning Process	1. Demonstration and conduction of experiments in the field. 2. Laboratory Demonstration
Module-3	
Laboratory Component: 7. Contouring and plotting with Total station. 8. Longitudinal sectioning and cross sectioning using Total station 9. Coordinate measurement with Total station.	
Teaching-Learning Process	1. Demonstration and conduction of experiments in the field. 2. Laboratory Demonstration
Module-4	
Laboratory Component: 10. Setting out simple curve using Rankine's method using Theodolite 11. Setting out central line of a small residential building.	
Teaching-Learning Process	1. Demonstration and conduction of experiments in the field. 2. Laboratory Demonstration
Module-5	
Laboratory Component: 1. Demonstration of GPS Surveying and surveying using Drones	
Teaching-Learning Process	1. Chalk and Board 2. PPT

Course Outcomes: A student will be able to come up with the following course outcome on completion of the course:

- **CO1:** Summarize various types of surveying and carry out distance measurement using various equipment's.
- **CO2:** Illustrate the use and applications of levelling and theodolite
- **CO3:** Plot contours, longitudinal and cross sections for construction projects.
- **CO4:** Set curves for construction works and carry out estimation of areas and volumes.
- **CO5:** Demonstrate the necessary skills to carry out GPS and DRONE Surveying

Suggested Learning Resources:

	BOOK TITLE / AUTHORS / PUBLICATION
T-1.	Punmia BC, & Jain Ashok Kumar. (2016). Surveying (17th ed., Vol. 1 and Vol . 2). Laxmi Publications.
T-2.	Dr. K.R. Arora. (2019). Surveying (17th ed., Vol. 1). Standard Book House.
T-3.	Charles D. Ghilani. (2012) (13 th ed.). Prentice Hall

Weblinks and Video Lectures (e-Resources):

W1	https://enterprise.dji.com/surveying/land-surveying
W2	https://www.gps.gov/applications/survey/
W 3	https://www.constructionplacements.com/total-station-in-surveying-types-uses-and-applications/
W 4	https://www.youtube.com/watch?v=bbs5AEPstl4
W 5	https://www.youtube.com/watch?v=KHI4TEeexuM&list=PLLy_2iUCG87DwNVc3Mz1yYlRA42jSQ1t
W 6	https://www.youtube.com/watch?v=Iu9vrE48_I4&list=PLLy_2iUCG87DwNVc3Mz1yYlRA42jSQ1tB
W 7	https://www.youtube.com/watch?v=RXUi2cX4CkU
W 8	https://www.youtube.com/watch?v=SVa66vO08So

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Hand on use of various surveying instruments
2. Surveying Civil engineering block and plotting with instruments of student's choice
3. Setting out a single bedroom house plan in field

COURSE OUTCOMES

A student will be able to come up with the following course outcome on completion of the course:

- **CO1:** Summarize various types of surveying and carry out distance measurement using various equipment's.
- **CO2:** Illustrate the use and applications of levelling and theodolite
- **CO3:** Plot contours, longitudinal and cross sections for construction projects.
- **CO4:** Set curves for construction works and carry out estimation of areas and volumes.
- **CO5:** Demonstrate the necessary skills to carry out GPS and DRONE Surveying

Mapping of Course Outcomes with POs & PSOs

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1		2		3			1	2				1	1	
CO2	1		1		2			1	2				2	2	1
CO3	1		2		3			1	2				3	1	1
CO4	1		2		3			1	2				3	2	1
CO5	1		1		3			1	1				2		
Average	1		1.6		2.8			1	1.8				2.2	1.2	0.6

ASSESSMENT DETAILS (BOTH CIE AND SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of the IPCC (maximum marks 25)

• 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

• Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).

• The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

• 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.

• On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.

• The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

• The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.

• Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.

- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC

The sum of two tests, assignments/ seminar/ quiz, and practical sessions will be out of 50 marks

Split-up of Marks used Practical Sessions

Split up of Marks	**Practical Sessions- Continuation Evaluation (CE) Methodology / Process Steps per Experiment**	**Marks**	**Scale down to**
#R1	Record writing	10	10
#R2	Observation, Write up of Procedure, Conduction of the experiment	10	5
#R3	Viva – Voce (Questions & Answers on relevant Experiment /Topic)	5	
Total Marks for each experiment		**15**	**15**
	Practical Sessions-Internal Assessment (IA)		
#R1	Write-up of Procedure/Program/Algorithm	10	-
#R2	Conduction/Execution	30	-
#R3	Viva-Voce	10	-
	Total Marks	**50**	**10**

SEE FOR IPCC THEORY

SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component

RUBRICS FOR PRACTICAL SESSIONS

Course: Engineering Survey **Course Code: BCV302**

Practical Sessions- Continuous Evaluation (CE)				
Evaluation Parameter	**Level of Achievement**			
#R1: Observation/ Conduction (10 Marks)	**Excellent (10-8)**	**Good (7-5)**	**Average (4-3)**	**Poor (2-0)**
	Observation is neatly written with all the values and units. Observation submitted on time.	Observation is neatly written with all the values and units Observation submitted with a delay of 1 - 3 days	Observation is neatly written with all the values and units Observation submitted with a delay of 4 to 5 days	Observation is neatly written with all the values and units Observation submitted after a delay of 1 week
#R2: Record (10 Marks)	**Excellent (10-8)**	**Good (7-5)**	**Average (4-3)**	**Poor (2-0)**
	Record is neatly written, handwriting is clear. Mistakes are covered and corrected properly and neatly. Record submitted on time	Record is neatly written, handwriting is clear. Most mistakes are covered and corrected properly and neatly. Record submitted with a delay of 1 - 3 days	Record is written in an unclear manner. Handwriting is not very clear. Mistakes are sometimes corrected properly. Record submitted with a delay of 4 to 5 days	Record is written in an unclear manner. Handwriting is not very clear. Mistakes are not corrected. Record submitted after a delay of 1 week
#R3: Viva (5 Marks)	**Excellent (5-4)**	**Good (3-2)**	**Average (2-1)**	**Poor (0)**
	Answered all questions with elaboration has excellent understanding of the topic.	Answered most of the questions Failed to elaborate some of the concepts	Answered a few questions. Subject knowledge is not adequate	Not able to answer any of the questions. Subject knowledge not adequate
Practical Sessions- Internal Assessment (IA)				
#R1: Write-Up (10 Marks)	**Excellent (10-8)**	**Good (7-5)**	**Average (4-3)**	**Poor (2-0)**
	Procedure neatly written. Handwriting is clear. Tabular Columns written with no mistakes.	Procedure neatly written. Handwriting is clear. Tabular Columns written with	Procedure neatly written. Handwriting is clear. Tabular Columns written with no mistakes	Procedure neatly written. Handwriting is clear. Tabular Columns

		very few mistakes.	with fewer mistakes.	written with lot of mistakes.
#R2: Conduction/Execution (30 Marks)	**Excellent (30-22)**	**Good (21-15)**	**Average (14-9)**	**Poor (8-0)**
	Execution of the experiment done as per the procedure. The Result was tabulated clearly with graph	Execution of the experiment done as per the procedure. With few mistakes	Execution of the experiment is not according to the procedure	Conduction of the experiment with incorrect result.
#R3: Viva (10 Marks)	**Excellent (10-8)**	**Good (7-5)**	**Average (4-3)**	**Poor (2-0)**
	Answered all questions with elaboration has excellent understanding of the topic.	Answered most of the questions Failed to elaborate some of the concepts	Answered a few questions. Subject knowledge is not adequate	Not able to answer any of the questions. Subject knowledge not adequate

Course Instructor **Domain Co-Ordinator** **Head of Department**

LIST OF MAJOR EQUIPMENT

Name of the Laboratory: SURVERING PRACTICE LAB

Sl. No.	Name of the Equipment	Specialization	Quantity
1	Total Station	Least count for total station for angle is 1” and distance is 1mm	2
2	Theodolite	Least count- 20”	10
3	Dumpy level	Least count of cross staff- 5mm	10
4	Compass	Least count is 30”	8

Room Number : **B-107**

Total Area of the laboratory : 105 Sq. Meters

Total Amount Spent : Rs. 19,10,266/-

Name of the HOD : Dr. Suman Kundapura

Name of the lab in charge : Dr. Amarnath Shetty

Name of the lab instructor : Ms. Shruthi

LIST OF EXPERIMENT

Additional Experiments- Content Beyond Syllabus

1. Plane table Surveying by Radiation method
2. Demonstration of intersection method by plane table
3. L/S and C/S survey by using levels

ENGINEERING SURVEY LAB

SUBJECT CODE: BCV302 **DEPARTMENT: CIVIL ENGINEERING**

EXPERIMENT NO: 1

USE OF VARIOUS TYPES OF TAPES, LASER DISTANCE METER, DISTANCE MEASURING WHEEL

AIM: To study of various instruments used for surveying, Tape, Laser distance meter, Distance measuring wheel.

TAPES:

Tapes are used in surveying to take linear measurements. They are available in different lengths and can be made of different materials.

Types of Tapes Used in Surveying

There are 5 types of tapes available in surveying for linear measurements and they are as follows :

1. Linen Tape
2. Woven Metallic Tape
3. Steel Tape
4. Synthetic Tape
5. Invar Tape

1. Linen Tape

Linen tape, also known as cloth tape is a varnished strip made of closely woven linen. The width of the strip is about 12 to 16 mm. It is available in different lengths such as 10m, 20m, 30m, and 50m. Both ends of the linen tape are provided with metallic handles and the whole tape is wounded in leather or metal case.

Linen tapes are light in weight and easy to handle. These tapes may shrink when exposed to water and also elongate when pulled. Hence, these tapes are not suitable for accurate surveying measurements. These are generally used for measuring offsets and for ordinary works.

2. Woven Metallic Tape

The metallic woven tape is an improved version of linen tape. Brass or copper made wires are used as reinforcement for the linen material. Hence, it is more durable than normal linen tape. A brass ring is provided at the end of the tape which is included in the length of the tape.

These tapes are available in different lengths of 2m, 10m, 15m, 20m, 30m, and 50m. These are used for survey works such as topographical survey works where minor errors are not taken into consideration.

3. Steel Tape

A steel tape is made of steel or stainless steel. It consists of a steel strip of 6mm to 16mm wide. It is available in lengths of 1m, 5m, 8m, 10m, 20m, 30m and 50m. Meters, decimeters, and centimeters are graduated in the steel strip. Steel tapes generally came up with the metal case with automatic winding device. The tape is withdrawn from the case by using a hand during measuring and it is rewound into the case by just pressing button provided on the case.

Steel tapes are not flexible and are suitable for measuring leveled surfaces only. They may corrode easily when exposed to moisture and to prevent this tape, it should be cleaned and oiled after every use. These tapes are generally used for standardizing chains, measurements of constriction works, etc.

4. Synthetic Tape

Synthetic tapes are made of glass fibers coated with PVC. These are light in weight and flexible. They are available in lengths of 5m, 10m, 20m, 30m, and 50m. Synthetic tapes may stretch when subjected to tension. Hence, these are not suitable for accurate surveying works. However, synthetic tapes are recommended in place of steel tapes where it is essential to take measurements in the vicinity of electric fences and railway lines, etc.

5. Invar Tape

Invar tapes are made of an alloy which consists of 36% of nickel and 64% of steel. Invar tape contains a 6mm wide strip and is available in different lengths of 30m, 50m, 100m.

The coefficient of thermal expansion of invar alloy is very low. It is not affected by changes in temperature. Hence, these tapes are used for high precision works in surveying such as baseline measurement, triangulation surveys, etc. Invar tapes are expensive than all the other types of tapes. These tapes should be handled with care otherwise bends or kinks may be formed.

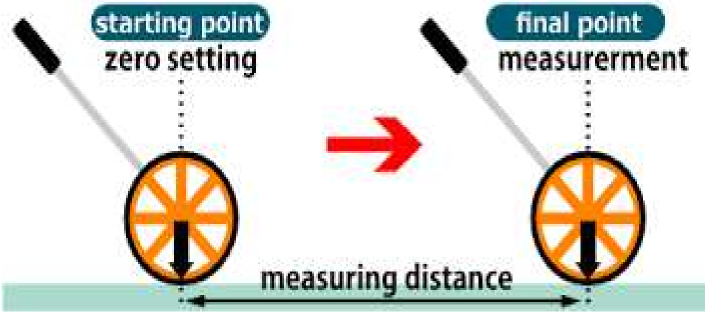
Laser Distance Meter:

A laser distance meter, also known as a laser rangefinder, is a device used to measure distance accurately using a laser beam. It operates on the principle of emitting a laser pulse towards a target and then measuring the time it takes for the pulse to reflect off the target and return to the device. By calculating the time taken and the speed of light, it determines the distance between the device and the target.
These devices come in various shapes and sizes, from handheld units for smaller measurements to more advanced and precise ones used in construction, surveying, and industrial applications. They are highly accurate, efficient, and offer quick measurements, making them valuable tools in fields where precise distance measurements are crucial. Some laser distance meters also come with additional features like area or volume calculations, Bluetooth connectivity, and data storage capabilities.

Basic Principles: A Laser Distance Meter sends out a finely focused pulse of light to the target and detects the reflection. The meter measures the time between those two events and converts this to a distance. The formula is simple: Distance = A (Speed x Time). However the speed of light is 300,000 kms. per second , so to resolve differences of (say) 1 cm, the meter must measure time intervals of the order of billionths of a second. Advantages: A Laser Distance Meter is accurate to within a few millimeters, certainly equaling a tape for larger distances, and the line is always dead straight. One has a choice of units, and there is no risk of misreading, as with the intermediate marks on a tape. The Laser distance Meter is much faster; just it should be pointed to the target, clicked and the result will be displayed. The job is done is done in just a fraction of the time it would take to use a tape.

Conclusions: A Laser Distance Meter is accurate and quick and requires only one person and one hand. It's easy to use and versatile. Laser distance Meters have on-board processing enabling the device to triangulate and calculate – the Pythagoras principle is laid in it.

DISTANCE MEASURING WHEEL: A distance measuring wheel, also known as a surveyor's wheel or a click wheel, is a hand-held device used to measure distances by rolling along the ground. It consists of a wheel attached to a handle or frame and typically features a counter to display the measured distance.
Here's how it works: When you roll the wheel along a surface, the wheel's circumference is known. The rotation of the wheel is translated into distance measurements by a mechanical or digital counter connected to the axle. As the wheel turns, it records the number of rotations, and this data is converted into distance based on the wheel's circumference.
Distance measuring wheels are commonly used in various industries like construction, landscaping, road surveying, and athletics, where quick and straightforward measurements of longer distances are required. They are often preferred for outdoor measurements where using a tape measure might be impractical or inefficient.


starting point
zero setting
final point
measurerment
measuring distance

EXPERIMENT NO: 2 A

SETTING OF GEOMETRICAL FIGURES USING PRISMATIC COMPASS

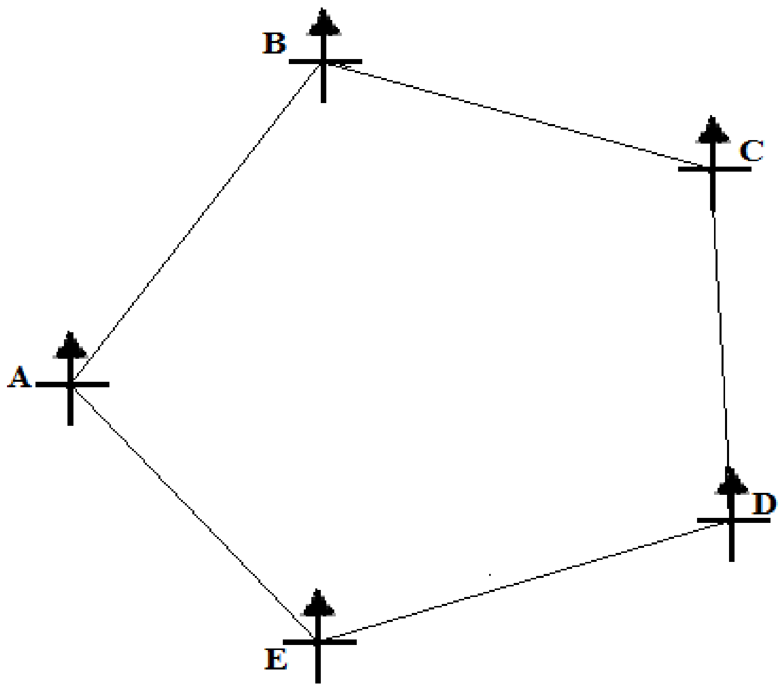
AIM: To set out Pentagon and Hexagon using compass.

EQUIPMENTS REQUIRED:

Tape, Compass [Prismatic Compass] and Arrows

PROCEDURE:

PENTAGON



1. Calculate the interior angle at each joint by using {(2n-4)x 90º}/n and then found the exterior angle.
2. For the given bearing of line, calculate the fore bearing of remaining sides by using, Fore bearing of any line= Back bearing of previous line - Interior angle.
3. Calculate the Back bearing of the lines using BB =(FB) +/- (180º).
4. For example, construct Pentagon by using tape and compass of 35º bearing of side 2m. as such, Mark one point A on the ground and measure 35º from point A using prismatic compass, before measuring the bearing, leveling and centering of the compass has to be carried out and mark 2m length and establish other point 'B'.

5. Shift the prismatic compass from point A to ‘B’ and leveling and centering of the compass has be to done then, focus to the point A, note down the back bearing of line AB.
6. Since the pentagon consists of 5 sides, Calculate the BB and FB, measure the required FB angle from point B and draw the line 6m and mark another point ‘C’.
7. Repeat the step (5) and step(6) up to the completion of the pentagon ABCDE, note down all the back bearing reading.

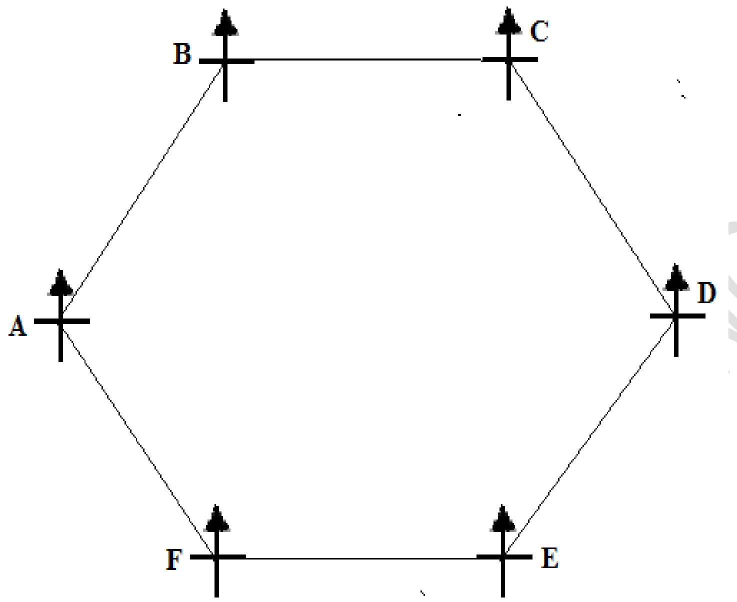
Observations and Tabular column:

Line	Theoretical Fore Bearing	Theoretical Back Bearing	Observed Back Bearing	Error
AB	35°	215°	215°	0°
BC	107°	287°	287°	0°
CD	179°	359°	359°	0°
DE	251°	71°	71°	0°
EA	323°	143°	143°	0°

RESULT:

Pentagon has been marked on the ground using prismatic compass

HEXAGON



1. Calculate the interior angle at each joint by using {(2n-4)x 90º}/n and then find the exterior angle.
2. For the given bearing of line, calculate the fore bearing of remaining sides by using, Fore bearing of any line= Back bearing of previous line - Interior angle.
3. Calculate the back bearing of the line using BB =(FB) +/- (180^0).
4. For example, construct Hexagon by using tape and compass of 35^0 bearing of side 2m. such that, Mark one point ‘A’ on the ground and measure 40^0 from point A using prismatic compass, before measuring the bearing, leveling and centering of the compass has to be carried out and mark 7m length and establish other point B.
5. Shift the prismatic compass from point A to B and leveling and centering of the compass has to be done then, focus to the point A, note down the back bearing of line AB.
6. Since hexagon consists of 6 sides, Calculate the BB and FB, measure the required FB angle from point B and draw the line 7m and mark the another point ‘C’.
7. Repeat the steps (5) and (6) up to the completion of the Hexagon ABCDEF. Note down all the Back bearing readings.

Observations and Tabular column:

Line	Theoretical Fore Bearing	Theoretical Back Bearing	Observed Back Bearing	Error
AB	35°	215°	215°	0°
BC	95°	275°	275°	0°
CD	155°	335°	335°	0°
DE	215°	35°	35°	0°
EF	275°	95°	95°	0°
FA	335°	155°	155°	0°

RESULT:

Hexagon has been marked on the ground using prismatic compass.

EXPERIMENT NO: 2B

PLANE TABLE SURVERING

AIM:- To understand the importance of plane table surveying by method of radiation

Principle:

The principle of plane tabling is parallelism, meaning that the rays drawn from stations to objectson the paper are parallel to the lines from the stations to the objects on the ground. The relative positions of the objects on the ground are represented by their plotted positions on the paper and lie on the respective rays. The table is always placed at each of the successive stations parallel to the position it occupied at the starting station. Plane tabling is a graphical method of surveying there the field work and plotting are done simultaneously and such survey does not involve the use of a field book.

Plane table survey is mainly suitable for filling interior details when traversing is done by theodolite sometimes traversing by plane table may also be done. But this survey is recommended for the work where great accuracy is not required. As the fitting and fixing arrangement of this instrument is not perfect, most accurate work cannot be expected.

Accessories of Plane Table:-

1. The Plane Table:-

The plane table is a drawing board of size 750 mm x 600 mm made of well-seasoned wood like teak, pine etc. The top surface of the table is well leveled. The bottom surface consists of a threaded circular plate for fixing the table on the tripod stand by a wing nut.

The plane table is meant for fixing a drawing sheet over it. The positions of the objects are located on this sheet by drawing rays and plotting to any suitable scale.

2. The Alidade:-

There are two types of alidade.

(i) Plain

(ii) Telescopic.

(a) Plain Alidade:-

The plain alidade consists of a metal or wooden ruler of length about 50 cm. One of its edge is beveled and is known as the fiducial edge. It consists of two vanes at both ends which are hingedwith the ruler. One is known as the ‘object vane’ and carries a horse hair, the other is called the ‘sight vane’ and is provided with a narrow slit.

(b) Telescopic Alidade:-

The telescopic alidade consists of a telescope meant for inclined sight or sighting distant objects clearly. This alidade has no vanes at the ends, but is provided with fiducial edge. The function of the alidade is to sight objects. The rays should be drawn along the fiducial ends.

3. The Spirit Level:-

The spirit level is a small metal tube containing a small bubble of spirit. The bubble is visible on the top along a graduated glass tube. The spirit level is meant for leveling the plane table.

4. The Compass:-

There are two kinds of compass.

(a) The trough compass and

(b) The circular box compass.

(a) The Trough Compass:-

The trough compass is a rectangular box made of non-magnetic metal containing a magnetic needle pivoted at the centre. This compass consists of a ‘D’ mark at both ends to locate the N-Sdirection.

(b) The Circular Box Compass:-

It carries a pivoted magnetic needle at the centre. The circular box is fitted on a square base plate sometimes two bubble tubes are fixed at right angles to each other on the base plate. The compass is meant for marking the north direction of the map.

5. U-fork or plumbing fork with plumb bob:-

The U-fork is a metal strip bent in the shape of a 'U' (hair pin) having equal arm lengths, the toparm is pointed and the bottom arm carried a hook for suspending a plumb bob. This is meant forcentering the table over a station.

Methods of Plane Table Surveying

Four classes of plane tabling surveys are recognized:

Radiation method;

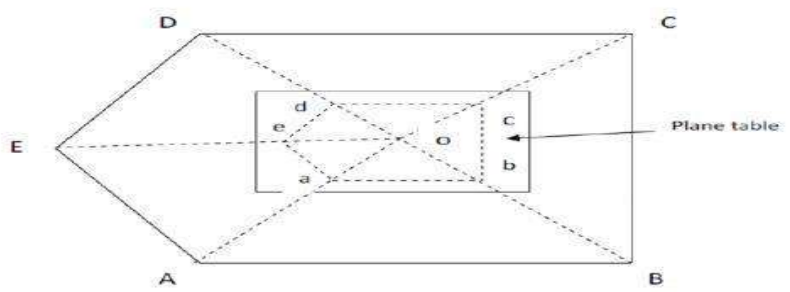
Intersection method;

Traversing method,

Resection method.

Radiation Method

Here, the plane table is set up at one station which allows the other station to be accessed. The points to be plotted are then located by radiating rays from the plane table station to the points. After reducing the individual ground distances on the appropriate scale, the survey is then plotted. This method is suitable for small area surveys. It is rarely used to survey a complete project but is used in combination with other methods for filing in details within a chain length.



The following steps are taken:

1. Select a point O such that all the points are visible

2. Set up and level the instrument at O

3. From O align the Alidade and draw radial lines towards. The stations A, B, C, D and E.

4. Measure the distances OA, OB, OC, OD and OE: scale and draw Oa, Ob, Oc, Od and Oe onthe paper.

Join the point a, b, c, d, and e to give the outline of the survey

Result: The given area has been surveyed using plane table by method of Radiation

EXPERIMENT NO: 3(a)

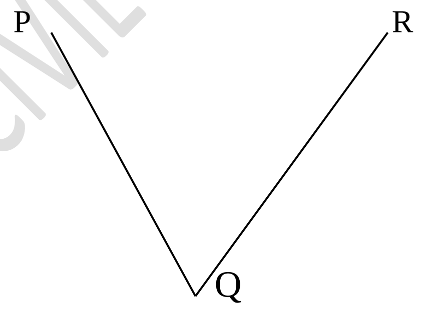
MEASUREMENT OF HORIZONTAL ANGLE USING THEODOLITE
i) Method of Repetition

AIM:- To measure the Horizontal angle by method of repetition

EQUIPMENTS REQUIRED: - Theodolite, tripod, Tape, Ranging rods

PROCEDURE:-

1. To measure the angle PQR set the Instrument at Q level it with the help of upper clamp and tangent screw.
2. Set Zero-Zero reading on vernier A. Note the reading on vernier B. Loose the lower clamp and direct the telescope towards the point P.
3. Clamp the lower clamp and bisect point P accurately by lower tangential screw. Unclamp the upper clamp and turn the instrument clock wise towards R. clamp the upper clamp and bisect R accurately with the upper tangent screw.
4. Note the reading on vernier A and B.
5. Unclamp the lower clamp and turn the telescope clockwise to sight P again. Bisect P accurately by using lower tangential screw 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 3 times.



ENGINEERING SURVEY LAB

SUBJECT CODE:BCV302 **DEPARTMENT: CIVIL ENGINEERING**

OBSERVATION AND CALCULATION TABLE

SI.no	Instrument at Q	Sighted to	FACE LEFT											
			A			B		MEAN			NO OF REPETITION	HORIZONTAL ANGLE		
			°	‘	“	‘	“	°	‘	“		°	‘	“
1	Q	P	0	0	0	0	0	0	0	0	-	-	-	-
2		R	31	27	0	7	0	31	17	0	01	31	17	0
3		R	63	21	0	1	2	63	11	0	02	31	54	0
4		R	94	32	0	12	0	94	22	0	03	31	11	0

SI.no	Instrument at Q	Sighted to	FACE RIGHT											
			A			B		MEAN			NO OF REPETITION	HORIZONTAL ANGLE		
			°	‘	“	‘	“	°	‘	“		°	‘	“
1	Q	P	0	0	0	0	0	0	0	0	-	-	-	-
2		R	31	31	0	11	0	31	21	0	01	31	21	0
3		R	63	24	0	4	0	63	14	0	02	31	53	0
4		R	94	35	0	15	0	94	25	0	03	31	11	0

RESULT:

The horizontal angle PQR **is = Face right = 31° 28’ 20”**
Face left = 31° 27’ 20”

EXPERIMENT NO: 3(b)

MEASUREMENT OF VERTICAL ANGLE USING THEODOLITE

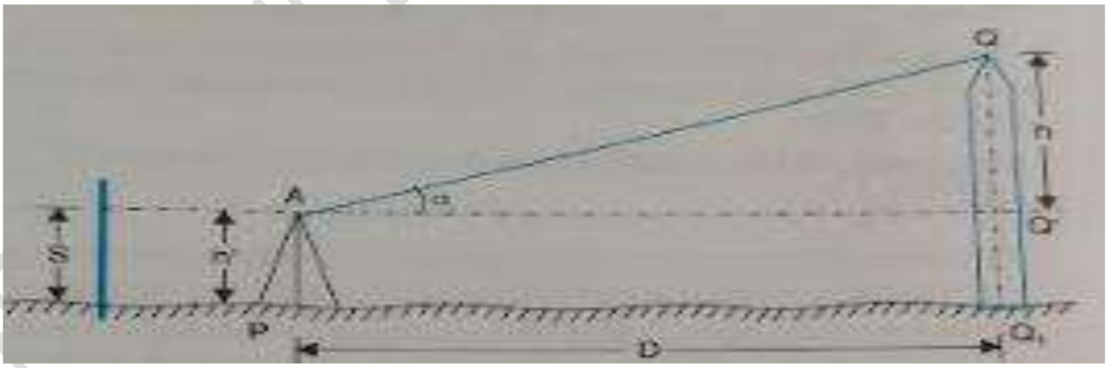
AIM:- To measure the Vertical angle by using Theodolite

EQUIPMENTS REQUIRED: - Theodolite, tripod, Tape, Ranging rods

PROCEDURE:-

1. Level the instrument with reference to the plate level.
2. Keep the altitude level parallel to any two-foot screw and bring the bubble central in position.

   Rotate the telescope through 90^{o} till the altitude level is on the third screw. Bring the bubble central in position with the third foot screw. Repeat the procedure till is the bubble central in both the positions.
3. Loose the vertical circle clamp and rotate the telescope in vertical plane to sight the object. Use vertical circle tangent screw for accurate bisection.
4. Read both the verniers C and D of vertical circle. The mean of the two gives vertical angle. Similar observation may be made with another face. Average of the two will give the required vertical angle.



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OBSERVATION AND CALCULATION TABLE

Face	S. No	Instrument at	Sighted to	C °	C '	C "	D °	D '	D "	MEAN °	MEAN '	MEAN "	Vertical angle °	Vertical angle '	Vertical angle "	Average vertical angle °	Average vertical angle '	Average vertical angle “
Face left	1.	P	Q	31	14	0	-	14	0	31	14	0	31	14	0			
Face right	1.	P	Q	30	51	20	-	11	20	30	31	20	30	31	20	31	23	10

AVERAGE VERTICAL ANGLE		
°	'	"
31	23	10

RESULT:

The vertical anglePQQ’ **is =31**° 23' 10”

ENGINEERING SURVEY LAB

SUBJECT CODE: BCV302 **DEPARTMENT: CIVIL ENGINEERING**

EXPERIMENT NO: 4

SETTING UP OF TOTAL STATION. FEATURES AND COMPONENTS OF TOTAL STATION

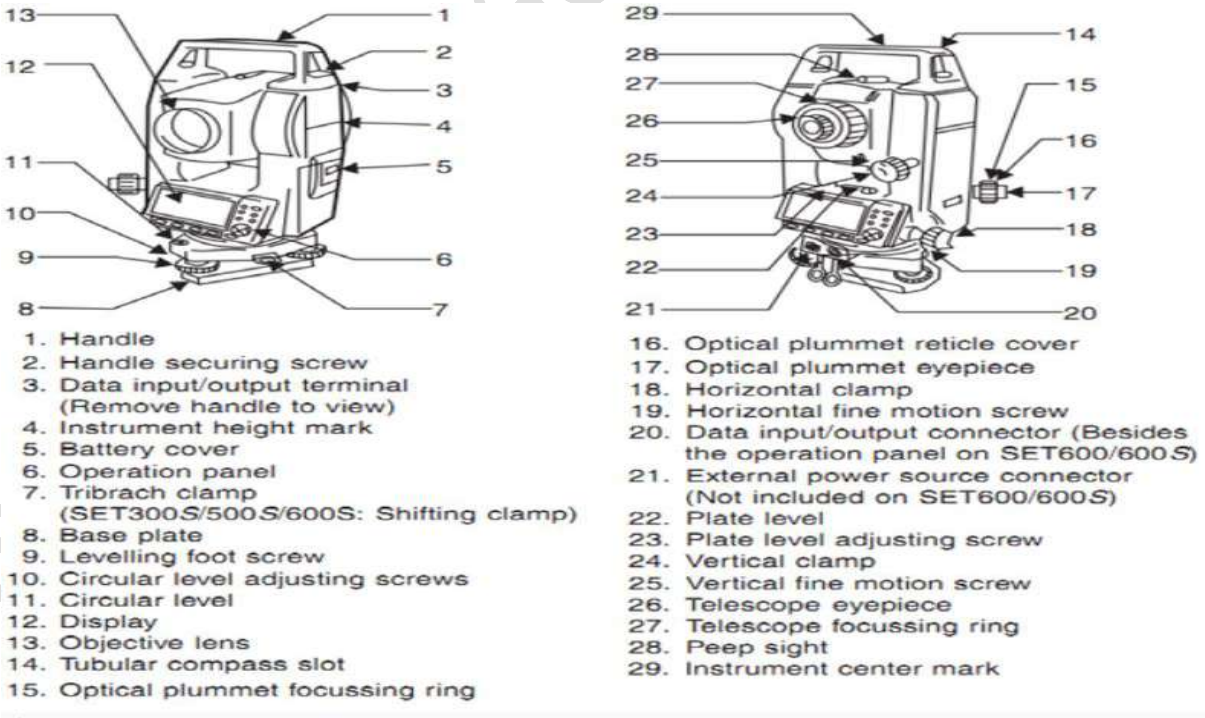
AIM: - To understand the setting up of total station, features, and components of total station.

APPARATUS: Total Station and all the accessories

THEORY:

A total station is an electronic theodolite and an electronic distance meter (EDM). This combination makes it possible to determine the coordinates of a reflector by aligning the instrument's cross hairs on the reflector and simultaneously measuring the vertical and horizontal angles and slope distances.

A microprocessor in the instrument takes care of recording, readings, and the necessary computations. The data is easily transferred to a computer where it can be used to generate a map. Wild, 'Tachymat 'TC 2000, and it is manufactured by M/s Wild Heerbrugg.



As a teaching tool, a total station fulfils several purposes. Learning how to properly use the total station involves the physics of making measurements, the geometry of calculations, and statistics for analysing the results of a traverse. In the field, it requires teamwork, planning, and careful observations.

If the total station is equipped with a data collector it also involves interfacing the data-logger with a computer, transferring the data, and working with the data on a computer. The more the user understands how a total station works, the better they will be able to use it.

Fundamental Measurements

- The rotation of the instrument's optical axis from the instrument north in a horizontal plane : i.e. **horizontal angle**
- Inclination of the optical axis from the local vertical i.e. **vertical angle.**
- Distance between the instrument and the target i.e. **slope distance**.

Horizontal Angle

The horizontal angle is measure from the zero direction on the horizontal scale. When the user first sets up the instrument the choice of the zero direction is made – this is Instrument North. The user may decide to set zero (North) in the direction of the long axis of the map area, or choose to orient the instrument approximately to True, Magnetic or Grid North.

The zero direction should be set so that it can be recover if the instrument was set up at the same location at some later date. This is usually do by sighting to another benchmark, or to a distance recognizable object. Using a magnetic compass to determine the orientation of the instrument is not recommended and can be very inaccurate.

Most total stations can measure angle to at least 5 seconds, or 0.0013888 degree. The best procedure when using a Total Station is to set a convenient " north " and carry this through the survey by using back sights when the instrument is move.

Vertical Angle

The vertical angle is measure relative to the local vertical (plumb) direction. The vertical angle is usually measure as a zenith angle (0 degree is vertically up, 90 degree is horizontal, and 180 degree is vertically down), although one is also given the option of making 0 degree horizontal. The zenith angle is generally easier to work with. The telescope will be pointing downward for zenith angles greater than 90 degree and upward for angles less than 90 degree.

Measuring vertical angles require that the instrument be exactly vertical. It is very difficult to level an instrument to the degree of accuracy of the instrument. Total stations contain an internal sensor (the vertical compensator) that can detect small deviations of the instrument from vertical.

Electronic in the instrument then adjust the horizontal and vertical angles accordingly. The compensator can only make small adjustments, so the instrument still must be well level. If it is too far out of the level, the instrument will give some kind of" tilt " error message.

Slope Distance

The instrument to reflect distance is measure using an Electronic Distance Meter (EDM). Most EDM's use a Gallium Arsenide Diode to emit an infra light beam. This beam is usually modulated to two or more different frequencies. The infra beam is emitted from the total station, reflect by the reflector, and received and amplify by the total station.

The receive signal is then compare with a reference signal generate by the instrument (the same signal generate that transmits the microwave pulse) and the phase-shift is determine. This phase shift is a measure of the travel time and thus the distance between the total station and the reflector.

Basic Calculations

Total Stations only measure three parameters:

- **Horizontal Angle**
- **Vertical Angle**
- **Slope Distance**

Horizontal Distance

Let us use symbol I for instrument (total station) and symbol R for the reflector. In order to calculate coordinates or elevations it is first necessary to convert the slope distance to a horizontal distance. The horizontal distance is –

Hd = Sd cos (90* – Za) = Sd sin Za

where Sd is the slope distance and Za is the zenith angle. The horizontal distance will be use in the coordinate calculations.

Vertical Distance

We can consider two vertical distances. One is the Elevation Difference (dZ) between the two points on the ground. The other is the Vertical Difference (Vd) between the tilting axis of the instrument and the tilting axis of the reflector. For elevation difference calculation we need to know the height of the tilting-axis of the instrument, that is the height of the center of the telescope, and the height of the center of the reflector (Rh)

The way to keep the calculation straight is to imagine that you are on the ground under the instrument. If you move up the distance Ih, then travel horizontally to a vertical line passing through the reflector then up (or down) the vertical distance (Vd) to the reflector, and then down to the ground. This can be write as

dZ = Vd + (Ih – Rh)

The quantities Ih and Rh are measure and recorded in the field. The vertical difference Vd is calculate from the vertical angle and the slope distance

Vd = Sd sin (90* – Za) = Sd cos Za

where dZ is the change in elevation with respect to the ground under the total station. We have chosen to group the instrument and the reflector heights. Note that if they are the same then this part of the equation drops out. If you have to do calculations by hand it is convenient to set the reflector height the same as the instrument height.

If the instrument is at a know elevation, Iz , then the elevation of the ground beneath the reflector, Rz , is

Rz = Iz + Sd cos Za + (Ih – Rh)

General setting required for station point or temporary adjustment of total Station:-
Temporary Adjustments of a Total Station

A total station is basically a theodolite hence temporary adjustments of the total station are more or same as that of a theodolite. Following are the temporary adjustments of a total station.

1. Setting up of tripod, taking out instrument from box & fixing the instrument on tripod head.
2. Levelling up of the instrument
   a) Coarse leveling with spirit level by leg adjustment.
   b) Fine leveling with digital bubble and foot screws.
3. Centering Up of the instrument
   a) Coarse centering by leg adjustment.
   b) Fine centering with laser plummet by shifting the instrument bodily on machine finished tripod head.

Levelling & centering shall be done in succession to each other till both of them are satisfactory.

4. Setting up the Station
   a) By inputting station name, instrument height & coordinates at first station &
   b) By recalling the station occupied from the memory at next stations.
5. Orienting the instrument
   a) By setting horizontal angle to 00 when instrument is directed toward the accepted meridian (usually North direction) at first station and
   b) By taking back sight to previously occupied traverse station (So that same meridian will be referred).

<u>Features of Total Station</u>

(a) Angle Measurement:

An electronic theodolite of a total station is used to measure angles. All the features of electronic theodolites are same as total station.

A total station can record angles with a resolution between 1″ and 20″. All the instruments incorporate either single-axis or dual-axis compensator, the latter being expensive.

(b) Distance Measurement:

Generally, a total station measures a slope distance and the microprocessor uses the vertical angle recorded by the theodolite along the line of sight to calculate the horizontal distance.

In addition, the height between the trunnion axis and prism center is also calculated and displayed.

All the total stations use co-axial optics in which the EDM transmitter and receiver are combined with the theodolite telescope.

These 3 modes are generally available for distance measurement.

#Standard or Coarse Mode

It has a resolution of 1 mm and measurement time of 1-2 seconds.

#Precise or Fine Mode

It has a resolution of 1″ but a measurement time of 8 – 4 seconds. This is more accurate than the standard mode, since the instrument refines the arithmetic mean value by making repeated measurements.

#Tracking or Fast Mode

The distance measurement is repeated automatically at interval of less than 1″. Normally this mode has a resolution of 10 mm.

(c) Control Panel:

The total station is activated through its control panel. It consists of keyboard and multiple line liquid crystal display (LCD).

The LCD is moisture-proof, can be illuminated and some LCD’s incorporate contrast controls to accommodate different viewing angles.

Some of the total stations have two control panels, one of each face the electronic theodolite to make them easier to use.

The keyboard enables the user to select different measurement and implement modes, enables instrument parameters to be changed and allows special software functions to be used.

Some keyboards incorporate multi-function keys to carry out specific tasks, whereas others use keys to activate and display menu systems.

Angle and distances are usually recorded electronically in a digital form as data. If a code is entered from the keyboard to define the feature being observed the data can be processed much more quickly by downloading it into appropriate software.

On numeric keyboards, codes are represented by numbers, whereas keyboards with feature codes are also available.

(d) Power Supply:

Rechargeable nickel- cadmium batteries are used for power supply. The usage time is 2-10 h.

Some total stations have an auto power save feature which switches the instrument off or into some standby mode after it has not been used for a specified time.

Components of a Total Station

Total Station is a compact instrument that weighs around 50 N to 55 N. It consists of a simple microprocessor, an angle measuring instrument (Theodolite), and a distance measuring instrument (EDM).

Moreover, there are approximately more than 40 different models available globally. Total-station is currently the most used instrument in the surveying field. The cheapest instrument is available in the range of 2000$ to 2500$.

The Total Station components used in surveying are the following:

1. Tripod

Uses to hold the total Station.

2. Electronic Notebook

Used to manipulate, calculate and record the field data

3. Prism and its Pole

It can measure lengths with a triple prism to 2 km and up to 6-7 km

4. Battery

ENGINEERING SURVEY LAB

SUBJECT CODE: BCV302 **DEPARTMENT: CIVIL ENGINEERING**

EXPERIMENT NO: 5

CONTOURING AND PLOTTING WITH TOTAL STATION/THEODOLITE

AIM: - Counter plan of given area (One full size drawing sheet)using total station/ to draw the contour plan of the given area using level or theodolite

APPARATUS: Total Station with all the accessories/ Dumpy level/theodolite, leveling staff, ranging rod, tape etc.

THEORY:

A contour is an imaginary line on the ground joining the points of equal elevation. It is a line in which the surface of ground is intersected by a level surface.

PROCEDURE (Using total station):

The elevation and depression and the undulations of the surface of the ground are shown as map by interaction of level surface with by means of contour line. A contour may be defined as the line of intersection of a level surface with the surface of the ground.

1. Fix the total station over a station and level it
2. press the power button to switch on the instrument.
3. select MODE B -------> S function------->file management------>create(enter a name)-- ----->accept
4. then press ESC to go to the starting page
5. then set zero by double clicking on 0 set(F3)
6. Then go to S function ------> measure-----> rectangular co-ordinate---->station --- >press enter.
7. Here enter the point number or name, instrument height and prism code.
8. Then press accept (Fs)
9. Adopt Cross section method for establishing the major grid around the study area.
10. project suitably spaced cross sections on either side of the center line of the area.
11. Choose several points at reasonable distances on either sides.
12. keep the reflecting prism on the first point and turn the total station to the prism, focus it and bisect

it exactly using a horizontal and vertical clamp.

13. Then select MEAS and the display panel will show the point specification
14. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.
15. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.
16. Then turn the total station to second point and do the same procedure.
17. Repeat the steps to the rest of the stations and get all point details.
18. Plot cross section lines to scale and enter spot levels.
19. The points on the chosen contours are interpolated assuming uniform slope between adjacent points and join them by a smooth line.

Result: The contour of given land is drawn in the sheet.

Procedure (Indirect method of contouring by level/theodolite):

Indirect Methods In this method, levels are taken at some selected points and their levels are reduced. Thus in this method horizontal control is established first and then the levels of those points found. After locating the points on the plan, reduced levels are marked and contour lines are interpolated between the selected points.

1. The area to be surveyed is divided into number of squares. The size of the square may vary from 5 to 10 m depending upon the nature of the contour and contour interval.
2. Set up the level at a convenient place so that all points and bench mark are visible properly.
3. Do the "temporary adjustments" properly and make the line of sight exactly horizontal.
4. Take the back sight by focusing the telescope towards the staff held on the bench mark and find the height of instrument.
5. Held the leveling staff on the corners of the square and find out its elevation.
6. The contour lines may then be drawn by interpolation

ENGINEERING SURVEY LAB

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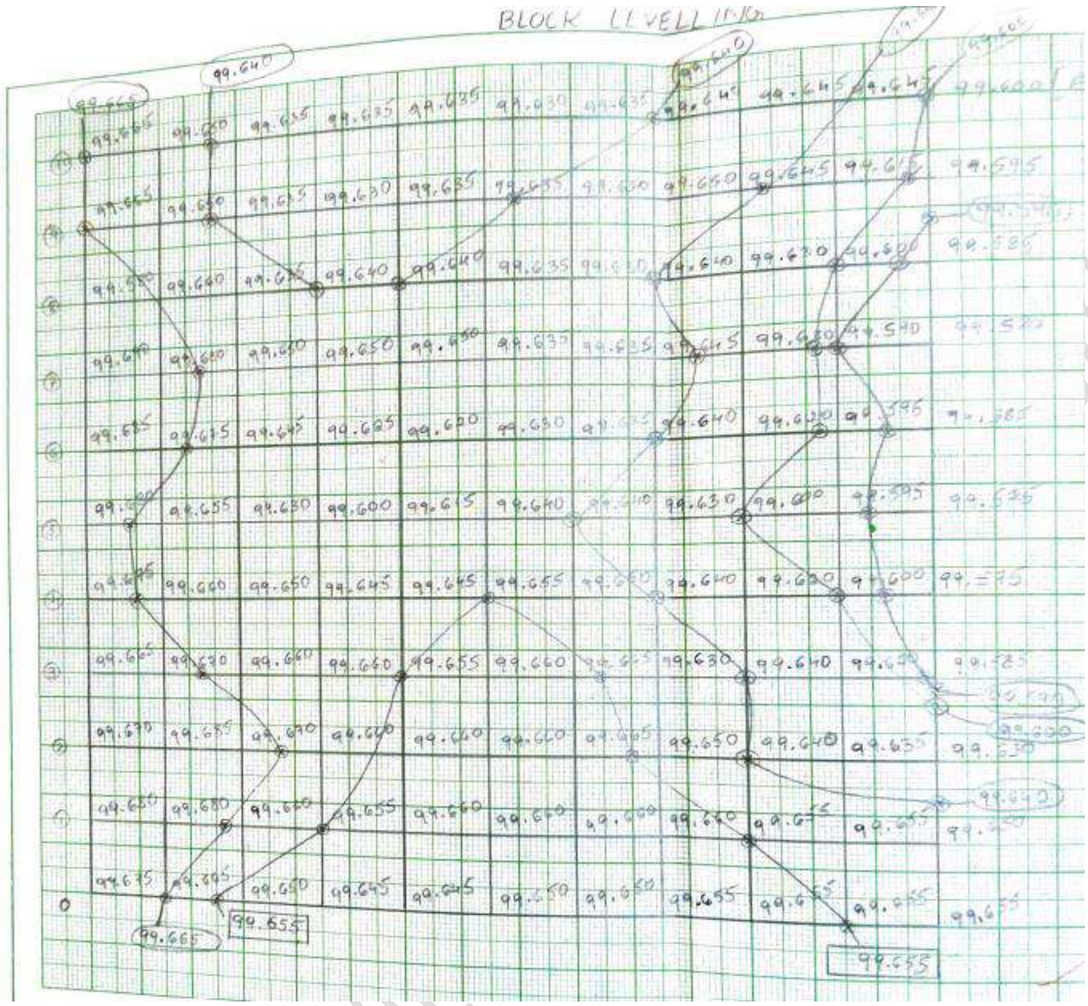
Observation Table:

RL of Bench Mark: _____100.000m________

Station	BS	IS	FS	HI	RL	Remarks
-	1.050			101.050	100.000	Bench Mark
B0		1.375			99.675	
B01		1.370			99.680	
B02		1.380			99.670	
B03		1.385			99.665	
B04		1.375			99.675	
B05		1.370			99.680	
B06		1.365			99.685	
B07		1.360			99.690	
B08		1.470			99.580	
B09		1.385			99.665	
B10		1.385			99.665	
B1		1.385			99.665	
B11		1.370			99.680	
B12		1.365			99.685	
B13		1.380			99.670	
B14		1.390			99.660	
B15		1.395			99.655	
B16		1.375			99.675	
B17		1.370			99.680	
B18		1.390			99.660	
B19		1.400			99.650	
B110		1.400			99.650	
B2		1.390			99.660	
B21		1.380			99.670	
B22		1.390			99.660	
B23		1.400			99.650	
B24		1.420			99.630	
B25		1.405			99.645	
B26		1.400			99.650	
B27		1.415			99.635	
B28		1.415			99.635	
B29		1.415			99.635	
B210		1.405			99.645	
B3		1.395			99.655	
B31		1.390			99.660	
B32		1.390			99.660	

B33		1.405			99.645	
B34		1.450			99.600	
B35		1.425			99.625	
B36		1.400			99.650	
B37		1.410			99.640	
B38		1.420			99.630	
B39		1.415			99.635	
B4		1.405			99.645	
B41		1.390			99.660	
B42		1.390			99.660	
B43		1.395			99.655	
B44		1.405			99.645	
B45		1.435			99.615	
B46		1.430			99.620	
B47		1.400			99.650	
B48		1.410			99.640	
B49		1.415			99.635	
B410		1.415			99.635	
B5		1.400			99.650	
B51		1.390			99.660	
B52		1.390			99.660	
B53		1.390			99.660	
B54		1.395			99.655	
B55		1.410			99.640	
B56		1.420			99.630	
B57		1.415			99.635	
B58		1.415			99.635	
B59		1.415			99.635	
B510		1.420			99.630	
B6		1.400			99.650	
B61		1.390			99.660	
B62		1.385			99.665	
B63		1.385			99.665	
B64		1.400			99.650	
B65		1.410			99.640	
B66		1.415			99.635	
B67		1.415			99.635	
B68		1.420			99.630	
B69		1.400			99.650	
B610		1.415			99.635	
B7		1.395			99.655	

B71		1.390			99.660	
B72		1.400			99.650	
B73		1.420			99.630	
B74		1.410			99.640	
B75		1.405			99.645	
B76		1.410			99.640	
B77		1.400			99.650	
B78		1.410			99.640	
B79		1.395			99.655	
B710		1.395			99.655	
B8		1.410			99.640	
B83		1.410			99.640	
B84		1.430			99.620	
B85		1.450			99.600	
B86		1.430			99.620	
B87		1.420			99.630	
B88		1.420			99.630	
B89		1.405			99.645	
B810		1.405			99.645	
B9		1.395			99.655	
B91		1.395			99.655	
B92		1.415			99.635	
B93		1.430			99.620	
B94		1.450			99.600	
B95		1.455			99.595	
B96		1.455			99.595	
B97		1.460			99.590	
B98		1.450			99.600	
B99		1.435			99.615	
B910		1.405			99.645	
B10		1.395			99.655	
B101		1.400			99.650	
B102		1.420			99.630	
B103		1.465			99.585	
B104		1.475			99.575	
B105		1.475			99.575	
B106		1.465			99.585	
B107		1.470			99.580	
B108		1.465			99.585	
B109		1.455			99.595	
B1010			1.450		99.600	Last point



Result: The contour of given land is drawn in the sheet.

EXPERIMENT NO: 6

LONGITUDINAL AND CROSS SECTION SURVEY

AIM:- To determine and understand the profile of the ground surface by longitudinal and cross section survey

APPARATUS: Dumpy level, leveling staff, ranging rod, tape etc.

THEORY:

Profile leveling: The process of determining elevations at points at short measured intervals along a fixed line is called Longitudinal or profile leveling.

Cross sectioning: It is a method of leveling to know the nature of Ground on either side of the centerline of the proposed route. Levels are taken at right angles to the proposed Direction of the road end at suitable distances and leveling is carried out along this cross Section.

During location and construction of highways, Rail tracks sewers and canals strakes or other marks are placed at various aligned points and the undulation of the ground surface along a predetermined line is adjoined. The line of section may be

A single straight lines changing directions.

Levels are taken at right angles to the proposed Direction of the road end at suitable distances and leveling is carried out along this cross section. Cross section are the sections run at right Angles to the centerline and on the either side of it for the purpose They are taken at each 10,m station on the centerline. The length of Cross section depends upon the nature of the work if cross sections are Short they are set square out by edge. If long they are set out by the Optical square, box sextant or theodolite. simultaneously with the longitudinal section they may be taken at the hand level, level, abney level or theodolite

PROCEDURE:

Longitudinal Sectioning:

1. Establish Benchmark near the starting points.
2. Fix the profile line AB and BC on the ground by fixing ranging rods at A,B,C, etc..
3. Align the line and mark number of points at equal intervals on the proposed intervals. (Points are 5m intervals).
4. Set up the leveling instrument on the side of the alignment on firm ground at some suitable place P,

to cover many points in the lines.

5. Take back sight on benchmark, to determine the height of instrument.
6. Hold the leveling staff at successive station A, 1,2,3,4,etc..
7. Other procedure followed by differential leveling.
8. Finally close the work by taking a Fore sight on the Benchmark-2 from the last instrument setup.
9. Enter the staff readings in the field book, reduced the levels and check in each page as usual.

Cross Sectioning:

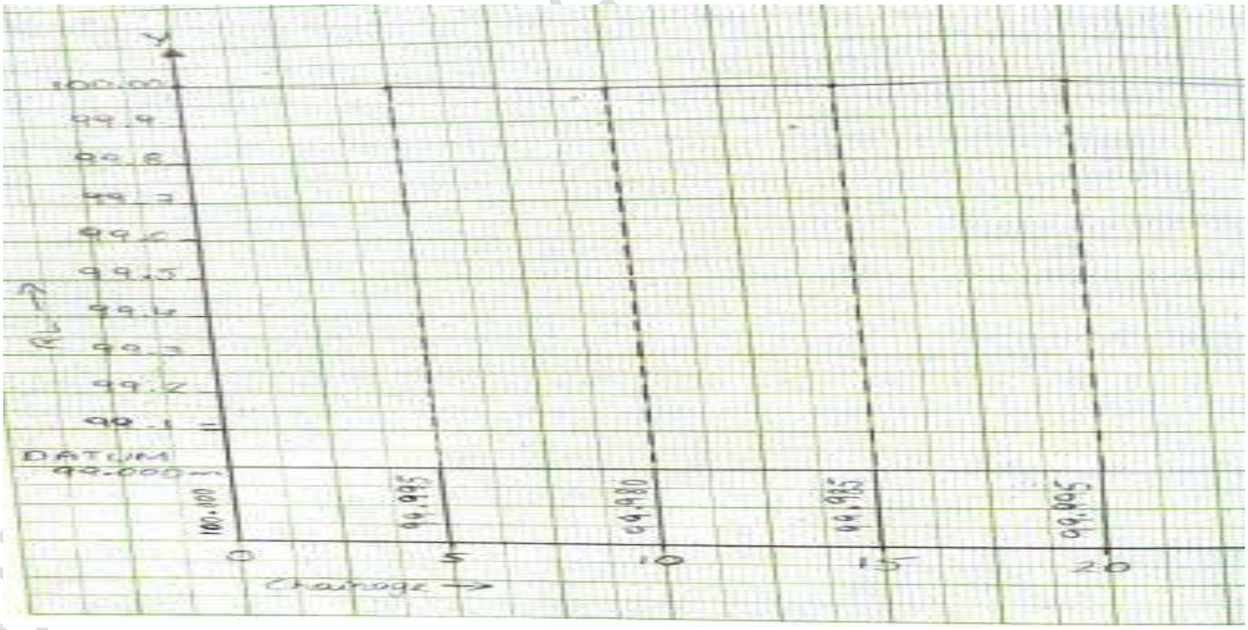
1. Mark the cross-section points on the proposed centerline alignment.
2. Set out perpendicular at three points on both sides on the center line using a chain or tape or cross staff or optical square.
3. Mark the cross-representative points along the erected perpendicular lines depending upon the nature of the ground, fix the arrows on these points. (Usually at interval of 2m, 3m, or 5m).
4. Left side marking L1, L2, L3, etc.. To the right-side markings R1, R2, R3 etc. to the center line.
5. Take staff readings on each cross-section on marked points from the instrument station.
6. Enter the staff reading at records.
7. Write full description of each cross section regarding the chain ages, number of the cross section, distance of points on the cross section from the center line.
8. Calculate the reduced levels and with usual check.

Tabulation:

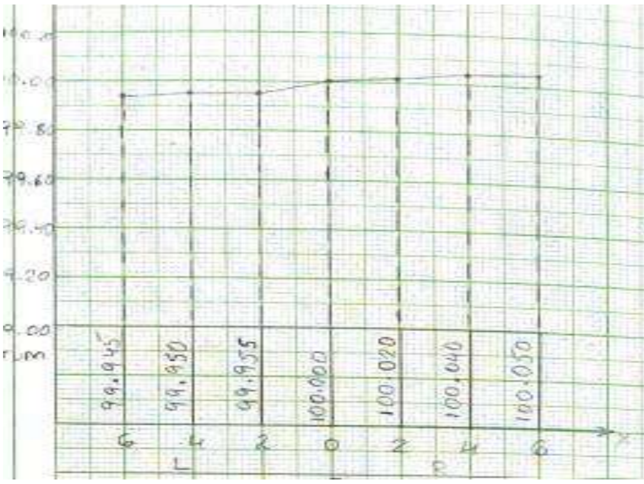
Reduced level of first point =.........100.00............ m

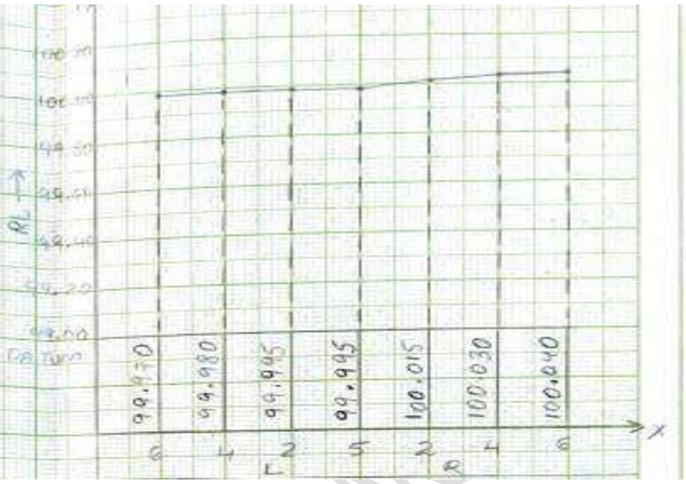
SI.NO	CHAINAGE			BS	IS	FS	HI	RL	REMARKS
	L	C	R						
		0		1.340			101.340	100.000	Bench mark
	L1				1.385			99.955	
	L2				1.90			99.955	
	L3				1.395			99.950	
			R1		1.320			100.020	
			R2		1.300			100.040	
			R3		1.290			100.050	

		5			1.345			99.995	
	L1				1.345			99.995	
	L2				1.360			99.980	
	L3				1.370			99.970	
			R1		1.325			100.015	
			R2		1.310			100.030	
			R3		1.300			100.040	
		10			1.360			99.980	
	L1				1.370			99.970	
	L2				1.375			99.965	
	L3				1.375			99.965	
			R1		1.390			99.950	
			R2		1.375			99.965	
			R3			1.365		99.975	

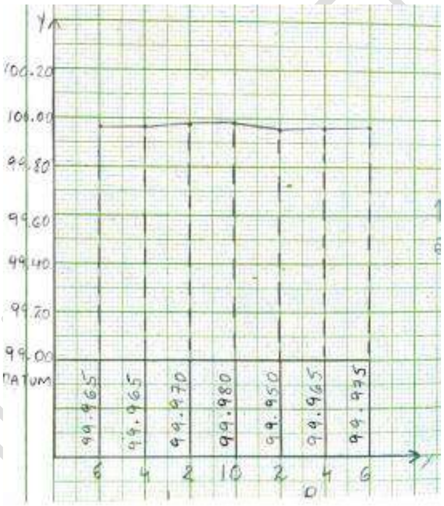


Longitudinal section





C/S at 0m Chainage **C/S at 5m Chainage**



C/S at 10m Chainage

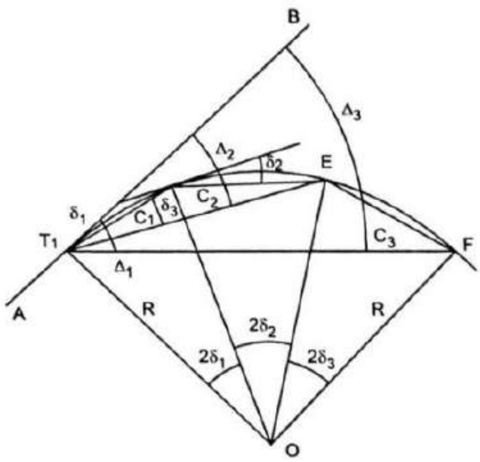
Result: The longitudinal and cross sectional levels are calculated and plotted.

EXPERIMENT NO: 7
SETTING OUT SIMPLE CURVE USING RANKINE'S METHOD USING THEODOLITE

AIM: - To set out simple curve using Rankine's method using Theodolite

APPARATUS: Theodolite, ranging rods, pegs, arrows etc.

THEORY:
The angle between the back and the chord joining the point of commencement of the curve and the other point on the curve is generally known as deflection angle.



In this method the curve is set out by the tangential angles (often called the deflection angles) with a theodolite and a chain or tape. The derivation of the formula for calculating the deflection angle it as follows:

Let, AB = the rear tangent to the curve.

T1 and T2 = the tangent points

D, E, F, etc. = the successive points on the curve.

δ1, δ2, δ3, etc. = the tangential angles which each of the successive chord T1D, DE. EF etc. makes with the respective tangents at T1, D, E, etc.

Δ1, Δ2, Δ3, etc. = the total tangential or deflection angles (between the rear tangent AB and each of the lines T1D, DE, EF, etc.

C_1, C_2, C_3 etc. = the lengths of the chord T_1D, DE, EF, etc.

R = radius of the curve

Chord T_1D = arc T_1D (very small) = C_1.

$BT_1D = \delta_1 = ½\ T_1OD$ i.e. $T_1D = 2\delta_1$

Procedure:

1. Prepare a table of deflection angles for the first sub chord, normal chord and last sub chord.
2. Set up a theodolite over T_1. Direct the telescope to bisect the point of intersection (V), with both plates clamped to zero.
3. Release the vernier plate and set angle Δ_1 on the Vernier. The line of sight is thus directed along chord T_1B
4. Point the zero end of the tape at T_1 and an arrow held at a distance C_1 along it and swing the tape around T_1 till the arrow is bisected by the cross hairs to fix point A.
5. Set the deflection angle $\Delta_2 = \Delta_1 + \delta_2$ on the vernier so that the line of sight is directed T_1D

   where,

   $$\delta_2 = 1718.9 \times \frac{C_2}{R} \text{ min.}$$ so the line of sight is along T_1V.
6. With zero end of the tape pinned at A and an arrow held at distance $AB=C_2$ along it and swing the tape around A till the arrow is bisected by the cross hairs thus fixing the point D.
7. Repeat steps 5 and 6 till the last point T_2 is reached.

Problem statement:

Two tangents intersect at a chainage 1000m. The deflection angle being 28°. Calculate the necessary data to set out the simple curve of radius 250m. by Rankeins deflection angle method and tabulate the results. Take peg interval 20m and least count of theodolite 20sec.

Solution

Given Data

PI = 1000m,

Δ = 28°,

R=250m,

Peg interval = 20m,

Least count = 20"

Tangent length, T = R tan $\frac{\Delta}{2}$ = 250 tan(28/2) = 62.33mm

Length of curve l = $\frac{\prod R\Delta}{180} = \frac{\prod * 250 * 28°}{180}$ = 122.17m

Chainage of T_1 (P.C) = PI – T = 1000 – 62.33 = 937.67m

Chainage of T_2 (P.T) = PC + l = 937.67 + 122.17 = 1059.84m

Approximate length of chord = 100

Number chords = 100/20 =5

Length of sub-chord = 122.17-100 = 22.17

Length of the first cord C_1 = 10m

Length of Last chord = 22.17-10 = 12.17m

No of Chords = C_1 + C+ C_n = 1 + 5 + 1 = 7

Rankeins Method

$\delta_1 = 1718.9 \frac{C_1}{R} = 1718.9 \frac{10}{250} = 1°8'15.36''$

$\delta_2 = 1718.9 \frac{C_2}{R} = 1718.9 \frac{20}{250} = 2°17'30.72''$

δ_3 to $\delta_6 = 2°17'30.72''$

$\delta_7 = 1718.9 \frac{C_1}{R} = 1718.9 \frac{12.17}{250} = 1°23'40.56''$

Chainage	Deflection angle			Theodolite angle		
$\Delta_1 = \delta_1$	1°	8'	45.36"	1°	9'	0"
$\Delta_2 = \Delta_1 + \delta_2$	3°	26'	16.08"	9°	26'	20"
$\Delta_3 = \Delta_2 + \delta_3$	5°	43'	46.8"	5°	44'	0"
$\Delta_4 = \Delta_3 + \delta_4$	8°	1'	17.52"	8°	1'	20"
$\Delta_5 = \Delta_4 + \delta_5$	10°	18'	48.24"	10°	19'	0"
$\Delta_6 = \Delta_5 + \delta_6$	12°	36'	18.96"	12°	36'	20"
$\Delta_7 = \Delta_6 + \delta_7$	13°	59'	59.52"	14°	0'	0"

Check = $\frac{\text{Total deflection angle}}{2}$ = theodolite angle Δ_7

= 28°/2 = 14° 0 '0" = 14° 0 '0"

Result:

The given simple curve is thus Setout.

EXPERIMENT NO: 8

SETTING OUT CENTRE LINE OF A SMALL RESIDENTIAL BUILDING

AIM: To set out Central line for a Small Residential Building

EQUIPMENTS REQUIRED:

Tape, Rope, Lime, Arrows

PROCEDURE:

Setting out the central line of a small residential building involves marking the precise position of the building's central axis or reference line on the ground. This central line serves as a guide for the construction of the building, ensuring accuracy and proper alignment of walls, columns, and other structural elements.

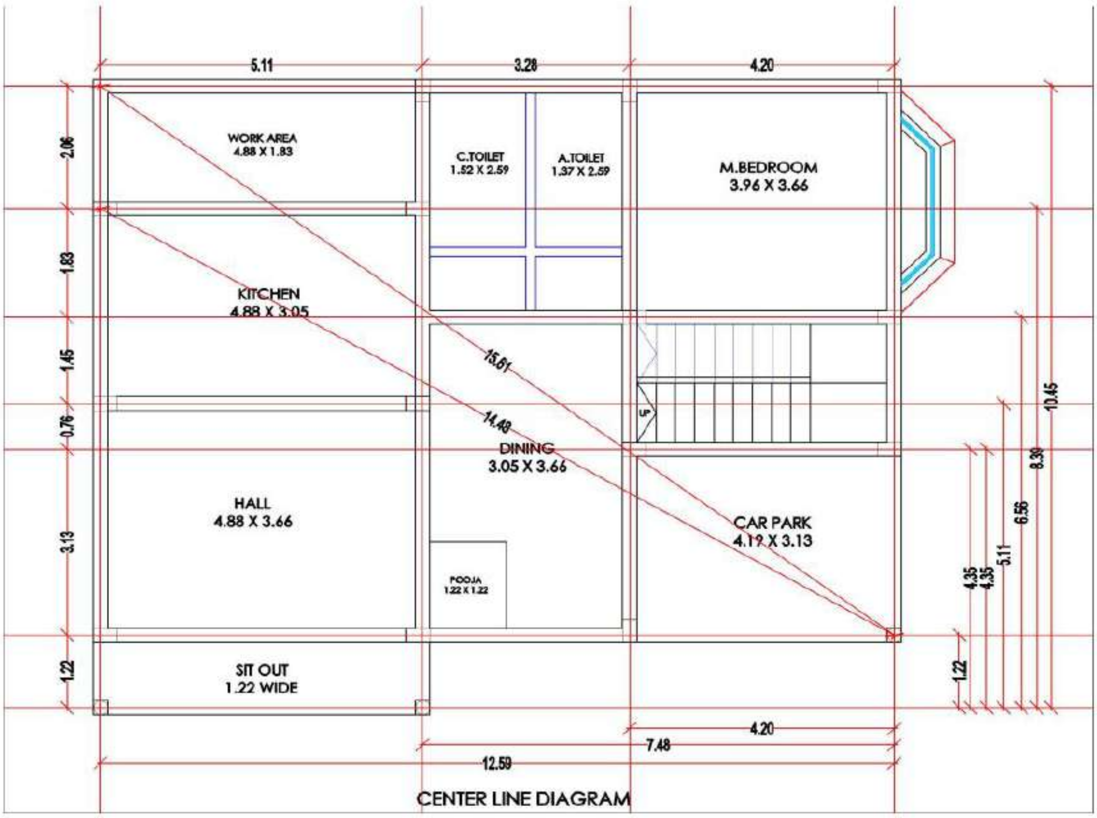
Here are the general steps to set out the central line:

1. **Blueprint Study**: Begin by thoroughly studying the architectural plans or blueprints of the building to understand the dimensions, layout, and measurements. Identify the central axis or reference line indicated on the plans.
2. **Site Preparation**: Prepare the building site by clearing any debris, ensuring a flat surface, and marking the boundaries where the building will be constructed.
3. **Establish Baseline**: Use a measuring tape or laser distance meter to establish a baseline from a fixed reference point or a known boundary of the property. Measure and mark the starting point accurately.
4. **Measure and Mark Central Line**: Using the blueprint dimensions and the central axis reference provided, measure and mark the central line perpendicular to the established baseline. This can be done by taking accurate measurements from the baseline and marking the points for the central line at regular intervals.

5. **Verify Accuracy**: Double-check the measurements and alignment of the central line by measuring diagonals from opposite corners. The measurements should be equal if the central line is accurate and perpendicular to the baseline.
6. **Marking Out:** Use stakes, pegs, or marking paint to clearly indicate the central line on the ground. Stretching a string or using a chalk line can help maintain a straight line between the marked points.
7. **Cross-Check**: Revisit the marked central line and confirm its accuracy before proceeding with further construction. Adjustments can be made at this stage if needed.

Remember, precision is key in setting out the central line as it forms the basis for the entire building's layout. It's advisable to use professional surveying equipment or seek assistance from a qualified surveyor if necessary, especially for larger or more complex projects.

Plan of the building



Observation and Calculation:

DIMENSIONS OF EACH COMPONENT OF A BUILDING

Area calculation:

1. Work area = 4.88*1.83=8.9304m^2
2. C. Toilet = 1.52*2.59 = 3.9368m^2
3. A Toilet = 1.37*2.59 = 3.5483m^2
4. M. Bedroom = 3.96*3.66 = 14.4936m^2
5. Kitchen = 4.88*3.05 = 14.88m^2
6. Hall = 4.88*3.66 = 17.860m^2
7. Dining = 3.05*3.66= 11.163m^2
8. Pooja = 1.22*1.22 = 1.488m^2
9. Carpark = 4.19*3.13= 13.114m^2

Result: Total horizontal distance = 12.59m

Total vertical distance:10.45m

Sloping distance=S_1=15.61M

S_2=14.48M

EXPERIMENT NO: 9

DIFFERENTIAL LEVELLING BY DUMPY LEVEL BY PLANE OF COLLIMATION METHOD (Additional Experiment)

AIM: To determine difference in elevation b/w two points using differential leveling method with the help of dumpy level by plane of collimation method

EQUIPMENTS REQUIRED:

Dumpy level with stand and Leveling staff

PROCEDURE:

1. Set up the instrument near the BM and do the temporary adjustments
2. Take B.S. on the bench marks
3. Do the leveling by taking FS and BS on change points until reaching the last point calculate the RL of all the points using plane of collimation method/ Height of instrument method

Observations and Tabular column:

I. HI Method (Height of Instrument Method)

Station	BS	IS	FS	HI	RL	Remarks
1	0.915			100.915	100.000	RL OF BM
2		1.370			99.545	
3	1.200		1.130	100.985	99.785	CP1
4		1.380			99.605	
5	1.290		1.520	100.755	99.465	CP2
6		1.285			99.470	
7	1.460		1.285	100.930	99.470	CP3
8		1.440			99.490	
9	1.235		1.465	100.700	99.465	CP4
10		1.300			99.400	
11			1.180		99.520	LAST POINT
	ΣBS=6.100		ΣFS=6.580			

Check:

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

6.100-6.580=99.520-100.000

-0.480m = -0.480m

Result: Difference in elevation between two points by using plane of collimation method = 0.480m

ENGINEERING SURVEY LAB

SUBJECT CODE: BCV302 **DEPARTMENT: CIVIL ENGINEERING**

EXPERIMENT NO: 10

STAKE OUT USING TOTAL STATION

GENERAL:

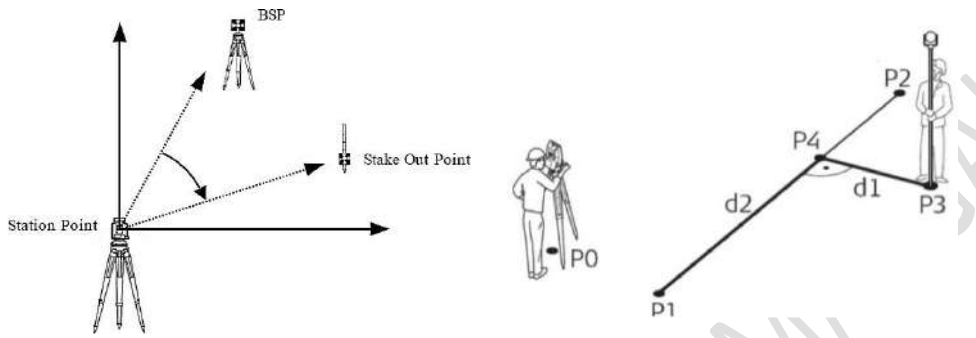


Fig: 1 Stake Out

Introduction

- To begin excavation of trenches required for a building's foundation, one must know the positions and levels of column/Footing on the ground surface.
- That is, the exact length, width, depth, and position must be marked on the ground.
- The process of transferring the Centre line of the column/footing of a plan of a building to the actual site is known as stake out.

1.1 Instruments required

Tape, Total Station with Tripod stand, Mini prism/Prism with prism rod, Laptop with preloaded Auto CAD application.

1.2 How to stake out with a total station

- Before starting a construction project, it is important to know the layout of the area in which you are working.
- A total station is a device that you can use to plot out an area of land before you begin construction. Once the area has been mapped out, you can use the total station to perform a task called a stake out.
- This will allow you to choose a point in the area and instantly know where that point lies

in relation to the location of the total station.

- Place the total station in the spot from which you want to stake out points. Make sure that the total station is level and on secure, even ground before continuing.
- Press the "Power" button to turn on the instrument.
- Do the initial adjustment and enter the station coordinates Next, press the "Menu" button and use the navigation arrows to move down to the "Stake Out" option. Press the "Select" button to enter the stake out menu.
- Enter the Coordinates of the points to be staked out.
- Aim at the Stake out point and press the “Measure "to begin the Stake Out.
- Angle and Distance of the points to be staked out will displayed in the menu.
- Turn the telescope until angle reads zero and fix the point on ground by measure the distance.

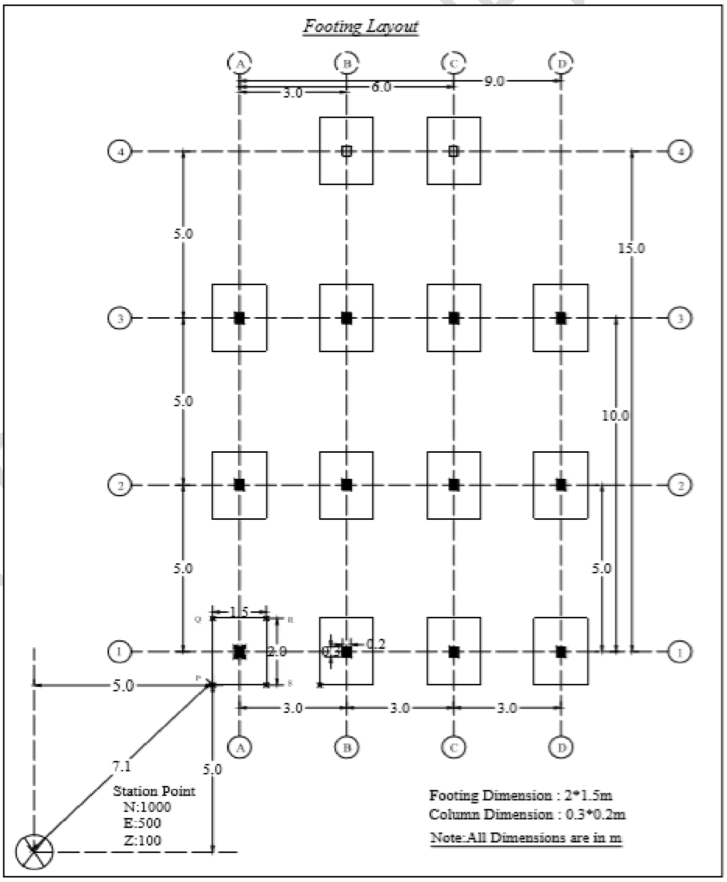


Fig 2. Footing layout

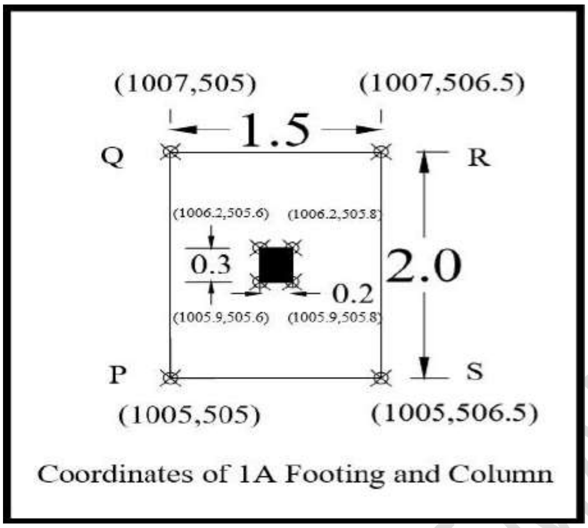


Fig 3. Coordinates of the Grid 1A Footing and column

1.3 *EXTRACTION OF POINT COORDINATE DATA TO EXCEL*

- Create the foundation and column drawing by adding points in all the corners.
- Select insert tab in the ribbon under linking and extraction click on ‘data extraction’ or type ‘**data extraction**’ in the command prompt.

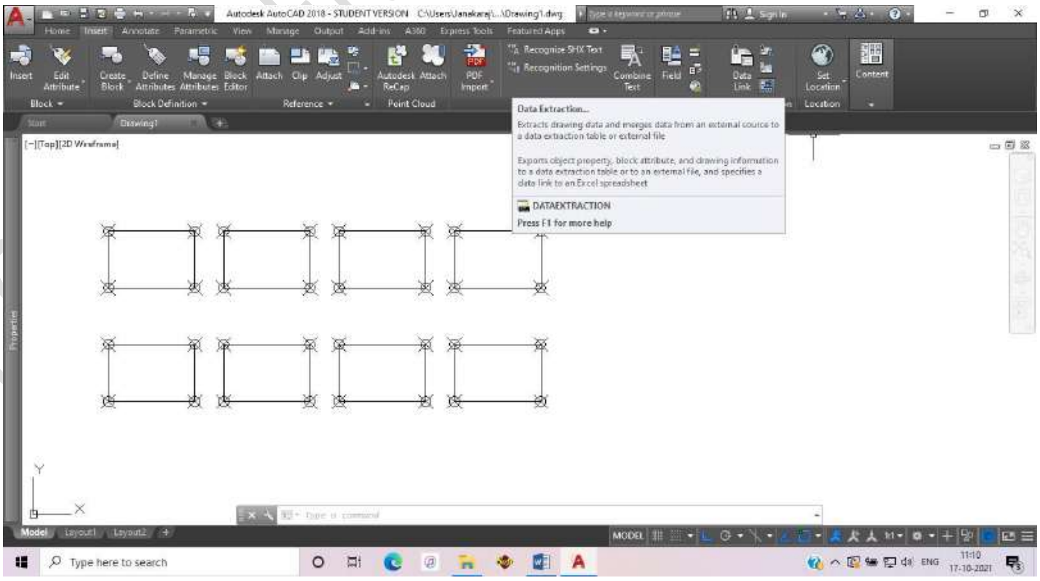


Fig 4) Selecting data extraction option

- Data extraction begin window will open, now click on new data extraction and save the file in "*.dxe*" format.

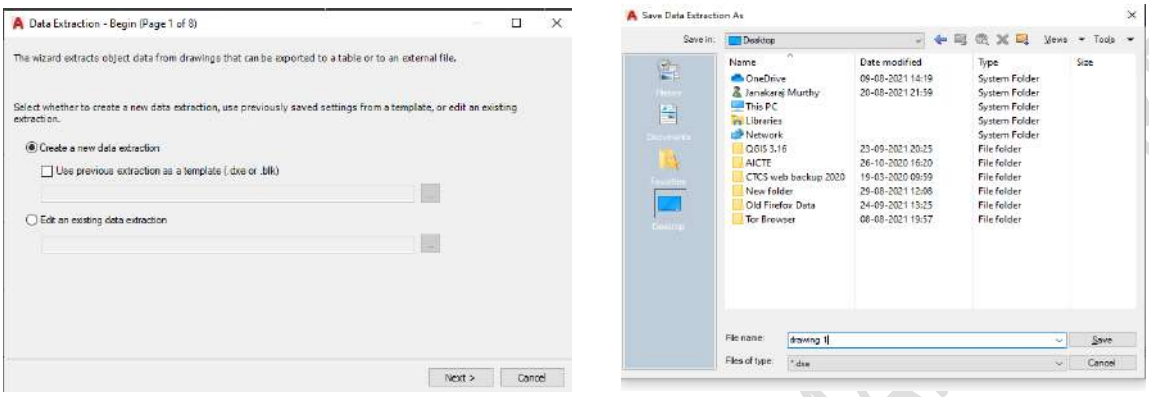
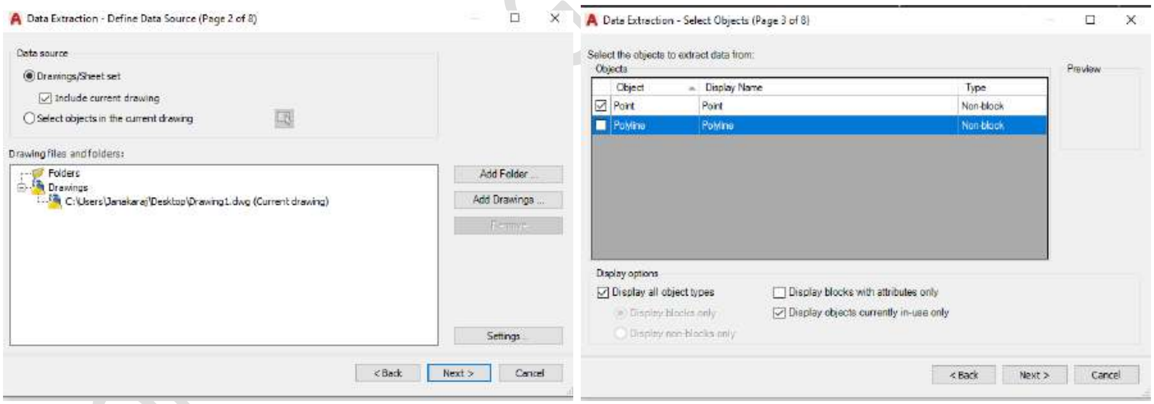


Fig 5. Creating a new data extraction and saving window

- Click on next and enter the (page 2 of 8) click on the next to enter (page 3 of 8); here select the objects to extract data from "select only point" and click next.



- **Fig 6)** Define data source and select object window

- Uncheck the 3D visualization, drawing and general; select only geometry in the select properties (page 4 of 8) and click next. Now you can see the refine data (page 5 of 8) and click next.

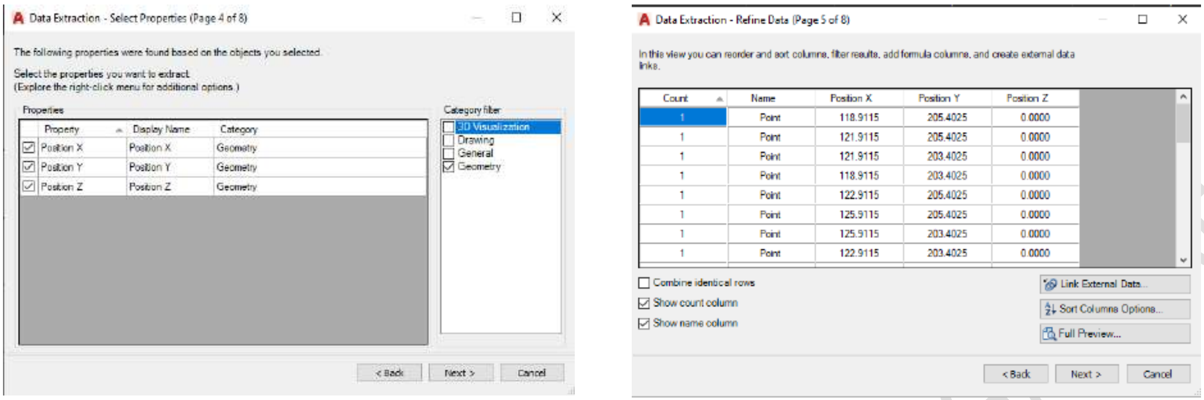


Fig 7) Select properties and refine data window.

- Choose output type (page 6 of 8) such as *.csv*, *.xls*, *.mdb*, *.txt*. here select '**.csv**' and save the file click next. Click finish to complete the extraction.
- The output file can be seen the data extracted and saved in .csv file
- Now transfer the file to total station for carrying stake out of column footing points on the ground.

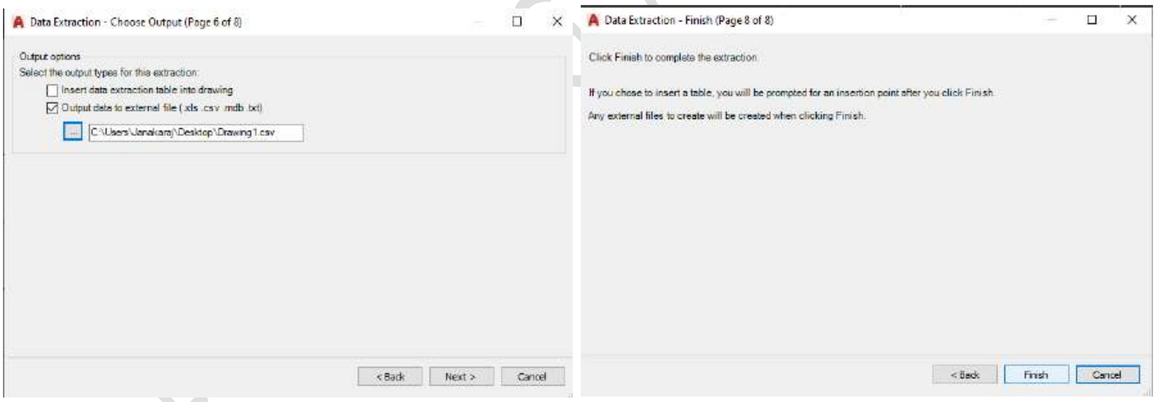


Fig 8) Choose output file type and finish data extraction window

1.4 REPRESENTATION OF COORDINATE USING ATTRIBUTES IN DRAWING

Specify the display style of point by entering a command ‘PTYPE

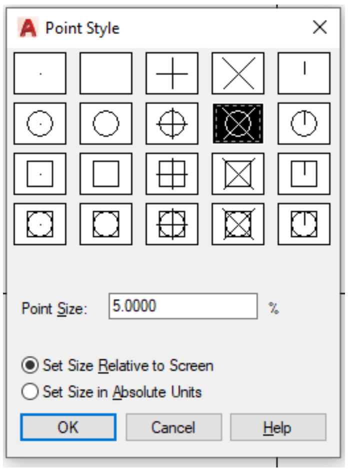


Fig 9): Point style window

1. Insert the point by using command ‘PO’
2. Create an attribute by entering command ‘ATTDEF’ (An attribute is an object that is created and included with a block definition. Attributes can store data such as part numbers, product names and so on).

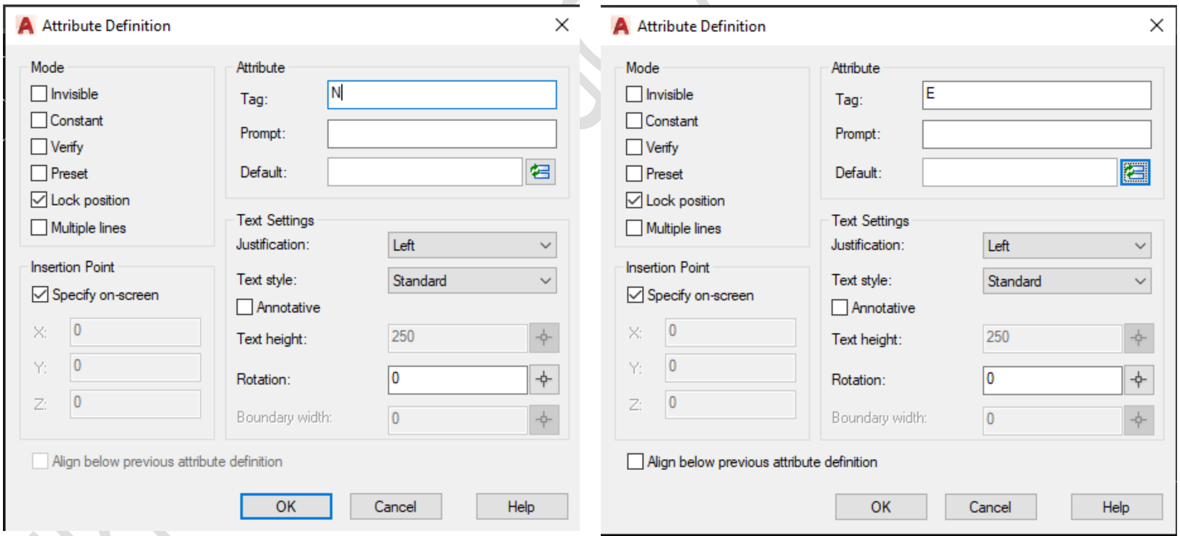


Fig 10): Attribute definition window

- Create a separate attribute definition for representing the North coordinate and East coordinate.

- Click on the default icon to define the parameters.

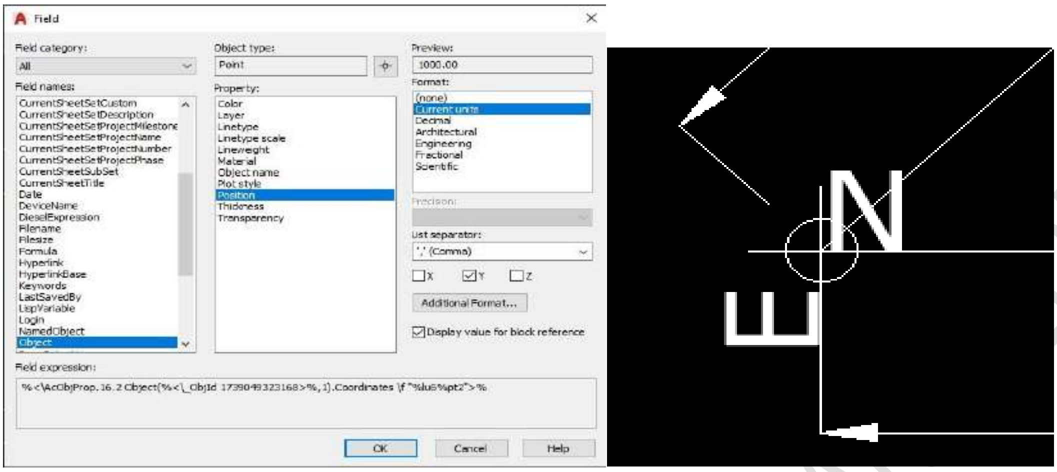


Fig 11): Attribute field definition & insertion of defined attribute on a point

- Under field category search for **object**, under object type select the **point** as object; select the point property as **position**; the preview can be seen; select the field X, Y, Z required to be displayed.
- You can add additional format such as prefix and suffix for X and Y coordinate.
- Click ok and place the defined attribute on the predefined point.

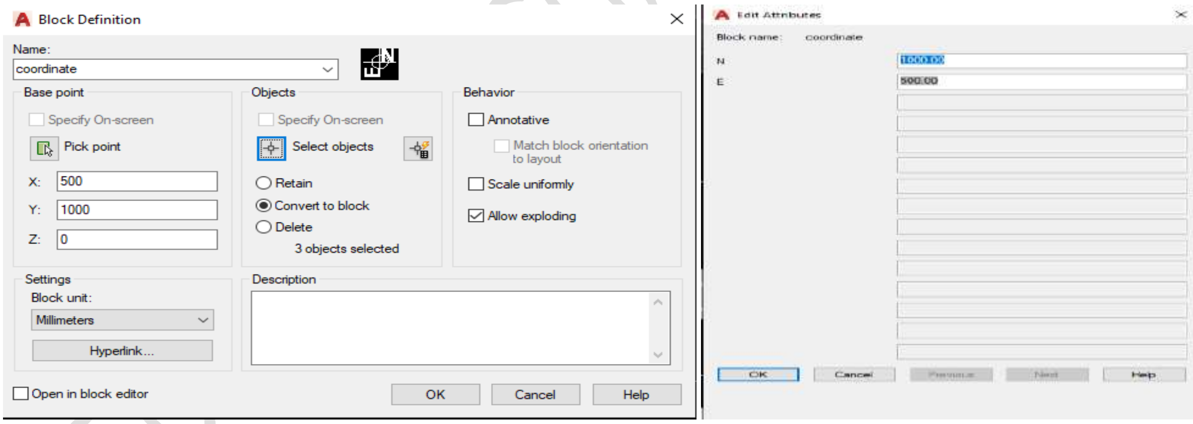
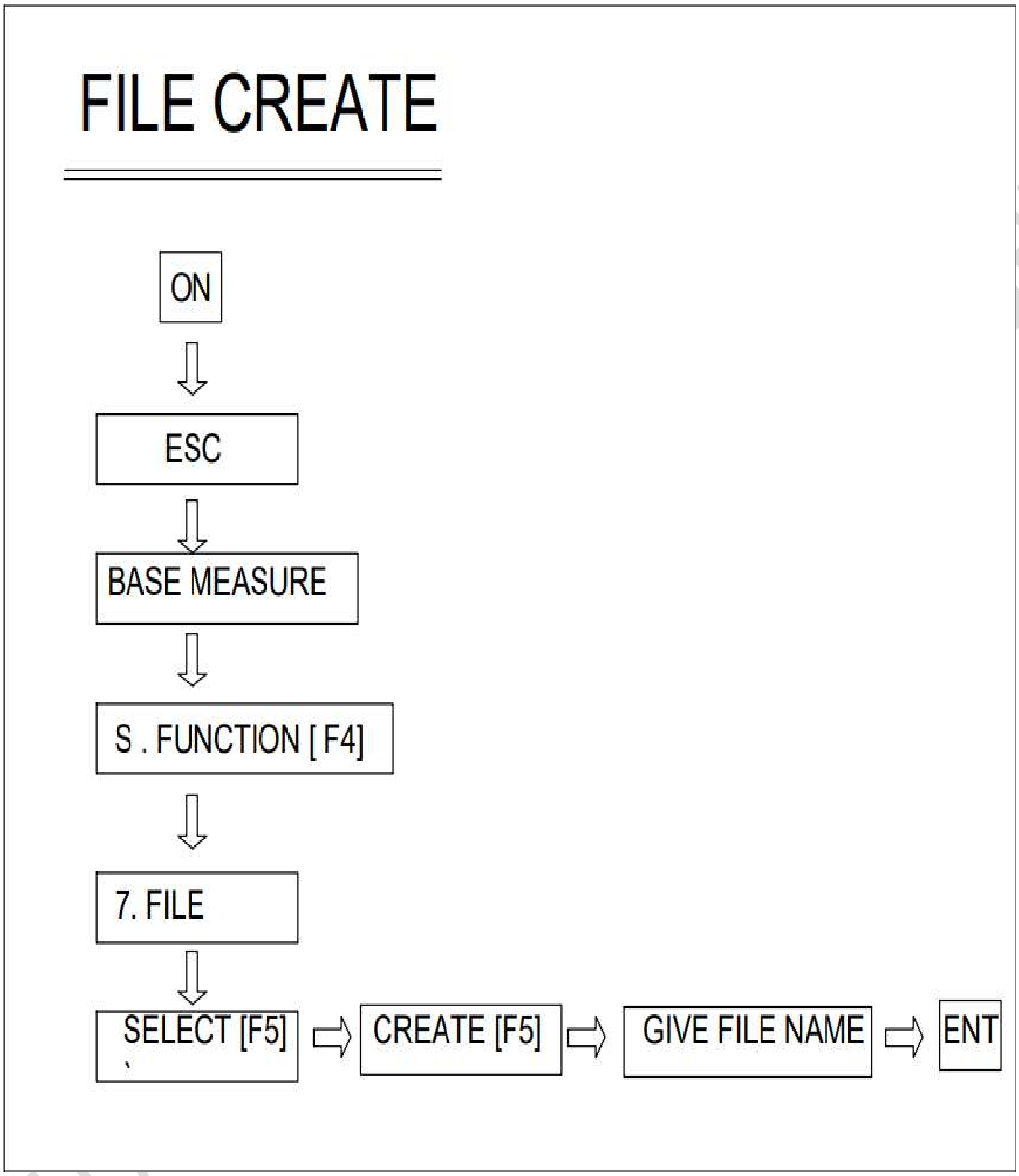


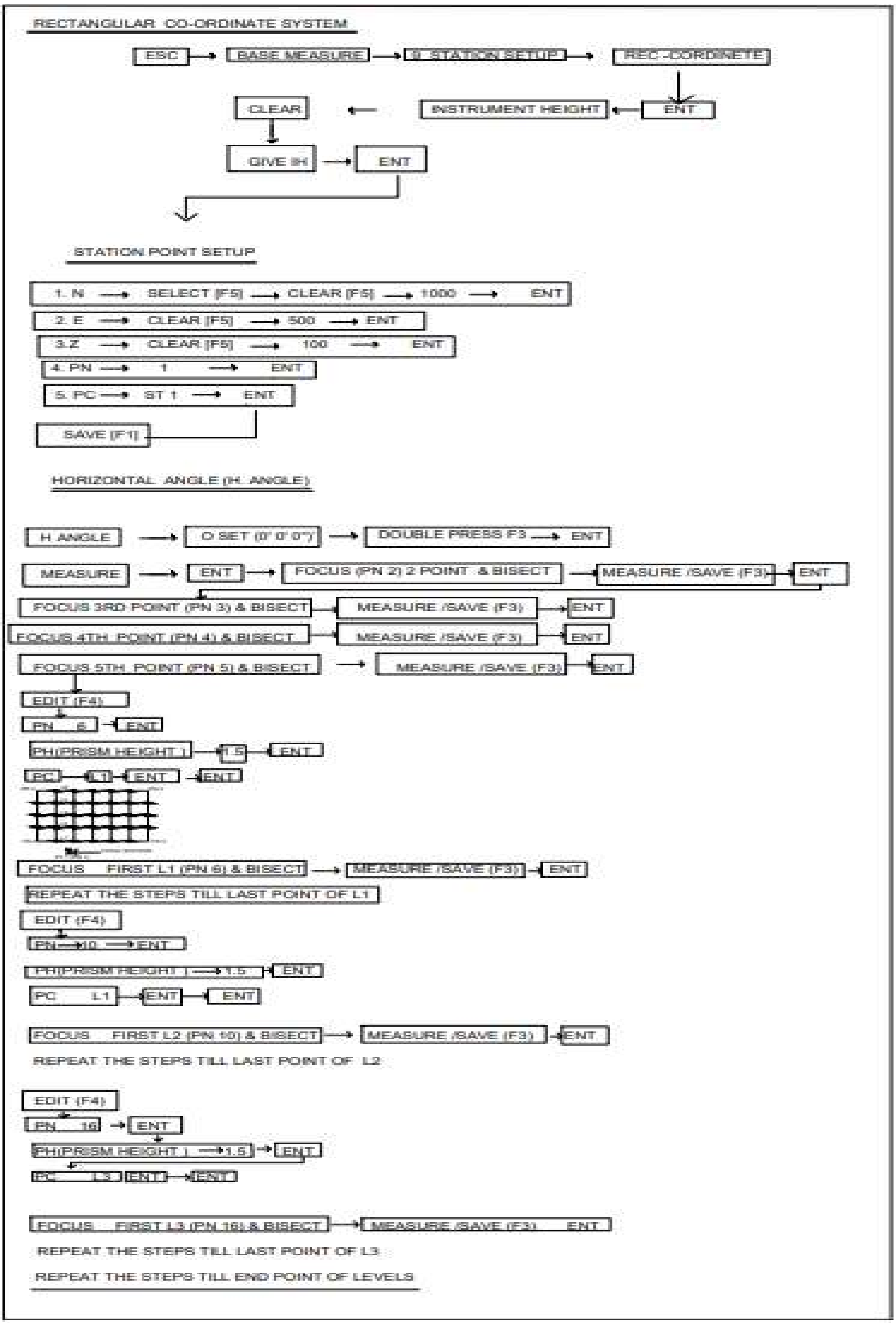
Fig 11): Block definition window

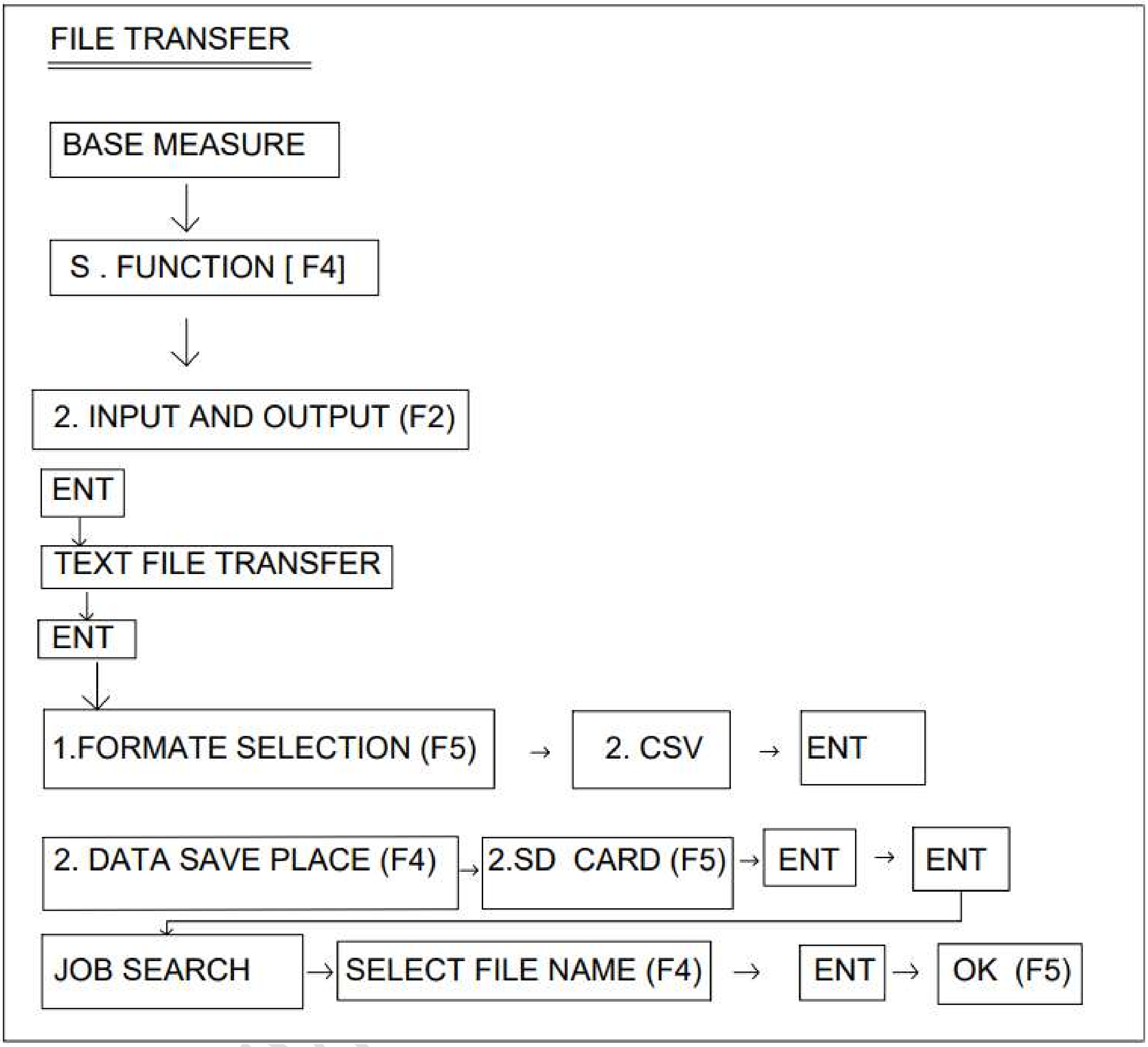
1. Convert the predefined attribute, point to block for storing the point property.
2. Insert defined block for displaying the point coordinate in drawing.

SHEETS FOR SUBMISSION

3. Building column plan
4. Column co-ordinates points for every column


FILE CREATE
ON
ESC
BASE MEASURE
S . FUNCTION [F4]
7. FILE
SELECT [F5]
CREATE [F5]
GIVE FILE NAME
ENT


RECTANGULAR CO-ORDINATE SYSTEM
ESC
BASE MEASURE
9. STATION SETUP
REC -CORDINETE
ENT
INSTRUMENT HEIGHT
CLEAR
GIVE IH
ENT
STATION POINT SETUP
1. N → SELECT [F5] → CLEAR [F5] → 1000 → ENT
2. E → CLEAR [F5] → 500 → ENT
3. Z → CLEAR [F5] → 100 → ENT
4. PN → 1 → ENT
5. PC → ST 1 → ENT
SAVE [F1]
HORIZONTAL ANGLE (H. ANGLE)
H ANGLE
O SET (0' 0' 0")
DOUBLE PRESS F3 → ENT
MEASURE
ENT
FOCUS (PN 2) 2 POINT & BISECT
MEASURE /SAVE (F3)
ENT
FOCUS 3RD POINT (PN 3) & BISECT
MEASURE /SAVE (F3)
ENT
FOCUS 4TH POINT (PN 4) & BISECT
MEASURE /SAVE (F3)
ENT
FOCUS 5TH POINT (PN 5) & BISECT
MEASURE /SAVE (F3)
ENT
EDIT (F4)
PN 6
ENT
PH(PRISM HEIGHT)
1.5
ENT
PC
L1
ENT
ENT
FOCUS FIRST L1 (PN 6) & BISECT
MEASURE /SAVE (F3)
ENT
REPEAT THE STEPS TILL LAST POINT OF L1
EDIT (F4)
PN → 10 → ENT
PH(PRISM HEIGHT) → 1.5
ENT
PC L1
ENT
ENT
FOCUS FIRST L2 (PN 10) & BISECT
MEASURE /SAVE (F3)
ENT
REPEAT THE STEPS TILL LAST POINT OF L2
EDIT (F4)
PN 16
ENT
PH(PRISM HEIGHT) → 1.5
ENT
PC L3
ENT
ENT
FOCUS FIRST L3 (PN 16) & BISECT
MEASURE /SAVE (F3) ENT
REPEAT THE STEPS TILL LAST POINT OF L3
REPEAT THE STEPS TILL END POINT OF LEVELS


FILE TRANSFER
BASE MEASURE
S . FUNCTION [F4]
2. INPUT AND OUTPUT (F2)
ENT
TEXT FILE TRANSFER
ENT
1.FORMATE SELECTION (F5)
2. CSV
ENT
2. DATA SAVE PLACE (F4)
2.SD CARD (F5)
ENT
ENT
JOB SEARCH
SELECT FILE NAME (F4)
ENT
OK (F5)

ENGINEERING SURVEY LAB

SUBJECT CODE:BCV302 **DEPARTMENT: CIVIL ENGINEERING**

VIVA QUESTIONS

1) What is surveying?

***Surveying* is the technique of determining the relative position of different features on, above or beneath the surface of the earth by means of direct or indirect measurements and finally representing them on a sheet of paper known as plan or map.**

2) What are the objectives of Leveling?

1. To determine the elevation of the given points with respect to the given/assumed reference line or datum.

2. To establish the points at a provided elevation or at various elevations with respect to a given or assumed datum.

3) Mention the types of errors in survey works.

(i) mistakes, (ii) systematic errors, and (iii) accidental errors.

4) What is accuracy and precision?

Accuracy: The ability of an instrument to measure the accurate value is known as accuracy. In other words, it is the *the closeness of the measured value to a standard or true value.*

Precision: The closeness of two or more measurements to each other is known as the precision of a substance. If you weigh a given substance five times and get 3.2 kg each time, then your measurement is very precise but not necessarily accurate. Precision is independent of accuracy.

5) Explain briefly the methods of determining heights

There are a lot of geodetic methods for determining of heights or height differences. These methods are classified as geometric levelling, trigonometric levelling, and GPS/Levelling according to used surveying instruments and applied measurement method.

6) Write the classification of survey based on instruments used.

There are different types of Surveying based on the instruments used such as.

1. **Theodolite Surveying**
2. **Tacheometric Surveying**
3. **Plane table Surveying**
4. **Chain Surveying**
5. **Compass Surveying**
6. **Aerial Photographic Surveying**
7. **Remote Sensing**

7) Mention the types of chains.

The following are the different types of chain in surveying that are commonly used:

Metric Chain

Surveyor's Chain or Gunter's Chain

Engineer's Chain

Revenue Chain

Steel Band or Band Chain

8) What are the different methods of making linear measurements?

Linear measurements in surveying can be performed by mainly three methods namely direct method, electromagnetic methods and optical methods. The direct method is the common method that employs a chain, tape or any other instrument to measure the linear distance.

9) Explain principles of surveying from whole to part.

Working from whole to the part: Major control points are selected and measured first with high degree of precision, minor details can be collected later on even with less degree of

precision. In this manner, errors involved in minor detailing will be compensating and will not affect the major dimensions

10) What is fore and back bearing?

Bearings measured in the direction of progress of the survey are known as fore bearing and bearings measured opposite to the direction of the survey are known as back bearing.

11) Write difference between Whole Circle Bearing and Quadrantal Bearing System.

The horizontal angle made by a line with the magnetic north in the clockwise direction is the whole circle bearing of the line. Only the magnetic north line is considered as reference line in whole circle bearing system. Both magnetic north and south lines are considered as reference line in quadrantal bearing system.

12) What is difference between Closed and Open traverse?

Closed traverse: When the lines form a circuit which ends at the starting point, it is known as closed traverse. 2. Open traverse : When the lines form a circuit ends elsewhere except starting point, it is said to be an open traverse.

13) Define Height of instrument

It is the elevation or reduced level of the line of sight with respect to the datum. The height of the instrument is not the height of the line of sight above the ground where the leveling instrument is set up.

14) Mention different methods of traversing.

The traversing is performed by four different methods and these methods are classified according to the survey instrument used. The methods are as follows.

1. **Chain Traversing**
2. **Compass Traversing**

3. **Theodolite Traversing**
4. **Plane Table Traversing**

15) What is the least count of Leveling Staff?

0.005m / 5mm

16) List the instruments used in plane table surveying.

- **Trough compass**
- **Plumbing fork or U-frame**
- **Spirit level**
- **Plumb bob**
- **Ranging rods**
- **Drawing sheet Instruments**
- **A spirit level is required to ensure levelling the table surface.**

17) List the methods of plane tabling.

There are mainly four methods of plane table surveying, radiation, intersection or triangulation, traversing, and resection.

18) Write the advantages and disadvantages of plane tabling over other methods.

Followings are the advantages of plane table surveying

- **Plane Table Surveying is most suitable for preparing small-scale maps.**
- **Plane Table Survey is a very swift method of surveying.**
- **The field book is not necessary as plotting is done in the field simultaneously with the field work. So the possible errors of the field book can be avoided.**

Followings are the disadvantages of plane table surveying

- **Plane table survey cannot be used in rainy season.**

- **Plane Table Survey instruments are heavy, cumbersome to carry.**
- **The table has to be cantered and oriented at every station which is really tiresome.**
- **It never produces accurate results**.

19) What is Resection?

Resection: It is a method of orientation employed when the table occupies a position not yet located on the drawing sheet. It is defined as the process of locating the instrument station occupied by the plane table by drawing rays from the stations whose positions have already been plotted on the drawing sheet.

20) What is three point problem?

Two point problems are the method of the resection, locating the point, and orientation. Resection is the process of the plane table surveying in which the location of the plane table is unidentified so in this method, the location of the plane table is identified by the known points.

21) How is three point problem solved by Bessel's Graphical Method?

It is based on the geometric principle that in any inscribed quadrilateral the angle made by one of the sides with one of the diagonals is equal to the angle made by the opposite side with the other diagonal.

22) What are the different sources of errors in plane tabling?

The errors in plane table surveying are of three types :

Instrumental errors.

Errors in plotting. Errors due to manipulation and sighting.

23) Describe Leveling

The technique of determining the relative altitude of a point on the earth's surface below the earth's surface is called LEVELLING.

24) Define Bearing.

In land surveying, a bearing is the clockwise or counterclockwise angle between north or south and a direction.

25) Define True Meridian.

The true meridian is the chord that goes from one pole to the other, passing through the observer, and is contrasted with the magnetic meridian, which goes through the magnetic poles and the observer.

26) What is Magnetic Meridian?

The magnetic meridian is a line joining the magnetic north pole with the magnetic south pole inside the earth. This is the horizontal component of the magnetic force lines along the surface of the earth. The magnetic meridian is parallel with the earth's magnetic lines of force.

27) What is Arbitrary Meridian?

Any convenient direction from a survey station to some well-defined permanent object is known as an arbitrary meridian.

28) What is Bench mark?

A benchmark is a reference point that helps one to calculate something

29) Define Datum.

Datums are used as the starting reference point for surveying jobs and put your work in a larger context.

30) What is Differential Leveling?

Differential leveling: It is the method of leveling to determine the elevation of points located at some distance apart or determine the elevation difference between two points or establish benchmarks.

31) What is Reduced level?

Reduced level in surveying refers to equating elevations of survey points with reference to a common assumed datum. It is a vertical distance between survey point and adopted datum plane.

32) Define Fly Leveling.

Fly levelling is a process of finding the level difference between two points and the levelling consists of taking back sights and fore sights only and not intermediate sights.

33) Define Back sight (BS), Fore sight (FS) and Intermediate sight (IS)

Back Sight.

A back sight (B.S) is the first staff reading taken after setting up the instrument in any position. This will always be a reading on the point of known elevation.

Fore Sight.

A fore sight (F.S) is the last staff reading taken before moving the instrument. This will always be reading on a point whose elevation is to be determined.

This reading indicates the shifting of the instrument.

Intermediate Sight.

An intermediate sight (I.S) is any staff reading taken on the point of unknown elevation after the back sight and before the fore sight.

34) What is Change Point?

A Change Point (C.P) is a point which shows the shifting of the level. It is a point on which fore and back sights are taken.

35) What is Local attraction and how is it detected?

While surveying, the magnetic needle of the compass gets disturbed due to the external influence of forces or objects. This prevents the needle from pointing correctly towards the magnetic north & creates an error.Such a disturbing influence of external forces or objects over the compass needle is said to be a local attraction.

After observing the fore bearing & back bearing of the survey line, we have to calculate the difference between the FB & BB observed from a particular station.

If the difference is 180° then we can conclude that there is no local attraction for that station & hence no correction is needed.If the difference is ±180° then we can conclude that there is a local attraction for that station & hence correction is needed.

36) How Local attraction can be eliminated?

Two methods are used to correct the errors formed by local attractions.

1. Correction in the bearings affected by local attraction.

2. Correction in the interior angles formed by the closed traverse.

37) List the variation in Declination.

Variations in magnetic declination can be categorized as daily, annual, secular, and irregular.

38) Write the temporary adjustments of Prismatic Compass.

Temporary Adjustments of a Prismatic Compass

Centring.

Levelling.

Focussing.

39) How Plane Table is oriented using trough compass?

The trough compass is placed on the top right corner of the plane table in such a way that the magnetic needle points exactly towards N-S direction. Draw this line along the edge of the compass. Sift and set up the plane table on the next station.

41). What are the fundamental parts of a theodolite?

Following are the parts of a theodolite:

- **Telescope**
- **Vertical circle**
- **Index frame**
- **The standards**
- **The upper plate**
- **The lower plate**
- **The leveling head**
- **The shifting head**
- **Plate level**
- **Tripod**
- **Plumb bob**
- **Magnetic compass**

48). What are the fundamental lines in a theodolite?

(i) **The vertical axis.**

(ii) The axis of the plate levels.

(iii) The axis of telescope.

(iv) The line of collimation.

42). What is the difference between a level and a theodolite?

The difference between these two machines is in their working. Dumpy level can be used only for vertical measurements while a theodolite functions in both horizontal and vertical measurements.

43). Name different types of theodolite?

There are two different kinds of theodolites: digital and non digital. Non digital theodolites are rarely used anymore. Digital theodolites consist of a telescope that is mounted on a base, as well as an electronic readout screen that is used to display horizontal and vertical angles.

44) Least count of prismatic compass

The smallest value that can be measured by the measuring instrument is called its Least Count. Least count of Prismatic Compass = 30 minutes = 30'.

45)Least count of theodolite

Least count of theodolite is 20 seconds.

Least count of vernier theodolite

It is the difference between the value of the smallest division on the main scale and that of the smallest division of the vernier scale. It is the smallest value measured by the theodolite.

Let (n-1) small divisions of the main scale is divided into n small divisions in the vernier scale

Then n x v = (n-1)d

v= (n-1) d/n

v = value of smallest division of Vernier scale.

d = value of smallest division of main scale.

So least count = d-v= d- (n-1)d/n= d/n

for example; d= 20' and n = 60;

least count = 20/60 x 60 = 20"