I

Name _____

Roll No. _____ Year 20____20____

Exam Seat No. _____

CIVIL GROUP | SEMESTER - II | DIPLOMA IN ENGINEERING AND TECHNOLOGY

# A LABORATORY MANUAL

# FOR

# BASIC SURVEYING

# (22205)

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

## VISION

To ensure that the Diploma level Technical Education constantly matches the latest requirements of technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

## MISSION

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the changing technological and environmental challenges.

## QUALITY POLICY

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

## CORE VALUES

MSBTE believes in the followings:

- Education industry produces live products.
- Market requirements do not wait for curriculum changes.
- Question paper is the reflector of academic standards of educational organization.
- Well designed curriculum needs effective implementation too.
- Competency based curriculum is the backbone of need based program.
- Technical skills do need support of life skills.
- Best teachers are the national assets.
- Effective teaching learning process is impossible without learning resources.

A Laboratory Manual for

# Basic Surveying

# (22205)

## Semester-II

**(CE/CR/CS)**

**Maharashtra State**
**Board of Technical Education, Mumbai**
**(Autonomous) (ISO 9001:2015) (ISO/IEC 27001:2013)**

Maharashtra State Board of Technical Education,
(Autonomous) (ISO 9001 : 2015 ) (ISO/IEC 27001 : 2013)
4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra ( East ), Mumbai - 400051.
(Printed on December, 2017)

# MAHARASHTRA STATE

# BOARD OF TECHNICAL EDUCATION

## Certificate

This is to certify that Mr. / Ms. …… Roll No. ……., of First Semester of Diploma in…….. …… of Institute,…….…….. …… (Code: ……...) has completed the term work satisfactorily in Subject **Basic Surveying (22205)** for the academic year 20…….. to 20…….. as prescribed in the curriculum.

Place: ……  Enrollment No:……

Date: ……  Exam. Seat No: ……

**Subject Teacher**  **Head of the Department**  **Principal**

Seal of Institution

# Preface

The primary focus of any engineering laboratory/field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative '**I**' Scheme curricula for engineering diploma programmes with outcome-based education as the focus and accordingly, relatively large amount of time is allotted for the practical work. This displays the great importance of laboratory work making each teacher; instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every practical has been designed to serve as a ***'vehicle'*** to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme laboratory manual development team designed the practicals to ***focus*** on the ***outcomes***, rather than the traditional age old practice of conducting practicals to 'verify the theory' (which may become a byproduct along the way).

This laboratory manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read through the concerned practical procedure that they will do the next day and understand the minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. The students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

Development and planning process for any civil engineering project needs survey of that area to be carried out and various types of survey maps are to be prepared. These maps and drawing are used for taking various decisions regarding the planning, designing, estimation, execution and construction process. This course is therefore one of the core courses required for Civil Engineers. Students are advised to master the desired skills which are expected from them for survey related works.

Although best possible care has been taken to check for errors (if any) in this laboratory manual, perfection may elude us as this is the first edition of this manual. Any errors and suggestions for improvement are solicited and highly welcome.

## Programme Outcomes (POs) to be achieved through Practical

Following programme outcomes are expected to be achieved out of the programme outcomes through the practicals of the course on:

PO1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems.

PO4. **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations.

PO 5**. The engineer and society:** Assess social, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Civil Engineering.

PO 6**. Environment and sustainability:** Apply Civil engineering solutions also for sustainable development practices in social and environmental context.

PO 7. **Ethics:** Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Civil Engineering.

PO8. **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

PO9. **Communication:** Communicate effectively in oral and written form.

PO10. **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Civil engineering and allied industry.

## List of Industry Relevant Skills

The following industry relevant skills of the competency in **"Basic Surveying"** are expected to be developed in you by undertaking the practicals of this laboratory manual.

1. Select the type of survey required for given situation.
2. Use appropriate instruments.
3. Check instruments before survey.
4. Record survey details correctly.
5. Prepare drawing from recorded survey details.

## Brief Guidelines to Teachers

1. Teacher should provide the guideline with demonstration of practical to the students with all features.
2. Teacher shall explain prior concepts to the students before starting of each practical
3. Involve students in performance of each practical.
4. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
5. Teachers should give opportunity to students for hands on experience after the demonstration.
6. Teacher is expected to share the skills and competencies to be developed in the students.
7. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected the students by the industry.
8. Finally give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions.

## Instructions for Students

1. Organize the work in the group and make record all programs.
2. Students shall develop maintenance skill as expected by industries.
3. Student shall attempt to develop related hand-on skills and gain confidence.
4. Student shall develop the habits of evolving more ideas, innovations, skills etc. those included in scope of manual
5. Student shall refer technical magazines.
6. Student should develop habit to submit the practicals on date and time.
7. Student should well prepare while submitting write-up of exercise.
8. Attach /paste separate papers wherever necessary.

## Practical- Course Outcome matrix

**Course Outcomes (COs):**

- **a.** Select the type of survey required for given situation.
- **b.** Compute area of open field using chain, tape and cross staff.
- **c.** Conduct traversing in the field using chain and compass.
- **d.** Use leveling instruments to determine reduced level of ground points.
- **e.** Draw/interpret contour maps of an area collecting field data.
- **f.** Use digital planimeter to calculate the areas.

| S. No. | Title of the Practical | CO a. | CO b. | CO c. | CO d. | CO e. | CO f. |
|---|---|---|---|---|---|---|---|
| **1.** | Measure distance between two survey stations using chain, tape and ranging rods to when two stations are inter visible. | √ | - | - | - | - | - |
| **2.** | Undertake reciprocal ranging and measure the distance between two stations. | √ | - | - | - | - | - |
| **3.** | Determine area of open field using chain and cross staff survey. | √ | √ | - | - | - | - |
| **4.** | Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass. | √ | - | √ | - | - | - |
| **5.** | Measure Fore Bearing and back bearing of a closed traverse of 5or 6 sides and correct the bearings and included angles for the local attraction. | √ | - | √ | - | - | - |
| **6.** | Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides around a building.(Compulsory)<br>Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project. | √ | - | √ | - | - | - |
| **7.** | Undertake simple leveling using dumpy level/ Auto level and leveling staff. | - | - | - | √ | - | - |
| **8.** | Undertake differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level/Auto Level and leveling staff. | - | - | - | √ | - | - |
| **9.** | Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff | - | - | - | √ | - | - |
| **10.** | Measure area of irregular figure using Digital planimeter | - | - | - | - | - | √ |
| **11.** | Undertake *Survey Project* with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval.<br>Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned | √ | - | - | √ | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **12.** | Conduct block contouring for the area of 40m x 40m to draw its contour plan | √ | - | - | - | √ | - |
| **13.** | Undertake *Survey Project* for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m**.** Plot the contours on A1 size imperial drawing sheet for data collected in *Survey Project* mentioned | √ | - | - | - | √ | - |

# Content Page

List of Practicals and Progressive Assessment Sheet

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 11. | Undertake *Survey Project* with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval**.** Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned | 47 | | | | | |
| 12. | Conduct block contouring for the area of 40m x 40m to draw its contour plan | | | | | | |
| 13. | Undertake *Survey Project* for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m**.** Plot the contours on A1 size imperial drawing sheet for data collected in *Survey Project* mentioned | | | | | | |
| **Total Mark** | | | | | | | |

* To be transferred to proforma of CIAAN 2017.

# Practical No. 1: Measure distance between two survey stations using chain, tape and ranging rods when two stations are inter visible.

## I Practical Significance:

Measurement of distance between two points is essential for plotting. Horizontal distances are measured on plane and sloping ground for planning and executing the civil engineering projects

## II Relevant Program Outcomes (POs):

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

## III Competency and Practical Skills:

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

i. Range a line using ranging rods or line ranger.
ii. Measure horizontal distance between two given points

## IV Relevant Course Outcome(s):

- Select the type of survey required for given situation.

## V Practical Outcome (PO)

- Use Chain, tape and accessories to:

i) Find the distance between two points on plane ground
ii) Find the distance between two points on sloping ground

## VI Relevant Affective domain related Outcome(s)

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical & professional practices.

## VII Minimum Theoretical Background:

For measuring the distance between two points the tape and chain should be put along straight line between the two stations. Hence concept of ranging should be clear. Least count of chain and tape should be known.

## VIII Practical set-up / Circuit diagram / Work –Field Situation

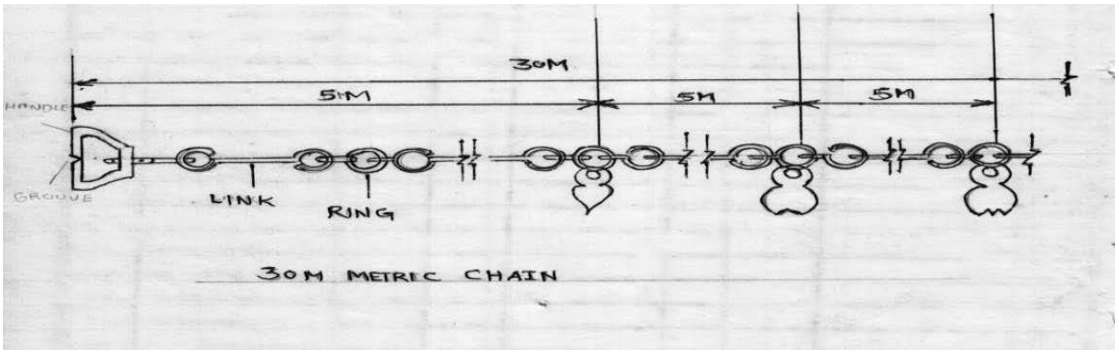


**Figure 1 : Metric Chain**

**Figure 2 : Metallic Tape and Line Ranger**

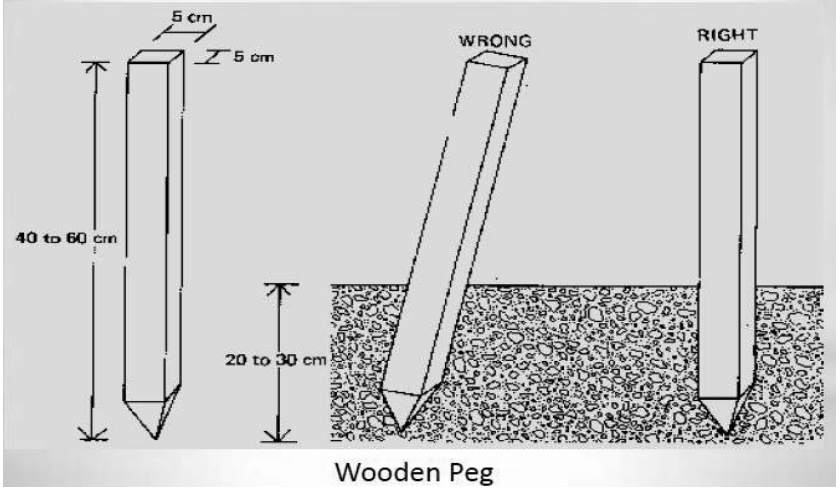


**Figure 3: Wooden Pegs**

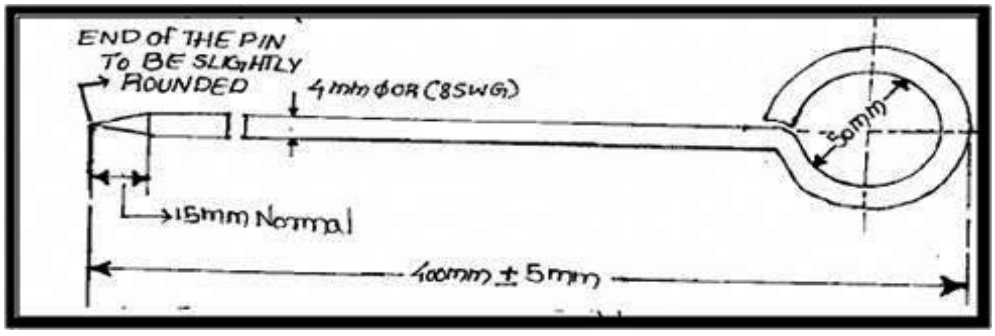


**Figure 4 : Arrow**

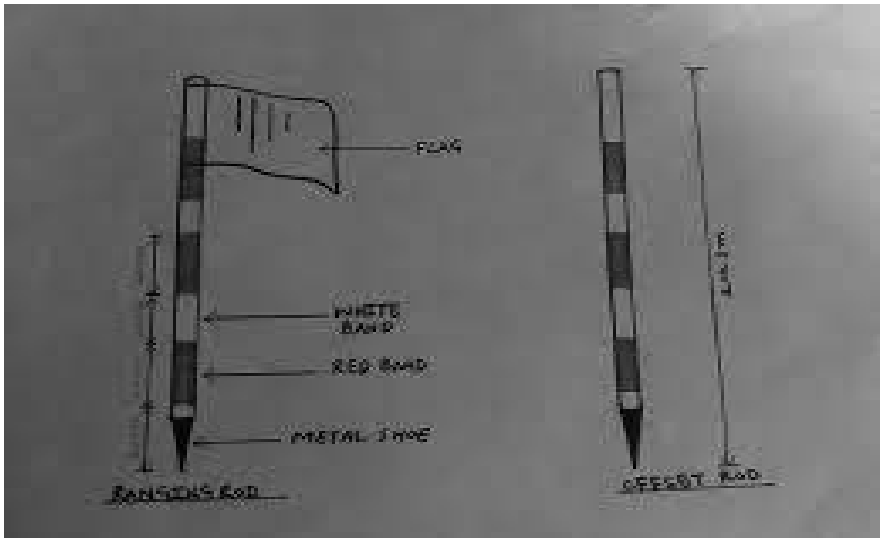


**Figure 5: Ranging Rod and flag**

## IX Resources Required:-

| S. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Metric chain | 30m | 2 No. |
| 2 | Metallic tape | 30m | 1 No. |
| 3 | Ranging rods | 2m length | 5 No. |
| 4 | Pegs | Wooden/Steel | 2 No. |
| 5 | Arrows | GI wired | 5 No. |
| 6 | Line ranger | As per standard specification | 1 No. |

## X Precautions to be Followed:

1. Pegs ,arrows and ranging rods should be fixed truly vertical
2. Calibrate the chain with standard gauge before starting the work
3. Ranging should be done precisely
4. Ensure that there are no kinks or knots in the chain while chaining

**XI Procedure:**

1. Collect the required instruments as per table in point IX from survey store.
2. Calibrate the given chain with standard guage before proceeding for practical work.
3. Fix the two station points using pegs.
4. Ranging should be done if the distance is more than one chain length.
5. Use ranging rods or line ranger for ranging.
6. Unfold the chain and put the zero end at the starting point and stretch it straight.
7. Fix the arrow at end of each chain length.
8. Repeat the procedure till the point B is reached.
9. Note the distance AB, in change as well as meters.
10. Fold the chain and return all the accessories to survey store.
11. Draw location sketches for station 'A' & station 'B'.
12. Record the field notes in field book.

**XII Resources Used:-**

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

……
……

**XIV Observations and Calculations** (use blank sheet provided if space not sufficient)

Distance AB = -------- Chainage

**XV Results**

1. Distance AB =_____m.
2. ……

**XV Interpretation of Results (**Give meaning of the above obtained results)

……
……
……

**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

Horizontal distance between AB is = _____m.

## XVIII Practical Related Questions

1. State the situation where chain is used instead of tape.
2. Describe the procedure of calibrating the given chain.
3. Which one is more precise: Ranging by eye judgment and Ranging by line ranger

**Space for Answer**

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## XIX References / Suggestions for further reading

https://www.youtube.com/watch?v=v8HpoVHBhho

## XX Suggested Assessment Scheme

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct survey practical | 50% | |
| 2 | Determining the length of the survey line | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100%** | |

***Names of Student Team Members***

1. ……..
2. …….
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related(17.5)** | **Product Related(7.5)** | **Total (25)** | |
| | | | |

# Practical No. 2: Reciprocal Ranging

**I Practical Significance:**

Reciprocal ranging is done when the two station points are not inter visible. Measurement of distance between such stations is essential for plotting. Hence initially intermediate points are established by reciprocal ranging and later the distance between the stations is measured.

**II Relevant Program Outcomes (POs):**

**Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems

**Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations.

**III Competency and Practical Skills:**

**This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

Reciprocal ranging using ranging rods.

Measure horizontal distance between two given points

**IV Relevant Course Outcome(s):**

Select the type of survey required for given situation.

**V Practical Outcome (PO)**

Use Chain, tape and accessories to:

Find the distance between two points on the ground which are not inter-visible

**VI Relevant Affective domain related Outcome(s)**

1. Follow safe practices.
2. Practice good housekeeping
3. Demonstrate working as a leader/a team member.
4. Maintain tools and equipment
5. Follow ethical practices & professional practices.

**VII Minimum Theoretical Background:**

Ranging is the process of locating the intermediate points between the two survey stations. Reciprocal ranging is done when the two end stations are not intervisible. Initially reciprocal ranging is done and later the distance between the stations is measured.

**VIII Practical set-up / Circuit diagram / Work –Field Situation**

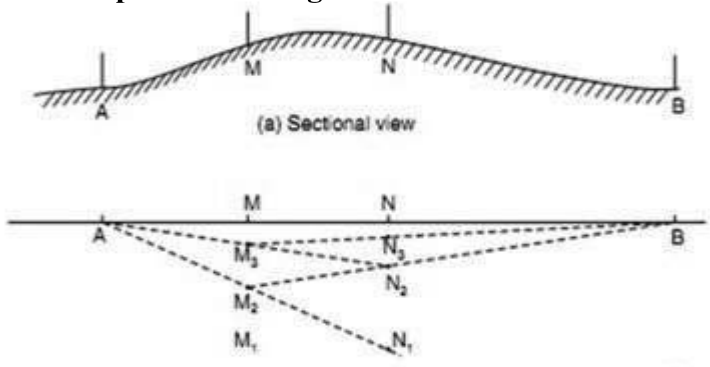


**Fig 1: Indirect or Reciprocal Ranging**

## VIII Resources Required:-

| S. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Metric chain | 30m | 1 No. |
| 2 | Metallic tape | 30m | 1 No. |
| 3 | Ranging rods | 2m length | 5 No. |
| 4 | Pegs | Wooden / Steel | 1 No. |
| 5 | Arrows | GI wired | 5 No. |

## IX Precautions to be followed

Pegs ,arrows and ranging rods should be fixed truly vertical Calibrate the chain with standard gauge before starting the work Choose the intermediate points M1 and N1 such that surveyor at M1 can see Station B and N1 and surveyor at N1 can see Station A and M1 Ranging should be done precisely, Ensure that there are no kinks or knots in the chain while chaining

## X Procedure

1. Collect the required instruments.
2. Fix the two stations which are not inter-visible using pegs.
3. Fix ranging rods at A and B.
4. Select two intermediate points M1 and N1 such that surveyor at M1 can see Station B. and N1 and surveyor at N1 can see Station A and M1
5. Surveyor at N1 will instruct the surveyor at M1 to come in line with N1A and M1 will occupy new position M2.
6. Then Surveyor at new positon M2 will instruct the surveyor at N1 to come in line with M2B to occupy new position N2.
7. Again surveyor at N2 will instruct the surveyor at M2 to come in line with N2A and M2 will occupy new position M3.
8. Calibrate the give chain with standard guage before starting the practical work.
9. Draw location sketches for station A & Station B. Rule out the field book page.
10. This process will be repeated till both surveyors occupy intermediate points M and N between A and B.
11. Now direct ranging can be done between AM, MN and NB.
12. Measure the distances AM, MN and NB using Chain or Tape.
13. Sum of AM+MN+NB= Distance AB
14. Return the instruments to the lab.

## XI Resources Used:-

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIII Observations and Calculations** (use blank sheet provided if space not sufficient)

Distance AM= _____m, MN = _____m, NB= _____m.

**XI Result**

Distance AB=_____m.

**XV Interpretation of Results (**Give meaning of the above obtained results)

**XVI Conclusions (**Actions/decisions to be taken based on the interpretation of results).

Horizontal distance between AB is =_____m.

**XVII Practical Related Questions**

a) State the length of the ranging rod used in reciprocal ranging.
b) Describe how chaining is done when the end points are not visible from the intermediate points.

**Space for Answer**

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## XVIII References / Suggestions for further reading

https://www.youtube.com/watch?v=DDspps1tdfg

## XIX Suggested Assessment Scheme

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct survey practical | 50% | |
| 2 | Determining the length of the survey line | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100%** | |

***Names of Student Team Members***

1. ……..
2. …….
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related(17.5)** | **Product Related(7.5)** | **Total (25)** | |
| | | | |

# Practical No. 3: Chain and Cross Staff Survey

## I Practical Significance:

Chain and Cross Staff Survey is an important type of survey in surveying to find the area of the given open field/ground. Most of the areas are bounded by straight lines. Chain and cross staff survey is a simple method used to determine the area of such fields.

## II Relevant Program Outcomes (POs):

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

## III Competency and Practical Skills:

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

i. Set out perpendicular offsets.
ii. Calculate the area of the field using the field measurements.

## IV Relevant Course Outcome:

Compute area of open field using chain, tape and cross staff.

**Practical Outcome (PO)**

Use Chain, tape and accessories to:
i) Find the chain ages and lengths of offsets
ii) Find the area of field bounded by straight lines

## V Relevant Affective domain related Outcome(s):

a) Follow safe practices.
b) Practice good housekeeping
c) Demonstrate working as a leader/a team member.
d) Maintain tools and equipment
e) Follow ethical practices

## VI Minimum Theoretical Background:

In surveying, one of the main tasks is to determine the area of field, ground or properties. Most of these fields are bounded by straight lines because of which it is possible to divide these fields into subparts which may be regular triangle, rectangle or trapeziums. The areas of these figures can be determined knowing their base and the corresponding offsets. In Chain and cross staff survey a base line passing approximately through the centre of area is laid and then the perpendicular offsets are erected from the base line to each corner of the field, dividing the total area into set of triangles, rectangles and trapeziums. Base of these figures and their corresponding offsets can be measured and the individual areas can be calculated. Summing these areas gives total area of the field.

## VII Work –Field Situation:

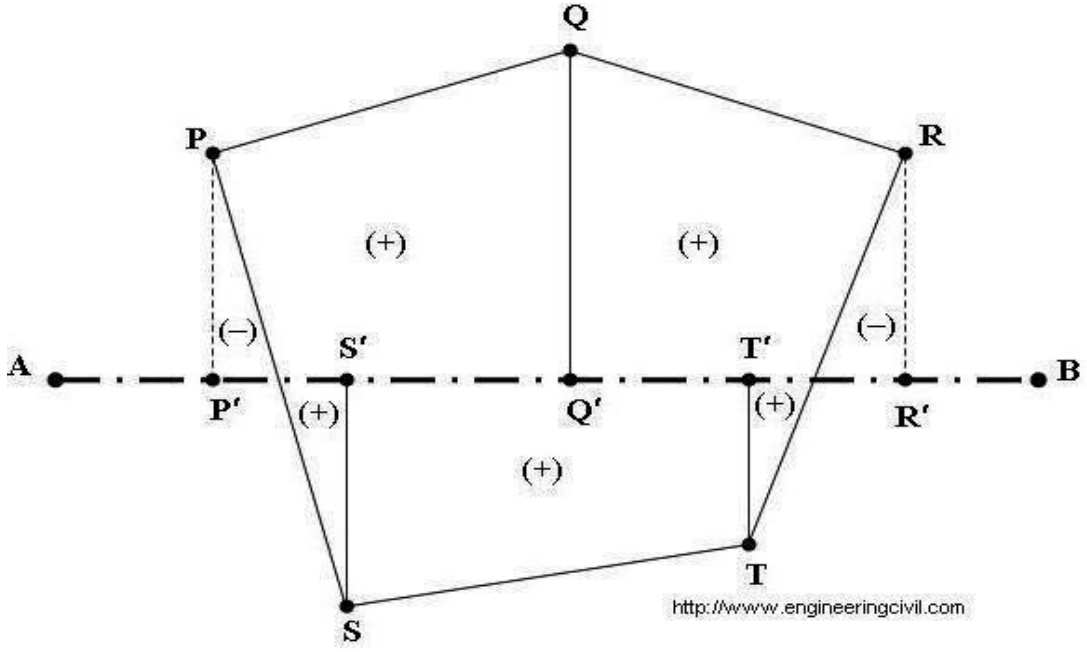


**Fig 1: Chain & Cross Staff**

| Sr. No | Figure | Chainage in m | Base Line in m | Offset in M | Mean offset in M | Area in Sq.m | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | + ve | - ve | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| Total | | | | | | | | |
| Net Area | | | | | | | | |

## VIII Resources Required:-

| S. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Metric chain | 30 m length | 1 No. |
| 2 | Metallic tape | 30 m length | 1 No. |
| 3 | Ranging rods | 2m length | 10No. |
| 4 | Pegs | Wooden | 8No. |
| 5 | Arrows | GI wire 4 mm in cross section | 5 No. |
| 6 | Line ranger | As per IS specifications | 1 No. |
| 7 | Open cross staff/Optical square. | As per IS specifications | 1 No. |
| 8 | Field book | As per standard norms of filed book page | 1 No. |

**IX Precautions to be followed:**

1. Pegs ,arrows and ranging rods should be fixed truly vertical
2. Calibrate the chain with standard gauge before starting the work
3. Ranging should be done precisely
4. Ensure that there are no kinks or knots in the chain while chaining
5. Base line should be laid approximately through center of the field to avoid very long offsets.
6. Perpendicular offsets should be erected truly perpendicular.

**X Procedure:**

1. Collect the required equipments as per table IX from survey store.
2. Inspect the area
3. Mark the corners of the field by fixing ranging rods.
4. Determine location and direction of base line so that it approximately passes through centre of area
5. Mark two ends of the base line using pegs and ranging rods.
6. Take at least two independent measurements from permanent features to each of the end points of the base line.
7. Draw the location sketches of the end points of base line.
8. Lay the base line by marking intermediate points using ranging process.
9. In case the base line intersects the boundary, mark the intersection points carefully using pegs.
10. Using open cross staff/ optical square, determine the foot of perpendicular offsets taken from base line to each corner of the field.
11. Book the field notes in the field book using standard practices.
12. Calculate area by making the relevant entries in the chain and cross staff area table.
13. Return the equipments to the store.
14. Rule out the page of field book.

**XI Resources Used:-**

| S. No. | Name of Resource | Make | Broad Specifications Details | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIII Observations and Calculations:**

(Use blank sheet provided if space not sufficient)

**XIV Results**

Area of the field, $A_1$= _____unit$^2$.

**XV Interpretation of Results (**Give meaning of the above obtained results)

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**XVI Conclusions (**Actions/decisions to be taken based on the interpretation of results). Find Corresponding ground area.

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**XVII Practical Related Questions**

1. State the alternate methods of setting the offsets.
2. Define the foot of perpendicular.

**Space for Answer**

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**XVIII References / Suggestions for further reading**

https://www.youtube.com/watch?v=Kp3iMHVzyO4

**IX Suggested Assessment Scheme**

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct survey practical | 50% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100 %** | |

***Names of Student Team Members***

1. ……..
2. ……
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related (17.5)** | **Product Related (7.5)** | **Total (25)** | |
| | | | |

# Practical No. 4: Prismatic Compass

**I Practical Significance:**

Prismatic compass is used to find the magnetic bearing of a survey line. Directions of the lines are required in traversing. To find the direction of the survey line with reference to Magnetic meridian, Prismatic compass is required. Traverses can be plotted with the known bearings.

**II Relevant Program Outcomes (POs)**

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

**III Competency and Practical Skills:**

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys.*'**

1. Measure magnetic bearings of the given survey line.
2. Plot the traverse.

**IV Relevant Course Outcome(s):**

Conduct traversing in the field using chain and compass.

**V Practical Outcome (PO)**

- Use Prismatic compass, tripod, Chain and accessories to: Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.

**VI Relevant Affective domain related Outcome(s)**

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical practices & professional practices

**VII Minimum Theoretical Background:**

Bearing of the line is the angle made by the survey line with respect to reference line called meridian. Meridians are of 3 types. Geographic, Magnetic and arbitrary meridian. Since it is easy to establish magnetic meridian, Prismatic compass is used to measure the magnetic bearing of a line. Fore bearing is the bearing of the line in the direction of progress of survey. Back bearing is the bearing of the line in the backward direction of progress of survey. Prismatic compass gives the Whole circle bearing of the line.

## VIII Work –Field Situation

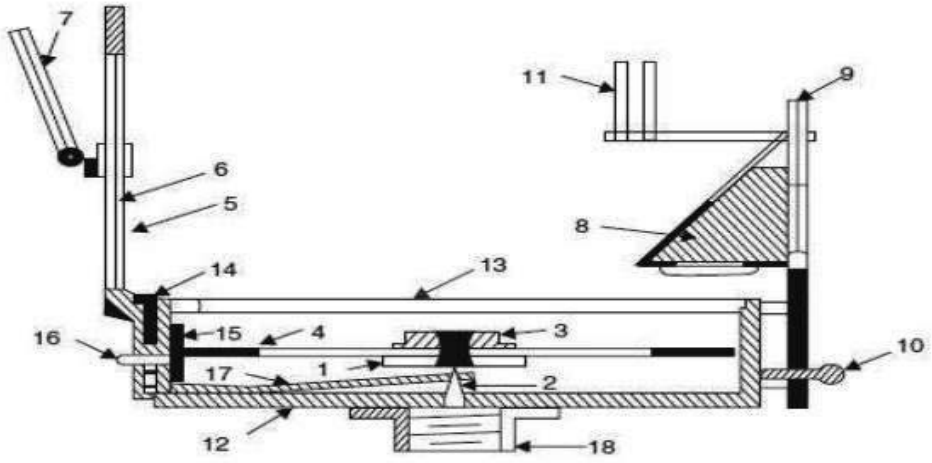


**Fig 1: Prismatic Compass**

| Part No. | Description | Part No. | Description |
|---|---|---|---|
| **1** | Needle | **10** | Focusing stud for prism |
| **2** | Pivot | **11** | Hinged Sun glasses |
| **3** | Agate Cap | **12** | Compass Box |
| **4** | Compass Ring | **13** | Glass Cover |
| **5** | Object vane | **14** | Lifting Pin |
| **6** | Horse Hair | **15** | Spring Break |
| **7** | Adjustable Mirror | **16** | Break Pin |
| **8** | Prism | **17** | Lifting Arm |
| **9** | Eye Vane | **18** | Ball & Socket Joint |

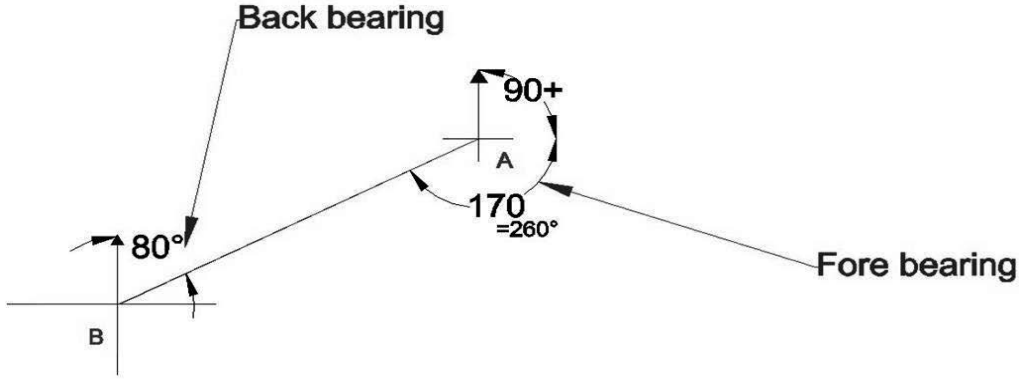


**Fig 2: Fore Bearing and Back Bearing**

## IX Resources Required

| Sr. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Metric chain | 30m | 1 No. |
| 2 | Metallic tape | 30m | 1 No. |
| 3 | Prismatic compass with stand | As per IS specifications | 1 No. |
| 4 | Ranging rods | 2m length | 5 No. |
| 5 | Pegs | Wooden/ Steel | 1 No. |
| 6 | Arrows | GI wired | 5 No. |
| 7 | Field Book | As per standard norms of field book page | 1 No. |

## X Precautions to be followed

1. Pegs ,arrows and ranging rods should be fixed truly vertical
2. Temporary adjustments of the compass should be done accurately.
3. The graduated aluminum ring should float freely
4. Record the readings in the field book accurately.

## XI Procedure

1. Collect the required equipment's as per table IX from survey store.
2. Set the instrument at A.
3. The following temporary adjustments are carried out at every set up of the instrument before taking any observations
   **Centering** is the process of keeping the instrument exactly over the station. It is carried out by dropping a small piece of stone from the underneath of the compass, so that is falls on the top of the peg fixed at the station point
   **Levelling** is done by means of ball and socket arrangement provided to the tripod stand so that the graduated ring may swing freely. The instrument is then clamped. **Focusing** the prism is done by moving the prism up or down till the graduations are seen sharp and clear
4. Fix ranging rod at B
5. Turn the compass until the ranging rod at station B is bisected by the horse hair of object vane when seen through the vertical slit above the prism
6. When the needle comes to rest, bisect ranging rod at B exactly and note the reading. It gives the fore bearing of the line AB
7. Shift instrument at B and do the temporary adjustments.
8. Turn the compass until the ranging rod at station A is bisected by the horse hair when seen through the vertical slit above the prism
9. When the needle comes to rest, bisect ranging rod at B exactly and note the reading. It gives the back bearing of the line AB.
10. Return back the instruments to survey store.
11. Rule out a page of field book.

## XII Resources Used:-

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations** (use blank sheet provided if space not sufficient)

**XV Results**

1. Fore bearing and Back Bearing of line respectively are _____&_____.
2. Difference between FB and BB of line AB is_____.

**XVI Interpretation of Results (**Give meaning of the above obtained results)

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

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**XVIII Practical Related Questions**

1 Why zero degree is marked at the south end of the graduated circle.

1 Did you observe the dip of magnetic needle in the area you surveyed?.

**Space for Answer**

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**XIX References / Suggestions for further reading**

https://www.youtube.com/watch?v=uM6ym2Iz0lA

**XX Suggested Assessment Scheme**

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct survey practical | 50% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100 %** | |

***Names of Student Team Members***

1. ……..
2. ……
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related(17.5)** | **Product Related(7.5)** | **Total (25)** | |
| | | | |

# Practical No.5: Prismatic Compass (Traverse Survey)

## I Practical Significance:

Local attraction is the condition arising when magnetic field around the instrument affects the magnetic bearing at the station. Errors due to Local attraction need to be corrected and later traverses can be plotted with the known bearings.

## II Relevant Program Outcomes (POs)

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

## III Competency and Practical Skills:

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

1. Measure magnetic bearings of the given closed traverse.
2. Identify the stations affected by local attraction.
3. Correct the bearings affected by local attraction.
4. Plot the traverse.

## IV Relevant Course Outcome(s)

- Conduct traversing in the field using chain and compass.

## V Practical Outcome (PO)

- Use Prismatic compass, tripod, Chain and accessories to:
  Measure Fore Bearing and back bearing of a closed traverse of 5or 6 sides and correct the bearings and included angles for the local attraction.
  .

## VI Relevant Affective domain related Outcome(s)

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical practices

## VII Minimum Theoretical Background:

Fore bearing is the bearing of the line in the direction of progress of survey. Back bearing is the bearing of the line in the backward direction of progress of survey. Prismatic compass gives the Whole circle bearing of the line. In the fields we come across many magnetic materials which influence the magnetic needle to deviate from magnetic north. Hence the observed bearings are affected. These erroneous bearings need to be corrected before plotting the traverse. Local attraction is identified when the difference in FB and BB of the given survey line is not equal to $180^0$. Observed bearings are corrected either by method of correction at station or by the method of included angles.

## VIII Work –Field Situation

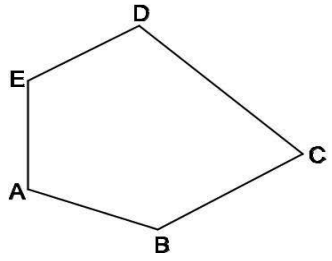


**Fig:- Closed traverse**

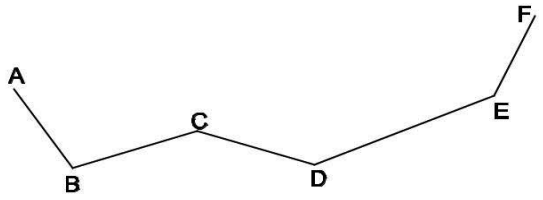


**Fig:- Open traverse**

## IX:- Resources Required

| S. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Metric chain | 30m | 1 No. |
| 2 | Metallic tape | 30m | 1 No. |
| 3 | Prismatic compass with stand | As per IS specifications | 1 No. |
| 4 | Ranging rods | 2m length | 5 No. |
| 5 | Pegs | wooden | 1 No. |
| 6 | Arrows | GI wired | 5 No. |
| 7 | Field Book | As per standard norms of field book page | 1 No. |

## X Precautions to be followed

1. Pegs ,arrows and ranging rods should be fixed truly vertical
2. Temporary adjustments of the compass should be done accurately.
3. The graduated aluminum ring should float freely

## XI Procedure:

1. Collect the required instruments as per table in point IX from survey store.
2. Detailed inspection of that place should be done
3. At each stations A,B,C,D and E drive pegs to fix their position
4. The compass is centered over station A, and is leveled
5. Measure distance AB by chaining
6. The fore bearing of the line AB and back bearing of line EA are taken by sighting the ranging rods at B and E respectively.
7. Record the observed FB and BB in bearing table in field book.
8. Shift the compass and set up at station B and levelled.
9. At station B, the back bearing of the line AB and the fore bearing of the line BC are taken by sighting ranging rods at A and C respectively
10. Measure distance BC by chaining.
11. Record the observed FB and BB in bearing table in field book.
12. Repeat the process from step 4-7 at station C, D and E
13. Record the fore bearing and back bearings of all lines
14. Find the difference between the FB and BB of each lines
15. Identify the stations affected by LA.
16. Calculate the included angles from observed bearing.
17. Check whether the sum of included angles=$(2n-4)\times 90^0$
18. If above condition is satisfied use first method given in Point number VII.

20. If above condition is not satisfied use second method given in Point number VII.
21. Return the instruments to survey store.
22. Rule out a page of field book.

**XII Resources Used:-**

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations** (use blank sheet provided if space not sufficient)

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**XV Results:**

1. Fore Bearing and back bearing of line AB, BC, CD, DE & EA etc. are_____respectively.
2. Difference between FB and BB of AB, BC, CD, DE & EA etc. are _____.

**XVI Interpretation of Results (**Give meaning of the above obtained results)

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

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**XVIII Practical Related Questions**

1 State the reasons for local attraction (LA).
2 Did you observe the LA in the area surveyed?

**Space for Answer**

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**XIX References / Suggestions for further reading**

https://www.youtube.com/watch?v=Cv7nEopg5-A

**XX Suggested Assessment Scheme**

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct of practical | 50% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100%** | |

***Names of Student Team Members***

1. ……..
2. …….
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related (17.5)** | **Product Related (7.5)** | **Total (25)** | |
| | | | |

# Practical No. 6: Simple Leveling Using Dumpy Level / Auto Level and Leveling Staff

**I Practical Significance:**

Dumpy level/Auto level is used to measure the elevations of different stations of the surface of the earth. Difference in elevations between different points can also be determined using Levels.

**II Relevant Program Outcomes (POs):**

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations.

**III Competency and Practical Skills:**

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

1. Measure elevations of different points on the earth's surface with reference to given datum.
2. Find the difference in elevation between various points.

**IV Relevant Course Outcome(s)**

Use leveling instruments to determine reduced level of ground points.

**V Practical Outcome (PO)**

- Use Dumpy level/ Auto level to:
  Undertake simple leveling using dumpy level/ Auto level and leveling staff.

**VI Relevant Affective domain related Outcome(s)**

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical practices

**VII Minimum Theoretical Background:**

Levelling is the process of measuring vertical distances with respect to given datum. Temporary adjustments of the level is to be performed before taking staff readings. Study of different leveling staves.

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## VIII Work –Field Situation

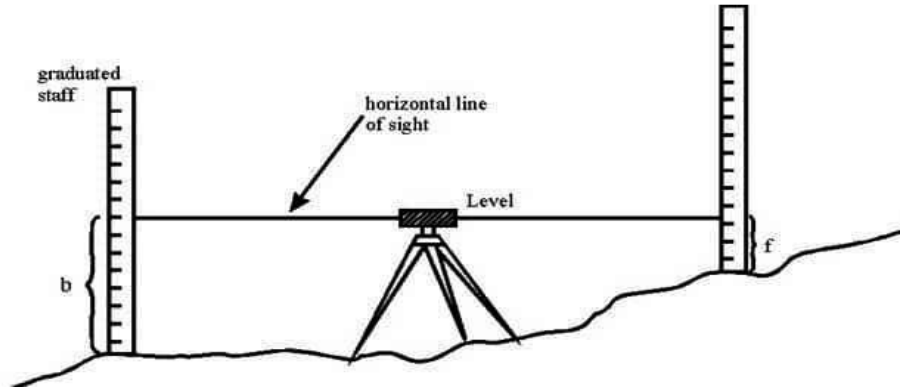


**Fig No.** 1. Simple levelling

## IX Resource Required:-

| Sr. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Dumpy/Auto level with tripod stand | As per standard Specification | 1 No. |
| 2 | Levelling staff | 4m | 1 No. |
| 3 | Field book for recording readings. | As per standard norms of field book page | 1 No. |

## X Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Record the reading accurately in the level book.

## XI Procedure:

1. Collect the required instruments as per table in point IX from survey store.
2. Mark the staff stations on the ground whose elevations are to be found.
3. Set up the level approximately midway between the stations and perform temporary adjustments.
4. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
5. Find the elevations of the points by HI or rise and fall method.
6. Return the instruments to survey store
7. Record field book page.

## XII Resources Used:-

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations:**
(use blank sheet provided if space not sufficient)

**XV Results:**
1. Elevation of A=_____.
2. Elevation of B=_____.

**XVI Interpretation of Results (**Give meaning of the above obtained results)

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

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**XVIII Practical Related Questions**
1. State the purpose of simple levelling.
2. To what accuracy we can find the elevations of different points

**Space for Answer**

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## XIX References / Suggestions for further reading

https://www.youtube.com/watch?v=Cv7nEopg5-A

## XX Suggested Assessment Scheme

The given performance indicators should serve as a guideline for assessment regarding process and product related marks:

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct of practical | 50% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100 %** | |

**Names of Student Team Members**

1. ……..
2. …….
3. …….
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| Process Related(17.5) | Product Related(7.5) | Total (25) | |
| | | | |

# Practical No.7: Differential Leveling Using Dumpy Level/ Auto Level and Leveling Staff

**I Practical Significance:**

Dumpy level/Auto level is used to measure the elevations of different stations of the surface of the earth. Difference in elevations between different points can also be determined using Levels.

**II Relevant Program Outcomes (POs):**

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

**III Competency and Practical Skills:**

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

a. Measure elevations of different points on the earth's surface with reference to given datum.
b. Find the difference in elevation between various points.

**IV Relevant Course Outcome(s):**

Use leveling instruments to determine reduced level of ground points.

**V Practical Outcome (PO)**

Use Dumpy level/ Auto level to:
Undertake simple leveling using dumpy level/ Auto level and leveling staff.

**VI Relevant Affective domain related Outcome(s)**

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical practices

**VII Minimum Theoretical Background:**

Leveling is the process of measuring vertical distances with respect to given datum. Temporary adjustments of the level is to be performed before taking staff readings. Study of different leveling staves.

## VIII Work –Field Situation:

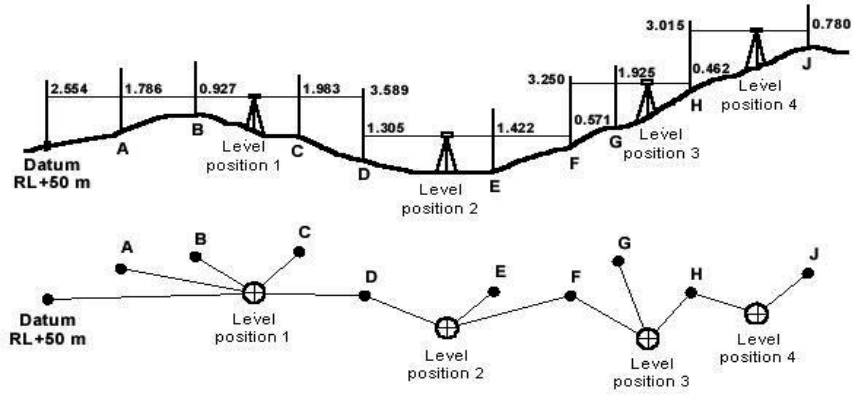


**Fig No.1** Differential levelling

## IX Resource Required:-

| Sr. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Dumpy/Auto level with tripod stand | As per standard Specification | 1 No. |
| 2 | Levelling staff | 4m | 1 No. |
| 3 | Field book for recording readings. | As per standard norms of field book page | 1 No. |

## X Precautions to be followed

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Enter the staff readings correctly in the level book.

## XI Procedure:

1. Collect the required instruments as per table in point IX from survey store.
2. Mark the staff stations on the ground whose elevations are to be found.
3. Set up the level at a point from where BM is visible and perform temporary adjustments.
4. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
5. Shift the instrument to new position when it is not possible to take readings from that position. Last reading from the earlier station will be FS and first reading from the new instrument position is the BS.
6. Continue the procedure till the readings on the last station is recorded.
7. Find the elevations of the points by HI or rise and fall method.
8. Return the instruments to survey store.
9. Rule out a page of filed book.

**XII Resources Used:-**

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations** (use blank sheet provided if space not sufficient)

**XV Results:**

1. Elevation of first station =
2. Elevation of last station =

**XVI Interpretation of Results (**Give meaning of the above obtained results)

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

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**XVIII Practical Related Questions**

1. State the purpose of differential levelling.
2. State the situation where differential leveling is done.

**Space for Answer**

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**XIX References / Suggestions for further reading**

https://www.youtube.com/watch?v=l9LLd4TLva4

**XX Suggested Assessment Scheme**

The given performance indicators should serve as a guideline for assessment regarding process and product related marks:

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct of practical | 50% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100 %** | |

**Names of Student Team Members**

1. ……..
2. ……
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| Process Related(17.5) | Product Related(7.5) | Total (25) | |
| | | | |

# Practical No.8: Undertake Fly Leveling Using Dumpy Level / Auto Level and Leveling Staff

**I Practical Significance:**

Dumpy level/Auto level is used to transfer the bench mark as well. Measure the elevations of different stations on the surface of the earth. Difference in elevations between different points can also be determined using Levels.

**II Relevant Program Outcomes (POs):**

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

**III Competency and Practical Skills:**

**This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

- Measure elevations of different points on the earth's surface with reference to given datum.
- Carry the Bench Mark to the working site
- Find the difference in elevation between various points.

**IV Relevant Course Outcome(s):**

- Use leveling instruments to determine reduced level of ground points.

**V Practical Outcome (PO)**

- Use Dumpy level/ Auto level to:
  Undertake fly leveling using dumpy level/ Auto level and leveling staff.

**VI Relevant Affective domain related Outcome(s)**

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical & professional practices.

**VII Minimum Theoretical Background:**

Levelling is the process of measuring vertical distances with respect to given datum. Temporary adjustments of the level is to be performed before taking staff readings. Study of different leveling staves. The Bench mark is to be carried to the working site by fly leveling only by taking Fore and Back sights.

## VIII Work –Field Situation

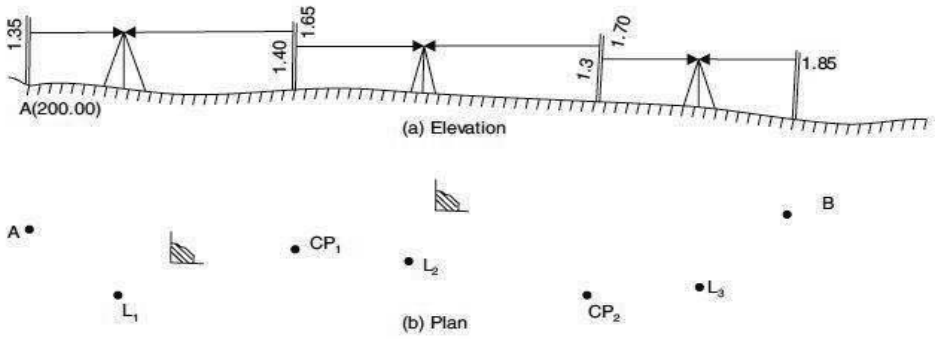


**Fig No 1** Fly levelling

## IX Resource Required:-

| Sr. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Dumpy/Auto level with tripod stand | As per standard Specification | 1 No. |
| 2 | Levelling staff | 4m | 1 No. |
| 3 | Field book for recording readings. | As per standard norms of field book page | 1 No. |

## X Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.

## XI Procedure:

1. Collect the required instruments as per table in point XI from survey store.
2. Set up the level at a point from where BM is visible and perform temporary adjustments.
3. Position of the level should be approximately midway between the BS and FS stations.
4. Rotate the telescope towards the leveling staff on BM, observe and record the staff readings in the BS columns of the level book.
5. Take a FS on the point towards working site. This point would be change point (CP).
6. Shift the instrument to new position. First reading from the new instrument position is the BS on change point.
7. Continue the procedure till the readings on the suitable station at working site is recorded.
8. Find the elevations of the points by HI or rise and fall method.
9. Return the instruments to survey store

## II Resources Used:-

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations:** (use blank sheet provided if space not sufficient)

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**XV Results**

1. R. L. of BM =
2. R.L .of starting station at work site =

**XVI Interpretation of Results (**Give meaning of the above obtained results)

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

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**XVIII Practical Related Questions**

1. State the purpose of fly levelling.
2. State the situation where fly leveling is done.

**Space for Answer**

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## XIX References / Suggestions for further reading

https://www.youtube.com/watch?v=TZg_qGSmDZA

## XX Suggested Assessment Scheme

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct of practical | 50% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100%** | |

**Names of Student Team Members**

1. ……..
2. …….
3. ……
4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related(17.5)** | **Product Related(7.5)** | **Total (25)** | |
| | | | |

# Practical No.9: Conduct block contouring for the area of 40m x 40m to draw its contour plan

**I Practical Significance:**

Contour maps are used to understand the topography of the site, locate watershed line, and determine reservoir capacity, inter-visibility between the two stations. Knowing the topography engineering projects can be planned accordingly & executed.

**II Relevant Program Outcomes (POs):**

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

**III Competency and Practical Skills:**

**This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

- Measure elevations of different stations on the earth's surface with reference to given datum.
- From known elevations draw contour maps using interpolation techniques.

**IV Relevant Course Outcome(s):**

Draw/interpret contour maps of an area.

.

**V Practical Outcome (PO)**

Conduct block contouring for the area of 40m x 40m to draw its contour plan

**VI Relevant Affective domain related Outcome(s)**

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical & professional practices.

**VII Minimum Theoretical Background:**

Contour maps are drawn to know the topography of the site from which different civil engineering projects can be planned. Procedure of locating a contour between two given points by linear interpolation is a prerequisite. Knowing the characteristics of contours is also essential.

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## VIII Work –Field Situation

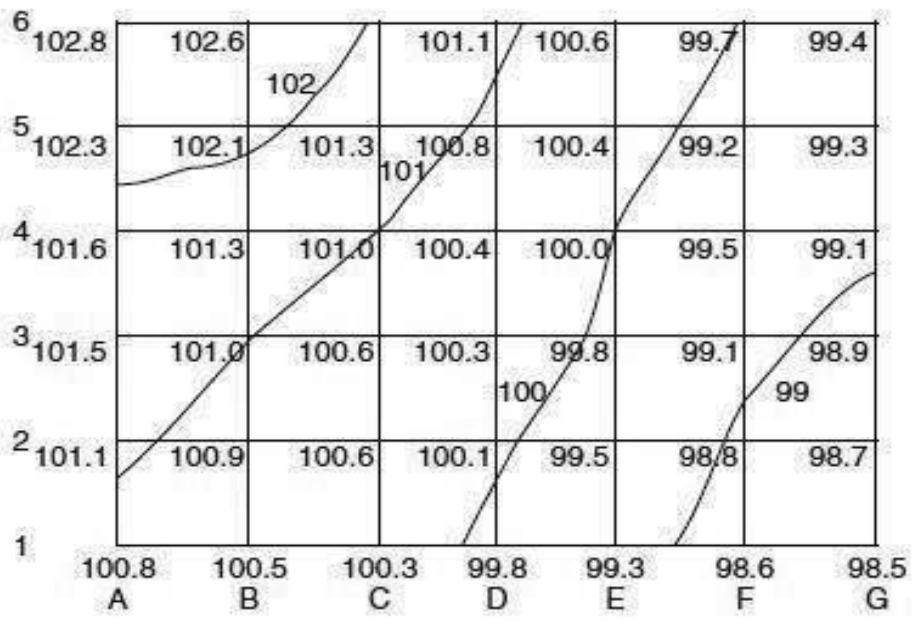


**Fig No 1** Block Contouring

## IX Resource Required:-

| Sr. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Dumpy/Auto level with tripod stand | As per standard Specification | 1 No. |
| 2 | Levelling staff | 4m | 1 No. |
| 3 | Field book for recording readings. | As per standard norms of field book page | 1 No. |
| 4 | Chain /Tape | 30m | 2 No. |
| 5 | Ranging rods | 2m | 8 No. |
| 6 | Open Cross staff with stand | As per standard specification | 2 No. |

## X Precautions to be followed

1. Lay down the grid accurately using Chain/tape and cross staff.
2. Measure the bearing of the centre line accurately.
3. Perform temporary adjustments of level precisely.
4. Hold the staff truly vertical.
5. Read staff reading accurately.
6. Record the readings correctly.

## XI Procedure:

1. Collect the required instruments as per table in point IX from survey store.
2. Lay down the grid of 5m x 5m size in the block of 40 m x 40 m.
3. Mark the staff stations on the ground whose elevations are to be found.
4. Set up the level and perform temporary adjustments.
5. Establish the BM by fly leveling.
6. Start the leveling process from the BM established in Sr.No.5.

7. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
8. Shift the instrument to new position when it is not possible to take readings from that position. For that select a change point (CP). Last reading from the earlier station will be FS then shift the instrument. First reading from the new instrument position shall be on the change point & mark as BS.
9. Continue the procedure till the readings on the last station is recorded.
10. Find the elevations of the points by HI or rise and fall method.
11. Return the instruments to survey store

**XII Resources Used:-**

| Sr. No. | Name of Resource | Broad Specifications | | Quantity | Remarks (If any) |
|---|---|---|---|---|---|
| | | Make | Details | | |
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations** (use blank sheet provided if space not sufficient)

**XV Results:**

1. RLs of all nodal points of the grid are calculated and shown on the grid
2. Contours at required interval are drawn using linear interpolation.

**XVI Interpretation of Results (**Give meaning of the above obtained results from the drawn contour map the topography of the terrain is interpreted )

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results).

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**XVIII Practical Related Questions**

1. Give Practical situation when two contours crosses each other's.
2. Interpret the topography of survey field.

**Space for Answer**

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**XIX References / Suggestions for further reading:**

https://www.youtube.com/watch?v=9QB94t8j1Rs

**XX Suggested Assessment Scheme**

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | | |
| 1 | Handling of the instrument & conduct of practical | 70% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | 30% | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | 100 % | |

***Names of Student Team Members***

1 ……..

2. ……

3. ……

4. ……

| Marks Obtained | | | Dated signature of Teacher |
|---|---|---|---|
| **Process Related(17.5)** | **Product Related(7.5)** | **Total (25)** | |
| | | | |

# Practical No.10: Digital Planimeter

**I Practical Significance:**

Digital Planimeter is a device used to find the area of irregular figures. In practice, measurement of area of the field needs to be computed. In topographic maps the areas are irregular and those areas cannot be calculated using formulae. Such areas are found out using Digital planimeter.

**II Relevant Program Outcomes (POs)**

- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems
- **Engineering tools:** Apply relevant civil technologies and tools with an understanding of the limitations

**III Competency and Practical Skills:**

- **This practical is expected to develop the following practical skills for the industry identified competency '*Undertake civil engineering surveys*.'**

Measure area of an irregular figure or area with irregular boundary

**IV Relevant Course Outcome(s)**

- Use digital planimeter to calculate the areas.

.

**V Practical Outcome (PO)**

- Measure area of irregular figure using Digital planimeter

**VI Relevant Affective domain related Outcome(s)**

- Follow safe practices.
- Practice good housekeeping
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment
- Follow ethical practices

**VII Minimum Theoretical Background:**

Digital planimeter is an instrument having microprocessor and sensor in it. It is used to determine the area enclosed by lines and the length of a line. It has the various features like control panel, roller, tracer arm and mode switch etc.

**VIII Work –Field Situation**

digtal

**Photo** Digital Planimeter

**Fig No 1 :** Digital Planimeter

## IX Resources Required

| S. No. | Name of Resource | Suggested Broad Specification | Quantity |
|---|---|---|---|
| 1 | Digital Planimeter | Measurement functions- Coordinates, area, line length, side length, radius, angle.<br>Measurement Modes- Line(Point),Curve(stream) Circular(arc)<br>Measuring Units – Metric, foot, user defined<br>Display- 140x30dot graphic liquid crystal (17 digit x 3 lines,<br>Measuring range – 380 mm x 10 m,<br>Linear resolution – 0.05 mm<br>Accuracy – 0.1 %<br>Power- Rechargeable Ni-Cd cell Charging time – About 10 hours in normal Use<br>Operating Time –About 40 Hrs of continuous operation after full charge<br>Dimensions – 350 x43x165 mm(main Body) 365 x 65 x 195mm (case)<br>Weight -1 Kg approximately(main body only) | 1 No. |
| 2 | Topo maps. | As per requirement | 01 No |

## X Precautions to be followed

1. The tracing point of the instrument should be moved exactly on the boundary of the figure.
2. Move the tracer point correctly as per the line/area under consideration.
3. Switch the instrument off after measurement.

## XI Procedure:

1. Collect the given map whose area is to be determined
2. Place the map firmly on the table using clamps.
3. Select the relevant mode on the given digital planimeter.
4. Lift the fixing lever of tracer arm to switch on the supply.
5. Set the units, vertical scales and horizontal scales by using the set and number keys.
6. Mark the starting point and set the tracer point on starting point and press the start switch to start the operation.
7. In case of straight line, move the tracer point to the other point of the line. In case of curved lines, move the tracer point carefully over the boundary in clockwise direction.
8. Press the hold and memory key after the measurement to display the lengths and areas in terms of the set units and scales.
9. Repeat the tracing process by changing the starting point.
10. Switch the instrument off after measurement.
11. Return the instruments to survey store.

## XII Resources Used

| S. No. | Name of Resource | Make | Broad Specifications Details | Qty. | Remarks (If any) |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |

**XIII Actual Procedure Followed** (use blank sheet provided if space not sufficient)

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**XIV Observations and Calculations:** (use blank sheet provided if space not sufficient)

**XV Results:-**

Average area of the given topo map $A_{1=}$ …….unit$^2$

**XVI Interpretation of Results (**Give meaning of the above obtained results).

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**XVII Conclusions (**Actions/decisions to be taken based on the interpretation of results)

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**VIII Practical Related Questions**

1. Mention the various units in which a digital planimeter can express the area
2. Explain the use of each function keys.

**Space for Answer**

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## XIX References / Suggestions for further reading

https://www.youtube.com/watch?v=pvGuGaImTek

## XX Suggested Assessment Scheme

| Sr. No | Performance Indicators | Weightage | Marks obtained |
|---|---|---|---|
| | **Process Related (17.5 Marks)** | **70%** | |
| 1 | Handling of the instrument & conduct of practical | 10% | |
| 2 | Calculation | 20% | |
| | **Product Related (7.5 Marks)** | **30%** | |
| 3 | Interpretation of result | 10% | |
| 4 | Conclusions | 10% | |
| 5 | Practical related questions | 10% | |
| | **Total (25 Marks)** | **100 %** | |

**Names of Student Team Members**

1. ……..
2. …….
3. ……
4. ……

| Marks Obtained | | | Dated Signature of Teacher |
|---|---|---|---|
| Process Related(17.5) | Product Related(7.5) | Total (25) | |
| | | | |

| Sr. No | Survey Projects |
|---|---|
| **11** | Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides around a building.<br>Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project. |
| **12** | Undertake *Survey Project* with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval**.**<br>Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned |
| **13** | Undertake *Survey Project* for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m**.**<br>Plot the contours on A1 size imperial drawing sheet for data collected in *Survey Project* mentioned |

# List Of Laboratory Manuals Developed by MSBTE

**First Semester:**

| | | |
|---|---|---|
| 1 | Fundamentals of ICT | 22001 |
| 2 | English | 22101 |
| 3 | English Work Book | 22101W |
| 4 | Basic Science (Chemistry) | 22102 |
| 5 | Basic Science (Physics) | 22102 |

**Second Semester:**

| | | |
|---|---|---|
| 1 | Bussiness Communication Using Computers | 22009 |
| 2 | Computer Peripherals & Hardware Maintenace | 22013 |
| 3 | Web Page Design with HTML | 22014 |
| 4 | Applied Science (Chemistry) | 22202 |
| 5 | Applied Science (Physics) | 22202 |
| 6 | Applied Machines | 22203 |
| 7 | Basic Surveying | 22205 |
| 8 | Applied Science (Chemistry) | 22211 |
| 9 | Applied Science (Physics) | 22211 |
| 10 | Fundamental of Electrical Engineering | 22212 |
| 11 | Elements of Electronics | 22213 |
| 12 | Elements of Electrical Engineering | 22215 |
| 13 | Basic Electronics | 22216 |
| 14 | 'C' programming Language | 22218 |
| 15 | Basic Electronics | 22225 |
| 16 | Programming in "C" | 22226 |
| 17 | Fundamentals of Chemical Engineering | 22231 |

**Third Semester:**

| | | |
|---|---|---|
| 1 | Applied Multimedia Techniques | 22024 |
| 2 | Advanced Serveying | 22301 |
| 3 | Highway Engineering | 22302 |
| 4 | Mechanics of Structures | 22303 |
| 5 | Building Construction | 22304 |
| 6 | Concrete Technology | 22305 |
| 7 | Strength Of Materials | 22306 |
| 8 | Automobile Engines | 22308 |
| 9 | Automobile Transmission System | 22309 |
| 10 | Mechanical Operations | 22313 |
| 11 | Technology Of Inorganic Chemicals | 22314 |
| 12 | Object Oriented Programming Using C++ | 22316 |
| 13 | Data Structure Using 'C' | 22317 |
| 14 | Computer Graphics | 22318 |
| 15 | Database Management System | 22319 |
| 16 | Digital Techniques | 22320 |
| 17 | Principles Of Database | 22321 |
| 18 | Digital Techniques & Microprocessor | 22323 |
| 19 | Electrical Circuits | 22324 |
| 20 | Electrical & Electronic Measurment | 22325 |
| 21 | Fundamental Of Power Electronics | 22326 |
| 22 | Electrical Materials & Wiring Practice | 22328 |
| 23 | Applied Electronics | 22329 |
| 24 | Electrical Circuits & Networks | 22330 |
| 25 | Electronic Measurments & Instrumentation | 22333 |
| 26 | Principles Of Electronics Communication | 22334 |
| 27 | Thermal Engineering | 22337 |
| 28 | Engineering Matrology | 22342 |
| 29 | Mechanical Engineering Materials | 22343 |
| 30 | Theory Of Machines | 22344 |

**Fourth Semester:**

| | | |
|---|---|---|
| 1 | Hydraulics | 22401 |
| 2 | Geo Technical Engineering | 22404 |
| 3 | Chemical Process Instrumentation & Control | 22407 |
| 4 | Fluid Flow Operation | 22409 |
| 5 | Technology Of Organic Chemicals | 22410 |
| 6 | Java Programming | 22412 |
| 7 | GUI Application Development Using VB.net | 22034 |
| 8 | Microprocessor | 22415 |
| 9 | Database Managment | 22416 |
| 10 | Electric Motors And Transformers | 22418 |
| 11 | Industrial Measurements | 22420 |
| 12 | Digital Electronics And Microcontroller Applications | 22421 |
| 13 | Linear Integrated Circuits | 22423 |
| 14 | Microcontroller & Applications | 22426 |
| 15 | Basic Power Electronics | 22427 |
| 16 | Digital Communication Systems | 22428 |
| 17 | Mechanical Engineering Measurments | 22443 |
| 18 | Fluid Mechanics and Machinery | 22445 |
| 19 | Fundamentals Of Mechatronics | 22048 |
| 20 | Guidelines & Assessment Manual for Micro Projects & Industrial Training | 22049 |

**Fifth Semester:**

| | | |
|---|---|---|
| 1 | Network Management & Administration | 17061 |
| 2 | Solid Modeling | 17063 |
| 3 | CNC Machines | 17064 |
| 4 | Behavioral Science(Hand Book) | 17075 |
| 5 | Behavioral Science (Assignment Book) | 17075 |
| 6 | Windows Programming using VC++ | 17076 |
| 7 | Estimation and Costing | 17501 |
| 8 | Public Health Engineering | 17503 |
| 9 | Concrete Technology | 17504 |
| 10 | Design of Steel Structures | 17505 |
| 11 | Switchgear and Protection | 17508 |
| 12 | Microprocessor & Application | 17509 |
| 13 | A.C. Machines | 17511 |
| 14 | Operating System | 17512 |
| 15 | Java Programming | 17515 |
| 16 | System Programming | 17517 |
| 17 | Communication Technology | 17519 |
| 18 | Hydraulic & Pneumatics | 17522 |
| 19 | Advanced Automobile Engines | 17523 |
| 20 | Basic Electrical & Electronics | 17524 |
| 21 | Measurement and Control | 17528 |
| 22 | Power Engineering | 17529 |
| 23 | Metrology & Quality Control | 17530 |
| 24 | Computer Hardware & Networking | 17533 |
| 25 | Microcontroller | 17534 |
| 26 | Digital Communication | 17535 |
| 27 | Control System & PLC | 17536 |
| 28 | Audio Video Engineering | 17537 |
| 29 | Control System | 17538 |
| 30 | Industrial Electronics and applications | 17541 |
| 31 | Heat Transfer Operations | 17560 |
| 32 | Chemical Process Instrumentation & control | 17561 |

**Sixth Semester:**

| | | |
|---|---|---|
| 1 | Solid Modeling | 17063 |
| 2 | Highway Engineering | 17602 |
| 3 | Contracts & Accounts | 17603 |
| 4 | Design of R.C.C. Structures | 17604 |
| 5 | Industrial Fluid Power | 17608 |
| 6 | Design of Machine Elements | 17610 |
| 7 | Automotive Electrical and Electronic Systems | 17617 |
| 8 | Vehicle Systems Maintenance | 17618 |
| 9 | Software Testing | 17624 |
| 10 | Advanced Java Programming | 17625 |
| 11 | Mobile Computing | 17632 |
| 12 | System Programing | 17634 |
| 13 | Testing & Maintenance of Electrical Equipments | 17637 |
| 14 | Power Electronics | 17638 |
| 15 | Illumination Engineering | 17639 |
| 16 | Power System Operation & Control | 17643 |
| 17 | Environmental Technology | 17646 |
| 18 | Mass Transfer Operation | 17648 |
| 19 | Advanced Communication System | 17656 |
| 20 | Mobile Communication | 17657 |
| 21 | Embedded System | 17658 |
| 22 | Process Control System | 17663 |
| 23 | Industrial Automation | 17664 |
| 24 | Industrial Drives | 17667 |
| 25 | Video Engineering | 17668 |
| 26 | Optical Fiber & Mobile Communication | 17669 |
| 27 | Therapeutic Equipment | 17671 |
| 28 | Intensive Care Equipment | 17672 |
| 29 | Medical Imaging Equipment | 17673 |

## Pharmacy Lab Manual

**First Year:**

| | | |
|---|---|---|
| 1 | Pharmaceutics - I | 0805 |
| 2 | Pharmaceutical Chemistry - I | 0806 |
| 3 | Pharmacognosy | 0807 |
| 4 | Biochemistry and Clinical Pathology | 0808 |
| 5 | Human Anatomy and Physiology | 0809 |

**Second Year:**

| | | |
|---|---|---|
| 1 | Pharmaceutics - II | 0811 |
| 2 | Pharmaceutical Chemistry - II | 0812 |
| 3 | Pharmacology & Toxicology | 0813 |
| 4 | Hospital and Clinical Pharmacy | 0816 |

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